BULLETIN

OF THE

TORREY BOTANICAL CLUB

VOL. XXVII

FOUNDED BY WILLIAM H. LEGGETT, 1870

NEW YORK
1900
PUBLISHED FOR THE CLUB
THE NEW ERA PRINTING HOUSE
LANCASTER, PA.

CONTENTS

VOL. 27 JANUARY, 1900. No. 1

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 1

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JANUARY 1900

Turgidity in Mycelia

BY CARLTON C. CURTIS

Although the question of the mechanics of growth has been canvassed since the time of Nägeli by so many writers as Schmitz, Krabbe, Wortmann, Strasburger, Eschenhagen, Askenacy, Zacharias, Noll, Schwandener, Strange, Reinhardt, Hegler, Pfeffer, True, and Copeland, we must still agree with Krabbe, that an acceptable theory of growth does not exist. Especially are we indebted to the researches of Pfeffer as set forth in the "Druck und Arbeitsleistung durch wachsende Pflanzen" and the second part of "Studien zur Energetik der Pflanzen" for an elucidation of the various phenomena associated with growth. Especial attention is called by Pfeffer to the fact that the mechanics of growth may not only vary in different cases, but that all growth is dependent upon the coöperation of many factors. Consequently the retarding or quickening of the rate of growth may not be ascribed to any one agency. So in regard to turgidity its action may be more than counter-balanced by other forces, and we find no "fixed relation between the turgor force, stretching of membrane, and rate of growth." The present work was undertaken to determine just what relation turgidity sustains to growth when all other conditions, so far as possible, are kept constant and only known variants are introduced. The hyphae of fungi were used for these observations. They were grown in nutrient solutions of varying degrees of concentration and transferred to solutions of higher or lower concentration. In this way wide variation of turgidity was created, and as the moment of the renewal of growth in the hyphae

[Issued 24 January.]

could easily be detected, it was possible to test the turgor force at the instant of the recovery from the effect of the change of substratum. The basis of all media used in the experiments which are here recorded was a nourishing solution composed of 3% cane sugar, .5% peptone and .5% beef extract, and from this were made solutions containing various gram-molecule percentages of potassium nitrate. By this means the plants were always afforded a constant nourishment and the effects of the introduction of a known factor, potassium nitrate, could readily be determined. In many respects the hyphae of the lower fungi are especially adapted to this character of work since they are easily cultivated and handled in microscopic examinations, and possess, to a marvelous degree, adaptability to varying degrees of concentration without injurious results, and are so simple in structure that changes of culture media produce immediate reactions. Many will grow in a saturated potassium nitrate solution, about 23%, and some will endure a transfer from relatively strong to zero solutions without bursting. The suitableness of these plants for measuring the turgor force is more apparent when we consider that Pfeffer has determined that in an artificial cell a 1% potassium nitrate solution produced a pressure 175.8 cm. of mercury, and that this estimate is low since the precipitation membrane is somewhat permeable for potassium nitrate.

It was found impossible to study the behavior of the mycelia in gelatine or agar since these media not only dissolve at relatively low concentrations of the substratum, but they are also objectionable as being somewhat unstable and permitting a rather slow and gradual penetration of the various culture solutions. Gypsum proved a fairly satisfactory means of fixing the spores for germination and subsequent study. The powdered gypsum was mixed into a paste with water, and to this mass the spores were added. The mass was then readily pressed out into a thin plate between glass slides, and hardens in a few minutes. These thin plates, however, were somewhat difficult to fasten to the slides, and are liable to break during an experiment. So attempts were made to germinate the spores in floss silk and strands of cotton fibers fastened to the cover glass with drops of balsam, and this led to a very simple and practical culture method. The spores were fastened to the cover glass with a film of dilute gelatine and covered with a narrow strip of silk paper or any thin unsized paper about 5 mm. long and 1 mm. wide. Each end of this paper had been previously touched with melted shellac so that a drop adhered to it. By applying a hot rod over the drop of shellac it is melted, fastening the paper firmly to the cover glass. In this way the paper is spread out smoothly over the spores, holding them firmly on the glass. The spores will germinate and push out from under the strip of paper and the mount can be handled without fear of destroying the hyphae, readily changed from one fluid to another and the growth studied in a hanging drop with ease. Furthermore the same hyphae can be observed during the entire experiment, and any error that might arise from a change from one filament to another can be avoided. Every precaution was taken to secure uniform external conditions. Repeated tests during the day showed that the ordinary variations of temperature produced no effect on the turgor force and rarely was there a variation of over one and a-half degrees during the majority of the experiments. The work prosecuted in the summer, however, was subject to a much more considerable range of variation than in the winter.

In regard to illumination, the alternation of light and darkness and different degrees of light intensity gave no different results from those obtained when the plants were grown in the dark room and received illumination only from the mirror of the microscope for a few moments at the time of the observations. For the purpose of uniformity all the cultures and examinations were made under the same conditions so far as possible and the greater part of the experiments were conducted under exceptionally uniform conditions.

The spores used were always taken from recent cultures since they produced plants of more uniform vigor. But even with this precaution here was presented the most serious difficulty in the work. For, having sown a few spores on a cover glass, not only do some fail to germinate but some are very slow to grow and others show a great vigor. Again, some will produce almost from the start a branched series of filaments and others will develop lateral branchlets only after extended growth. Now it is evident that these variations are the expression of different conditions and forces existing in the plant and if the measurement of the turgidity is to be of any value it must be determined from plants presenting a uniform vigor of growth. It was often a difficult task to find in successive cultures hyphae showing the same vigor and condition of growth. The fluctuations in the rate of growth due in some cases to preparations for branching on the part of the plant and in other instances due to no apparent cause, rendered it difficult to select plants in the various experiments that would give real comparative values. This difficulty presented itself again when changes from one media to another had been made. For perhaps the hyphae under observation would not respond to the change for half an hour or longer after others had showed the desired effects. The question then presents itself, How much weight can be given to any measurement in such an instance? Obviously such conditions necessitated repetition of experiments many times to arrive at any conclusions.

To secure the most uniform conditions possible the spores, prepared as above described, were germinated in closed Stender dishes, 8 × 4½ cm., the cover glasses being just covered with the fluid. By this means the spores and germinating plants were exposed to the same atmospheric conditions and always had the same volume of nutrient solution to draw upon, while the solution could not materially absorb or evaporate water—factors of vital importance to the success of the work. By removing the covers of the dishes the cultures could readily be examined on the table of the microscope without danger of disturbing them and when found ready for use the cover glass was removed, carefully freed of the fluid with a blotter save about the hyphae and studied in a hanging drop over a damp chamber. In all experiments the damp chamber (made from a piece of thick cardboard) was placed in a Stender dish, the bottom of which was covered with the same solution as used in the hanging drop. I found this to be of the greatest importance for if there was any considerable variation in the concentration of the hanging drop and the fluid of the damp chamber a very considerable change would result in the concentration of the hanging drop producing very material alterations in the rate of growth and turgor. In this way the damp chamber was also constantly kept saturated and the drying up of the drop prevented. Having selected from the drop culture a plant for testing, the cover glass was quickly freed from all fluid possible by means of the feathered edge of blotting paper, washed in the solution to which it is to be transferred, placed in a Stender dish and covered with the fluid after the manner described for germinating the spores. This insured an immediate action of the substratum and, owing to the relatively large volume of the substratum, it is not subject to any material change through the metabolism of the plant or the diffusion of any portion of the previously used culture fluid which might still cling to the cover glass through the capillarity of the paper or mycelia. Of course when the period of recovery from a change was short it was only necessary to wash the culture in the fluid to which it was to be transferred and mount it on the damp chamber in a fresh drop of this fluid. Knowing, by experiment, approximately when the plants would recover from the change of substratum, the cover glass was wiped dry, leaving a hanging drop on the mycelia, and placed on the damp chamber.

It was possible to determine the exact moment of renewal of growth after a change of substratum owing to the fact that this was announced by the enlargement of the apices of the hyphae, which were very constant and characteristic features. The turgidity of the plant was tested at this moment, although the swelling would go on for varying lengths of time, amounting in some cases to 10 or 15 minutes before a branch or usually branches would appear that increased the length of the hyphae.

Every precaution possible was exercised to secure accurate measurements of the turgidity. With the first sign of the enlargement of the apex the cover glass was freed of the fluid and immersed in the plasmolyzing fluid, isotonic solutions of sodium nitrate being used. A stock of the various percentages required was made up and used through all the experiments, and fresh volumes were taken from these jars for each experiment. The turgor force of a plant recovering from a change was always compared at the same time with the turgor force of a plant that had germinated and grown in the same strength of fluid to which the trial plant had been changed. In this way two plants in the same condition of development were compared, the one with the turgor normal to the solution in which it was growing and the other had so adjusted its turgor to this same concentration of the substratum that growth became possible. It was found, after trying a certain percentage of the plasmolyzing solution on a plant without producing plasmolysis that any subsequent tests with higher strengths were unreliable, giving too high values to the turgor force. This is doubtless due to the fact that a solution too weak to plasmolyze does cause a concentration of the cell contents as is seen from the reduced size of the hyphae. One of the surprising features of the work was the variability of the turgidity, so that it was not at all safe to rely upon any determination of the turgor force of plants grown in a given concentration as a basis for comparison of plants changed to this concentration; as mentioned above, a test plant was always used as a check upon all measurements. This variability of the turgidity was also observed while working with Prof. Pfeffer, for whose courtesy in extending to me the privileges of the laboratory, I wish to return thanks.

Some of the results of the experiments upon *Mucor* will be found in the first table. The first column shows the average temperature of the day on which the experiment was made. In the second column is the record of the changes of the substratum; thus 0–4 indicates that the spores were grown in a simple nutrient solution and transferred to a nutrient solution containing 4% KNO_3. The third column shows the time elapsing after the change before growth appeared. For example, in the first experiment the culture was transferred at 8.10 to a 4% KNO_3 nutrient solution. Growth ceased till 10.13, or growth was renewed after two hours and three minutes. The turgidity in percentages of $NaNO_3$ is found in the fourth column. A — after a number indicates that this percentage did not plasmolyze as perfectly as in the case of the plant used as a check and for comparison. A + signifies the reverse condition, and that the plasmolysis was more severe than in the check plant. N. P. indicates that the percentage used failed to plasmolyze at all the hypha. The last column includes the measurements of the turgidity of the plants used as checks and for comparison with the plant subject to the change of substratum. Considering the second experiment, 18 in the fifth column indicates that this was the turgor force of plants germinated and grown in a 4% KNO_3 nourishing solution on the day of the experiment, while in the fourth column 18 — records the fact that this same strength of the plasmolyzing solution did not plasmolyze as strongly the plant that was subjected to the change of concentration.

I.

1	2	3	4	5
21.	0–4	2.3	17 n. p.	18
21 5	"	2.15	18 —	18
22.	"	1.43	18	18
21.5	"	1.35	18 —	18
22.	"	1.45	18 +	18
22.6	"	.59	20 +	20
22.6	"	1.33	20 +	20
22.6	"	1.25	20 +	20
21.5	"	1.50	18 —	18
20.8	"	.45	18	18

These are a few illustrations taken from many experiments to give an idea of the range of variation in different cases. The interesting feature appears in columns 4 and 5. All the measurements show practically the same result, that before growth is renewed the turgor force has become equal to the turgor of plants growing normally in this solution. Scores of experiments were performed testing the plants as in the first experiment with a lowei

II.

1	2	3	4	5
22.	4–0	15 min.	8	8
22.6	"	40	8	8
22.6	"	34	8	8
21.5	"	20	8 —	8
21.5	"	50	8 —	8
25.	"	35	7 n. p.	8
25.	"	30	8	8
23.	"	47	8 —	8
22 5	"	28	8 +	8
21.	"	32	8 —	8

percentage than the check plant indicated. The result was either as in this case a lack of plasmolysis or only slight indications of it.

The three measurements indicating a turgor force of 20 are introduced to illustrate the variations that appear without any assignable reason. From other experiments it is not at all possible to conclude that temperature is the cause of the rise.

In Table II. will be found some of the results obtained by germinating spores of *Mucor* in a nourishing solution containing 4% KNO_3 and transfering to a simple nourishing solution.

Here again there is a complete agreement between the turgor forces of the plants grown under the different conditions; the slight variations indicated by the — or the + are of little importance as they are found to be equally distributed throughout my experiments. The turgor force was not always as constant as indicated in column 5, some tests showing a force of 7 and a few of 9. In the majority of cases it was very constant.

In Table III. are given a few of the results of experiments on *Botrytis*.

III.

1	2	3	4	5
21.	0-4	.41 min.	22	22
22.2	"	.60	22 —	22
22.6	"	1.12	22 n. p.	22
21.	"	1.10	22	22
21.8	"	.50	23	23
23.4	"	1.35	22 n. p.	23
24.	"	1.53	21	21

IV.

1	2	3	4	5
22.	4-0	50 min.	12 n. p.	13
22.8	"	51	12	12
21.6	"	55	12 +	12
23.4	"	42	12	12
22.6	"	62	12 —	12
22.6	"	38	12	12
24.	"	46	12	12

The generally longer period of recovery noted in Table IV. is not due apparently to the considerably higher turgor force developed in the plants, since the difference of turgor in the 4% and null solutions is practically the same in both *Botrytis* and *Mucor*, *i. e.*, 10. On the other hand the periods of recovery found in Table III. are somewhat shorter than in Table I.

The tests upon *Penicillium* were more unsatisfactory than any of the others owing to the fact that the turgor varied considerably on different occasions. It might naturally be supposed that this was due to some faulty application of the plasmolyzing solutions. More tests, however, were made upon *Penicillium* than upon any of the others in the hope of securing uniform measurements. But the fact remained that there would occur variations of one to three per cent. But this fluctuation does not affect the results of the work because of the practice of comparing every measurement obtained in an experiment with the turgor force of a test plant.

V.

1	2	3	4	5
21.	0–4	63 min.	16 —	16
21.4	"	41	16	16
21.8	"	76	15	15
21.8	"	70	13	13
21.6	"	46	16	16
22.	"	47	16 —	16
21.4	"	88	16 +	16

VI.

1	2	3	4	5
22.6	4–0	21	10 —	10
22.8	"	25	10	10
22.8	"	45	10	10
22.	"	38	8 +	8
21.4	"	22	9 +	9
21.6	"	50	9	9
21.	"	42	9	9

It is very noticeable that the turgor force has a marked influence in regulating the period of recovery. While in Table III. it is more usually over one hour and averages somewhat higher than the table indicates, in Table V. the recovery is decidedly shorter. The same ratio exists in Tables IV. and VI. In the case of *Botrytis* there was produced by the changes of the substratum a difference of 10 in the turgor force while in *Penicillium* this only amounted to about 6. The results obtained in the experiments with *Mucor* are not so easily explained, for while the period of recovery is shorter than in *Penicillium*, when changing from 4 to 0, the reverse change results in a rather longer period of retardation approximating that of *Botrytis*. This latter relation would be be expected since the difference in turgor produced by the two substrata are about equal, *i. e.*, 10. It is quite possible that the structure of the two plants has much to do with the variation, the one being essentially weak in this particular and the other septate.

I was interested to substitute NaCl for KNO_3 for the purpose of determining whether the replacement of a salt that is of so vital importance to the plant with one of slight value would produce any pronounced results. The action of this salt was most striking and it was found impossible to use only comparatively weak solutions. *Mucor* would not tolerate as well a 2 per cent. solution as the corresponding value of KNO_3, and this often produced bursting in *Botrytis*. *Penicillium* was more resistant and would usually withstand a change from 4 to 0. The results may be summarized as follows:

Mucor in a temperature averaging 24.5 recovered very slowly in changing from a nutrient solution to 2% NaCl solution. The period ranged from 3 hours and 40 minutes to 5 hours and 46 minutes and the turgor was found to be 21–22 in the recovering and test plant. In transferring from 2 to 0 recovery was effected in 19 to 43 minutes, turgor force 9. This higher turgor force (9) was probably due to the temperature and this is to be noticed generally in all work done in the summer. *Penicillium* recovered, temperature 25, from a change of 0 to 2 in 1.24 to 2.36 hours, turgor in all comparative tests alike and ranging from 19 to 20. Transferring from 2 to 0, recovering in 36 to 56 minutes, turgor ranging from 11 to 12. Changed from 0 to 4 solution, recovery 1.55 to 2.50 hours, turgor 29–30; transferred from a 4 to 0, recovery in 31 to 70 minutes with turgor force as stated above. *Botrytis*, transferred from 0 to 2% solution, recovered in 1.40 to 3.10 hours, turgor 23–24. Changing from 2 to 0, recovering in 30 to 80 minutes, turgor 13. These tests show the same results and general relations as those found in Tables I and II. The excessive turgor pressure is manifestly due to the injurious and retarding influence of the NaCl upon the rate of growth.

A summary of the results obtained with the higher concentrations of the KNO_3 nourishing solutions is given below. *Penicillium* was found to have the greatest power of adaptation and would sometimes withstand a transfer from 19 to 0 solution without seriously bursting all of the hyphae. In transferring *Penicillium* from 0 to 9 recovery followed in 2 to 5.30 hours, turgor 28. Changing from 9 to 0, recovery in 50 minutes to 1.50 hours, turgor 11; changed from 0 to 14, recovery 2.40 to 7 hours, turgor 36; changed from 14 to 0 recovery, 55 to 1.41, turgor 11; changed from 0 to 19, recovery 5.40 to 12.18 hours, turgor 43. *Botrytis* 0 to 9, recovery in 1.56 to 6.10 hours, turgor 34, 9 to 0, recovery 48 to 2.21, turgor 13, 0 to 14, recovery in 3.10 to 7.43, turgor 39. Less importance is attached to these experiments owing to the frequent bursting of the hyphae. However, they show that the same relations exist between the turgor of the recovering plant and the test plant as appeared in the preceding work.

The result of the work was unexpected and seems to indicate that a much closer relation exists between turgor and growth in these simple plants at least than has been supposed. I had anticipated finding several percentages of difference between the turgor force of the plant just recovering from a change of substratum and that of a plant germinated and grown in this substratum. It appears from these experiments that there is a necessity of a certain turgor force before growth is possible and that growth cannot occur until a turgor pressure has been reached which is normal to the plant growing in the given solution. That turgor is not alone the cause of growth is apparent from the acceleration of the rate of growth after a change of substratum. In the following statements it will be seen that there is always a short period of slow growth. The figures represent divisions on the micrometer eye piece, the periods of measurement being 5 minutes.

1 5	1.5	1.	2.	.5	.5
1.	1.5	2.	2.5	1.	.5
2.5	2.5	3.5	3.	.5	2.
3.	3.	4.5	3.	1.5	2.5
3.	3.5	6.	3.	3.	3.

Again it is to be noticed that when the turgor pressure was enormously increased by changing from high to low concentrations no growth followed but the quite uniform period of recovery indicates that some agency other than the widely various turgor pressure was at work and it seems quite probable, as has been suggested by Townsend and by True, that the cessation of growth is to be considered as the response of the irritability of the protoplasm due to shock. In fact, the measurements obtained by Townsend by injuring the hyphae and observing the period of recovery correspond with some of the above measurements. This shock also entered as a factor in the changes from low to higher concentrations, but the periods of recovery constantly grew longer in as much as the accumulation of turgor force is a slow process and requires more time than recovery from shock. In the cases where we are dealing with a reduction of the turgor force a comparative short period, *i. e.*, the recovery from shock, is sufficient to adjust the turgor since this is brought about by purely physical laws. The accumulation of high pressures in the plants retarded in their growth by NaCl and the low turgor of the plants growing rapidly in solutions of slightly lower concentration, a phenomenon that has often been discussed, seem to point to the same conclusion. A certain maximum turgor force is necessary to start growth. If for any reason growth is checked there follows an increase of the pressure tending to continue the normal growth. Under the reverse conditions a rapid growth lowers the pressure which is, however, high enough to play its rôle in growth. Eschenhagen has demonstrated that the turgor pressure of fungi is considerably in excess of the substratum in which they are growing and this is to be looked upon as an adaptive provision permitting changes of substratum. It is possible that there must also be a certain excess of turgor to inaugurate growth and higher than is actually required to sustain it. Naturally a rapid growth expends a portion of this surplus reducing turgor. These variations of pressure are comparable to the work done in overcoming the inertia of an object at rest, a greater force is required to start the motion that is necessary to maintain it. A better comparison is found in a water reservoir with a constant supply and a siphon discharge. A certain maximum volume of water is required to bring the siphon into action, but once in action it will continue the flow of water, though the volume in the reservoir is greatly reduced. Furthermore, by reducing the caliber of the siphon the volume rises, but by increasing it the volume diminishes in both cases in proportion to the area of the siphon.

Turgor then is regulatory in its action. We can neither say that it controls growth nor, on the other hand, is it controlled by growth, but it must sustain a certain fixed relation and come into harmony with the other existing forces and conditions before growth is possible.

The more important features of the work may be summarized as follows:

1. The hyphae of fungi possess remarkable powers of adaptation but show considerable individuality in this respect.

2. The turgidity varies under uniform conditions.

3. The moment of recovery from a change of concentration can be accurately noted since it is indicated by an apical enlargement preceding the elongation of the hypha.

4. Changes from a low to a higher conception of the substratum resulted in a steadily increasing period of recovery in proportion to the concentration of the substratum.

5. Recovery from a change from a higher to a lower concentration was controlled only to a limited extent by the degree of concentration. But there was also to be observed an individuality peculiar to the genus employed which brought about these changes in shorter or longer periods of time.

6. The turgidity of a plant recovering from a change of concentration is the same as that of a plant germinated and growing in the concentration to which the trial plant has been changed.

7. Turgidity appears to be a regulatory force.

New Species of Fungi

By Charles H. Peck

Amanita calyptrata

Pileus fleshy, thick, convex or nearly plane, centrally covered by a large irregular persistent grayish white fragment of the volva, glabrous elsewhere, striate on the margin, greenish yellow or yellowish brown tinged with green, the margin often a little paler or more yellow than the rest : lamellae close, nearly free but reaching the stem and forming slight decurrent lines or striations on it, yellowish white tinged with green : stem stout, rather long, equal or slightly tapering upward, surrounded at the base by the remains of the ruptured volva, white or yellowish white with a faint greenish tint : spores broadly elliptic, 10 μ long, 6 μ broad, usually containing a single large nucleus.

Pileus 10–20 cm. broad: stem 10–15 cm. long, 12–20 mm. thick.

Rich ground in fir woods or their borders. Autumn. Oregon. Dr. H. Lane.

This is a large and interesting species, well marked and easily recognized by its large size, by the greenish tint that pervades the pileus, lamellae, annulus, and stem and especially by the large persistent patch of grayish white felty material that covers the center of the pileus and sometimes extends nearly to the margin. This is in fact the upper part of the ruptured volva that is carried up by the growing plant and is very suggestive of the specific name. In the young state the plant is entirely enveloped in the volva which then is similar to a goose egg in size and shape, and its walls are one-fourth to one-half an inch thick. So thick and firm are they that the young plant appears sometimes to be unable to break through and it decays in its infancy.

Dr. Lane says that, having found that the Italians made use of this mushroom for food, he began eating it and introducing it to his friends, and he learned by personal trial that it is a thoroughly good and wholesome mushroom, which, when broiled with bacon, fried, baked or stewed, may be eaten with perfect safety and that it is a nutritious food.

Amanita crenulata

Pileus thin, broadly ovate, becoming convex or nearly plane and somewhat striate on the margin, adorned with a few thin whitish floccose warts or with whitish flocculent patches, whitish or grayish, sometimes tinged with yellow: lamellae close, reaching the stem, and sometimes forming decurrent lines upon it, floccose crenulate on the edge, the short ones truncate at the inner extremity, white: stem equal, bulbous, floccose mealy above, stuffed or hollow, white, the annulus slight, evanescent: spores broadly elliptic or subglobose, 7.5–10 μ long, nearly as broad, usually containing a single large nucleus.

Pileus 2.5–5 cm. broad: stem 2.5–5 cm. long, 6–8 mm. thick.

Low ground, under trees. Eastern Massachusetts. September. Mrs. E. Blackford and George E. Morris.

The volva in this species must be very slight, as its remains quickly disappear from the bulb of the stem. The remains carried up by the pileus form slight warts or thin whitish areolate patches. The annulus is present in very young plants, but is often wanting in mature ones, in which state the plant might be mistaken for a species of *Amanitopsis*. Its true affinity is with the tribe to which *Amanita rubescens* belongs. As in that species, the bulb soon becomes naked and exhibits no remains of the volva. It is similar to *Amanitopsis farinosa* also in this respect, but quite unlike it in color, in the adornments of the pileus and in the character of its margin, which is even in the young plant and but slightly striate in the mature state. Its dimensions are said sometimes to exceed those here given, and it is reported to have been eaten without harm and to be of an excellent flavor. I have had no opportunity to try it.

Lepiota rugulosa

Pileus thin, submembranaceous, broadly convex or nearly plane, umbonate, rugulose, widely striate on the margin, whitish: lamellae thin, narrow, close, free, whitish: stem short, equal, slightly silky, whitish, the annulus thin, persistent, white: spores elliptic, 7.5 μ long, 4 μ broad.

Pileus 12–20 mm. broad: stem about 2.5 cm. long, 2 mm. thick.

Moist grassy places under trees. Washington, D. C., July. Mrs. E. M. Williams. Perhaps in the fresh state the pileus is not as distinctly rugulose as when dry.

Agaricus brunnescens

Pileus thick, firm, hemispherical, becoming convex or nearly plane, fibrillose, sometimes slightly squamose, bay brown or brownish, the margin extending beyond the lamellae and appendiculate by the remains of the veil, flesh whitish or grayish white, unchangeable, taste agreeable: lamellae close, rounded behind, free but reaching the stem, at first whitish, then reddish pink, finally brown: stem short, silky, stuffed or hollow, whitish, the annulus thick, of a soft felty texture, persistent, whitish, often striated on the upper surface by impressions of the edges of the lamellae: spores broadly elliptic or subglobose, 6–8 μ long, 4–6 μ broad.

Pileus 5–10 cm. broad: stem 2.5–4 cm. long, 8–16 mm. thick.

Dump ground on deposits of manure and street scrapings. East Cambridge, Mass. September and October. Miss Helen M. Noyes.

The species differs from the common mushroom, *A. campester*, in its brown color, in its thicker and more persistent collar, its hollow stem and more rosy tint of the immature lamellae. The cavity of the stem is small. From *A. maritimus*, to which it has some points of resemblance, it may be separated by its darker color, its thicker and more persistent collar and by its flesh not assuming reddish hues where wounded.

Mr. G. B. Fessenden informs me that he found this mushroom seven years ago growing in soil made of the sweepings of cattle cars, but that he had not seen it since until this season. The plants are gregarious and grow in very rich loose and dryish soil composed of manure and sweepings of streets and cattle cars. They continue to appear for several weeks in succession or until cold weather stops their growth. They frequemtly develop fully beneath the surface of the ground. *A. maritimus* also has this same peculiarity. It is an edible species and is eagerly sought by Italians who are after them every day by 4 o'clock in the morning.

Stropharia irregularis

Pileus thin, fragile, subcampanulate, irregular, umbonate, glabrous, often rimose about the umbo and split on the thin wavy or irregular margin, whitish, grayish or yellowish, often white on the margin: lamellae close, dingy pink when young, becoming brown with age: stem slender, fragile, slightly floccose, hollow, often cracking transversely, shining, white, the slight annulus soon breaking into fragments and disappearing: spores elliptic, 6–7.5 μ long, 4–5 μ broad.

Pileus 2.5–5 cm. broad: stem 5–14 cm. long, 4–6 mm. broad.

Cespitose. Mountain pastures. Linden, Va. August. Mrs. E. M. Williams.

Boletus caespitosus

Pileus broadly convex or nearly plane, sometimes slightly concave by the elevation of the margin, even, brown or blackish brown, the margin often a little paler or reddish brown, flesh slightly tinged with red: tubes adnate or slightly decurrent, yellow, their mouths rather large, angular, concolorous: stem short, even, solid, glabrous, tapering upward, brown or reddish brown: spores oblong elliptic, 10 μ long, 5 μ broad.

Pileus 1–2.5 cm. broad: stem 2–2.5 cm. long, 4–6 mm. thick.

Cespitose. Virginia. August. R. S. Phifer.

A small species growing in tufts and referrable to the tribe *Subtomentosi*. The tubes retain their bright yellow color in the dried specimens.

Boletus subsanguineus

Pileus convex or slightly depressed in the center, glabrous, viscid, bright red or scarlet, flesh thick, firm but flexible, white, slowly changing to a pale brownish lilac on exposure to the air, taste slightly bitter: tubes very short, 2–4 mm. long, adnate but often separating from the stem with the expansion of the pileus, reddish, the mouths minute, stuffed at first, pinkish, then brownish yellow changing to a light brown where wounded: stem short, thick, uneven, often tapering downward, streaked with red, pale yellow at the top, white at the base, marked at the top by the decurrent walls of the tubes.

Pileus 2.5–10 cm. broad: stem 2.5–5 cm. long, 2–4 cm. thick.

Solitary, gregarious or cespitose. Under beech trees. West Philadelphia, Pa. August. C. McIlvaine.

This is a very showy species, easily recognized by its bright red viscid pileus and its short thick and uneven or somewhat lacunose stem. It is closely related to the European *B. sanguineus* With from which it is separated by its minute tubes, its uneven stem and the brownish hues assumed where wounded.

The spore characters of this and the four succeeding species are unknown, but the other characters are quite distinctive and apparently sufficient for the recognition of the species. The descriptions have been derived from colored figures and other data furnished by Mr. McIlvaine who says all are edible.

Boletus eccentricus

Pileus thick, firm, convex, irregular, glabrous, more or less lobed or wavy on the involute margin, gray or yellowish gray, flesh white, close grained, elastic, unchangeable, taste and odor farinaceous : tubes convex, depressed around the stem, not reaching the margin of the pileus, somewhat uneven or pitted on the surface, yellowish brown, the mouths subangular, at first concolorous, becoming reddish or reddish purple : stem eccentric, tapering downward, solid, uneven with short irregular shallow grooves or obscure reticulations, tinged with red at the top, grayish below, tinged with red or purple within at the base.

Pileus 5–10 cm. broad : stem 4–5 cm. long, 3–4 cm. thick at the top.

Sandy soil in grassy places in woods. Mt. Gretna, Pa. August and September.

The species is well marked by its eccentric stem, thick irregular pileus and the reddish or reddish purple mouths of the mature tubes. Mr. McIlvaine remarks that when it is cooked it is delicate and savory.

Boletus badiceps

Pileus firm, convex or somewhat centrally depressed when mature, dry, velvety, obliquely truncate on the margin, bay red or dark maroon color, flesh white, unchangeable, taste and odor mild, sweet, suggestive of molasses : tubes plane, adnate, white or whitish, becoming dingy with age, the mouths minute : stem equal or slightly swollen in the middle, radicating, glabrous, solid, brownish.

Pileus 4–8 cm. broad : stem 4–5 cm. long, 1.5–3 cm. thick.

Oak woods. West Philadelphia, Pa. August and September.

The truncate or beveled margin of the pileus is a striking feature in this species. It is about 4 mm. broad and as even as if cut with a knife. Sometimes the surface of the stem ruptures transversely just below the top, the liberated shreds above curling upward against the tubes and those below curving outward and downward. In mature plants brownish spots appear in the flesh of the pileus. "When cooked it is of high flavor and tender as kidney," C. McIlvaine.

Boletus crassipes

Pileus convex or centrally depressed, firm, dry, velvety, brown tinged with yellow, the wavy or lobed involute margin extending beyond the tubes, flesh lemon yellow, unchangeable, taste sweet, odor like that of yeast: tubes rather short, depressed around the stem, almost free, yellowish mottled with brown, the mouths minute, stuffed when young: stem stout, thick, sometimes swollen in the middle and sometimes bulbous, beautifully reticulated but the reticulations sometimes disappearing with age, orange yellow tinged with brown, flesh of a brighter yellow than that of the pileus.

Pileus 5–10 cm. broad: stem 6–8 cm. long, 2.5–3.5 cm. thick.

Oak woods. Mt. Gretna, Pa. August and September.

The thick, beautifully reticulated stem, the deep velvety brown color of the pileus and the yellow color of the flesh serve to distinguish this species.

Boletus fulvus

Pileus thick, convex or subcampanulate, dry, glabrous, rimose areolate, tawny yellow, the extreme margin dark brown, flesh spongy, tough, white, slowly assuming a reddish tint on exposure to the air: tubes rather long, ventricose, depressed around the stem and free or nearly so, greenish yellow, the mouths small, tawny yellow: stem rather long, often narrowed and striate at the top, dotted with brownish orange granules or points, radicating, tough, stuffed with greenish yellow fibers, colored like the pileus.

Pileus 5–7.5 cm. broad: stem 10–12.5 cm. long, 8–16 mm. thick.

Cespitose on decaying stumps. West Philadelphia, Pa. August. Mr. McIlvaine says that there were between 20 and 30 specimens on and about an old stump and that they were as attractive to the eye as a cluster of *Clitocybe illudens*.

Polyporus albiceps

Pileus tough, plane or slightly depressed in the center, even, glabrous, dry, opake, white without and within: pores short about 1 mm. long, minute, subrotund, decurrent, white, the thin dissepiments dentate on the edge: stem central or nearly so, subequal, glabrous, solid, pallid.

Pileus 2.5–5 cm. broad: stem 2.5–4 cm. long., 6–8 mm. thick.

Decaying wood buried in the ground under walnut trees. Sea beach, New Hampshire. Mrs. A. M. Hadley.

Stereum pulverulentum

Resupinate, hard, adnate, tuberculose, crowded, appearing as if confluent in a continuous stratum with the tubercles separated by narrow cracks, the surface pulverulent, pale clay color inclining to wood-brown.

Bark of paper birch, *Betula papyrifera.* Orono, Maine. October. F. L. Harvey.

The species is related to *Stereum frustulosum*, but the tubercles are more crowded, smaller and thinner than in that species and have no blackish margin. The pulverulence is more conspicuous on the larger and thicker ones.

Guepinia biformis

Pileus stipitate, at first erect and cupulate, then curved to one side, often split to the stem on one side and lobed on the margin, tough, gelatinous and tremelloid when moist, tapering downward into the stem, minutely granulose tomentose or subvelvety and grayish or dingy buff externally : the hymenium glabrous, even or with a few folds or ridges radiating from the base, reddish-brown : stems terete or compressed, tough or coriaceous, velvety tomentose, grayish or dingy buff, often seriately confluent at the base.

Pileus 6–12 mm. broad : stem 4–10 mm. long, 2–4 mm. thick.

Decaying wood of deciduous trees. Ames, Iowa. September. Miss Alice Hess.

The species is apparently related to *G. cohaerens* Mig., *G. cochleata* B. & Br. and *G. palmiceps* Berk., from all of which it differs in color. The hymenium when moist resembles raisins in color and when turned to one side it is strongly suggestive of the apothecia of some species of *Peltigera.* The tomentum of the stem is similar to that of the exterior surface of the pileus.

Hypomyces volemi

Subiculum very thin, whitish or isabelline : perithecia minute, brown, nestling in the subiculum : asci very slender, 100–125 μ long, sporiferous part, 4 μ broad : spores oblong fusiform, 12–15 μ long, 4 μ broad, commonly binucleate.

Parasitic on the hymenium of *Lactarius volemus.* Pennsylvania. Charles McIlvaine.

The hymenium of the host plant is changed in appearance by the parasite, but the stem and upper surface of the pileus remain unchanged.

Cordyceps nigriceps

Club subovate, obtuse, minutely papillose from the slightly prominent perithecia, greenish black when fresh and moist, black when dry, about 12 mm. long and 10 mm. broad, the margin free and extending below the attachment to the stem: stem equal, solid, pale cadmium yellow toward the base, suffused with bluish green above, pale yellow at the top, white within, 7–8 cm. long, 5–6 mm. thick: asci 280–350 μ long, 12 broad: spores 8, filiform, hyaline, separating into cylindric segments, each 20–40 μ long, 4 μ broad, generally containing 3–6 minute nuclei.

Among fallen pine leaves. Saco, Maine. November. Charles L. Fox.

The substance on which the specimens grew was not ascertained, but probably it was some subterranean fungus. The species is remarkable for the pileate character of the club by which it may be distinguished from its allies. It resembles *Cordyceps capitata* but may be readily distinguished from it by the free margin of the club and the more narrow spore segments. In drying the green hues disappear.

Macrophoma curvispora

Perithecia minute, numerous, erumpent, surrounded and partly covered by the remains of the ruptured epidermis, black: spores oblong, curved, colorless, 15–17 μ long, 4 μ broad, supported on sporophores as long as or a little longer than the spores.

Bark of apple trees. British Columbia. Collected by R. M. Palmer. Communicated by William Paddock.

The fungus seems to cause the bark of the branches to loosen and crack.

Fistulina hepatica monstrosa n. var.

Subglobose, supported on a short stem or stem-like base, the external surface entirely covered with tubules 2–4 mm. long.

Pennsylvania. C. McIlvaine. In color and texture resembling the common form, but Mr. McIlvaine informs me that there is nothing in the position or place of growth of the specimens to account for their peculiar character. They are 3–4 inches in diameter.

An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXVIII

By H. H. Rusby

(Continued from Bull. Torr. Club, **26**: 200 10 Ap. 1899.)

Cestrum sparsiflorum Britton, sp. nov.

Younger portions of the stem sparsely puberulent; branches elongated, straight and rigid: petioles 5 mm. long, narrowly margined: blades 6–12 cm. long, 2–4 cm. broad, oblong, acuminate at both ends, the point slender and very acute, entire, dark-green, thin but rigid, the midrib channeled above, underneath terete and prominent, like the 10–12 pairs of very slender, strongly upwardly arched secondaries, which connect near the margin: peduncles solitary from the axils, together with the rachis about 2 or 3 cm. long, slightly recurved, angled, several-flowered, the flowers more or less secund, sessile upon small nodular bases: calyx 5 mm. long, 2 or 3 mm. broad, campanulate, lobed one-fourth of the way, the lobes triangular-acuminate and acute: corolla-tube many-nerved, 2 cm. long, at the base 1 mm., at the summit 2.5 mm. broad, the base loosely enclosed in the calyx, the lobes 6 mm. long, triangular-ovate: fruit not seen.

Yungas, 6000 ft., 1885 (no. 816).

Sessea dependens R. & P. Fl. Per. **2**: 9. *pl. 116.* Unduavi, 10000 ft., Oct., 1885 (no. 2625). The same as Mandon's no. 450.

Fabiana imbricata R. & P. Fl. Per. **2**: 12. *pl. 122.* Near Valparaiso, Chili, June, 1885 (no. 825). Local name "Pichi."

Nicotiana undulata R. & P. Fl. Per. **2**: 16. Mapiri, 5000 ft. April, 1886 (no. 822). The same as Bang's no. 1858.

Nicotiana tomentosa R. & P. Fl. Per. **2**: 16. Yungas, 6000 ft., 1885 (no. 2435). Grows 12 to 15 feet high, the leaves very large and with a strong odor of tobacco.

Nicotiana pandurata Dunal; DC. Prod. 13: *pl. 569.* Beni River, July, 1886 (no. 821).

Nicotiana glauca Grah. Bot. Mag. *pl. 2837.* Vic. La Paz, 10000 ft., April, 1885 (no. 813). Grows on banks of streams; the leaves used as a narcotic.

Nicotiana Rusbyi Britton, sp. nov.

Glandular-hairy, the leaves shortly and finely soft-tomentose; stems stoutish, flexuous, erect: petioles (largest leaves not present) 2–4 cm. long, stout, margined: blades .8–2.5 dm. long, .3–1.2 dm. broad, ovate, the base abruptly contracted into the petiole, short-pointed and acute at the apex, entire, thick and rigid, the venation slender, not prominent except the midrib underneath: inflorescence widely and loosely paniculate (in the specimens 3 dm. long and broad), the branchlets subulate-bracted: pedicels short, becoming about 1 cm. long and erect in fruit: calyx in flower 5 mm., in fruit 1 cm. long, campanulate, lobed about one third of the way, the lobes triangular, acute, the sinuses about the same: corolla 1.5–2 cm. long, about 5–7 mm. broad, lightly curved and ventricose, apparently pale-yellow, the lobes about 5 mm. long, triangular-ovate: capsule elongated-globular, about 7 mm. long, or, after opening, the valves nearly 1 cm. long.

Yungas, 4000 ft., 1885 (no. 2434). The same as Bang's no. 1182.

Nierembergia pulchella Gill. ex Miers; Hook. Lond. Journ. Bot. **5**: 173. 1846. Vic. La Paz, 10000 ft., April, 1895 (no. 1982). The same as Mandon's, no. 1476.

Schizanthus pinnatus R. & P. Fl. Per. **1**: 13 f. 17. Near Valparaiso, Chili, June, 1885 (no. 1023).

Brunfelsia latifolia (Pohl.) Benth. in DC. Prod. **10**: 199 (*Franciscea latifolia* Pohl. Pl. Bras. Ic. 3. *pl. 2*) Mapiri, 5000 ft., April, 1886 (no. 621) and Beni River, July, 1886 (no. 2122).

Brunfelsia hydrangeaeformis (Pohl.) Benth.; DC. Prod. **10**: 108 (*Franciscea hydrangeaeformis* Pohl Pl. Bras. Ic. **1**: 7. *pl. 7*.) Yungas, 4000 ft., 1885 (no. 1030), Mapiri, 2500 ft., May, 1876 (no. 2611) and Beni River, July, 1886 (no. 862).

SCROPHULARIACEAE.

Fagelia chelidonioides (H.B.K.) Kuntze Rev. Gen. Pl. **2**: 459. Unduavi, 8000 ft., Oct., 1885 (no. 1056).

Fagelia integrifolia (Murray) Kuntze Rev. Gen. Pl. **2**: 460 (*Calceolaria integrifolia*) Murr Syst. ed. 13, 64. Near Valparaiso Chili, June, 1885 (no. 1051).

Fagelia polifolia (Hook.) Kuntze Rev. Gen. Pl. **2**: 460 (*Calceolaria polifolia*) Hook. Bot. Mag. *pl. 2897*. Near Valparaiso, Chili, June, 1885 (no. 1054).

Fagelia teucrioides (Griseb.) (*Calceolaria teucrioides* Griseb. Goett. Abh. **19**: 212. 1874 ?). Vic. La Paz, 10000 ft., Apr., 1885 (no. 1058). The flowers are distinctly larger, and it will very likely prove to be an undescribed species.

Fagelia virgata (R. & P.) Kuntze Rev. Gen. Pl. 460 (*Calceolaria virgata* R. & P. Fl. Per. **1**: 20 *pl. 31*). Sorata, 8000 ft., Feb., 1886 (no. 1060).

Fagelia canescens (Willd.) Kuntze Rev. Gen. Pl. **2**: 459 (*Calceolaria canescens* Willd. ex Roem. & Schult. Syst. Mant. **1**: 165). Vic. La Paz, 10000 ft., Apr., 1885 (no. 1053). This species, with several others, forms a dense mass of low shrubbery on gravelly banks, resembling a growth of *Vaccinium*.

Fagelia scabra (R. & P.) Kuntze Rev. Gen. Pl. **2**: 460 (*Calceolaria scabra* R. & P. Fl. Chil. **1**: 19. *pl. 59*). Yungas, 6000 ft., 1885 (no. 1057).

Fagelia Boliviana Britton, sp. nov.

Puberulent throughout: branchlets elongated, erect or ascending, coarsely angled: petioles .5–1 cm. long, broad, weak: blades 4–6 cm. long, 2–3 cm. broad, ovate, rounded at the base, acuminate and acute at the apex, rather coarsely crenate, the yellowish midrib and 7–9 pairs of strongly ascending secondaries rather prominent underneath: cymes 5–8 cm. broad, loosely about 10-flowered: the peduncles 2–5 cm. long: pedicels 1–1.5 cm. long, stoutish, ascending: calyx about 7 mm. long, foliaceous, the ovate obtuse lobes not very unequal: corolla (as pressed) about 2 cm. long and broad, bright yellow: style 6 mm. long, stoutish, slightly tapering: the stigma capitate, small.

Yungas, 6000 ft., 1885 (no. 1052).

Alonsoa acutifolia R. & P. Syst. Veg. 153. Sorata, 8000 ft., Feb., 1886 (no. 1084).

Alonsoa incisaefolia R. & P. Syst. Veg. 154. Sorata, 8000 ft., Feb., 1886 (no. 1086). The same as Mandon's 464.

Galvesia Limensis Dombey ex. Chav. Monog. Antirrh. 180, Payta, Peru, Feb. 6, 1883 (no. 2504).

Leucocarpus alatus G. Don.; Sweet Brit. Fl. Gard. **5**: *pl. 124*. Yungas, 6000 ft., 1885 (no. 2423).

Mimulus glabratus H.B.K. Nov. Gen. et Sp. **2**: 370. Sorata, 10000 ft., Feb., 1886 (no. 1096).

Stemodia Chilensis Benth. Bot. Reg. *pl. 1470*. Near Valparaiso, Chile, June, 1885 (no. 1072).

Monniera procumbens (Mill.) Kuntze, Rev. Gen. Pl. **2**: 463 (*Erinus procumbens* Mill. Gard. Dict. ed. 8, n. 6. *Herpestis chamaedryoides* H.B.K. Nov. Gen. et Sp. **2**: 369). Falls of Madeira, Brazil, Oct., 1886 (no. 1094).

Forenia parviflora Buch.-Ham. ex Wall. Cat. no. 3958. Falls of Madeira, Brazil, Oct., 1886 (no. 1388).

Vandellia diffusa L. Mant. 89. Guanai, 2000 ft., May, 1886 (no. 2566), and Falls of Madeira, Brazil, Oct., 1886 (no. 1775). The drying plant has the odor of tobacco.

Ilysanthes gratioloides (L.) Benth.; DC. Prod. **10**: 419 (*Capraria gratioloides* L. Syst. ed. X, 1117). Guanai, 2000 ft., May, 1886 (no. 2566).

Sibthorpia nectarifera Wedd. Chlor. And. **2**: 111. Sorata, 13000 ft. Feb., 1886 (no. 2477). The same as Mandon's 471.

Sibthorpia pinchinchensis H.B.K. Nov. Gen. et Sp. **2**: 390. *pl. 176* (?) Unduavi, 8000 ft., Oct., 1885 (no. 1245). The same as Mandon's 470.

Scoparia pinnatifida Cham., in Linnaea **8**: 22. 1833. Falls of Madeira, Brazil, Oct., 1886 (no. 2603).

Scoparia dulcis L. Sp. Pl. 116. Mapiri, 5000 ft., Apr., 1886 (no 1817), and falls of Madeira, Brazil, Oct., 1886 (no. 1374).

Ourisia chamaedrifolia Benth. in DC. Prod. **10**: 493. Sorata, Bolivia, 10000 ft., Feb., 1886 (no. 1104). Also collected near Unduavi.

Veronica peregrina L. Sp. Pl. 14. Sorata, 10000 ft., Feb., 1886 (no. 1854).

Gerardia rigida Gill. ex Benth. in Hook. Comp. Bot. Mag. **1**: 206. 1835 (?). The long recurved calyx-teeth are as in *G. genistillifolia*, but the stem is quite different. Vic. La Paz, 10000 ft., Apr., 1885 (no. 1079). The same as Bang's no. 2530 and no. 2854.

Gerardia lanceolata (R. & P.) Benth. in Hook. Comp. Bot. Mag. **1**: 207. 1835 (*Virgularia lanceolata* R. & P. Syst. Veg. 161). Unduavi, 8000 ft., Oct., 1885 (no. 1078) the same as Mandon's no. 479. No. 1077, from Sorata, 10000 ft., Feb., 1886, the same as Pearce's collection at Muña, 8000–9000 ft.

Gerardia brevifolia sp. nov.

Foliage lightly scabrous, the corolla pubescent: stems stout, erect and erect-branched, terete, the branchlets quadrangular, densely leafy: leaves sessile, .75–2 cm. long, 3–27 mm. broad, lance-oblong, obtuse at the base, the apex blunt but apiculate, entire, very thick, the midrib very stout and prominent underneath, the broader 3-nerved: pedicels 5–8 mm. long, stout: calyx thick, about 1.25 cm. long, lobed about half way, the tube campanulate, the lobes triangular, acute, the sinuses rather broader, obtuse: corolla-tube 2.5 cm. long, 1 cm. broad, infundibular-campanulate, the lobes 7 mm. long, the 3 lower 6 or 7 mm. broad, the margin rounded, obscurely sinuate, the 2 upper united: stamens not reaching to the base of the corolla-lobes, the filaments adnate to the lower fourth of the corolla, the anthers 4 mm. long: style about equaling the stamens: capsule about 1 cm. long, broadly oval or subglobose.

Yungas, 6000 ft., 1885 (no. 1080). This is the same as Pearce's from Unduavi, 10000 ft., July, 1866. No. 1082, from Sorata, 8000 ft., Feb., 1886, the same as Mathews' no. 3137, is probably of this species also.

Castilleia communis Benth.; DC. Prod. **10**: 529. Sorata, 10000 ft., Feb., 1886 (no. 1097). The same as Mandon's no. 475.

Castilleia pumila (Benth.) Wedd. Chlor. And. **2**: 119 (*Castilleia nubigena pumila* Benth.; DC. Prod. 10: 534). Sorata, 13000 ft., Feb., 1896 (no. 1088).

Castilleia fissifolia L. F. Suppl. 293. Sorata, 10000 ft., Feb., 1886 (no. 1087).

Bartsia laxiflora Benth.; DC. Prod. **10**: 547. Sorata, 10000 ft., Feb., 1886 (no. 1089). The same as Bang's 691. All these *Bartsias* grow on open, grassy hillsides, especially in wet places.

Bartsia patens Benth.; DC. Prod. **10**: 546. Unduavi, 8000 ft., Oct., 1885 (no. 1090). The same as Bang's 2028.

Bartsia inaequalis Benth.; DC. Prod. **10**: 545. Sorata, 10000 ft., Feb., 1886 (no. 1091). The same as Mandon's 480 and Bang's 668.

Bartsia breviflora Benth.; DC. Prod. **10**: 545. Sorata, 13000 ft., Feb., 1886. The same collected by Pearce at Peluchuco.

Bartsia hispida Benth.; DC. Prod. **10**: 547 (?) Sorata, 10000 ft., Feb., 1886 (no. 1083). This bears some resemblance to *B. subincisa*. No. 1349, from Sorata, 10000 ft., may be the same, but my specimen is fragmentary.

LENTIBULACEAE

Utricularia alpina Jacq., Enum. Pl. Carib. 11. Mapiri, 8000 ft., May, 1886 (no. 2765). The same collected by Bang.

Utricularia pusilla Vahl. Enum. **1**: 202. Yungas, 4000 ft., 1885 (no. 1357).

Pinguicula antarctica Vahl. Enum. **1**: 192 (?) Unduavi, 8000 ft., Oct., 1885 (no. 1356). Collected at the same place by Pearce. Grows on wet mossy banks and rocks.

GESNERIACEAE

Achimenes Rusbyi Britton, Mem. Torr. Club, **6**: 95. Yungas, 4000 ft., 1885 (no. 1102).

Achimenes gracilis Britton, sp. nov.

Sparsely strigose; stems 3–5 dm. long, simple, erect or ascending, slender and weak, coarsely angled and sulcate, from a finely many-branched root: leaves opposite, those of the pair somewhat unequal; petioles .4–1 cm. long, weak: blades .6–1 dm. long, 2.5–3.5 cm. broad, oblong, inaequilateral, narrowed or acuminate at the base, rather abruptly short-pointed and acute at the apex, entire, very thin, deep green above with the very slender venation inconspicuous, pale underneath with the midrib and about 6 pairs of very strongly ascending secondaries slightly prominent: pedicels 5–8 cm. long, filiform: calyx-tube turbinate, 4–5 mm. long, the lobes narrowly linear, the longest nearly 1 cm. long: corolla crimson, the tube 2 cm. long, campanulate, somewhat ventricose, the spreading limb nearly 2 cm. broad: stamens equaling the corolla-tube or slightly exserted, the filaments very slender.

Yungas, 6000 ft., 1885 (no. 2421). Dr. Britton thinks that Pearce's plant, collected at Los Piños, 6000 ft., Mar., 1864, is of this species.

Seemannia ternifolia Regel. Gartenfl. **4**: 183. *pl. 126.* 1855. Unduavi, 8000 ft., Oct., 1885 (no. 1101). The same as Matthews' no. 1335.

Seemannia sylvatica (H.B.K.) Hanst. Linnaea **29**: 540. 1857–8 (*Gesnera sylvatica* H.B.K. Nov. Gen. et Sp. **2**: 393. Yungas, 4000 ft., 1885 (no. 1100). The same also collected by Bang.

Koellikeria argyrostigma (Hook.) Regel. Fl. 250. 1848. Mapiri, 2500 ft., May, 1886 (no. 2658).

Diastemma purpurascens sp. nov.

Sparsely to very sparsely coarse-pilose throughout: stems 4–7 cm. high, tufted, erect, sub-simple, but appearing as though branched by the widely spreading pedicels: petioles 4–6 mm. long, broad, weak: leaves deep purple, 1.5–4 cm. long, 1–2 cm. broad, ovate, abruptly short-produced at the base, blunt at the apex, coarsely sinuate at the margin, thin, the midrib and about 4 pairs of secondaries very prominent underneath: pedicels 1–2 cm. long, thickened upward, weak: calyx-tube turbinate, in flower 3 mm. long by 2 mm. broad, the lobes about equal, rotund ovate, narrowed at the base, spreading or reflexed, herbaceous, both the tube and the lobes greatly enlarging in fruit: corolla nearly 1 cm. long, the tube campanulate, strongly declined or deflexed at the base, the mouth oblique, 7 or 8 mm. broad.

Unduavi, 8000 ft., Oct., 1885 (no. 2604), and Yungas, 4000 ft., 1885 (no. 1984).

Isoloma Sprucei Britton, Mem. Torr. Club, **6**: 97. Mapiri, 5000 ft., Apr., 1886 (no. 2151). The same as Bang's no. 1541 and Spruce's no. 5841.

Isoloma flexuosa sp. nov.

Ferruginous-tomentose, the upper leaf-surfaces coarsely short-strigose: stems ascending, very weak and flexuous, obtusely angled: petioles 1–3 cm. long, weak, broad: blades 4–8 cm. long, 2–5 cm. broad, ovate, rounded at the base, acute at the apex, crenate, thin, pale, the venation coarse, strongly prominent underneath, the secondaries about 10 pairs, strongly incurved, the tertiaries meeting about midway between them: pedicel 2 or 3 cm. long, weak, shaggy: calyx-tube 5 mm. broad, sub-hemispherical, the lobes nearly 1 cm. long, foliaceous, ovate, with contracted base, acute: corolla red, strongly declined, very oblique at the base, less so at the mouth, 1.75 cm. long, 1 cm. broad, as pressed, campanulate, with highly contracted mouth, the short lobes unequal, erect-spreading: anthers all coherent, the quadrilateral mass about 3.5 mm., square: style nearly 1.5 cm. long, thickish, pilose, the stigma slightly dilated, blunt: disk nearly as long as the ovary, of five separate, thick, fleshy glands, two of them larger and 2-lobed.

Yungas, 6000 ft., 1885 (no. 2424).

Isoloma (?) urticifolia sp. nov.

Coarsely pilose, the older portions sparsely, the younger densely, or somewhat tomentose: stems thick, but weak, decumbent or ascending, pale, coarsely angled: petioles 3–5 cm. long, broad and weak, much dilated at the insertion: blades .5–1 dm. long, 2.5–5 cm. broad, ovate, mostly inaequilateral, the base rounded but abruptly slightly produced into the petiole, acute and short-pointed at the apex, rather coarsely serrate, very thin, pale, the midrib and 9 or 10 pairs of very slender secondaries lightly prominent underneath: cymes mostly 3–5-flowered, the filiform pedicels 2 or 3 cm. long: calyx 5 mm. long, parted almost to the base, the lobes ovate, obtuse, foliaceous, widely spreading: corolla 1.5 cm. long, .75 cm. broad, as pressed, red, cylindraceous, lightly dilated about the middle, the base very oblique, the lobes about 2 mm. long, unequal, broad, rounded, erect-spreading: stamens about equaling the corolla, the filaments slender, the light-yellow anthers about 1.25 mm. long, coherent in pairs, the cells parallel, truncate at apex, cordate at base: ovary broadly ovoid: style stoutish, 1 cm. long, the stigma dilated, concave: disk of 3 oblong small glands.

Mapiri, 2500 ft., May, 1886 (no. 2422).

This species varies greatly from the genus in the form of its stigma, more like that of *Gesnera*, and in the absence of two lobes of the disk.

Kohlerianthus Fritschii (Rusby) Fritsch, Pflanzenfam., Nacht. 300. Yungas, 6000 ft., 1885 (no. 2438).

Alloplectus dichrons DC. Prod. 7: 546? Mapiri, 2500 and 5000 ft., Apr. and May, 1886 (nos. 2484 and 2700). Both specimens are very imperfect. They are the same as Spruce's no. 185, placed under *A. Patrisii* in Herb. Kew.

DIPLOLEGNON gen. nov.

Calyx free, laterally compressed, gibbous, colored, 5-parted, the segments ample, unequal, entire, the margins of the lower replicate. Corolla-tube cylindraceous, the base oblique, the mouth slightly contracted, the limb very short, 2 of the lobes erect, rounded, enclosing the other three, which form an inner cartilaginous-thickened series, their apices strongly induplicate. Filaments dilated below, monadelphous and adnate to the corolla at the base, the anthers coherent in pairs, the cells parallel, distinct; staminodium not apparent. Disk of two large glands, the anterior somewhat smaller. Ovary superior, ovoid, the style shorter than the corolla, stout, sigmoid-curved, the stigma large, strongly 2-lobed. Suffruticose, tomentose, the leaves opposite, nearly equal, the flowers fascicled in the axils. Plant having the habit of *Alloplectus*, to which it is closely related.

Name in allusion to the double rim or margin of the corolla.

Diplolegnon Riceanum sp. n.

Densely short-velutinous, the upper leaf-surfaces scabrous; stems (only the uppermost portions seen) light-brown, stout, coarse and weak: petioles 2 to 4 cm. long, very stout; blades 1.25 to 2.25 dm. long, 5 to 8 cm. broad, oblong to ovate: blunt at the base, very short-pointed and acute at the apex, finely and very shortly serrate, thickish but flaccid, dark-green above, ferruginous underneath, the venation lightly prominent on both sides, rather more so above, the midrib and 12 to 14 pairs of slightly ascending secondaries coarse and broad: pedicels .5 to 1 cm. long, very stout, nerved: calyx nearly 2 cm. long, purple, strongly nerved, parted nearly to the base, the lower lobe keeled, its edges strongly reflexed, all broadly ovate, acute, hirsute: disk of two scutellate lobes, thick and fleshy: ovary 5 mm. long, ovoid, compressed: style 1 cm. long, the stigma 3 mm. broad: corolla 2.5 cm. long, 1 cm. broad, thick, red, hirsute, a little broadened upward: stamens about equaling the corolla, the blackish connectives greatly enlarged.

Yungas, 6000 ft., 1885 (no. 2152).

Species dedicated to Dr. Charles Rice, Chairman of the Revision Committee of the U. S. Pharmacopoeia, who has kindly suggested the generic name.

Alloplectus grandifolius Britton, sp. nov.

Ferruginous-tomentose, the upper leaf-surfaces coarsely strigose: stems very stout, weak: only the uppermost leaves seen: the petioles 3–5 cm. long, very broad, the blades 2–3 dm. long, 1–1.5 dm. broad, oval, varying to ovate or obovate, blunt or rounded at the base, obtuse at the apex, thin, dark-green and rough above, with the venation scarcely prominent, deep-purple underneath, with the very broad, coarse midrib and 10–12 pairs of coarse, moderately upcurved secondaries prominent, the margin irregularly serrate-dentate: pedicels 2 or 3 cm. long, stout, weak: calyx deep-purple, 2 cm. long, divided nearly to the base, the lobes obovate, acutish, coarsely serrate-dentate, strongly veined: ovary 5 mm. long and about as broad, strongly and sharply ridged, hirsute when young: style 2 cm. long, pilose: one lobe of the disk prominent, ovate, rounded at the apex, the others inconspicuous and very irregular: corolla not seen.

Mapiri, 2500 ft., May, 1886 (no. 2483).

Columnea Boliviana Britton ex-Rusby, Mem. Torr. Club, 4: 238. Yungas, 4000 ft., 1885 (no. 1352), 6000 ft. (no. 2487) and Mapiri, 2500 ft., May, 1886 (no. 2488).

Columnea sp. Yungas, 6000 ft., 1885 (no. 2153).

Besleria montana Britton ex-Rusby, Mem. Torr. Club, 4: 240. Yungas, 6000 ft., 1885 (nos. 2150 and 2425). The same as Spruce's no. 4564 from Tarapota, *fide* Britton.

Besleria Sprucei Britton, sp. nov.

Stems ascending, weak, very coarsely angled, hirsute with spreading yellowish hairs, the internodes 5 or 6 cm. long, only the upper seen: petioles 1–3 cm. long, coarse and broad: blades 1–2 dm. long, 6–8 cm. broad, obovoid, inaequilateral, acuminate at the base, abruptly and acutely short-pointed, finely and sharply serrate, coarsely strigose, very pale underneath, the midrib coarse and broad, the secondaries 10 to 12 pairs, strongly incurved; peduncles 1.5–2 cm. long, 5–7-flowered: pedicels about 1 cm. long, thickened upward: calyx-tube short-crateriform, the lobes about 3–5 mm. long, triangular, ovate, acute: corolla 1–1.5 cm. long, the tube lightly contracted at about the middle, abruptly ventricose above, the lobes short, broad spreading: anthers semi-circular, the connective broad, dark, concave: ovary 4 mm. long, stout style 1 cm. long, both pilose, especially the former: disk cupulate, 1 mm. long, the margin entire or very slightly sinuately lobed.

Mapiri, Bolivia, 2500 ft., May, 1885; grows in deep woods (no. 2149). The same as Bang's no. 2537 and 2538.

Besleria pauciflora sp. nov.

Coarsely pilose, the youngest portions somewhat ferruginous-tomentose: stems stout, weak, coarsely quadrangular, the internodes about 5 cm. long: petioles 3–5 cm. long, tomentose: blades 1–1.5 dm. long, 5–7.5 cm. broad, oval, very abruptly contracted into the petiole, distantly short-serrate, thin, deep-green and sparsely pilose above, pale and pubescent underneath, with the midrib and about 8 pairs of secondaries lightly prominent: peduncles 1 to few-flowered, about 5 cm. long, erect, slender: calyx about 1 cm. long, the tube sub-hemispherical, the lobes lance-ovate, acuminate and acute: corolla light-red, nearly 2 cm. long, the tube ventricose above the middle, the lobes about 2 mm. long, broad, rounded, strongly reflexed: anthers cordate, 1 mm. long, 1.5 cm. broad, with a broad, dark connective: style 1 cm. long, stout, flattened, thickened upward: stigma nearly as broad as the anthers, strongly 2-lobed: ovary 5 mm. long, broadly ovoid: disk very short, interrupted upon one side to form 2 small lobes, the remainder inclined to be 3-lobed.

Mapiri, 2500 ft., May, 1886 (no. 2437).

New Plants from Wyoming.—XI

BY AVEN NELSON

Potentilla Wyomingensis

Root deep set and woody: caudex densely caespitose; its branches thick and closely covered with brown scales (the remains of old leaves): stems numerous, bearing 1–3 small leaves, pubescent, 1.5–2.5 dm. high: leaves crowded on the crown, silky pubescent, more sparsely so on the upper surface, usually some of them glabrate, pinnate, 5–10 cm. long: leaflets 13–19, irregularly disposed on the channelled rachis and with smaller oblong-linear ones interspersed, crowded toward the apex, the lower 3–5-fid, the upper with more numerous pinnate segments, the segments oblong to linear: cyme irregular, open, 3–9-flowered, rarely 13; pedicels spreading, 1–4 cm. long: hypanthium hirsute, in fruit 5–7 mm. in diameter: bractlets small, oblong-linear, much shorter than the ovate-lanceolate sepals: petals yellow, very broadly obovate, retusely truncate at summit: stamens 20: pistils 15–20.

This species belongs to the section Multijugae and finds its affinity with *P. pinnatisecta* (Wats.) Aven Nelson, though it is a much larger plant with more numerous and much more finely dissected leaflets and more spreading habit. It is sub-alpine while *P. pinnatisecta* is distinctly alpine.

First collected in fruit only, on a grassy north slope near the highest summits of the Seminole Mountains, by Elias Nelson, July 21, 1898, no. 4916. Better specimens secured by the writer in an exactly similar location on Druid Peak, in the Yellowstone Park, July 12, 1899, no. 5781, may be cited as typical of this species.

Potentilla jucunda

Stems usually several, green, obscurely appressed-pubescent rather slender, nearly erect, simple except for the corymbosely-branched, open cyme: stipules lanceolate, acute, entire; basal leaves several to many, digitately 5–7-foliate, greatly variable in size, on slender petioles, 5–20 cm. long; leaflets 4–7 cm. long, from narrowly obovate to oblanceolate, coarsely serrate, the teeth extending nearly half way to the midrib, green on both sides, nearly glabrous above, lightly pubescent beneath: stem leaves smaller and shorter petioled, the uppermost sessile with narrow leaflets: cyme many-flowered, loose and open: hypanthium softly pubescent, in fruit 1 cm. in diameter: bractlets linear-lanceolate, a little shorter than the broadly lanceolate sepals: corolla large: petals broadly obcordate, 8–10 mm. long, distinctly surpassing the bracts and sepals.

This member of the *Graciles* section is to be compared with *P. etomentosa* Ryd. It is separated from that by its slender habit, differences in leaflets, in bracts and pubescence, and by larger flowers with petals decidedly surpassing the sepals. In some respects it suggests *P. dissecta glaucophylla*, but is a much larger and more nearly erect plant. Collections of it are Green Top, June 28, 1897, no. 3223*a*, and Pole Creek, July 22, 1897, no. 3420, both localities in the Laramie Hills.

✓Erigeron luteus

Densely tufted on a multicipital caudex: leaves closely crowded on the crowns, all narrowly linear with slightly tapering, petiole-like base, sub-cinereous with a minute pubescence, 3–5 cm. long: stems monocephalous, simple, one only from each crown, scape-like but bearing 2 or more short leaves below, these obscured by the numerous, fascicled crown leaves, the peduncular portion usually with one small bract, from barely exceeding the leaves to about twice as long: heads 6–8 mm. high, the involucral bracts linear, acutish, somewhat unequal and in two rows, rather shorter than the disk: rays 30–40, a pure yellow, rather broad and short, the ligule only 3–4 mm. long: pappus in two series, the outer of very short, inconspicuous bristles; the inner bristles rather sparse and coarse, nearly as long as the tube of the disk corollas: akenes minutely pubescent.

A distinctly yellow *Erigeron* is somewhat anomalous. Two collections of this show it constantly and strikingly so. It is true that Dr. Gray, in Syn. Fl. 213, admits some pure yellow forms into his *E. peucephyllus* but those are admitted into that species as exceptions. The localities and colors as there given would lead one to believe that the original of that species had pale blue rays and came from British Columbia. This in connection with the fact that *E. peucephyllus* is a larger plant, with coarser and much taller and more leafy stems, with sometimes 2–3 heads, coarser pubescence, larger and fewer rays, etc., leads me to think that these yellow Rocky Mountain forms may best stand as a species. The characterization of *E. peucephyllus* as densely caespitose on the enlarged crown of the caudex would be thoroughly diagnostic, but *E. luteus* has a caudex that is itself much branched and caespitose.

Collected on a stony, gravelly hillside near Junction Butte, no. 5741, and on gravelly bars on Soda Butte Creek, no. 5852; both from Yellowstone Park, July 9, 1899.

Artemisia rhizomata

Perennial from rather slender, horizontal, semi-woody rhizomes, white or grayish tomentose throughout: stems rather numerous, slender, ascending or nearly erect, simple but for short foliose shoots in the axils of the leaves: leaves entire (rarely incised), linear-oblong to lanceolate, 2–4 cm. long: those of the short axillary shoots crowded and much smaller, only 1–2 cm. long: inflorescence paniculate, consisting of a succession of axillary, spike-like, nearly simple racemes which are crowded and naked above, the lower axillary shoots mostly sterile but sometimes all floriferous: heads oval or campanulate, about 4 mm. high and 20 flowered, of which nearly half are female, some of the disk flowers apparently not maturing akenes: akenes oblong, smooth, about 1.5 mm. long.

The only species in this range with which this is comparable is *A. Ludovicana*, but the habit and leaf characters, and its rather unusual inflorescence, clearly separate it. Its rhizomes, too, are peculiar. *A. Ludoviciana* occurs on dry ravine banks among the hills, while this is found on low saline flats adjacent to streams. First collected on the Sweetwater, Sept. 9, 1894, no. 1181, and distributed as *A. Mexicana* Willd., though to this it bears little resemblance. Since collected at Laramie also.

Artemisia rhizomata pabularis

More slender than the species with more numerous, erect stems: the more slender rhizomes freely spreading just below the surface of the soil: leaves crowded, nearly linear, more or less incisely toothed at apex, 3–5 cm. long: the axillary, spicate flower clusters shorter and more crowded: flowers fewer (about 15) nearly all hermaphrodite.

This is probably a good species, but as I have but one collection of it, it may stand as a variety until it has again been studied in the field. It was secured in the Red Desert, near Creston, Aug. 29, 1897, no. 4426, in a saline draw, where it was growing freely intermingled with the grasses (*Agropyron* sp.). In a region in which the *Artemisias* constitute an appreciable part of the forage, it would seem that this must be the best, whether as winter feed on the ground or cut and cured with the grasses.

Artemisia paucicephala

Tufted and matted, the long, woody rhizomes intricately interlaced and bearing numerous, fibrous roots: thinly but permanently silvery-tomentose throughout: stems numerous, leafy to the summit, erect, simple or sparingly branched, 2–4 dm. high: leaves 4–8 cm. long, mostly entire, linear to lanceolate, some with a broad, 3–5-cleft apex, nearly all with a narrowed, petiole-like base, only a few of the uppermost reduced and bract-like: heads few, racemosely disposed on the main stem and its slender branches (if any), rather large, sessile or short pedicelled, broadly campanulate, about 5 mm. in diameter (40–60 flowered); involucral bracts oval or ovate, scarious margined: the pistillate flowers few, very slender, with linear-clavate styles; the hermaphrodite with spreading recurved styles and penicillate stigmas protruded between the lobes of the corolla: corolla sparsely resinous dotted, mainly on the tube.

This has affinities with both *A. Ludoviciana* Nutt. and *A. Natronensis* Aven Nelson but may at once be distinguished by its tufted caespitose habit, its low, erect stems, its different leaves and few, many-flowered heads.

Collected near Yellowstone Lake, on the banks of a tributary creek, where occasional mats of it were to be found; no. 6344, Aug. 6, 1899.

Artemisia gracilenta

Tufted perennial, from a deep-set caudex whose numerous branches are spreading-rhizomatous and give rise to numerous, fibrous roots: white tomentose throughout: stems herbaceous, slender, strict, erect, 4–8 dm. high: leaves numerous, sessile by a narrow base, 3–5 cm. long, pinnately parted; the 5 or more divisions linear, widely divergent and often more or less cleft towards the apex, 1–2 cm. long; the lower bracts similar but smaller, gradually passing into the small, linear, entire ones of the summit: inflorescence spicate-axillary, the rather large heads produced singly, or sometimes more crowded, the inflorescence then tending to become thyrsoid-paniculate with smaller heads: heads broadly campanulate, 5–7 mm. high and nearly as broad, sessile or on rather stout pedicels 1–several mm. long, these erect or only slightly recurved; the involucral bract short, oblong-ovate: the flowers (30–60), all fertil, the pistillate few, with exserted, recurved styles, the hermaphodite with short, included, cleft style: the stigmas truncate, penicillate: the corollas resinous dotted throughout.

This *Artemisia* does not seem to be closely allied to any of the known Rocky Mountain species, but in some respects at least it is allied to *A. Ludoviciana* Nutt. Its silvery-white aspect, numerous, slender, erect stems, narrow leaf segments and many-flowered heads are characteristic. Seemingly rare: only a few clumps of it observed on the sandy beaches and banks of Yellowstone Lake. Type number, 6612, Aug. 22, 1899.

Artemisia subglabra

Herbaceous perennial, the tufted stems rather few, erect-ascending, slender, more or less branched above, very obscurely glandular-pruinose, otherwise green and glabrous as are also the leaves, 3–5 dm. high: leaves pinnate or bi-pinnate; the segments linear or sometimes broader, widely divaricate, the margins more or less revolute: inflorescence racemiform or narrowly paniculate; the heads medium size (3–5 mm.), shortly pedicelled, spreading or deflexed; the involucral bracts green, oblong, with ciliate-lanate margins: flowers 12–20, all fertile, the pistillate with flattened or grooved spatulate styles.

In general aspect somewhat suggesting *A. dracunculoides* but wholly different in floral characters, in which it more closely approaches *A. incompacta* Nutt. It was secured on the stony banks of Yellowstone River, near Yancey's, Yellowstone Park, July 9, 1899, no. 5743.

The Crystals in Datura Stramonium L.*

By Henry Kraemer

The value of the study of the distribution of crystals of calcium oxalate in plants from a systematic standpoint has been demonstrated by R. V. Weltstein in an exhaustive study of the members of the family Umbelliferae. In some, if not all of the members of the family Solanaceae, are to be found in one or more elements (root, stem, leaf, etc.) cryptocrystalline crystals of calcium oxalate. These are also referred to by different writers as "Sable tetraédrique" or as "Krystallsand." In the genera *Atropa* and *Solanum* these crystals occur uniformly in some of the parenchyma cells of roots, stems and leaves. In some other genera, as in *Hyoscyamus*, these cryptocrystalline crystals may be replaced for the most part by monoclinic prisms or pyramids and in still other genera, as in *Datura Stramonium* L., by rosette aggregates and other crystals. The form of the crystals as well as their distribution in the members of the family Solanaceae will, no doubt, prove of significance in the developmental history of the genera comprising this order. In the root of *Datura Stramonium* L., we find in the parenchyma of the primary cortex, numerous cells which possess a very large number of small cryptocrystalline crystals of calcium oxalate which are more or less deltoid in shape and from 2–10 μ in their longest diameter. On account of the small size of these crystals there are likely to be some differences of opinion as to which system they belong. Vesque describes them as "Sable tetraédrique," indicating that they are hemiedral forms of the isometric system. But inasmuch as calcium oxalate crystals are only known to occur in the monoclinic or tetragonal systems it seems that they are probably hemiedral forms of either one or the other of these systems. It would appear that part of the crystal was formed and that the formation of the remaining part was either interrupted or disturbed. It is not at all unlikely that further investigations will demonstrate that they are hemiedral forms of the

* Presented at the Columbus Meeting of the American Association for the Advance- of Science.

monoclinic system. Instead of the crystals having a true deltoid form like a tetrahedron, one axis is frequently as much as twice as long as the other two axes. It may be mentioned that it is not unusual to find associated with these hemiedral forms crystals which resemble the octahedrons or hexahedrons of the isometric system, but the greater difference in the length of one axis indicates that they are either prisms or octahedrons of the monoclinic system. In the stem we find the same kind of crystals as well as a similar distribution of them that we noted in the root. The crystals may in some cases be larger, measuring as much as 15 μ in their longest axis. There are also present in some of the cells monoclinic prisms (about 20 × 5 × 5 μ) as well as rosette aggregates made up of about 12 of these prisms. In some specimens these prisms are replaced by acicular crystals (35 μ long) which may be united or aggregated to form large sphere crystals.

In the petiole of the leaf we find numerous hemiedral cryptocrystalline crystals (20 × 10 × 10 μ). There are, however, in addition many monoclinic prisms (14 × 10 × 10 μ) or pyramids (25 × 10 × 10 μ) or a few rosette aggregates of crystals (30 μ in diameter). In some specimens the hemiedral forms may be largely replaced by monoclinic prisms (15 × 4 × 4 μ) or pyramids (10 × 3 × 3 μ) or acicular crystals (35 μ in length). In the parenchyma of the nerves of the lamina there are many cells that possess cryptocrystalline crystals, but we also find large monoclinic pyramids (28 × 15 × 15 μ) and rosette aggregates (28 μ in diameter). There are also present in some specimens numerous small prisms and acicular crystals.

In the mesophyll of the leaf the cryptocrystalline crystals are entirely replaced by rosette aggregates (17 to 24 μ in diameter): one occurring in each parenchyma cell directly below the palisade layer.

In the parenchyma of the flower stalk we find very small rosette aggregates of crystals (10 μ in diameter). In the parenchyma of the calyx a few small prisms (1–3 μ long) and rosette aggregates (10–14 μ in diameter) are found.

In the parenchyma of the corolla are small prisms (2–3 μ long) and some small rosette aggregates. In the filaments of the stamens there are some exceedingly small cryptocrystalline crystals.

In the ovary a very large number of the cells contain cryptocrystalline crystals ($2 \times 1 \times 1\ \mu$) and in the region of the placenta or inner epidermis rosette aggregates ($14\ \mu$ in diameter) may be found.

It is rather interesting to note that the cryptocrystalline crystals which are found in such abundance in the parenchyma of roots and stems of *Datura Stramonium* L. are replaced in part in the petiole and nerves of the leaves by prisms, pyramids and rosette aggregates of crystals and that in the lamina the prisms and pyramids evidently are united to form rosette-shaped aggregates only.

Not infrequently do we find in a cell containing cryptocrystalline crystals a large rosette-shaped mass of what appears to be an aggregate of small hemiedral crystals.

The fact that we find monoclinic prisms in *Hyoscyamus* and raphides in some instances in *Atropa* and *Solanum* is further indicative that all the various forms of crystals in *Datura Stramonium* L. are likewise of the monoclinic system.

That there is a close relationship between the different genera of the family Solanaceae is evidenced by the observations that some of the parenchyma cells of some of the elements of nearly all of the genera and species appear to contain hemiedral cryptocrystalline crystals. These are contained uniformly and in greatest amount in the genera of the Solaneae and Datureae and to the least extent in some of the genera of the Cestreae and Salphiglossideae, there being some exceptions to the last groups in *Vestia* (of the Cestreae) and *Anthocercis* (of the Salphiglossideae).

Proceedings of the Club

WEDNESDAY EVENING, OCTOBER 25, 1899

Vice-President T. F. Allen in the chair; 38 persons present.

One resignation was offered, that of Mr. Edward B. Miller, now permanently removed to Woodland, Ulster Co. On motion of Dr. Britton this resignation was accepted and the name transferred to the list of corresponding members.

The scientific program opened with a paper by Dr. D. T. MacDougal on "The Mycorhiza of *Cephalanthera*," describing the general characters of this Pacific coast plant, with special reference to its symbiotism, and exhibition of specimens in alcohol. Dr. MacDougal's specimens form probably the most complete examples of its root system ever procured, the plant growing among matted hemlock roots and very difficult to get at. Discussion by Dr. Britton of the taxonomic relations of *Cephalanthera* followed.

The second subject of the evening was "Notes on Ferns," presented by Mrs. Britton, with specimens and lantern views. Among other interesting plants exhibited were some very large examples of *Botrychium lanceolatum*, from the fcot of Mt. Rainier, about a foot high, including roots, and with the lamina nearly three inches in length.

Mr. W. N. Clute spoke of finding *Dryopteris Goldieana* at Bedford Park, and of continued discoveries of *Dryopteris simulata*, usually in company with *Woodwardia areolata.*

Mrs. Britton spoke of the association of *Dryopteris simulata* on the Pocono with *Rhododendron maximum*, in very different surroundings, and called attention to its distinctly blue-green coloring.

Mr. Clute reported a new station for *Schizaea pusilla* at Allen's Bridge, N. J., on the east branch of the Wading River, in quantity, observed last July. The sporophylls of last year were then still remaining on the plant. Sterile leaves were coiling about neighboring stems as if with a trace of the climbing habit of its relative *Lygodium.* This coiling tendency has occasioned the name of curly-grass, which was found in use in New Jersey for *Schizaea.*

The Secretary referred to the successful transplanting of *Schizaea* into a locality near Lakewood, N. J., by Miss R. W. Farrington.

The Secretary made some remarks upon singularities in the distribution of *Aster Schreberi*, a species described by Nees in 1818 from a single plant, and afterward omitted by botanists, until the publication of the Illustrated Flora. The abundance of this species, which he finds characteristic of the Schoharie drainage-basin of the Catskills, contrasts strangely with its absence from other parts of that region.

Judge Brown reported finding *Solidago odora* on high ground near Sam's Point late in the season, many scattered plants appearing in flower at about 2000 ft. altitude.

Dr. Britton remarked that this forms an interesting addition to the number of coast plants found in the Shawangunk range. It has been claimed that the breaking up of sandstone rocks there has produced a sandy soil sufficiently similar to that of the seashore to permit the growth of certain arenophilous plants usually found only on the coast.

Mr. R. S. Williams, of Montana, recently returned from the Klondike, spoke of the forests there, of the use of the paper birch for fuel, and of the numerous shrubs, a small *Amelanchier*, etc. Strawberry blossoms were abundant. A yellow-berried raspberry occurs, from which the Indians prepare a drink. Mosses were abundant, covering swamps, becoming dry in the latter part of the season, and ready to burn. The more moist parts of the land never thaw more than 15 inches below the surface. One party put down a shaft 130 feet through frozen gravel, and then reached unfrozen gravel, through which the shaft was continued 60 feet further.

Dr. T. F. Allen spoke of a specimen of *Rhus vernicifera*, the lacquer tree of Japan, which is growing luxuriantly on his lawn in Connecticut. It resembles our swamp sumach, *Rhus venenata*, in appearance, and is becoming a handsome tree. Some of his family who are sensitive to *Rhus* poisoning, find it necessary to avoid going near it.

Discussion followed regarding localities for *Rhus typhina* near New York. Dr. Britton mentioned its occurrence in several localities on the Palisades and in the mountains in New Jersey. Miss Ingersoll mentioned Ulster county, Mrs. Britton, High Bridge within the city, and the Secretary stated that he had recently observed it at Alpine, N. J., in considerable quantity. Dr. Britton alluded to its desirable qualities as an ornamental tree, improving greatly in cultivation, as may be seen at the Botanical Garden.

Dr. Britton also reported a gift to the Botanical Garden of about 200 volumes which had belonged to the botanist, David Hosack. They are in excellent condition and some of them extremely rare.

Adjournment followed.

TUESDAY EVENING, NOV. 14, 1899

Dr. Rusby in the chair; 29 persons present.

Two new members were elected: Miss Carrie Huse, 223 West 23d Street, Mrs. Wm. E. Damon, of the same address, both proposed by Miss Murray.

The scientific program consisted of a paper by Mrs. C. L. Pollard on "Types of Vegetation on the Florida Keys," illustrated by the lantern. Mr. Pollard described the successive steps in the formation of those islands, and distinguished their belts of mangrove and occasionally of fine littoral flora, with interior zones known as "scrub-hammock" and "tall-hammock," and with pine-barrens, and salt-barrens. He ascribed the flora to a West Indian origin, and remarked also upon the chief fruits and garden plants cultivated, and the weeds of the gardens. Beautiful views were exhibited, showing the *Casuarina*, much planted in Key West, competing there with the cocoanut palm as a shade-tree; *Tillandsias* in the scrub-hammock each holding a quart of water among its leaf-bases, even on the driest day, etc. Among the most interesting views were those showing the development of an island originated by a single mangrove-tree. The mangrove seedlings drop like a plummot through the water into the mud, and may be washed a little way by the tide, but as the tidal force is small, it is very rare that a mangrove seedling dies, and there is little chance of its failing to strike root promptly, except when it happens, rarely, to strike upon a coral rock.

Dr. Rusby alluded to the mangrove roots as an important source for tannin.

Mr. Lighthipe spoke of the fragrance which he finds characterizes *Tillandsia usneoides* at the time of flowering. Around Jacksonville this is now growing scarce in consequence of its extensive collection to manufacture "mohair" for mattresses.

WEDNESDAY EVENING, NOVEMBER 29, 1899

Fifty-two persons present; President Brown in the chair.

Attention of the Club was called to the Card Index of Current American Literature, hitherto published by the Cambridge Botanical Supply Company, and it was moved and carried that the Card Index be contined under the auspices of the Torrey Club. It is prepared by the editors of the BULLETIN, and it would seem proper that the distribution of the Index be under their control. It is understood that the passage of this motion will not expose the Club to financial responsibility.

Dr. Britton raised the question of continuance of field excursions through the winter, for study of bryophytes, algae, etc.; the reports from the November excursions warranted their continuation, and the Club voted that the Committee be requested to continue the excursions until further action.

Two new members were elected: Miss Louise B. Dunn, assistant, Barnard College; Mr. David Griffiths, Columbia University. Both proposed by Professor Underwood.

The scientific program consisted of a paper by Dr. C. C. Curtis, on the algae, with lantern views illustrating the leading families, and with a condensed summary of the modes of reproduction and other characteristics of each. Dr. Curtis also gave brief directions respecting methods of collecting and preserving the marine algae, urging the collector to make microscopic study of all forms, and pointing out the great need of further observation to clear up doubtful points in their reproductive processes.

President Brown exhibited specimens found by Dr. Meredith at Danville, Pa., of *Ajuga Genevensis* and of *Hieracium Pilosella*. The first had been observed on ballast in New York City, but not the latter.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matters relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Arthur, J. C. Indiana Plant Rusts, listed in Accordance with latest Nomenclature. Proc. Indiana Acad. Sci. 1898: 174–186. 1899.

Ashe, W. W. Contributions from my Herbarium. Bot. Gaz. **28**: 270–272. 21 N. 1899.

Crataegus Sauratonae sp. nov., and *Crataegus Chapmani* (Beadle) nom. nov.

Bicknell, E. P. Studies in Sisyrinchium—VI: Additional new Species from the Southern States. Bull. Torr. Club, **26**: 605–616. 22 D. 1899.

Sisyrinchium incrustatum, *S. versicolor*, *S. Asheianum*, *S. capillare*, *S. dichotonum*, *S. tenellum*, *S. membranaceum*, *S. flexile*, *S. Tracyi*, and *S. nanum*, sp. nov.

Brannon, M. A. Some Indiana Mildews. Proc. Ind. Acad. Sci. 1898: 291–295. 1899.

Child, W. A. The Study of Mushrooms. Jour. and Proc. Hamilton Assoc. **15**: 100–109. 1899.

Clark, J. F. A new Volutella. Bull. Torr. Club, **26**: 617–620. *pl. 371*. 22 D. 1899.

Volutella mellea Clark.

Clifford, J. B. The Mycorhiza of *Tipularia unifolia.* Bull. Torr. Club, **26**: 635–638. *pl. 372.* 22 D. 1899.

Coulter, S. Notes on the Germination and Seedlings of certain native Plants. Proc. Indiana Acad. Sci. 1898: 215–222. 1899.

Cunningham, A. M. Geographical Distribution of the Species of Cuscuta in North America. Proc. Indiana Acad. Sci. 1898: 214, 215. 1899.

Cunningham, A. M. Morphological Characters of the Scales of Cuscuta. Proc. Indiana Acad. Sci. 1898: 212, 213. 1899.

Cunningham, C. A. A bacterial Disease of the Sugar Beet. Bot. Gaz. **28**: 177–192. *pl. 16–20.* 25 S. 1899.

Curtiss, R. G. A red Mould. Proc. Indiana Acad. Sci. 1898: 202–208. *f. 1–10.* 1899.

Davenport, G. E. Ferns of Maranacook, Maine. Rhodora, **1**: 218–220. D. 1899.

Day, M. A. Plants from the Eastern Slope of Mt. Equinox. [Vermont]. Rhodora, **1**: 220–222. D. 1899.

Derick, C. M. Note on the Development of the Holdfasts of certain Florideae. Bot. Gaz. **28**: 246–263. *pl. 21–23, f. 1–5.* 21 N. 1899.

De Toni, J. B. The Botanical Garden and Institute in Padua. Bot. Gaz. **28**: 268–270. 21 N. 1899.

Dickson, J. M. *Trillium grandiflorum* Salisb. Jour. and Proc. Hamilton Assoc. **15**: 99. 1899.

Notes on the green-flowered forms.

Dietel, P. Uredineae brasilienses a cl. E. Ule lectae. II. Hedwigia, **38**: 248–259. 10 O. 1899.

New species in *Uromyces*, *Puccinia*, *Diorchidium*, *Ravenelia*, *Anthomyces* nov. gen., *Didymospora*, nov. gen., *Uredo* and *Aecidium*.

Earle, F. S. Some Fungi from South America. Bull. Torr. Club, **26**: 632–634. 22 D. 1899.

Puccinia bombacis Dietel, *Uromyces cissampelidis* Dietel, *Apiospora sparsa* Earle, *Hypoxylon Bakeri* Earle, and *Marsonia agaves*, new species; *Auricularia nigra* (Schw.) Earle, new name.

Fairchild, D. G. Notes on Travel—II. Payta and the Desert Region of Peru. Bot. Gaz. **28**: 203–207. 25 S. 1899.

Fernald, M. L. *Ranunculus acris* var. *Steveni*, in New England. Rhodora, **1**: 227–229. D. 1899.

Fernald, M. L. Some Plants recently introduced into Florida. Bot. Gaz. **28**: 362, 363. 30 N. 1899.

Fink, B. Notes on the Lichen Distribution in the Upper Mississippi Valley. Mem. Torr. Club, **6**: 285–307. 1 D. 1899.

List of 527 species with their distribution.

Golden, K. E. *Aspergillus oryzae* (Ahlburg) Cohn. Proc. Indiana Acad. Sci. 1898: 188–201. *f. 1–12.* 1899.

Greene, E. L. New or Noteworthy Species.—XXV. Pittonia, **4**: 68–72. 7 Jl. 1899.

New species in *Argemone, Lesquerella, Aragallus, Solidago, Eucephalus, Machaeranthera* and *Bidens.*

Greene, E. L. New or Noteworthy Species.—XXVI. Pittonia, **4**: 98–101. *pl. 11.* 8 D. 1899.

New species in *Chaenactis, Machaeranthera, Leucelene, Solidago, Polemonium, Gerardia* and *Orthocarpus.*

Greene, E. L. New Species of *Antennaria.* Pittonia, **4**: 81–85. 8 D. 1899.

A. sordida, A. Holmii, A. nardina, A. propinqua, A. alsinoides and *A. borealis*, new.

Greene, E. L. Segregates of *Caltha leptocephala.* Pittonia, **4**: 73–81. 8 D. 1899.

C. malvacea, C. confinis, C. Macounii, C. chelidonii, C. Howellii, C. rotundifolia, and *C. chionophila*, new.

Greene, E. L. West American Asperifoliae—IV. Pittonia, **4**: 86–97. 8 D. 1899.

New species in *Mertensia, Lithospermum, Oreocarya*, and *Lappula.*

Griffiths, D. *Anthurus borealis* Burt. Bull. Torr. Club, **26**: 628–631. 22 D. 1899. [Illust.]

Hart, J. H. *Piper nigrum* in Trinidad. Bull. Bot. Dept. Trinidad. **21**: 223. *f. 1, 2.* O. 1899.

Heller, A. A. New and interesting Plants from Western North America.—VIII. Bull. Torr. Club, **26**: 621–627. 22 D. 1899.

Microsteris MacDougalii, Brittonastrum pallidiflorum, Senecio Hartianus, Draba patens, D. Neo-Mexicana robusta, D. pallida and *D. rubricaulis*, new; notes on *Draba Helleriana* and *D. Neo-Mexicana.*

Hervey, E. W. Honey-guides of Night Bloomers. Rhodora, **1**: 222, 223. D. 1899.

Hill, E. J. *Quercus ellipsoidalis* in Iowa. Bot. Gaz. **28**: 215, 25 S. 1899.

Hoffman, R. Three Plants of Berkshire County, Massachusetts. Rhodora, **1**: 229, 230. D. 1899.

Holway, E. W. D. Mexican Fungi.—II. Bot. Gaz. **28**: 273, 274. 21 N. 1899.

Ustilago Holwayana, *U. andropogonis-hirtifolii*, and *U. panici-proliferi*, new species, proposed by P. Hennings.

Hosmer, A. W. Further Additions to the Flora of Middlesex County, Mass. Rhodora, **1**: 223, 224. D. 1899.

Jacky, E. Die Compositen-bewohnenden Puccinien vom Typus der *Puccinia Hieracii* und deren Specialisierung. Zeitschr. fur Pflanzenkrankheiten, **9**: 193–224. 20 O. 1899.

Jelliffe, S. E. The Flora of Long Island. i–xvi, 1–163. 1899.

Killebrew, J. B. Grasses and Forage Plants. Bull. Tenn. Agric. Exp. Sta. **11**: 1–72. Je. 1898; 73–112. S. 1898; 113–144. D. 1898.

Account of (1) domesticated grasses, (2) leguminous plants, and (3) meadows and wild pastures.

Longyear, B. O. Two new Michigan Fungi. Bot. Gaz. **28**: 272, 273. 21 N. 1899.

Tubaria luteoalba and *Galera crispa* proposed by the author.

Macoun, J. List of Plants collected by Mr. J. B. Tyrrell, in the Klondike Region in 1899. Ottawa Nat. **13**: 209–218. D. 1899.

Miller, W. A practical Reform in the Nomenclature of Cultivated Plants. Bot. Gaz. **28**: 264–268. 21 N. 1899.

Mottier, D. M. Endosperm Haustoria in *Lilium candidum*. Proc. Ind. Acad. Sci. 1898: 168, 169. 1899.

Mottier, D. M. Nuclear Division in vegetative Cells. Proc. Indiana Acad. Sci. 1898: 164–166. 1899.

Mottier, D. M. The Centrosome in Cells of the Gametophyte of *Marchantia*. Proc. Indiana Acad. Sci. 1898: 166–168. 1899.

Olive, E. W. Affinities of the Mycetozoa. Proc. Indiana Acad. Sci. 1898: 209–212. 1899.

Rich, W. P. Winter Botanizing. Rhodora, **1**: 215–217. D. 1899.

Ripley, G. E. Absorption of Water by decorticated Stems. Proc. Indiana Acad. Sci. 1898: 169–174. 1899.

Robinson, B. L. A newly observed Station for *Galinsoga hispida*. Bot. Gaz. **28**: 216. 25 S. 1899.

Robinson, B. L. Revision of the North American Species of *Tephrosia*. Bot. Gaz. **28**: 193–202. 25 S. 1899.

Tephrosia Rugelii Shuttleworth, *T. chrysophylla Chapmani*, *T. Smallii*, *T. villosa flexuosa*, *T. ambigua gracillima* and *T. purpurea angustissima*, new species, varieties and names.

Robertson, C. Flower Visits of oligotropic Bees. Bot. Gaz. **28**: 215. 25 S. 1899.

Rothrock, J. T. Red Oak (*Quercus rubra* L.). Forest Leaves, **7**: 88. *2 pl.* D. 1899.

Sauvagean, C. The Sexuality of the Tilopteridaceae. Bot. Gaz. **28**: 213, 214. 25 S. 1899.

Translation by B. M. Davis.

Smith, E. F. Wilt Disease of Cotton, Watermelon, and Cow Pea (*Neocosmospora* nov. gen.). Bull. U. S. Depart. Agric. (Div. Veg. Path.) 17: 1–53. *pl. 1–10.* 22 N. 1899.

Snyder, L. The Uredineae of Madison and Noble Counties with additional Specimens from Tippecanoe County. Proc. Indiana Acad. Sci. 1898: 186–189. 1899.

Soraurer, P. Erkrankungsfälle durch Monilia. Zeitschr. für Pflanzenkrankheiten, **9**: 225–235. *pl. 4.* 20 O. 1899.

Spalding, V. M. & Fernow, B. E. The White Pine (*Pinus Strobus* Linnaeus). Bull. U. S. Depart. Agric. (Div. Forestry), **22**: 1–185. *pl. 1–13.* 1899.

Stevens, F. L. The compound Oösphere of *Albugo bliti*. Bot. Gaz. **28**: 149–176. *pl. 11–15.* 25 S. 1899; 225–245. 21 N. 1899.

Thaxter, R. Preliminary Diagnoses of new Species of Laboulbeniaceae.—I. Proc. Amer. Acad. **35**: 153–209. D. 1899.

Includes 99 new species of *Laboulbenia*.

Thomas, M. B. Some Desmids of Crawfordsville. Proc. Indiana Acad. Sci. 1898: 163, 164. 1899.

Townsend, A. B. An hermaphrodite Gametophore in *Preissia commutata*. Bot. Gaz. **28**: 360–362. *f. 1.* 30 N. 1899.

Tracy, S. M. Key and Flora [to Bergen's Elements of Botany], Southern United States edition, 1–266. 1899.

Underwood, L. M. A Review of the Genera of Ferns proposed prior to 1832. Mem. Torr. Club, **6**: 247–283. 1 D. 1899.

Includes discussion of generic types, and advocates the adoption of the first-named species under a genus as its type.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT :

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895 ; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT :

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth) ; $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896 ; Emeritus Professor 1896,—and Hon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages ; Vol. 2 642 pages ; Vol. 3, 588 pages ; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes ; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895 ; Tutor in Botany, 1895–.

Octavo, 360 pages ; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, usilltrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.]

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–4, 294 pp., 3 maps, and 8 plates, 1896–99. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of over a hundred new species. Price to members of the Garden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal. Price, 25 cents.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg. Price, 25 cents.

No. 3. The dichotomous *Panicums*: some new Species, by Geo. V. Nash. Price, 25 cents.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg. Price, 25 cents.

All subscriptions and remittances should be sent to

THE ACCOUNTANT

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

PUBLICATIONS OF THE TORREY BOTANICAL CLUB.

(1) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates Price $2 00 per annum. For Europe 10 shillings. Dulau & Co. 37 Soho Square London are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898), are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(2) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume 1, No. 1.—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume 2, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. 3. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. 4. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents.

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No. 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. 5. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S Price, $3.00.

Vol. 6. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*) With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. 7.—The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol. 8. No. 1, Part 1.—The Comparative Embryology of the Rubiaceae. With four plates. By Francis Ernest Lloyd. Price, 50 cents.

---

(3) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

Address: ***L. M. UNDERWOOD,***
COLUMBIA UNIVERSITY, NEW YORK CITY.

VOL. 27 FEBRUARY, 1900. No. 2

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL,
ARTHUR HOLLICK, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
BYRON D. HALSTED, Sc. D.
CARLTON C. CURTIS, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D., MARIE L. SANIAL,
HELEN M. INGERSOLL, ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City,
GEORGE V. NASH, EUGENE SMITH,
MARIE L. SANIAL, W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 2

BULLETIN

OF THE

TORREY BOTANICAL CLUB

FEBRUARY 1900

New Species of Fungi from various Localities with Notes on some published Species

BY J. B. ELLIS AND B. M. EVERHART

Echinodontium E. & E. nov. gen. (Family *Hydnaceae*).

Differs from *Hydnum* in the thick, woody pileus of *Fomes* and the teeth beset with spines, as in *Mucronoporus* and *Hymenochaete*.

E. tinctorium E. & E.

Fomes tinctorius E. & E. Bull. Torr. Club, **22**: 362. 1895

Hydnum tinctorium Lloyd in literis. On *Abies grandis*, Jonesville, Idaho (Prof. C. V. Piper, comm. C. G. Lloyd).

In the specimen from which *Fomes tinctorius* was described the teeth were all broken off so as to resemble a *Polyporus*: but what were taken for pores were only the hollow bases of the brittle, cinereous teeth which, in the Idaho specimens are about 1 cm. long and 1.5–2 mm thick at the base. The hymenial surface is rather sparingly clothed with subconical, reddish-brown spines, 20–30 × 6–7 μ. The spores at first are nearly hyaline.

The characters of this fungus differ so much from *Hydnum* that we propose it here as a new genus.

Corticium macrosporum E. & E.

On dead limbs of *Fraxinus*? Ohio (Lloyd, no. 3113).

Dull white, appressed, thin, appearing at first in orbicular patches 3–5 mm. in diameter, the narrow, white, cottony margin sometimes narrowly involute, at length confluent: spores ovate-elliptical, 10–14 × 7–8 μ, abundant.

[Issued 17, February.]

The hymenium is of a somewhat waxy nature, smooth, but uneven, showing the inequalities of the bark.

Hymenochaete asperata E. & E.

On pine bark, Abita, East Louisiana, Jan. 1898 (Langlois, no. 2647).

Effused, adnate, dull yellow, becoming a little darker in the center, thin, margin irregular, spreading over the bark in irregular shaped patches, 2–6 or more cm. in extent: setae stout, 60–70 × 7–8 μ, tubercular-roughened above and often prolonged at the tip into a hyaline, lance-shaped slender point 20–30 μ long, but often the tips of the setae are rounded and obtuse but still hyaline: spores small, subglobose, 3 μ.

Seems different from *H. scabriseta* Cke.

Zygodesmus pubidus E. & E.

Forming a thin, loosely compacted, light yellow, membranaceous, subpuberulent coating on rotten wood. Newfoundland (Rev. A. C. Waghorne, no. 1026).

Hyphae branching at right angles, subhyaline, sparingly septate, with an occasional zygodesmoid joint: conidia short-elliptical, hyaline, smooth, 4 × 3 μ, with a single large mostly eccentric nucleus.

Mucronoporus sublilacinus E. & E.

On pine logs, Abita Springs, East Louisiana (Langlois, no. 2529).

Pileus semiorbicular, firm, flat, 6–7 cm. long, 9–10 cm. broad, repeatedly zonate with elevated ridges and shallow furrows; surface at first clothed with a cinereous-gray cuticle which finally disappears: margin spreading, subacute, pores round, 0.5–1 cm. long, mouths slightly uneven, obtuse, 200 μ in diameter (not including dissepiments), lilac color on the surface, cinnamon color within; flesh bright cinnamon-yellow, zonate within, about 0.5 cm. thick in the middle, thinning out towards the margin; spines stout, cylindric-conical, projecting part 15–20 × 4 μ.

The lilac colored, larger pores and thicker substance distinguish this from *M. licnoides* Mont.

Dacryomyces cenangioides E. & E.

On dead birch limbs, Nuttallburg, W. Va., Dec. 1897 (L. W. Nuttall, no. 922).

Erumpent, mostly cespitose and connate, forming tufts 0.5–1 cm. in diameter, obconic, discoid, concave above at first but when mature convex above, variously wrinkled, folded and immarginate, liver-color with a lilac tint when fresh, drab-color when dry and quite fragile, texture of coarse inflated hyphae resembling, when the dry plant is broken open, a mass of dirty light-yellowish tomentum: basidia clavate-cylindrical, 40–50 × 6–7 μ with two short, obtuse sterigmata: spores shaped like apple seeds, 12–20 (mostly 15) × 6–8 μ, filled with minute nuclei, becoming 3 or more septate, hyaline.

When dry, bears a striking resemblance to a cespitose *Cenangium*. *Tremella sarcoides* (Dicks.) is found with this.

Asterina Mexicana E. & E.

On *Agave Mexicana*, City of Mexico, May, 1898 (Dr. B. F. G. Egeling).

Perithecia amphigenous, subastomous, small (110–150 μ), rough, black, fringed around the base with coarse, brown, subincurved hairs, seated on appressed, reticulately branched, black mycelium of the *Meliola* type: asci obovate, abruptly short-stipitate, 40–60 × 20–30 μ, or becoming subglobose, 8-spored: sporidia crowded, clavate-cylindrical, uniseptate and constricted near the upper end, upper cell globose, and easily separable, lower cell oblong, 22–27 × 8–10 μ, filled with granular matter, nearly hyaline, becoming brown.

The perithecia are crowded in orbicular patches about 1 cm. diam., often with a white spot in the center.

Melanomma gregarium E. & E.

On decorticated cottonwood limbs, Rooks Co., Kansas, Jan. 1899 (Bartholomew, no. 2532).

Perithecia gregarious, globose-conical, slate color and minutely roughened, 250–350 μ in diameter, base slightly sunk in the wood, finally collapsing above: ostiolum papilliform, black and shining: asci clavate-cylindrical, p. sp. 50–70 × 10–12 μ with abundant, filiform paraphyses: sporidia subbiseriate, oblong or ovate-elliptical, 3-septate and finally slightly constricted at the septa, 12–15 × 5–7 μ.

Differs from *M. rhypodes* E. & E. in its broader, shorter sporidia and collapsing perithecia.

Amphisphaeria aspera E. & E.

On *Tetradymia*, Montrose, Colorado (Bethel, no. 517).

Perithecia gregarious or cespitose, the lower half sunk in the bark, 400–600 μ in diameter, depressed-globose, densely roughened with projecting points, ostiolum papilliform or short-cylindrical: asci clavate-cylindrical, short-stipitate, 80–90 × 75 μ, obscurely paraphysate: sporidia uniseriate, oblong, subinequilateral, uniseptate, not constricted, 20–30 × 8–10 μ, clear brown.

Teichospora brachyasca E. & E.

On decorticated limbs of *Quercus Watsoni*, Rooks Co., Kansas, May, 1899 (Bartholomew, no. 2599).

Perithecia scattered, superficial, depressed-globose, 0.25–0.35 mm. in diameter, ostiolum obscure, papilliform or wanting: asci obovate-oblong, sessile or nearly so, 35–45 × 16–20 μ, sporidia irregularly crowded, obovate, 3-septate, slightly constricted, more distinctly so at the middle septum, one or two cells divided by a longitudinal septum, 14–18 × 6–7 μ.

Schizostoma Nevadensis E. & E.

On decorticated *Ephedra Nevadensis*, Mesa Verde, Colorado, July, 1899 (Bethel, no. 518).

Perithecia gregarious, globose or subelliptical, sunk in the matrix with the upper part projecting, about .5 mm. in diameter, ostiolum narrow, not very conspicuous: asci cylindrical, 75–80 × 7–10 μ, with abundant paraphyses: sporidia overlapping-uniseriate or biseriate, oblong-fusoid, uniseptate, scarcely constricted, 15 × 4–5 μ, pale-brown.

Mycosphaerella lithospermi E. & E.

On dead stems of *Lithospermum officinale*, Gillivray, Ontario, Canada, June, 1898 (Dearness, no. 2862).

Perithecia scattered, pustuliform-prominent, but subcuticular, 170–200 μ in diameter, flattened or sub-collapsed above: asci oblong cylindrical, short-stipitate, 70–80 × 12–15 μ: sporidia biseriate, ovate-elliptical, hyaline, uniseptate and constricted, 12–16 × 6–8 μ.

Leptosphaeria fraserae E. & E.

On dead stems of *Frasera speciosa*, Rico, Colorado, July, 1899 (Bethel, no. 502).

Perithecia scattered, subcuticular, but by the falling away of the cuticle, superficial, globose, becoming depressed, 0.25 mm. in diam., ostiolum conic-papilliform, distinct: asci cylindrical or clavate-cylindrical, stipitate, paraphysate, 80–110 × 8–10 μ: sporidia uniseriate, oblong-elliptical, yellow-brown, 3-septate, becoming lightly constricted, especially at the middle septum, 14–16 × 7–8 μ.

The sporidia are much like those of *L. fuscella* B. & Br., but in that species the perithecia are buried and have no ostiolum.

Thyridium vitis E. & E.

On dead shoots of *Vitis riparia*, Rooks Co., Kansas (Bartholomew).

Perithecia gregarious, often 2–3 subconfluent, entirely buried in the bark which is raised into low, flattish pustules over them, 250–300 μ in diameter, grayish inside, thin-walled, globose: ostiolum inconspicuous, barely penetrating the bark: asci clavate-cylindrical, short-stipitate, 100–115 × 15–18 μ, with abundant paraphyses: sporidia obliquely uniseriate, or subbiseriate above, obovate-oblong, brown, 5–7-septate, constricted in the middle, obtusely rounded at the ends, 18–22 × 10–12 μ, with a longitudinal septum running through one or more cells.

Differs from *T. antiquum* E. & E. in its larger asci and larger, differently shaped 5–7-septate sporidia.

Hysterographium graminis E. & E.

On dead culm of *Panicum virgatum* and *Andropogon provincialis*, Rooks Co., Kansas, March, 1899 (Bartholomew, no. 2556).

Erumpent-superficial, 0.5–1 mm. long, 150–200 μ broad, rounded at the ends, with a slight longitudinal furrow along the center: asci clavate-oblong, short-stipitate, paraphysate, p. sp. 60–75 × 15–20 μ: sporidia biseriate, oblong-elliptical, yellow, becoming brown, 3-septate, compressed, scarcely or only slightly constricted at the septa, 16–20 × 7–10 μ, 5–6 μ thick, with a longitudinal septum on the flattened side running through all the cells, viewed edgewise only the transverse septa are visible.

The sporidia resemble very much those of some species of *Pleospora*, as *P. aurea*, *P. compressa*, *P. permunda*, etc.

Hypoderma equiseti E. & E.

On dead stems of *Equisetum hyemale*, Rooks Co., Kansas, Jan., 1899 (Bartholomew, no. 2535).

Perithecia oblong or linear, 1–3 mm. long, covered by the thin epidermis which is split along the middle: asci oblong-clavate, 35–45 × 10–12 μ, short-stipitate, paraphysate? sporidia biseriate, oblong, obtuse, uniseptate, constricted, 13–15 × 4–5 μ, hyaline.

Phyllosticta canescens E. & E.

On leaves of *Ribes divaricatum*, Bear Creek, near Volmer, Idaho, Oct., 1898 (Prof. L. F. Henderson, no. 4707).

Spots large, irregularly occupying and killing half of the leaf, or lobe of a leaf, rusty brown whitening out and becoming minutely furfuraceous above, the surrounding parts of the leaf becoming yellowish: perithecia epiphyllous, prominent, small, 80–100 μ, black: sporules oblong- or ovate-elliptical, mostly with a nucleus in each end, 5–8 × 2.5–3.5 μ.

PHYLLOSTICTA GALACTIS Cke. Grev. **14**: 70. 1885. Exsicc. E. & E., N. A. F. 3153

On leaves of *Galax aphylla*, West Va. (Nuttall).

Spots irregular, pale brown or cinereous, without any distinct margin: perithecia gregarious in dense patches, very minute (80 μ), immersed at the base, punctiform, black, shining: sporules cylindrical, rounded at the ends, 2–4-nucleate, hyaline, 12–15 × 4 μ.

The specimens in N. A. F. are poor and do not well represent this species.

Phyllosticta zonata E. & E.

On living leaves of *Pirus Ioensis*, Ames, Iowa, August, 1899 (H. Harold Hume).

Spots irregular, reddish-brown, 2–10 mm. in diam. or confluent over the greater part of the leaf: zonate, definite, with margin very slightly raised and a little darker: perithecia punctiform, minute, innate, covered by the thin, whitish epidermis, epiphyllous: sporules oblong-elliptical, 3.5–4 × 1.5 μ.

Differs from *P. Briardi* Sacc. and *P. limitata* Pk. in its smaller sporules and zonate spots.

Phoma erysiphoides E. & E.

On *Gnaphalium?* and *Achillea Millefolium*, Morrison, Colorado, May, 1899 (Bethel, no. 472).

Perithecia minute, thickly and evenly scattered on the stems, erumpent-superficial, subglobose, membranaceous, subastomous, of coarse cellular structure: sporules short-elliptical, hyaline, 8–12 × 6–7 μ.

Rhabdospora pachyspora E. & E.

On dead stems of *Erigeron ?* Morrison, Colorado, May, 1899 (Bethel, no. 473).

Perithecia scattered, minute, conic-globose, semierumpent: sporules arcuate, 3–4-nucleate, hyaline, subobtuse, 16–25 × 3.5–4 μ.

Dothiorella rhoina E. & E.

On dead limbs of *Rhus Toxicodendron*, Morrison, Colorado, May, 1899 (Bethel, no. 475 partly).

Perithecia bursting through the epidermis, 4–6 together stromatically connected or scattered singly, raising and finally piercing the epidermis or sometimes on the gregariously crowded and slightly connected at base, .35–.5 mm. in diameter, hemispheric-globose, with a papilliform ostiolum: sporules elliptical or ovate-elliptical, subolivaceous, 4–7 × 3–4 μ.

Exosporium pallidum E. & E. occurs on the same limbs.

Sphaeropsis hederae E. & E.

On dead stems of *Hedera Helix*, Nuttallburg, West Va., July, 1899 (L. W. Nuttall, no. 961).

Perithecia suberumpent, thickly scattered, rather flattened above, about 0.25 mm. in diameter with an obscurely papilliform or short conical ostiolum: sporules oblong-elliptical, 20–25 × 8–10 μ.

Sphaeropsis helicis Cke. & Mass. is said to have a long exserted ostiolum and spores 12 × 8 μ.

Sphaeropsis dircae E. & E.

On dead stems of *Dirca palustris*, near Ottawa, Canada, April, 1899 (Macoun, no. 705).

Perithecia gregarious, minute, raising the epidermis into little pustules perforated at the summit by the minute ostiolum: sporules oblong-elliptical, 15–18 × 7–8 μ.

Diplodia hypoxyloides E. & E.

On dead twigs of *Menispermum Canadense*, Emma, Mo., Nov. 1899 (Rev. C. H. Demetrie, no. 720).

Perithecia erumpent, surrounded by the ruptured epidermis, depressed-hemispherical, convex above, about 1 mm. diameter whitish in the center at first, soon slaty-black, white inside and soon hollow, of carbonaceo-coriaceous texture, resembling the perithecia of

Hypoxylon: sporules oblong brown, becoming uniseptate; 12–16 × 4–5.5 μ on slender basidia about 20 × 2 μ.

Varies from the usual type of *Diplodia.*

Ascochyta mali E. & E.

On living limbs of *Pirus Malus,* at the Agricultural College, Mich., May, 1899 (C. F. Wheeler).

Spots circular, 0.5–1 cm. in diameter concave, of a pale brick-red color, with the margin narrowly free, sometimes becoming much larger, extending for 2 cm. and nearly surrounding the limb. These spots appear to be formed from the altered substance of the bark which is changed in color and cracks away around the margin from the surrounding bark which remains in its normal condition: perithecia at first solitary, a single one erumpent in the center of the circular disk, finally 2–4 or more scattered on the same disk: sporules oblong or oblong-elliptical, smoky-hyaline, uniseptate, 6–8 × 2.5–3.5 μ. On the same spots also occurs a *Phoma* (*P. ambigua* Sacc.)? with sporules much resembling those of the *Ascochyta* only without any septum, and a *Phlyctaena* (*P. Mali* E. & E.) with filiform sporules curved near one end, 20–27 × 1.25–1.5 μ in numerous smaller perithecia scattered on the spots. The fungus soon kills the limbs.

Stagonospora desmodii E. & E.

On dead stems of *Desmodium tortuosum,* Lake City, Fla., Oct. 1899 (H. H. Hume).

Perithecia scattered or gregarious on reddish-brown discolored, indefinite spots which become darker, subcuticular, 150–200 μ in diameter, slightly raising the cuticle which is blackened over them: sporules oblong, hyaline, 3–4-guttulate, 8–12 × 4–5 μ.

On the same stems, on elongated black spots with a white center is a *Cercospora* with long, brown, septate hyphae cespitose on a sphaeroid base and slender, hyaline, multinucleate conidia 80–100 × 3–4 μ, becoming multiseptate (*Cercospora melaleuca* E. & E.).

Camarosporium hederae E. & E.

On dead shoots of *Hedera Helix,* Nuttallburg, W. Va., July, 1899 (L. W. Nuttall, no. 958).

Perithecia erumpent-superficial, ovate, attenuated above into a short-conical or short-cylindrical ostiolum, about 200 μ in diameter, thickly scattered or even densely crowded: sporules globose or ovate, 1–3-septate, olive-brown, 7–10 × 5–7 μ, occasionally with a longitudinal septum across one or more of the cells.

C. sarmentitium Sacc., on the same host, has spores twice as large but does not differ otherwise. Possibly the W. Va. specimen should be considered as a small-spored form of this.

Septoria philadelphi E. & E.

On leaves of *Philadelphus Lewisii*, near Juliaetta, Idaho, Oct., 1898 (Prof. L. F. Henderson, no. 4702).

Spots amphigenous, irregular in shape, partly limited by the veinlets, 2–10 mm. in diameter, more or less confluent, dirty brown, becoming more or less silvery white: perithecia amphigenous, scattered on the spots, 100–120 μ in diam.: sporules fusoid, mostly curved, 3–6-septate, narrower at one end, 20–40 (exceptionally 60) × 4–5 μ.

Septoria fulvescens Ell. & Halsted.

On faded leaves of *Acer saccharinum.*

The fungus occurs on leaves already faded to light-yellow by the autumnal frosts. On these leaves, mostly along the main nerves are indistinct blotches of a deeper yellow, 1–1.5 cm. broad and indefinitely limited perithecia hypophyllous on these spots 70–80 μ in diameter, slightly flattened or depressed, numerous: sporules oblong-cylindrical, slightly curved, continuous, hyaline, 7–12 × 1.5–2 μ, mostly not over 10 μ long.

Septoria Salliae Ger. and *S. acerinum* West, have longer and different spots.

Septoria flagellifera E. & E.

On leaves of *Pisum sativum,* Brookings, So. Dakota, July, 1898 (L. W. Carter), comm. Dr. N. L. Britton.

Amphigenous, spots suborbicular, 0.25–1 cm., diameter, subzonate, with a slightly raised border, rusty-brown at first, whitening out in the center: perithecia hemispheric—prominent or subconical, dark amber color, 75–120 μ in diameter, sporules filiform, hyaline, nucleolate, only slightly curved, 80–120 × 2–2.5 μ.

Differs from *S. pisi* West, in the different character of the spots and the much longer sporules.

Kellermannia alpina E. & E.

On dead stems of *Aquilegia coerulea* and other dead herbaceous stems. Red Mountain, Colorado, June, 1899, alt. 12,000 ft. (Bethel, no. 490 in part).

Perithecia erumpent-superficial, black, depressed-globose, about .35 mm. in diameter, with a papilliform ostiolum, membranaceous, cellular, the cells around the ostiolum arranged in radiating lines: sporules fusoid, 4–6-nucleate, hyaline, prolonged above into a slender, slightly curved awn, including which the length is 30–35 μ, width 2.5–3 μ.

Cylindrosporium smilacinae E. & E.

On *Smilacina amplexifolia* Nutt. Near Lake Coeur d'Alene, Idaho, Aug. 1898 (Prof. L. F. Henderson, no. 4688).

Spots dirty-brown, irregular and indefinite, 2–10 mm. diameter, partly limited by the veinlets, soon confluent over the greater part of the leaf, which turns yellow around them, acervuli amphigenous, tuberculiform-erumpent, black outside, amber-color or flesh-color within: conidia cylindrical or clavate-cylindrical, guttulate, more or less curved, mostly narrowed at one end, hyaline, 50–70 × 3.5–4.5 μ.

The black, erumpent acervuli have the appearance of a *Phyllachora.*

Pestalozzia crataegi E. & E.

On leaves of *Crataegus parvifolia*, Lake City, Florida, Nov. 1899 (H. H. Hume).

Acervuli black, erumpent, convex, 150 μ in diameter, mostly concentrically arranged on large (0.5–1.5 cm.) brown spots, mostly on the upper side of the leaf, but occasionally hypophyllous: conidia oblong-cylindrical, 5-septate, scarcely constricted, the four inner cells brown, terminal cells small, hyaline, 20–23 × 7–8 μ, apical cells with a short (4–5 μ), single oblique bristle, pedicel slender, hyaline, 12–15 μ.

Diplocladium cylindrosporum E. & E.

On dead leaves of *Asimina triloba*, Nuttallburg, West Va., July 31, 1899 (L. W. Nuttall).

Fertile hyphae fasciculate, hyaline, erect, 1–2-septate, 50–110 × 5–6 μ, subdichotomously branched above, the terminal branchlets short and slightly curved, bearing at their tips the cylindrical hyaline, erect, obtuse, uniseptate conidia 40–50 × 4–5 μ.

The short terminal branches resemble birds' claws. With the fertile hyphae are a few much longer, simple straight ones swollen at the tip.

Hadotrichum lupini E. & E.

On leaves of *Lupinus humilis*, Wyoming (Nelson), on *L. albifrons*, California (McClatchie), on *Lupinus* sp., Colorado (C. F. Baker).

Fertile hyphae clavate-cylindrical, continuous, olivaceous, 20–25 × 4 μ, densely fasciculate: conidia globose, subolivaceous, smooth, with a rather thick epispore, 10–12 μ in diameter.

In company with *Phyllosticta ferax* E. & E. (Proc. Phil. Acad. 1894: 355).

Mostly in the center of brownish dead spots surrounded by a broad belt of perithecia of the *Phyllosticta* of which it seems to be the conidial stage.

Pilacre pallida E. & E.

On rotten wood, Chattanooga, Colorado, June 19, 1899 (E. Bethel, no. 489).

Gregarious. Stipe stout, 1.5–2 mm. high, .75 mm. thick, equal or slightly contracted below, surrounded at base by white, straight, radiating threads which are closely appressed to the matrix, surface of stipe slightly roughened, dirty-flesh-color: head depressed, subdiscoid, subumbilicate beneath, 1–1.5 mm. across, covered with a thin umber colored membrane which soon disappears, exposing the dirty white, coarsely reticulate capillitium, the fertile threads of which are roughened by minute projecting points bearing the elliptical 6–8 × 5–6 μ, nearly hyaline conidia.

The head finally falls off all but the base which remains as a white convex disk on the top of the stipe.

Exosporium pallidum E. & E.

On dead limbs of *Rhus Toxicodendron*, Morrison, Colorado, May, 1899 (Prof. E. Bethel, no. 475).

Sporodochia bursting through the epidermis, 3–4 or more together, stromatically connected at base or occasionally single, 0.5–0.75 mm. in diameter, mostly flattened above, grayish inside, densely clothed on the surface with the stout (20–30 × 5–7 μ) hyaline (becoming black)? simple sporophores bearing at their tips the oblong or oblong-elliptical, 2- (sometimes 3-) septate more or less constricted, yellow-brown conidia 25–50 × 14–18 μ.

Differs from *E. clavuligerum* Lk. in its continuous, hyaline sporophores.

Dasyscypha tuberculiformis E. & E.

On dead stems of *Aquilegia coerulea*, Red Mt., Colorado, June, 1899, 12,000 ft. alt. (Bethel, no. 490).

Gregarious, erumpent, tuberculiform, 0.5 mm. in diameter, subtremelloid when fresh, clothed with long, white, mostly appressed hairs, immarginate, with a small, round opening at the top, the orifice surrounded by reflexed, straight, white, continuous hairs: asci clavate-cylindrical, short-stipitate, $75 \times 10\ \mu$, with straight, linear paraphyses about as long as the asci: sporidia biseriate, oblong, hyaline, continuous, $10–12 \times 2.5–3\ \mu$.

The specimens were not well matured so that the form and size of the sporidia will have to be more accurately ascertained hereafter.

Pyrenopeziza Coloradensis E. & E.

On dead stems of *Potentilla*, Red Mountain, Colorado, June, 1899, alt. 12,000 ft. (Bethel, no. 492).

Ascomata scattered, superficial, black, with a narrow, slightly incurved margin, disk concave or plane, $\frac{1}{12}$–1 mm. across: asci clavate-oblong, $100–110 \times 15\ \mu$, with simple stout paraphyses: sporidia biseriate, elliptical, with two large nuclei, hyaline, $20 \times 10\ \mu$.

Haematomyxa ascoboloides E. & E.

On dead herbaceous stems, Takoma Park, Maryland, February 26, 1899 (C. L. Shear).

Erumpent-superficial, orbicular, carnose-tremellose, convex-discoid and wine-color when fresh, concave and nearly black when dry, 0.5–0.75 mm. in diameter with a slight, dark-colored margin. The surface of the disk when fresh is distinctly roughened by the projecting tips of the asci as in *Ascobolus*: asci clavate-cylindrical, $80–100 \times 12–15\ \mu$, yellowish in the mass, paraphyses filiform, branched above, sporidia uniseriate, oblong-elliptical, 3-septate and more or less constricted at the septa, rounded at the ends, some of them slightly curved, submuriform, yellowish-hyaline, $18–22 \times 8–10\ \mu$.

Also on weather-beaten oak post, Kansas (Bartholomew).

Puccinia annulata E. & E.

On *Epilobium* sp., Yellowstone National Park, July, 1899 (Prof. Aven Nelson, no. 5930).

III. Sori hypophyllous, minute, crowded in orbicular patches 1–4 mm. in diameter surrounded by a narrow pallid ring and covered more or less with fragments of the ruptured epidermis: teleutospores cuneate or clavate, 25–35 × 12–15 μ, distinctly constricted, smooth, pale-yellow, epispore much thickened at the apex (8–10 μ thick) and dark-brown, upper cell elliptical or subglobose, lower cell narrowed to the pedicel which is hyaline, attenuated below and about 20 μ long.

The sori are nearly black and occur also sparingly along the midrib on the upper side of the leaf.

Puccinia synthyridis E. & E.

On leaves of *Synthyris rubra* Kunth, Pullman, Wash., June, 1898 (Prof. C. V. Piper, no. 390).

III. Sori amphigenous, scattered, 0.5–1 mm. in diameter, covered at first, then erumpent and surrounded by the ruptured epidermis, cinnamon-brown, flattish and pulverulent: teleutospores elliptical, rounded at both ends, constricted in the middle, light brown, epispore smooth or nearly so, slightly thickened at the apex with a flattish, transparent papilla, 20–30 × 15–20 μ: pedicels very short.

Differs from *P. acrophila* Pk. in the absence of any decided spots and the rather smaller spores. Specimens were sent to Mr. Peck who is of the opinion that this is not his *P. acrophila*.

Puccinia circinans E. & E.

On *Pentstemon spectabilis*, Grand Cañon of the Colorado (Prof. J. W. Toumey).

Spots orbicular or irregular, rusty-brown, zonate, darker in the center, 0.5–1.5 cm. in diameter, teleutosori amphigenous, subhemispherical, about .5 mm. in diameter, subcircinately arranged on the spots: teleutospores obovate or elliptical, cinnamon-brown, 30–40 × 15–20 μ, constricted, rounded above, and sometimes below, epispore thickened at the apex and darker: pedicels hyaline, as long as or longer than the spores.

Differs from *P. pentstemonis*, Pk. in the large conspicuous spots and according to Prof. J. C. Arthur, is distinct from *P. Mexicana* Dietel and Holway.

Puccinia musenii E. & E.

On *Musenium tenuifolium*, "Freeze out Hills," Wyoming, July 10, 1898 (Elias Nelson, 4491).

III. Sori pustuliform, oblong, 1–5 mm. long by 1 mm. broad, loosely covered by the lead-colored epidermis which is tardily ruptured: teleutospores elliptical, scarcely constricted at the septum, rounded at the ends, deep chestnut-brown, 22–30 × 15–20 μ epispore minutely muriculate-roughened, very slightly thickened at the apex: pedicels short, 10–15 μ long, deciduous.

Seems distinct from any of the other species on the Umbelliferae. Comes near *P. enormis* Fckl. from which it differs in its shorter, deeper colored spores without any apical papilla.

Puccinia cornigera E. & E.

On *Tetraneuris Torreyana*, "Freeze-out Hills," Wyoming, July 10, 1898 (Elias Nelson, no. 4852).

III. Sori minute (0.5 mm.) orbicular, crowded, deeply sunk in the leaf and covered by the epidermis, then suberumpent and open above, amphigenous, leaf more or less swollen: teleutospores oblong, broadly constricted in the middle, rather abruptly attenuated or rounded below, epispore thickened above, with a conical, horn-like, subhyaline projection (often oblique) at the apex, 8–12 μ long: pedicel nearly hyaline, 60–80 μ long.

HENDERSONIA DIPLODIOIDES E. & E. Bull. Torr. Club, **25**: 510. 1898

The specific name should be changed to *angustifolia*, as there is already a *Hendersonia diplodioides* E. & E., Bull. Wash. Coll. **1**: 6.

GLOEOSPORIUM ALBOFERRUGINEUM E. & E. Proc. Acad. Nat. Sci. Phil. 1898: 371

A reëxamination of specimens of this species shows only *Discosia maculicola* Ger., the sporules of which may have been mistaken for *Gloeosporium* spores, and if so the species must be abandoned.

USTILAGO SPOROBOLI E. & E. Bull. Torr. Club, **24**: 282. 1897
Ustilago funalis E. & E. *id.* **24**: 257. 1897

This is not distinct from *Ustilago hypodiles* (Schlecht.).

UROMYCES BICOLOR E. & E. Bull. Torr. Club, **24**: 282. 1897

Specimens of this species collected by Professor Aven Nelson in the Yellowstone National Park differ from the original specimen from "Death Valley," in having the teleutospore sori elongated 1–5 × 0.5–0.75 mm., finally naked but surrounded by the lead-colored, ruptured epidermis. On some of the leaves, however, are found the small (0.5–1 mm.) punctiform sori mentioned in the original description. The uredospores are accompanied by paraphyses.

PUCCINIA SIMILIS E. & E., Bull. Torr. Club, **25**: 508. 1898

The measurements of the teleutospores of this species are incorrectly given. They should be $35–55 \times 22–27 \mu$. The uredospores also vary from globose; $15–26 \mu$ in diameter to ovate or elliptical, $20–30 \times 16–22 \mu$ and are coarsely echinulate, much more distinctly so than in *P. tanaceti* according to Prof. J. C. Arthur. This is identical with *P. conferta* D. & H., but the descriptions of these two species are very different. *P. similis* has the sori *scattered* and larger, and teleutospores rounded at both ends, not to speak of the presence of *Uredo* and *Aecidium* in the last mentioned species.

PUCCINIA GRINDELIAE Peck, Bot. Gaz. **4**: 127. 1879

Puccinia variolans Hark. Bull. Calif. Acad. Sci. Feb. 1884, and *Puccinia tuberculans* E. & E. Proc. Phil. Acad. 153. 1893, are synonyms of this species.

CYTISPORA ANNULARIS E. & E. Bull. Torr. Club, **24**: 288. 1897

Found also in Canada, by Mr. Macoun, on *Fraxinus sambucifolia.* When the epidermis is pulled off the perithecia come with it and when dry they are strongly compressed below so as to become cup-shaped.

ANTHOSTOMELLA MAMMOIDES E. & E. Proc. Acad. Nat. Sci. Phila. 139. 1893

A reëxamination of the original material shows that some of the larger pustules contain 2–4 perithecia.

The species then is ambiguous between *Anthostomella* and *Anthostoma.*

LOPHIOSTOMA PUSTULATUM E. & E. Bull. Torr. Club, **25**: 503. 1898, is not distinct from *Pseudovalsa viticola* E. & E. Proc. Acad. Nat. Sci. Phil. 343. 1894.

It is *Pseudovalsa* and not *Lophiostoma* for though some of the ostiola are slightly compressed, the perithecia are, as a rule, enclosed in a hemispherical stroma two to four in a stroma. The examination of more abundant material recently sent by Mr. Bartholomew, makes this correction necessary.

RAMULARIA SIDALCEAE E. & E. Jour. Mycology 1: 1888

Specimens on *Sidalcea candida* collected by Mr. E. Bartholomew at Ohio City, Colorado, Sept., 1899, vary from the description cited in having the spots confluent over the greater part of the upper surface of the leaf and the tuft of hyphae also densely confluent below. The conidia also vary from globose, 10–15 μ in diam. to oblong or oblong-elliptical, 12–22 $\times$ 8–10 μ.

This is not typical *Ramularia*.

Catalogue of Plants collected by Messrs. Schuchert, Stein and White on the East coast of Baffin's Land and West coast of Greenland

By Theo. Holm

The present catalogue is based upon a collection of plants which was made in connection with the Peary Arctic expedition of 1897. Messrs. Charles Schuchert and David White collected at Signuia, near Cape Haven, on the east coast of Baffin's Land, c. 63° n. lat. and 64° w. long., besides on the Nugsuak peninsula in Greenland between 70° and 71° n. lat., while Mr. Robert Stein collected on Hoyt island, about 15 miles north of Wilcox Head, c. 74°10′ n. lat., on the west coast of Greenland. The localities Umanak (island), Sarfarfik, Pagtorfik and Kook are situated on the northern coast of the Nugsuak peninsula, Ata and Atanikerdluk on the southern.

Dryas integrifolia M. Vahl. Signuia; Umanak; Kook; Pagtorfik.

Potentilla pulchella R. Br. Pagtorfik.

Potentilla Vahliana Lehm. Hoyt island.

Potentilla nivea L. Umanak; Pagtorfik; Ata.

Chamaenerium latifolium (L.) Spach. Signuia; Umanak; Atanikerdluk.

Chamaenerium latifolium, β tenuiflorum Th. Fr. et Lge. Signuia.

Empetrum nigrum L. Kook; Umanak; Hoyt island.

Silene acaulis L. Signuia; Umanak.

Melandrium apetalum (L.) Fzl. Umanak; Pagtorfik.

Melandrium involucratum (Cham. et Schl.) *β affine* Rohrb. Umanak.

Halianthus peploides (L.) Fr. *β diffusa* Hornem. Signuia; Kook; Atanikerdluk.

Arenaria verna Bartl. *δ propinqua* (Rich.). Pagtorfik.

Stellaria humifusa Rottb. Signuia.

Stellaria longipes Goldie. Signuia; Cape Haven; Umanak; Pagtorfik.

Cerastium alpinum L. Umanak.

Cerastium alpinum β lanatum Lindbl. Signuia.

Cochlearia fenestrata R. Br. Pagtorfik.

Draba nivalis Liljebl. Cape Haven; Hoyt island.

Draba corymbosa R. Br. Pagtorfik.

Draba arctica M. Vahl. Umanak; Pagtorfik; Ata.

Cardamine bellidifolia L. Signuia; Hoyt island.

Arabis alpina L. Ata.

Papaver radicatum Rottb. Signuia; Umanak; Hoyt island.

Ranunculus pygmaeus Wahlbg. Signuia.

Ranunculus hyperboreus Rottb. Signuia.

Ranunculus nivalis L. Pagtorfik.

Saxifraga nivalis L. Pagtorfik; Hoyt island.

Saxifraga stellaris L. *forma comosa* Poir. Signuia.

Saxifraga cernua L. Umanak; Pagtorfik.

Saxifraga rivularis L. Cape Haven; Hoyt island.

Saxifraga decipiens Ehrh. Signuia; Pagtorfik.

Saxifraga tricuspidata Rottb. Umanak; Pagtorfik; Hoyt island.

Saxifraga aizoides L. Ata; Pagtorfik.

Saxifraga oppositifolia L. Atanikerdluk; Pagtorfik; Hoyt island.

Armeria vulgaris Willd. var. *Sibirica* (Turcz.). Umanak.

Veronica alpina L. Ata.

Veronica saxatilis L. f. Ata; Atanikerdluk.

Pedicularis hirsuta L. Signuia; Umanak; Pagtorfik.

Pedicularis lanata Cham. Kook.

Stenhammaria maritima (L.) Rchb. Signuia.

Diapensia Lapponica L. Signuia.

Pyrola grandiflora Rad. Umanak; Hoyt island.

Arctostaphylos alpina (L.) Spr. Cape Haven.

Phyllodoce coerulea Gr. et Godr. Cape Haven.

Cassiope tetragona (L.) Don. Signuia; Umanak; Pagtorfik; Hoyt island; Kook.

Loiseleuria procumbens (L.) Desv. Hoyt island.

Ledum palustre L. *β decumbens* Ait. Cape Haven; Kook.

Vaccinium uliginosum L. **microphyllum* Lge. Cape Haven; Umanak.

Campanula uniflora L. Signuia.

Campanula rotundifolia L. δ *arctica* Lge. Umanak.

Taraxacum officinale Web. **ceratophorum* (Ledebour). Signuia ; Sarfarfik.

Artemisia borealis Pall. Ata ; Umanak.

Antennaria alpina Gaertn. Umanak ; Hoyt island.

Erigeron uniflorus L. β *pulchellus* Fr. Hoyt island.

Arnica alpina Murr. Umanak ; Sarfarfik.

Koenigia Islandica L. Signuia.

Polygonum viviparum L. Collected at all stations.

Oxyria digyna Campd. Collected at all stations.

Salix herbacea L. Cape Haven.

Salix Groenlandica Lundstr. Cape Haven.

Salix glauca L. Signuia ; Cape Haven ; Ata ; Umanak.

Betula nana L. Umanak.

Tofieldia borealis Wahlbg. Hoyt island.

Juncus arcticus Willd. Ata.

Luzula arcuata (Wahlbg.) Hook. Umanak ; Hoyt island.

Luzula confusa Lindeb. Cape Haven.

Eriophorum Scheuchzerii Hppe. Signuia ; Hoyt island.

Eriophorum angustifolium Roth. Signuia.

Carex misandra R. Br. Godhavn on Disco island.

Carex rigida Good. Cape Haven.

Carex vesicaria L. γ *alpigena* Fr. Umanak.

Elymus arenarius L. β *villosus* E. Mey. Umanak ; Atanikerdluk.

Alopecurus alpinus Sm. Umanak ; Pagtorfik.

Hierochloa alpina R. et S. Cape Haven ; in Greenland at all stations.

Calamagrostis stricta (Timm.) var. *borealis* Laest. Godhavn ; on Disco island.

Trisetum subspicatum Beauv. Cape Haven ; in Greenland at all stations.

Catabrosa algida Fr. Cape Haven.

Colpodium latifolium R. Br. Umanak.

Poa glauca M. Vahl. Cape Haven.

Poa glauca δ *atroviolacea* Lge. Umanak.

Poa alpina L. Umanak.

Poa flexuosa Wahlbg. Cape Haven ; in Greenland at all stations.

Festuca ovina L. γ *alpina* Koch. Cape Haven.

Festuca ovina δ *duriuscula* (L.). Umanak.

Lycopodium Selago L. Signuia; Hoyt island.

Cystopteris fragilis Bernh. var. *arctica* Koch. Pagtorfik; Hoyt island.

Equisetum variegatum Schl. Sarfarfik.

Equisetum arvense L. Kook; Sarfarfik.

BROOKLAND, D. C., Nov. 1899.

An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXIX

By H. H. Rusby

(Continued from Bull. Torr. Club, 26: 31. 22 Ja. 1900.)

Besleria longipedunculata Britton sp. nov.

Branchlets, inflorescence and lower leaf-surfaces sparsely short pilose: petioles (only the upper leaves seen) 3–5 cm. long, stout, broad, channeled above, nerved underneath: blades 1.5–3 dm. long, .5–1.5 dm. broad, obovate, the margin coarsely and most irregularly sinuately lobed, as though due to injury, but the same in both Mr. Bang's collections and my own, very thin, dark-green above, pale underneath, where the broad coarse midrib and strongly incurved secondaries are very prominent: peduncles 1–1.5 dm. long, weak, ascending, about 5–8-flowered: pedicels 1.5–3 cm. long, coarse and weak: calyx-tube 5 mm. long and nearly twice as broad, hemispherical, the lobes of about the same length: corolla 2 cm. long, campanulate with the upper half contracted, glabrous, thickish, crimson, the lobes 5–8 mm. long.

Mapiri, Bolivia, 5000 ft., Apr., 1880 (no. 2436). The same as Bang's no. 2539. Dr. Britton says, "Related to *B. divaricata* Poepp. (Mathews' no. 2006), but leaves and flowers twice as large."

BIGNONIACEAE

Arrabidaea obovata DC. Prod. 9: 185. Guanai, 2000 ft., May, 1886 (no. 1153), and Mapiri, nos. 1131 and 1132.

Arrabidaea florida DC. Prod. 9: 184. Guanai, 3000 ft., May, 1886 (no. 1133), and Reis, 1500 ft., June (no. 1135).

Arrabidaea Orbignyana DC. Prod. 9: 184. Guanai, 2000 ft., May, 1886 (no. 1134).

Lundia densiflora DC. Prod. 9: 181. Mapiri, 5000 ft., April, 1886 (no. 1136). The same as Spruce's 2232.

Bignonia glutinosa DC. Prod. 9: 162. Guanai, 2000 ft., May, 1886 (nos. 1147 and 1154).

Bignonia pyramidata Rich. Act. Soc. Hist. Nat. Par. 1: 110. 1792? Guanai, 2000 ft., May, 1886 (nos. 1149 and 1152). The leaves are less pubescent underneath.

Bignonia unguis L. Sp. Pl. 623. Junction of Rivers Beni and Madre de Dios, Aug. 1886 (nos. 1137 and 2569).

Bignonia venusta Ker. Bot. Reg. *pl. 249.* Guanai, 2000 ft. May, 1886 (no. 2725).

Bignonia sp. near *B. dentata* DC., but probably undescribed. Flowers are wanting. Guanai, 2000 feet, May, 1886 (no. 1148).

Bignonia, three species, the specimens unfit for determination. Guanai, 2000 ft., May, 1886 (nos. 1138 and 1146), and Unduavi, 8000 ft., Oct., 1885 (no. 2537).

Bignonia sp. (?) Guanai, 2000 ft., May, 1886 (no. 2724). The material is unfit for dissection.

Bignonia sp., Guanai, 2000 ft. May, 1886 (no. 1148). This is almost certainly undescribed, but flowers are wanting.

Bignonia Benensis Britton, sp. nov.

Inflorescence and flowers minutely puberulent: branchlets slender, coarsely sulcate: petioles 3 or 4 cm. long, stoutish, deeply pitted at the enlarged summit, between the petiolules: leaflets 2 or 3: petiolules of the lateral .5–1 cm. long, the blades 6 or 7 cm. long, 2.5–3.5 cm. broad, ovate, slightly cordate, very short-pointed but obtusish, dark-green, coriaceous, the slender venation lightly prominent on both sides, the 10–12 pairs of secondaries connecting near the margin: terminal leaflet similar, but its petiolule two or three times as long, the blade one third longer and relatively broader: cyme shortly and stoutly peduncled or sub-sessile, subulate-bracted: pedicels about 7 mm. long, thickened at the summit: calyx thick, nearly 1 cm. long, 6 mm. broad, campanulate, the mouth oblique, sinuately lobed: corolla-tube infundibular, the lower half lightly contracted and darker, about 5 cm. long, 1.5 cm. broad at the summit, the spreading limb 3 cm. broad: the lobes rounded.

Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1143).

Bignonia Boliviana sp. nov.

Glabrous except the minutely puberulent flowers: branches terete, gray, white spotted: branchlets slender, strongly striate: leaves ternate; petioles 3–5 cm. long, striate: lateral petiolules, .5–1 cm., terminal 2 cm. long: leaflets, .5–1 dm. long, 3–6 cm. broad, oval or ovate, at the base rounded, truncate or sub-cordate, at the apex very short-pointed and obtuse, very thin, dark-green, the dark, coarse and coarsely reticulate venation not prominent, the secondaries 8 or 10 pairs: panicles 1 dm. long, loosely flowered, stoutly peduncled: pedicels slender, .5–1 cm. long: calyx 6–7 mm. long, 5–6 mm. broad, campanulate, the margin truncate, almost entire: corolla (color?) 5 cm. long, the tube campanulate, the spreading limb nearly 3 cm. broad, as pressed.

Junction of Rivers Beni and Madre de Dios, August, 1886 (no. 1142). No. 1210 (Beni River, July, 1886) may be the same. Its leaves are biternate, the leaflets ovate, 1–1.5 dm. long, 4–6.5 cm. broad, the flowers large and distinctly yellow.

Bignonia Rusbyi Britton, sp. nov.

Yellowish-tomentellate except the upper leaf-surfaces: branchlets stoutish, purplish, finely many-striate: petiole 2 cm. long, stout, costate: leaflets 2, the petiolules nearly equaling the petiole, blades .75–1.25 dm. long, 3–5 cm. broad, oblong, blunt to rounded at the base, abruptly very short-pointed and obtuse at the apex, thickish, the venation lightly impressed above, prominent underneath, the secondaries 8–10 pairs: panicle 1 dm. long or less, shortly and stoutly peduncled, densely flowered: pedicels .5–1 cm. long, very stout: calyx thick, 8 mm. long and broad, campanulate, the margin truncate and entire: corolla-tube strongly curved, campanulate-infundibular, 4 cm. long, 2 cm. broad at the summit, as pressed; the recurved limb 4–5 cm. broad.

Junction of Rivers Beni and Madre de Dios, August, 1886, (no. 1140). Dr. Britton regards Spruce's no. 1721, from the Rio Negro, as of this species.

Bignonia brevipes sp. nov.

Finely puberulent: branches terete, finely costate: petioles about 2 cm. long: leaflets 2, the petiolules about 1 cm. long, stoutish, sub-terete: blades .5–1 cm. long, 2–3 cm. broad, lance-oblong, rounded at the base, acuminate and acute at the apex, entire, thin but rigid, bright-green, punctate, the venation inconspicuous above, prominent underneath, the secondaries about 6 pairs, strongly ascending and incurved, their upper portions sinuous near the margin before communicating, connected by the straightish tertiaries, the lowest pair elongated so as to make the leaf somewhat 3-nerved; racemes very short, densely several-flowered, short-peduncled, lanceolate-bracted: pedicels about 5 mm. long, slender: calyx campanulate, 7 mm. long and somewhat broader, lobed about one third of the way, the lobes broad, rounded at the apex, the sinuses acute; corolla-tube nearly 3 cm. long, the lower fourth contracted, the remainder broadly and openly campanulate, the recurved-spreading limb about 2 cm. broad: pod cylindrical, elongated, 4–5 mm. thick.

Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1144).

Macfadyena Bangii sp. nov.

Glabrous: branchlets stoutish, light-gray-brown: petioles 2–3 cm. long, stout, strongly sulcate: leaflets 2, with a terminal tendril: petiolules .5–1 cm. long, very stout, broadly channeled above: leaflets 1–1.25 cm. long, 5–6 cm. broad, ovate, rounded to subcordate at the base, very short-pointed at the apex, thick and rigid, pale-green, slightly shining above, the venation lightly prominent underneath, the 7 pairs of very slender secondaries connected distantly from the margin: tendril simple, stout, elongated: peduncle about 5 cm. long, stout, few-flowered: pedicels about 5 mm. long, very stout: bract 3 cm. long, closed toward the base, campanulate, lightly nerved, tipped with a short, very thick, black, blunt strongly incurved beak: tube of the yellow corolla 5 cm. long, 1 cm. broad at the summit, infundibular, strongly nerved: lobes 3 cm. long and broad, narrowed at the base, rounded at the summit.

Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1139). Mixed with this species are some fragments of another with lanceolate leaflets, little more than half as long, and thin, and the flowers smaller though very similar. This also appears undescribed, but the material is too scanty.

Adenocalymna multiglandulosum Benth. (*fide* Britton). Junction of Rivers Beni and Madre de Dios, Aug. 1886 (nos. 1145 and 1786), and Unduavi, 8000 ft., Oct. 1885 (no. 1141).

Adenocalymna bracteatum (Cham.) DC. Prod. **9**: 200 (*Bignonia bracteata* Cham. Linnaea, **7**: 692. 1832. Guanai, 2000 ft., May, 1886 (nos. 1129 and 1130).

Pleonotoma Brittoni sp. nov.

Glabrous: branches very slender, coarsely angled: stipules 1.75 cm. long, 2.25 cm. broad, cordate, highly inaequilateral, mucronate, entire, conspicuously nerved: petioles 5 or 6 cm. long: entire leaf about 2 dm. long and broad: pinnae three pairs, one of the lowest pair a tendril, the other of two and a half pairs of leaflets (of which the lowest or middle pair are ternate) the middle of one and a half pairs, the upper of single leaflets: leaflets sub-sessile or short-petioluled, except the terminal, which are strongly petioluled, 2.5–6 cm. long, 1.25–3 cm. broad, the terminal much larger, ovate, rounded at the base, abruptly short-acuminate and acute at the apex, thin, deep-green, the venation very slender, lightly prominent underneath, the rather crooked secondaries about 6 pairs, connecting near the margin: panicle (but one seen) 5 or 6 cm. long, loosely few-flowered: pedicels about 1 cm. long: calyx companulate, 8 mm. long, 6 mm. broad, as pressed, rounded at the base, truncate and entire at the apex, thickish, obscurely nerved: abruptly contracted base of light-yellow corolla-tube 1.5 cm. long, 3.5 mm. broad, as pressed, cylindrical, the remainder 3 cm. long, 1.6 cm. broad, campanulate, the spreading border 4 cm. broad, the lobes sub-rotund.

Falls of Madeira, Brazil, Oct., 1886 (no. 1150).

Callichlamys riparia Miquel, Linnaea, **18**: 254. 1844. Yungas, 4000 ft., 1885 (no. 2271).

Tecoma Capensis Lindl. Bot. Reg. *pl. 1117*. Yungas, 4000 ft., 1885 (no. 2448).

Tecoma Gaudichaudii DC. Prod. **9**: 223. Unduavi, 8000 ft., Oct., 1885 (no. 2412).

Tecoma mollis (H.B.K.) Nov. Gen. et Sp. **3**: 144. Sorata, 8000 ft., February, 1886 (no. 1128). The same as Mandon's no. 503.

Jacaranda acutifolia Humb. & Bonp. Pl. Aequin. **1**: 59. *pl. 17*. Yungas, 6000 ft., 1885 (no. 1164).

Jacaranda longiflora Britton, sp. nov.

Glabrous: branchlets stout, soft, whitish: petioles dark-purple, coarsely sulcate, 5 or 6 cm. long: primary petiolules 1.5–2 cm. long, about 4 pairs: entire leaf (but one seen) 3.5 dm. long, 3 dm. broad, bipinnate, the leaflets about 6 pairs on the principal pinnae, subsessile, 3–5 cm. long, 1.5–2.5 cm. broad, ovate, mostly slightly inequilateral, blunt at the base, abruptly short-pointed and acute at the apex, entire, thin, dark-green, venation lightly prominent underneath, the secondaries about 10 pairs, at an angle of about 45°, slightly up-curved: panicles fascicled, about 1.5 dm. broad, loosely flowered, the peduncles dark, 1.5–2 cm. long: bracts 5–8 mm. long, lanceolate, acuminate and acute: pedicels about 5 mm. long thickened at the summit, mostly 2-bracteolate: calyx campanulate with a turbinate base, about 8 mm. long, 5 mm. broad, the teeth 1–2 mm. long, very acute, the sinuses very broad and shallow: corolla 6–7 cm. long, slightly curved; base of the tube contracted abruptly, 1 cm. long, 5 mm. broad, the remainder infundibular, 4 cm. long, 1.25 cm. broad, as pressed, the spreading limb 3.5 or 4 cm. broad: filaments, one pair strongly sigmoid-curved, the others simply curved, reaching, as curved, about to the middle of the corolla, slender: anthers transverse, about 4 mm. long: style stout, upwardly thickened, the branches 6 mm. long, broad, flattened, the apex rounded.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 1151).

ACANTHACEAE.

Mendoncia puberula micropus Nees; DC. Prod. **11**: 53. Guanai, 2000 ft., May, 1886 (nos. 2406 and 2407).

Mendoncia glabra Nees; DC. Prod. **11**: 52. Mapiri, 2500 ft., May, 1886 (no. 2409).

Mendoncia Lindavii Rusby, Mem. Torr. Club, **4**: 24. (no. 2405).

Mendoncia Velloziana Nees; DC. Prod. **11**: 52. Guanai, 2000 ft., May, 1886 (no. 2408).

Elytraria imbricata (Vahl.) Pers. Syn. **1**: 23 (*Justicia imbricata* Vahl. Eclog. Am. **1**: 1. *E. tridentata* Vahl, Enum. **1**: 107). Reis, 1500 ft., June, 1886 (no. 1115).

Ruellia pedunculosa Nees; DC. Prod. **11**: 211 in Syn. sub. *Arrhostoxylum pedunculosum.* Guanai, 2000 ft., May, 1886 (no. 2426). The same as Bang's no. 1223 and Mathews' no. 3148.

Ruellia paniculata L. Sp. Pl. 635, *fide* Britton. Yungas, 6000 ft., 1885 (no. 2410).

Ruellia Willdenoviana (Nees) Lindau (*Stemonacanthus Willdenoviana* Nees; DC. Prod. **11**: 207). Guanai, 2000 ft., May, 1886 (nos. 1120 and 1123), Mapiri, 2500 ft., May, 1886 (no. 1122), and Yungas, 6000 ft., 1885 (no. 1124).

Ruellia Bangii Rusby, Mem. Torr. Club, **6**: 102. Guanai, 2000 ft., May, 1886 (no. 1117).

Ruellia (Dipteracanthus) elliptica sp. nov.

Strigose-hirsute: root stout, coarsely branched: stems erect, stoutish, terete, branched from the base: leaves sessile, 3–6 cm. long, 1–2 cm. broad, obovate, acute at the base, blunt at the apex, entire, thickish: calyx 5–7 mm. long, divided nearly to the base, the lobes lance-linear, acuminate: corolla pale-purple, pubescent, nearly 3 cm. long, the tube strongly curved, passing gradually into the infundibular-campanulate limb, the lobes 5–7 mm. long:

anthers 3.5 mm. long, 1 mm. broad, lanceolate, obtuse, obtusely sagittate, the thecae subequal.

Guanai, 2000 ft., May, 1886 (no. 2562). The same as Bang's no. 2472.

Ruellia Lechleri Britton, sp. nov.

Younger portions, leaf-surfaces, etc., finely short-strigose: branches erect, quadrangular, dark-brown or blackish: petioles 1–3 cm. long, sharply margined, dilated at the insertion: blades .5–1 dm. long, 1.75–3.5 cm. broad, ovate, abruptly acuminate and acute at both ends, dark-green, thin, the venation prominent both sides, the 8 or 10 pairs of secondaries stout, strongly ascending, connected by numerous stout, straight tertiaries: flowers sessile and concealed at the base among the crowded, closely appressed terminal leaves: bracts foliaceous: calyx 1.5 cm. long, the tube campanulate, 3 or 4 cm. long, the lobes linear-attenuate, rigid, acute: corolla-tube consisting of a strongly curved, cylindrical lower portion 3.5 cm. long (in the type) and about 2 mm. thick, pubescent with spreading or slightly reflexed hairs, and an upper, infundibular, sigmoid curved portion about 1 cm. long, the lips nearly 2 cm. long: stamens not reaching to the base of the lips, the filaments thick and dilated, the anthers nearly 5 mm. long, 2 mm. broad at the base, sagittate, obtuse, the thecae parallel: style about equaling the stamens, thick like the branches, which are 2.5 mm. long.

Mapiri, 5000 feet, May, 1886 (no. 1165). Dr. Britton regards it as identical with Lechler's no. 2171 from Peru.

Dr. Britton regards no. 1118, from near La Paz, 10,000 feet (?), April, 1885, as a variety or form of the same. Its flowers are a fourth smaller, its calyx-lobes relatively broader, and its leaves smaller.

Ruellia Lechleri grandifolia Britton, var. nov.

Petioles 5 or 6 cm. long, blades reaching 1.5 cm. or more long, 8 cm. broad, thinner: flower-bases less concealed by the upper leaves: calyx-lobes broader: pod 1.5 cm. long, broadly lance-oblong.

Yungas, 6000 feet, 1885 (no. 1116).

Sanchesia Peruviana (Nees) Rusby, Mem. Torr. Club, 6: 102. Guanai, 2000 ft., May, 1886 (no. 1119).

Lophostachys conferta Rusby, Mem. Torr. Club, 6: 103. Mapiri, 5000 ft., April, 1886 (no. 1114).

Eranthemum cordatum Nees; Benth. Voy. Bot. Sulph. 147. Guanai, 2000 ft., May, 1886 (no. 1168).

Lepidagathis justicioides Britton, sp. nov.

Short-pilose throughout, including the corolla: stems weakly erect, 1–3 dm. long, terete, much-branched, the branches slender, widely spreading: leaves sessile by a narrow petiole-like base, 2–4 cm. long, .75–1.5 cm. broad, oval to obovate, abruptly contracted into the narrow base, blunt at the apex, very thin, the coarse venation lightly conspicuous underneath, the secondaries about 6 pairs: spikes long and slenderly peduncled, the flowers densely arranged, leafy-bracted, the bracts oblong, 5–7 mm. long: calyx 5 mm. long, one lobe longest, oval, herbaceous, obtuse, nearly 2 mm. broad, the others linear, acute, the shorter 4 mm. long: corolla-tube, 3 mm. long, cylindraceous-infundibular, the remaining portion campanulate, 3 mm. long: lobes nearly 2 mm. long, oblong-ovate: stamens reaching to the base of the corolla-lobes: anthers .5 mm. broad, half as long, minutely mucronate: ovary oval, brown, 2 mm. long: style 3 mm. long, slender, the branches recurved.

Guanai, 2000 ft., May, 1886 (no. 2563).

Aphelandra tetragona (Vell.) Nees in DC. Prod. **11**: 295. Guanai, 2000 ft., May, 1886 (no. 1107).

Aphelandra acutifolia Nees in DC. Prod. **11**: 299 (no. 2054).

Aphelandra sp. (?) Reis, 1500 ft., June, 1886 (no. 1125). Material for dissection is wanting.

Aphelandra castanaefolia Britton, sp. nov.

Pilose with slightly ferruginous hairs, the leaves nearly glabrous: stems very stout, terete below, obtusely quadrangular above, the branchlets sharply quadrangular at the summit: petioles 1–2 cm. long, very broad and stout: blades 1.5–2.5 dm. long, 5–7 cm. broad, oblong to obovate, narrowed into the petiole, abruptly short-acuminate and acute, very coarsely serrate with spinulose teeth and rounded sinuses, coriaceous, the venation prominent on both sides, especially underneath: secondaries about 16 pairs, continued into the teeth, the venation coarsely reticulate between: bracts 1.25–2.5 cm. long, lanceolate, acuminate from the broad base and very acute, rigid: calyx 1.5 cm. long, parted nearly to the base, glabrous, coriaceous, the lobes ovate, acuminate and acute: corolla 5 cm. long, the lips nearly 2 cm. long: middle lobe of lower lip very large and broad, the lateral 1 cm. long, 2 or 3 mm. broad, oblong, very delicate, acutish, the upper lip 2-lobed, the lobes 5 mm. long, acutish: stamens equaling the upper lip, the anthers 3 mm. long: mature capsules not seen.

Yungas, 4000 ft., 1885 (no. 1098), and Mapiri, 2500 ft., May, 1886 (no. 1112).

Aphelandra Rusbyi Britton, sp. nov.

Coarsely, and the leaves sparsely, pilose : stems stoutish, terete : leaves sessile above, short-petioled below, 1–1.5 dm. long, 6–9 cm. wide, obovate, acuminate at the base, acute at the apex, the margin bearing 5 or 6 pairs of large spinulose teeth, deep-green above, pale underneath, where the venation is prominent, the 12–14 pairs of primaries very slender, continued into the teeth : spikes (in bud) short-peduncled, about 6 cm. long, 2 or 3 cm. broad, densely flowered : bracts 1.5–2 cm. long, 5–7 mm wide, exclusive of the teeth, ovate, acute, bearing long setiform teeth, 3-nerved : calyx 1.25 cm. long, parted nearly to the base, the lobes lanceolate, acuminate and acute, lightly keeled and finely nerved, pilose : flowers not seen.

Reis, 1500 ft., June, 1886 (no. 1108).

Pachystachys Riedeliana N. ab. E.; Endl. & Mart. Fl. Bras. Fasc. 7: 93. Junction of Rivers Beni and Madre de Dios, August, 1886 (no. 1099).

Pseuderanthemum Bolivianum Britton, sp. nov.

Sparsely short-pilose : branchlets elongated, slender, ascending, reddish : petioles about 5 mm. long, consisting of the narrowed leaf-bases, inserted into saucer-shaped dilations of the node : blades 3.5–7 cm. long, .75–2.5 cm. broad, lance-ovate, acuminate and acute at both ends, entire, deep-green, thin, the slender venation inconspicuous on both sides : peduncles and petioles each 3 mm. long, sharply quadrangular : calyx 6 or 7 mm. long, divided nearly to the base, the lobes narrowly linear, acuminate and acute, the tube hemispherical : corolla-tube 1.5 cm. long, very narrowly infundibular, the limb abruptly spreading, the lobes nearly 1 cm. long : capsule 2 cm. long, including the stalk, which is 1 cm. long, the body oblong, shortly and acutely pointed : seed 3 mm. long, 2.5 mm. broad, ovate, acutish, strongly flattened, 1-ribbed, strongly tuberculate.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 1166).

Hansteinia crenulata Britton ex Rusby, Mem. Torr. Club, **4**: 242. Yungas, 4000 ft., 1885 (no. 1818) and Mapiri, 5000 ft., April, 1886 (no. 1103).

Beloperone Cohabambensis Rusby, Mem. Torr. Club, **6**: 103.

Guanai, 2000 ft., May, 1886 (no. 1113). The same as Bang's no. 1215.

Beloperone Bangii Rusby, Mem. Torr. Club, **6**: 104. Beni River, July, 1886 (no. 1749).

Beloperone denudata Nees; DC. Prod. **11**: 423. Guanai, 2000 ft., May, 1886 (no. 1121), and Beni River, July, 1886 (no. 1819). The same as Mathews' no. 1208.

Chaetochlamys macrosiphon Lindau, Bull. Herb. Boiss. **3**: 409. 1895. Mapiri, 2500 ft., May, 1886 (no. 1111).

Justicia laeta (Nees) Lindau, Pflanzenf. 4^{3b}: 350 (*Rhytiglossa laeta* Nees; Mart. Flor. Bras. **9**: 126). Yungas, 6000 ft., 1885 (no. 1920).

Justicia parviflora (Nees) Lindau, Pflanzenf. 4^{3b}: 350 (*Leptostochys parviflora* Nees; Mart. Fl. Bras. **9**: 151). Mapiri, 2500 ft., May, 1886 (no. 2470).

Justicia breviflora (Nees); (*Rhytoglossa breviflora* Nees; DC. Prod. **11**: 352). Falls of Madeira, Brazil, Oct., 1886 (no. 1167).

Justicia Boliviana Rusby, Mem. Torr. Club, **6**: 104. Unduavi, 8000 ft., Oct., 1885 (no. 1170). The same as Bang's no. 1225.

Justicia Rusbyana Lindau ex Rusby, Mem. Torr. Club, **4**: 243. Yungas, 6000 ft., 1885 (no. 1171). The same as Bang's 379.

Justicia (Amphicropia) longiacuminata sp. nov.

Younger portions and leaf-surfaces very sparsely coarse-pilose: branches elongated, slender, strongly recurved and apparently reclining, terete: leaves subsessile by a narrow base, 2.5–4.5 cm. long, .7–1 cm. broad, lanceolate, abruptly contracted into a narrow petiole-like base, long-acuminate and acute at the apex, entire, thickish, bright-green, the midrib lightly impressed above, prominent underneath, the strongly ascending secondaries 8 or 10 pairs, slender, the venation obscure on both sides: spike (but one seen) 2 cm. long, 1.5 cm. broad, exclusive of the flowers, dense: bracts 7–9 mm. long, 4 or 5 mm. broad, ovate, acute, bright-green, thick and rigid, the reticulated stout veins conspicuous underneath: calyx 5 mm. long, parted to the base, the lobes narrowly linear-attenuate, pilose: corolla-tube about 1 cm. long, infundibular, lightly curved, the lower lip 4 mm. long, 5 mm. broad, the lobes rounded, the upper 4 mm. long and broad, erect.

Yungas, 6000 ft., 1885 (no. 2411).

Justicia (Dianthera) Reisensis sp. nov.

Very finely white-strigose: branches slender, erect or strongly ascending, flexuous, the internodes 3 or 4 cm. long: petioles 1–2 cm. long, narrowly margined: blades 3.5–8 cm. long, 2–4 cm. broad, ovate, mostly, especially the larger, inequilateral, at the base very abruptly contracted, then tapering into the petiole, abruptly very short-pointed and obtusish at the apex, dark-green, thin, the dark venation not prominent, the strongly ascending secondaries about 6 pairs, slender: spikes .5–1 dm. long, very slender, weak, rather loosely flowered: bracts 2 or 3 mm. long, linear, thick, rigid and tightly appressed: calyx 6 or 7 mm. long, parted to the base, the divisions lance-linear, attenuate, rigid, dark-green: corolla (unexpanded) 1 cm. long, infundibular: anthers nearly 2 mm. long, the connective bright-green, the thecae overlapping, broadly oblong or oval.

Reis, 1500 feet, June, 1889 (no. 1169).

Justicia sp. The material unfit for a diagnosis Mapiri, 5000 ft., Apr., 1886 (no. 1750).

Jacobinia Rusbyi Britton, sp. nov.

Upper portions of stem and inflorescence, including the corolla, densely glandular-pubescent, the upper leaf-surfaces sparingly pilose on the veins: stems elongated, ascending, weak, coarsely and irregularly quadrangular: petioles 5–8 mm. long, consisting of the narrowed leaf-bases, inserted into small cup-shaped projections of the nodes: blades .6–1 dm. long, 3–4 cm. broad, oval to ovate, abruptly acuminate and acute at both ends, entire, thin, deep-green above, yellowish underneath (as dried), the 10 or 12 pairs of secondaries very slender, strongly incurved, prominent both sides, especially underneath: panicle long-peduncled, the flowering portion about 1 dm. long and broad, loosely flowered: bracts 3–5 mm. long, broadly ovate, acute: calyx about 7 mm. long, parted nearly to the base, the lobes oblong-ovate, acutish; corolla about 4 cm. long, narrowly infundibular, nearly straight, the lips 1.5 cm. long: stamens about equaling the upper lip, the anther nearly 4 mm. long, the large, thickened connective blackish, thecae nearly 2 mm. long, one reaching nearly to the base of the other, acuminate at the base.

Yungas, 6000 ft., 1885 (no. 2404).

VERBENACEAE

Lantana trifolia L. Sp. Pl. 626. Guanai, 2000 ft., May, 1886 (no. 921).

Lantana velutina Mart. et Gal. Bull. Acad. Brux. 1: 325. Yungas, 6000 ft., 1885 (nos. 922 and 923).

Lantana lilacina Desf. Cat. Hort. Par. ed. 3, 392. Sorata, 8000 ft., Feb., 1886 (no. 925).

Lantana tiliifolia Cham. Linnaea, 7: 122. 1832. Guanai, 2000 ft., May, 1886: (924).

Lippia vernonioides Cham. Linnaea, 7: 232. 1832. Guanai, 2000 ft., May, 1886 (no. 926), and Reis, 1500 ft., June, 1886 (no. 927).

Lippia betulifolia H.B.K. Nov. Gen. et Sp. 2: 264. Junction of Rivers Beni and Madre de Dios, Aug., 1886, and Falls of Maderia, Brazil, Oct., 1886 (no. 917).

Lippia scorodonoides H.B.K. Nov. Gen. et Sp. 2: 269. Vic. La Paz, 10000 ft., Apr., 1885 (no. 920).

Lippia urticoides (Cham.) Steud. Nom. (ed. 2,) 2: 54 B. (*Aloysia urticoides* Cham. in Linnaea, 7: 238. 1832. Guanai, 2000 ft., May, 1886 (no. 1403).

Bouchea Ehrenbergii Cham. Linnaea, 7: 253. 1832. Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 915). The same as Holton's no. 505.

Valerianodes Cayennensis (Vahl) Kuntze, Rev. Gen. Pl. 510 (*Stochytarpheta Cayennensis* Vahl Enum. 1: 208). Reis, 1500 ft., June, 1886 (no. 914).

Priva cuneato-ovata (Cav.); (*Castelia cuneato-ovata* Cav.; Anal. Cienc. Nat. 3: 134. 1801. *Priva laevis* Juss. in Anal. Mus. Par. 7: 70. 1806.) Tacna, Mar., 1885 (no. 2531).

Priva lappulacea (L.) Pers. Ench. 2: 139. Vic. La Paz, 10000 ft., Apr., 1885 (no. 1785), and Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1784). The same as Holton's no. 496.

Verbena minima Meyen Reise 1: 451. Unduavi, 10000 ft., Oct., 1885 (no. 2670). Also collected by Mandon.

Verbena littoralis H.B.K. Nov. Gen. 2: 276. Tacna, Mar., 1889 (nos. 910, 912 and 913), Yungas, 4000 ft., 1885 (no. 907), Sorata, 8000 ft., Feb., 1886 (no. 911), Beni River, July, 1886 (no. 908).

Verbena hispida R. & P. Fl. Per. 1: 22. *pl. 34. f. a.* Tacna, Mar. 1885 (no. 909).

Petrea bracteata Steud. Flora. 764. 1843. Beni River, July, 1886 (no. 933), and Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 932).

Citharexylon ilicifolium H.B.K. Nov. Gen. et Sp. **2**: 256. Sorata, 10000 ft., Feb., 1886 (no. 2058).

Citharexylon spicatum sp. nov.

Ferruginous-tomentose, the upper leaf-surfaces sparsely short-pilose: stems stout, erect, terete, the internodes 4–5 cm. long: petioles 4–8 mm. long, stout: blades .75–1.25 dm. long, 3–5 cm. broad, lance-ovate, rounded at the base, abruptly contracted into a tapering, acute apex, thickish, rigid, dark-green above, yellowish underneath, with the coarsely reticulate venation prominent, the secondaries 10–12 pairs, connecting about two-thirds of the way from the midrib to the margin: peduncle stout, 2–3 cm. long, the loose compound spike 4–5 cm. long: flowers sessile, the calyx campanulate, nerved, 4 mm. long, 3 mm. broad, the lobes about 1 mm. long, 1.5 mm. broad, triangular-ovate: corolla thick, purple, 5–7 mm. long, the tube cylindraceous, the abruptly spreading or recurved limb 4–5 mm. broad.

Yungas, 6000 ft., 1885 (no. 2701).

Aegiphila tomentosa Cham. in Linnaea, **7**: 110. Reis, 1500 ft., June, 1886 (no. 2516).

Aegiphila arborescens (Aubl.) Vahl, Ecl. **1**: 15. Yungas, 4000 ft., 1885 (no. 2458). Probably also no. 2459.

Aegiphila oblongifolia sp. nov.

Minutely puberulent: stems very slender and weak, coarsely angular: petioles 5–7 mm. long, weak: blades 1–1.5 dm. long, 2–6 cm. broad, oblong, acuminate at the base, abruptly acuminate and obtuse at the apex, entire, very thin, dark-green, venation very slender, inconspicuous on both sides, the secondaries about 15 pairs: panicles 5 or 6 cm. long and broad, loosely flowered: bracts linear, very small: pedicels 2–4 mm. long, slender: calyx 4 mm. long and broad, campanulate, the margin truncate, obscurely sinuate: corolla-tube 3 mm. long, cylindraceous, the lobes 5 mm. long, 3 mm. broad, oval: stamens equaling the corolla-lobes, the filaments very slender, the blackish anthers 1 mm. long, triangulate: ovary globoidal, 1 mm. long: fruit 8 or 9 mm. long, nearly as broad, truncate, strongly lobed.

Reis, 1500 ft., June, 1886 (no. 2472) and Junctions of Rivers Beni and Madre de Dios, Aug. 1886 (no. 2473).

Vitex triflora Vahl Eclog. **2**: 49. Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1027).

Clerodendron aculeatum (L.) Griseb. Fl. Brit. W. Ind. 500 (*Volkameria aculeata* L. Sp. Pl. 637). Falls of Madeira, Brazil, Oct., 1886 (no. 2572).

Clerodendron Bolivianum sp. nov.

Densely and shortly ferruginous-tomentose, the leaves pubescent on the veins: stems very stout, obtusely quadrangular: branchlets short, stout, widely spreading, leafy: petioles about 1 cm. long: blades 3–6 cm. long, 2–3 cm. broad, obovate, abruptly tapering into the petiole, rounded at the apex, entire, thickish, the venation impressed and short-pubescent above, coarse, slightly prominent and strongly pubescent underneath, the secondaries about 6 pairs, strongly ascending: flowers pendulous, 3–5-fascicled, the fascicles sessile or short-peduncled: pedicels 3–5 mm. long: calyx turbinate-campanulate, 3 mm. long, 4 or 5 mm. broad, thick, ferruginous without, deep-purple within, the lobes about 1 mm. long, recurved: corolla deep-purple, the tube nearly 2 cm. long, slenderly infundibular, the strongly recurved lobes 5–7 mm. long, broadly ovate: filaments slender, reaching about 3 mm. beyond the corolla-tube, the strongly curved anthers oblong, about 3 mm. long.

Unduavi, 8000 ft., Oct. 1885 (no. 2619).

LABIATAE.

Ocimum micranthum Willd. Enum. Hort. Berol. 630. Mapiri, 5000 ft., Apr., 1886 (no. 1811), and Yungas, 6000 ft., 1885 (no. 2440).

Marsypianthes Chamaedrys (Vahl) Rusby, Mem. Torr. Club, **4**: 245. Mapiri, 5000 ft., Apr., 1886 (no. 1748), and Reis, 1500 ft., June (no. 1412). The same as Spruce's, no. 6514.

Mesosphaerum affine (Benth.) Kuntze, Rev. Gen. Pl. 526 (*Hyptis affinis* Benth. Lab. Gen. et Sp. 109). Reis, 1500 ft., June, 1886 (no. 1413).

Mesosphaerum capitatum (Jacq.) Kuntze, Rev. Gen. Pl. 525 (*Hyptis capitata* Jacq. Coll. **1**: 102, Ic. Rar. 1: *pl. 114*). Mapiri, 2500 ft., May, 1886 (no. 918), and Junction of Rivers Beni and Madre de Dios, Aug. 1886 (no. 1391).

Mesosphaerum eriocephalum (Benth.) Kuntze, Rev. Gen. Pl. 526. Sorata, 8000 ft., Feb., 1886 (no. 1404). The same as Bang's no. 976.

Mesosphaerum excelsum (Mart. et Gal.) Kuntze, Rev. Gen. Pl. 526 (*Hyptis excelsa* Mart. et Gal. in Bull. Acad. Brux. 11, **2**: (1844) 188. Reis, 1500 ft., June, 1886 (nos. 928 and 1783).

Mesosphaerum lantanifolium (Poit.) Kuntze, Rev. Gen. Pl. 526 (*Hyptis lantanifolia* Poit. Ann. Mus. Par. **7**: 468. *pl. 29*). Mapiri, 5000 ft., Feb., 1886 (no. 1408). Apparently a badly developed plant of this species.

Mesosphaerum odoratum (Benth.) Kuntze, Rev. Gen. Pl. 526. Yungas, 6000 ft., 1885 (no. 1417). The same as Bang's no. 270a.

Mesosphaerum recurvatum (Poit.) Kuntze, Rev. Gen. Pl. 527 (*Hyptis recurvata* Poit. in Ann. Mus. Par. **7**: 467. *pl. 28. f. 1.* 1806). Reis, 1500 ft., June, 1886 (no. 1392).

Mesosphaerum spicatum (Poit.) (*Hyptis spicata* Poit. in Ann. Mus. Par. **7**: 474. *pl. 28. f. 2.* 1806). Mapiri, 5000 ft., Apr., 1886 (no. 1393). Reis, 1500 ft., June, 1886 (no. 1395). Guanai, 2000 ft., May, 1886 (no. 1394) and Sorata, 8000 ft., Feb., 1886 (no. 1409).

Mesosphaerum uncinatum (Benth.) Kuntze, Rev. Gen. Pl. 527 (*Hyptis uncinata* Benth. Lab. Gen. et Sp. 80). Mapiri, 5000 ft., Apr., 1886 (no. 1396). The same as Bang's no. 1236.

Mesosphaerum Yungasense Britton ex Rusby, Mem. Torr. Club, **4**: 246. Yungas, 6000 ft., 1885 (no. 1410).

Mentha aquatica L. Sp. Pl. 576. Vic. Valparaiso, Chili, June, 1885 (no. 1062).

Mentha Pulegium L. Sp. Pl. 577. Near Valparaiso, Chili, June, 1885.

Bystropogon canus Benth. Lab. 326. Vic. La Paz, 10000 ft., February, 1885 (no. 1406).

Bystropogon mollis H.B.K. Nov. Gen. et Sp. **2**: 317. Unduavi, 8000 ft., October, 1885 (no. 1499).

Bystropogon andinum Britton, sp. nov.

Finely and closely tomentellate throughout: branchlets numerous, divaricate, elongated, very slender, reddish, the internodes about 2 cm. long: petioles 2–3 mm. long, very slender, channelled above: blades 5–8 mm. long, 4–7 mm. broad, ovate, varying to oval, rounded and very slightly produced at the base, obtuse, obscurely sparse-serrate, thickish, grayish-green: venation obscure above, prominent underneath: clusters short-peduncled, mostly about 5-flowered, occasionally 10-flowered: flowers sessile: calyx 2.5 mm. long, campanulate, faintly nerved, the lobes .5 mm. long, ovate, acute: corolla 2 mm. long, the tube about as long as the limb, the lobes spreading or reflexed, subrotund.

Vic. La Paz, 10000 ft., April, 1885 (no. 1398). The same as Mandon's no. 515.

Micromeria Boliviana Benth. Lab. Gen. et Sp. 731. Unduavi, 10000 ft., October, 1885 (no. 1500). The same as Mandon's nos. 717 and 718.

Hedeoma Mandoniana Wedd. Chlor. And. **2**: 148. Sorata, 10000 ft. and 13000 ft., February, 1886 (nos. 1497 and 1498).

Gardoquia obovata R. & P. Syst. Veg. 150. Near Valparaiso, Chili, June, 1885 (no. 1061).

Alguelagum tenuiflorum (Benth.) Kuntze, Rev. Gen. Pl. 512 (*Sphacele tenuiflora* Benth. in DC. Prod. **12**: 257). Sorata, 10000 ft., February, 1886 (no. 1407), and Unduavi, 8000 ft., October, 1885 (no. 1411). The same as Mandon's no. 720.

Alguelagum Salviae (Lindl.) Kuntze, Rev. Gen. Pl. 512 (*Stachys Salviae* Lindl. Bot. Reg. *pl. 1226*; *Sphacele Lindleyi* Benth. in Bot. Reg. Sub. *pl. 1289*). Near Valparaiso, Chili, June, 1885 (no. 1399).

Alguelagum salviifolium (H.B.K.) Kuntze, Rev. Gen. Pl. 512 (*Sideritis salviifolium* H.B.K. Nov. Gen. et Sp. **2**: 307). Sorata, 8000 ft., Feb., 1886 (no. 1416). The teeth are narrower than in Bang's no. 1108.

Alguelagum confertum (Benth.) Kuntze, Rev. Gen. Pl. 512 (*Sphacele conferta* Benth. Pl. Hartw. 244). Unduavi, 8000 ft., Oct., 1885 (no. 1415). The same as Bang's no. 689.

Salvia Rusbyi Britton ex Rusby, Mem. Torr. Club **4**: 247. Yungas, 6000 ft., 1885 (no. 2414). The same as Bang's no. 422.

Salvia tiliifolia Vahl Symb. **3**: 7. Yungas, 6000 ft., 1885 (no. 1402). The same as Bang's no. 310.

Salvia occidentalis Sw. Prod. Veg. Ind., Dec. 14. Vic. La Paz, 10000 ft., April, 1885 (no. 1414).

Some Monstrosities in Spikelets of Eragrostis and Setaria

By W. J. Beal

In central Michigan we usually have a severe frost by September 5th–15th, but in 1898, it was delayed until about October 7th. This unusual delay of frost with warm weather and moisture enough was favorable for late growth of some plants.

On October 6th, I found a few plants of *Eragrostis major* Host., a common weed among grasses, which had apparently, like most others of its kind, made plans for closing its season of growth early in September, maturing spikelets 6 mm. long with 12–18 florets well filled with grain, but before drying up and dying—the weather was so fine—a new growth of the rachilla was made prolonging the axis to 17 mm. with 32 florets (Fig. 4), more than double the original length (Fig. 3). This new growth was not able to mature grain.

The first growth was broad and faded; the new was slender and olive green, making a sharp contrast in appearance.

Fig. 1, 2. *Chamaeraphis viridis*. 3, 4. *Eragrostis major*.

An increased number of florets has been recorded by others in *Hordeum*, *Lolium*, *Avena* and *Catabrosa*, but I have seen no account of this in *Eragrostis major*. From countries with warmer seasons, I have heard of spikelets of *Eragrostis major* containing as many as 50 florets on an axis 20 mm. long.

The spikelets of *Chamaeraphis* (*Setaria*) *viridis* (L.) Porter, bear 1–5 persistent, awnlike, barren branches or bristles.

In October, 1898, in rich ground, I found several thrifty plants of this species, in which a considerable number of the upper bristles bore at the apex, each a spikelet, and in one case, a spikelet was borne on the side of a bristle about two-thirds the distance from the base to the top (Fig. 2). The specimens with spikelets on the bristles confirm the statement, if it needs any further confirmation, that these bristles are actually branches and not mere hairs.

Notes on Cabomba Caroliniana A. Gray

BY W. J. BEAL

Perhaps it is ten years ago that I bought some small plants of this species of the water-lily family and placed in a small pond in the botanic garden. Nothing seemed to come of them, and they were given up for lost. In four years, there appeared some plants in considerable quantity in the center of a larger pond below and connected with the one where the *Cabomba* had been planted. I supposed it was something else, but found the flowers to be those of the long-lost *Cabomba*. It spreads, and is inclined to take complete possession of the lower ground, mixing in and crowding the water lilies which were previously well established.

Notes on Some Southwestern Plants

By T. D. A. Cockerell

Kallstroemia grandiflora Arizonica n. var.

On October 9, 1899, I observed that the plants of *K. grandiflora*, growing abundantly by the roadside and in waste places at Phoenix, Arizona, were easily separable into two forms, one of them the genuine *grandiflora*, the other undescribed. I tabulated the characters thus :

K. GRANDIFLORA	**Arizonica** n. var.
Flower 30 mm. in diam. (*i. e.*, the cup of the living flower).	Flower 20 mm. in diam.
Pistil 9 mm. long.	Pistil shorter, 6 mm. and stouter in proportion to its length. Filaments sho rter.
Sepals 12 mm.	Sepals 8 mm.
Peduncles 34–43 mm.	Peduncles 14–22 mm.
Leaves rather paler : leaflets longer in proportion to breadth, second pair 8–10.5 mm. long, 3–3.5 broad.	Leaves rather darker : leaflets (second pair) 6–8 mm. long, 3–4 broad.
Beak of fruit much longer (10 mm.) and not so thick.	Beak of fruit shorter (8 mm.) and stouter.

My first opinion was that these were clearly distinct species, but without being able to prove one thing or the other, I now incline to the opinion that *Arizonica* should be considered a variety or dimorphic form of *grandiflora*.

Holacantha Emoryi Gray

At Buckeye, Arizona, in October, I found a plant growing close to a ditch, and, apparently as the result of the unusual moisture, putting forth numerous narrow leaves, 15 mm. long. Dr. B. L. Robinson tells me that Mr. Pringle also collected the plant in this condition.

Malvastrum dissectum (Nutt.)

Sida dissecta Nutt.; Torr. & Gray, Fl., i. p. 235.

At Las Vegas, N. M., I found *M. dissectum* growing commonly, and at the same place plenty of *M. coccineum*, which is a very distinct plant. In Wet Mountain Valley, Colorado, *M. dissectum* was common, and passed for *M. coccineum*, which was not found there. In addition to the taller growth and very different leaves of *M. coccineum*, there is a difference in the lobes of the calyx, which in *dissectum* have short linear reddish tips, wanting in *coccineum*.

M. dissectum in the young state of the fruit has two ovules in each carpel, but one aborts, or not rarely both. Thus the distinction between *Malvastrum* and *Sphaeralcea* must rest not so much on the number of ovules as on their condition when mature: in the former genus closely adherent to the carpel wall, in the latter free and pubescent. It is unfortunate that the use of the name *dissectum* in a specific sense will interfere with the South African *M. dissectum* Harv.; in Harv. & Sond., Fl. Cap. **1**: 164.

Sphaeralcea lobata perpallida n. var.

Flowers very pale pinkish instead of scarlet. This occurs as a sport in the Mesilla Valley, N. M., but from Rincom, N. M., twenty miles or more northward along the railroad, it occurs abundantly to the exclusion of the type. *S. lobata* (typical form) occurs as high up as Las Vegas, N. M., in abundance. *S. cuspidata* (Gray) is common at the same place, and very distinct from *lobata*. The pollen of *cuspidata* is pale lemon-yellow, that of *lobata* bright orange.

PROSOPIS VELUTINA Wooton

I found this common throughout the Salt River Valley, Arizona, and at Buckeye. At the last mentioned place it grows to a tree of very fair size.

ROSA ARKANSANA SUFFULTA=*R. suffulta* Greene, Pittonia, **4**: 12

I found this abundant at Las Vegas, between the town and the Hot Springs. The stipular leaflets are as described by Greene.

VERBENA MACDOUGALII Heller

This is extremely common at Las Vegas, N. M., and I had noticed that it did not agree with the description of *V. stricta*. The following bees were observed to visit its flowers at Las Vegas and the vicinity:

Anthophara (*Amegilla*) *cardui* Ckll., 1 ♂, Hot Springs, Aug. 10, W. Porter.

Anthophara (*Amegilla*) *cleomis* Ckll., 1 ♂, Las Vegas, July 20, W. Porter.

Anthophara maculifrons Cresson, 4 ♂, 2 ♀, Las Vegas, Aug. 9, W. Porter.

Calliopsis verbenae Ckll. & Porter, Several ♂, ♀, Las Vegas, Aug. 9, W. Porter.

Halictus tegularis Rob., 1 ♀, Hot Springs., Aug. 10, W. Porter.

Megachile fidelis Cresson, ♂, Las Vegas, July 6–19, Porter and Ckll.

Megachile fortis Cresson, 1 ♂, Hot Springs, Aug. 10, W. Porter.

Melissodes grindeliae Ckll., 1 ♀, Las Vegas, July 19, W. Porter.

Melissodes pallidicincta Ckll., 1 ♀, Las Vegas, July 6–11, M. Winters and Ckll.

Also two or three species of *Megachile* not yet determined.

DELPHINIUM CAMPORUM Greene, var.

Las Vegas, N. M., July 20, 1899 (*M. Winters* and *N. Stern*).

This plant seems not to agree wholly with the described forms: it is about three feet high, with tall spikes a foot long, with very numerous flowers: leaves with linear divisions. The flowers are glabrous, but with a lens one can see a short pubescence on the spurs and peduncles. Sepals greenish-white: lower petals violet, bearded with yellow hairs: upper petals white, outwardly stained at apex with purple, and lower with blue: anthers purplish: filaments ringed with deep blue just below the anthers.

UROMYCES COMPACTUS Peck (det. Ellis and Peck)

Mesilla, N. M., Nov. 1897. I found this abundantly on the stems of *Aster spinosus*: it was originally described as from an unknown composite.

MESILLA PARK, N. M., Dec. 15, 1899.

Proceedings of the Club

TUESDAY EVENING, DEC. 12, 1899

President Brown in the chair, 33 persons present. Two new members were elected. Dr. D. T. MacDougal, Botanical Garden, N. Y., and Miss Anna F. Thompson, Summit, N. J.

The scientific program was opened by a paper by Dr. L. M. Underwood, "On the Genera of the Schizaeaceae."

Dr. Underwood explained the peculiar characters of the sporangium by which the Schizaeaceae are distinguished, illustrating with figures, and then sketching the history of the order. Linnaeus put its species under *Acrostichum* and *Osmunda;* Richard was the first to begin segregation, erecting in 1792, the genus *Lophidium.* In 1793, *Schizaea* was founded by Smith on a South African plant common through the Transvaal region, quite similar to our own species of New Jersey. Wallich founded another genus, *Actinostachys*, in 1822, on an East Indian form. Dr. Underwood considered these three genera to be valid, though recent German systematists, as Prantl, have not recognized them.

Swartz constituted another genus in 1800, *Mohria*, from Cape Colony, of which only one species is known. *Lygodium*, our best known genus, was established by Swartz in 1800, and includes one well-known Atlantic species, *L. palmatum*, the Climbing-fern.

Several other genera, as *Anemia* and *Trochopteris*, were discussed, with remarks on principal species. About 90 species of the order have been published, largely American and tropical, especially the abundant Brazilian forms of *Anemia* and allies.

Professor Lloyd suggested the interest attaching to *Trochopteris* as possibly a very primitive form.

Dr. Underwood said it is sparsely represented from Brazilian collections, perhaps because of its small size and habit of growth close to the ground, the largest specimen known being only three inches in diameter.

The second paper was by Dr. D. T. MacDougal, "Studies on *Hexalectris*." This rare Southern orchid is of great interest on account of its supposed near relationship to *Corallorhiza*, which develops short coralloid outgrowths without roots, but producing a mycorhiza and sending out hyphae into the soil. Material of *Hexalectris* from Alabama, although possessed of somewhat similar coralloid growths, was found to contain no fungi, and to be without apparent adaptation to growth by mycorhiza. No one seems to have seen the roots of this plant.

The third paper was by Dr. N. L. Britton, "Notes on Species of *Crataegus*."

Dr. Britton exhibited and discussed 34 species of the northeastern United States, and remarked upon the great need of persistent field-study in determining this genus. One must have flowers, mature leaves and mature fruit from any individual bush before he can begin to find its relationship to any other form. The most difficult part of the genus is perhaps the *C. tomentosa* group. Many southern species have recently been found to extend their range into Virginia, as *C. Chapmani*, *C. Carolina*, etc.; and others into Missouri, as *C. berberifolia*. The identity of the original of *C. coccinea* of Linnaeus proves to have a special local interest. Linnaeus seems to have had, as often, no specimen before him, but based his description on a plate of Plunkenet and another of Ray. Few herbarium specimens correspond well to the figure, which answers only to leaves of a shrub collected twice near New York, once by Mr. E. P. Bicknell along the Harlem River, and once by the late Professor E. H. Day on Persimmon Island, near New Rochelle, N. Y. The leaves bear a remarkable resemblance to those of *Betula nigra*. Search for similar specimens near New York should be made; the leaves are longer, and with blunter, shallower lobes than in the commonly-received *C. coccinea*.

Dr. Britton is endeavoring to get together at the Botanical Garden a collection of these species, and has now a dozen or more; but the wild stock is very difficult to grow and is impatient of transplanting. Most gardeners graft or grow from seed.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matters relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Anderson, F. M. *Picea Breweriana.* Erythea, 7: 176. 31 D. 1899.

Beadle, C. D. Studies in *Crataegus.*—I. Bot. Gaz. **28**: 405–417. 10 Ja. 1900.

Crataegus Biltmoreana, C. Sargenti, C. Boyntoni, C. austromontana, C. Harbisoni, C. silvicola, and *C. Mohri,* sp. nov.

Boodle, L. A. Stem-structure in Schizaeaceae, Gleicheniaceae, and Hymenophyllaceae. Ann. Bot. **13**: 624, 625. D. 1899.

Butters, F. K. Observations on *Rhodymenia.* Minn. Bot. Stud. **2**: 205–213. *pl.* 2. 29 D. 1899.

Campbell, D. H. A peculiar Embryo-sac in *Peperomia pellucida.* Ann. Bot. **13**: 626. D. 1899.

Clark, A. M. The Trees of Vermont. Bull. Vermont Agric. Exper. Sta. 73: 35–86. O. 1899. [Illust.]

Clark, J. F. On the toxic Effect of deleterious Agents on the Germination and Development of certain filamentous Fungi. Bot. Gaz. **28**: 289–327. 30 N. 1899; 378–404. 10 Ja. 1900.

Clute, W. N. Two new Stations for *Schizaea pusilla.* Fern Bull. **8**: 15, 16. Ja. 1900.

Darwin, F. On Geotropism and the Localization of the sensitive Region. Ann. Bot. **13**: 567–574. *pl. 79.* D. 1899.

Davenport, G. E. John Williamson. Fern Bull. **8**: 1–5. *portrait.* Ja. 1900.

Davis, K. C. A synonymic Conspectus of the native and garden Aconitums of North America. Minn. Bot. Stud. **2**: 345–352. 29 D. 1899.

Davis, K. C. A synonymic Conspectus of the native and garden Aquilegias of North America. Minn. Bot. Stud. **2**: 331–343. 29 D. 1899.

Dyer, W. T. T. On the Influence of the Temperature of liquid Hydrogen on the germinative Power of Seeds. Ann. Bot. **13**: 599–607. D. 1899.

Eastwood, A. Another introduced Plant. Erythea, **7**: 176. 31 D. 1899.

Linaria reticulata aurea-purpurea at Santa Maria, Cal.

Eastwood, A. Migratory Plants in Alameda County [California]. Erythea, **7**: 175, 176. 31 D. 1899.

Eastwood, A. Short Articles. Erythea, **7**: 149, 150. 30 N. 1899.

Includes notes on "Introduced Plants in Placer County, California," "Sedge used in Indian Basket-making," and "Mr. Hendrie's gifts to the California Academy of Sciences."

Eaton, A. A. Two new *Isoetes.* Fern Bull. **8**: 12–14. Ja. 1900.

I. Macounii and *I. Orcutti*, new.

Eggleston, W. W. *Woodsia alpina.* Fern Bull. **8**: 5, 6. Ja. 1900.

Fernald, M. L. Three new western Plants. Erythea, **7**: 121, 122. 30 N. 1899.

Carex Blankinshipii, *Amelanchier Cusickii*, and *Castilleia Dixoni.*

Fink, B. Contribution to the Knowledge of the Lichens of Minnesota. IV. Lichens of the Lake Superior Region. Minn. Bot. Stud. **2**: 215–276. 29 D. 1899.

Fink, B. Contributions to the Knowledge of the Lichens of Minnesota. V. Lichens of the Minnesota Valley and Southwestern Minnesota. Minn. Bot. Stud. **2**: 277–329. 29 D. 1899.

Includes *Pyrenula megalospora*, new species.

Freeman, E. M. Observations on *Chlorochytrium.* Minn. Bot. Stud. **2**: 195–204. *pl. 19.* 29 D. 1899.

Gilbert, B. D. Some hitherto unnoted Variations of familiar Ferns. Fern Bull. **8**: 9–11. Ja. 1900.

Graves, C. B. Connecticut Stations for *Asplenium montanum*. Fern Bull. **8**: 18, 19. Ja. 1900.

Graves, H. S. Practical Forestry in the Adirondacks. Bull. U. S. Dept. Agric. (Div. Forestry), 26: 1–84. *pl. 1–20*. O. 1899.

Greenman, J. M. Northwestern Plants, chiefly from Oregon. Erythea, **7**: 115–120. 30 N. 1899.

Spiraea discolor glabrescens, *Oxytropis Cusickii*, *Conanthus parviflorus*, *Mertensia umbratilis*, *Lophanthus Cusickii*, and *Mimulus* (*Eunanus*) *clivicola*, new species and variety; also notes on other species.

Griffon, E. L'assimilation chlorophyllienne. Ann. Sci. Nat. VIII. **10**: 1–123. *pl. 1–4*. S. 1899.

Harper, R. A. Cell-division in Sporangia and Asci. Ann. Bot. 13: 467–525. *pl. 24–26*. D. 1899.

Hedgcock, G. C. & Hunter, A. A. Notes on *Thorea*. Bot. Gaz. **28**: 425–429. *pl. 26*. 10 Ja. 1900.

Hitchcock, A. S. Note on Corn Smut. Bot. Gaz. **28**: 429, 430. 10 Ja. 1900.

Holmboe, J. En fjeldform af *Capsella Bursa-pastoris*. Bot. Notiser. 1899: 261–266. 1899.

Holzinger, J. M. *Talinum rugospermum* n. sp. Asa Gray Bull. **7**: 115–117, *f. 1*. D. 1899.

Hume, H. H. Some Peculiarities in *Puccinia* Teleutospores. Bot. Gaz. **28**: 418–423. 10 Ja. 1900. [Illust.]

Hyams, C. W. A new *Lilium*. Bot. Gaz. **28**: 431. 10 Ja. 1900.
Lilium Masseyi Hyams.

Jepson, W. L. Biographical Sketch of H. G. Bloomer. Erythea, **7**: 163–166. 31 D. 1899.

Jepson, W. L. Early scientific Expeditions to California. II. Erythea, **7**: 129–134. 30 N. 1899.

Jepson, W. L. Epitaph of David Douglas. Erythea, **7**: 174, 175. 31 D. 1899.

Jepson, W. L. Teratology of *Scrophularia Californica*. Erythea, **7**: 123–127. *pl. 4*. 30 N. 1899.

Knapp, S. A. The present status of Rice Culture in the United States. Bull. U. S. Dept. Agric. (Div. Bot.) 22: 1–56. *pl. 1–3*. 1899.

Kofoid, C. A. Plankton Studies—III. On *Platydorina* a new Genus of the Family Volvocidae, from the Plankton of the Illinois River. Bull. Ill. State Lab. Nat. Hist. **5**: 419–440. *pl. 38.* 28 D. 1899.

Platydorina caudata sp. nov. Synopsis of species of subfamily Volvocinae.

Kränzlin, F. *Rodriguezia Juergensiana* n. sp. Notizbl. konigl. bot. Garten zu Berlin **2**: 377, 378. 29 D. 1899.

From Brazil.

MacDougal, D. T. Studies in Plant Physiology—IV. Asa Gray Bull. **7**: 110–114. D. 1899.

MacMillan, C. A botanical Art Gallery. Bot. Gaz. **28**: 430, 431. 10 Ja. 1900.

Meehan, T. *Hibiscus militaris.* Meehan's Monthly, **9**: 161, 162. *pl. 11.* N. 1899.

Meehan, T. *Oxybaphus hirsutus.* Meehan's Monthly, **9**: 177, 178. *pl. 12.* D. 1899.

Meehan, T. *Sanguinaria Canadensis.* Meehan's Monthly, **10**: 1, 2. *pl. 1.* Ja. 1900.

Moore, G. T. Algae as a Cause of the Contamination of Drinking Water. Am. Jour. Pharm. **72**: 25–36. Ja. 1900.

Morgan, A. P. The Myxomycetes of the Miami Valley, Ohio. Journ. Cin. Soc. Nat. Hist. **19**: 147–166. 4 Ja. 1900.

Nelson, E. Some new Western Species. Erythea, **7**: 166–170. 31 D. 1899.

Valeriana micrantha, *V. Wyomingensis*, *Phlox Whitedii*, *Saxifraga saximontana*, and *S. subapetala*, proposed as new by the author.

Nelson, A. Some Rocky Mountain Chrysothamni. Bot. Gaz. **28**: 369–377. 10 Ja. 1900.

Chrysothamnus pulcherrimus, *C. pulcherrimus fasciculatus*, *C. frigidus concolor*, *C. pallidus*, *C. Wyomingensis*, *C. affinis*, *C. oreophilus*, *C. pumilus varus*, and *C. pumilus acuminatus*, sp. et var. nov.; *C. affinis attenuatus* (Jones), nom. nov.

Palmer, T. C. *Isoetes Dodgeii*—a new Station. Fern Bull. **8**: 6–8. Ja. 1900.

Peck, C. H. Report of the State Botanist, 1898. Bull. N. Y. State Mus. **5**: 619–688. *pl. 57–61.* O. 1899.

New species in *Lepiota*, *Marasmius*, *Clitopilus*, *Hebeloma*, *Gomphidius*, and *Polyporus*. Descriptions and illustrations (colored) of twelve edible fungi.

Piper, C. V. A new California *Parnassia*. Erythea, **7**: 128. 30 N. 1899.

Parnassia cirrata Piper.

Piper, C. V. New and noteworthy Northwestern Plants.—II. Erythea, **7**: 159–163;—III. **7**: 171–174. 31 D. 1899.

Mitella stauropetala, *M. stenopetala*, *M. stenopetala Parryi*, *M. micrantha*, *M. anomala*, *Spiraea cinerascens*, *S. Hendersoni* (Canby), *S. uniflora* (Wats.), *Boykinia major intermedia*, *Rudbeckia alpicola*, *Senecio Elmeri*, and *Polemonium amoenum*, new species, varieties and names.

Rothrock, J. T. Red Oak (*Quercus rubra* L.). Forest Leaves, **7**: 88. D. 1899. [Illust.]

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886.—XXVI. Bull. Torr. Bot. Club, **26**: 145–152. 18 Mr. 1899;—XXVII., **26**: 189–200. 12 Ap. 1899.

New species, varieties and names in *Cordia*, *Saccellium*, *Tournefortia*, *Heliotropium*, *Ipomoea*, *Jacquemontia*, *Solanum*, *Cyphomandra*, *Physalis*, *Bassovia*, *Brachistus* and *Solandra*.

Rydberg, P. A. What is *Prunus insititia?* Bot. Gaz. **28**: 423–425. 10 Ja. 1900.

Saunders, C. F. *Dryopteris simulata* in Pennsylvania. Fern Bull. **8**: 14, 15. Ja. 1900.

Scribner, F. L. New or little-known Mexican Grasses. Circ. U. S. Dept. Agric. (Div. Agrost.) **19**: 1–4. *f. 1*. 2 Ja. 1900.

New species in *Panicum* (3) and *Avena* (2).

Shear, C. L. A Truffle from Maryland. Asa Gray Bull. **7**: 118. D. 1899.

Terfezia oligosperma Tul.

Shear, C. L. Our Puff balls.—II. Asa Gray Bull. **7**: 105–110. *pl. 7*. D. 1899.

Synopsis and descriptions of American species adapted from Saccardo.

Stephani, F. Species Hepaticarum. Bull. Herb. Boiss. **7**: 84–110. 16 F. 1899; 198–225. 25 Mr. 1899; 381–407. 31 My. 1899; 518–533. Jl. 1899; 655–695. S. 1899; 727–764. O. 1899.

Includes descriptions of the following new species from America: *Fimbriaria atrispora*, *F. Macounii*, *F. commutata*, *F. alpina*, *Aneura autoica*, *A. intermedia*, *A. alata*, *A. Portoricensis*, *A. Corralensis*, *A. spectabilis*, *A. Negeri*, *A. conimitra*, *A. metzgeriaeformis*, *A. tenax*, *A. Breutelii*, *A. pallidevirens*.

Trask, B. Field Notes from Santa Catalina Island. Erythea, **7**: 135–146. 30 N. 1899.

Wager, H. The Sexuality of Fungi. Ann. Bot. **13**: 575–597. D. 1899.

Waghorne, A. C. The Flora of Newfoundland, Labrador and St. Pierre et Miquelon. Part III. Proc. and Trans. Nova Scotian Inst. Sci. **9**: 361–401. 31 D. 1899.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, usilltrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.]

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–4, 294 pp., 3 maps, and 8 plates, 1896–99. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. 1. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of over a hundred new species. Price to members of the Garden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal. Price, 25 cents.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg. Price, 25 cents.

No. 3. The dichotomous *Panicums:* some new Species, by Geo. V. Nash Price, 25 cents.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg. Price, 25 cents.

All subscriptions and remittances should be sent to

THE ACCOUNTANT

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

Vol. 27 MARCH, 1900. No. 3

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

The New Era Printing Company
Lancaster, Pa.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL,
ARTHUR HOLLICK, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
BYRON D. HALSTED, Sc. D.
CARLTON C. CURTIS, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D.,
HELEN M. INGERSOLL,
MARIE L. SANIAL,
ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH,
MARIE L. SANIAL,
EUGENE SMITH,
W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

Vol. 27 No. 3

BULLETIN

OF THE

TORREY BOTANICAL CLUB

MARCH 1900

A new Genus of Hepaticae from the Hawaiian Islands

By Alexander W. Evans

(With Plate 1)

Among the tufts of *Herberta sanguinea* collected more than twenty years ago by D. D. Baldwin on the island of Maui, the late C. F. Austin found a few sterile and fragmentary specimens of an hepatic which he recognized as new and doubtfully referred to the genus *Mastigobryum*, as *M. integrifolium*. At my request, Mr. W. H. Pearson kindly sent me, for examination, a portion of Austin's original material. In the packet there is a single stem of the new species, but it is sufficient to show that, although the plant has much in common with *Mastigobryum* or *Bazzania*, as it is now called, it can hardly be retained in this genus, but should rather form the type of a new genus of Hepaticae. The branching of the leafy liverworts was just beginning to receive attention from descriptive hepaticologists at the time Austin wrote, and, as the most essential difference between the new genus and *Bazzania* is a difference in branching, the disposition which he made of his plant was perhaps justified.

An examination of Baldwin's material of *Herberta sanguinea* in the Eaton Herbarium brought to light several additional specimens of this curious species and among them a few showing the floral parts but no perianths. During the past summer, however, Mr. C. M. Cooke, Jr., had the good fortune to find a considerable quantity of the plant on Konahuanui, a mountain about three thousand feet high, on the island of Oahu. As in Baldwin's material, the specimens do not form pure tufts but grow scattered among other hepatics, here, for the most part, species of *Bazzania*, *Pleurozia* and *Anastrophyllum*. Both male and female flowers occur somewhat abundantly and a few of the latter show well developed perianths. Mature capsules, unfortunately, are not present. The descriptions in the present paper are drawn almost entirely from Mr. Cooke's material, which has also served for the drawings.

At a cursory glance, the plant looks unlike a typical *Bazzania*; in the first place because its leaves are transversely inserted and strongly squarrose instead of being incubous and appressed, and in the second place, because its underleaves are relatively larger than those of *Bazzania* and are also strongly squarrose. These peculiarities might seem to indicate an affinity with certain genera of the Ptilidioideae, such as *Mastigophora* or *Herberta* or the curious and imperfectly understood *Herpocladium* of Mitten. The position of the sexual organs, however, both male and female, on short branches axillary to the underleaves, shows at once that the true affinities of the new genus are with the Trigonantheae. The bracts and bracteoles, moreover, as well as the fully developed perianths, are essentially like those of *Bazzania* and of certain other genera of this same tribe.

More important as a generic character than the foliar differences just indicated is a peculiar kind of branching, unlike anything hitherto described for the Hepaticae. In the related *Bazzania*, as is well known from the studies of Leitgeb, the branching is of two kinds. In the first, the so-called "Endverzweigung" or "terminal branching,"* the branches are exogenous in origin and lateral, each branch representing the postical half of one of the lateral segments of the apical cell.† The leaf, which normally develops from the whole of such a segment, is here restricted to the antical half and is therefore narrower than an ordinary leaf and not toothed at the apex. A branch here, which is always an ordinary leafy branch, is of about the same size as the axis from which it springs; and, as the axis is itself deflected in the opposite direction from that taken by the branch, the plants of many species appear

* Untersuch. über die Lebermoose, 2: 22, 23. *pl. 4. f. 2, 4.* 1875.

† Branching from the postical half of a lateral segment occurs in many genera of the Jungermanniaceæ and (with the modification seen in *Radula*, etc.) is the only type of terminal branching described by Leitgeb.

as if they were repeatedly dichotomous. In the second or "intercalary branching,"* the branches are endogenous in origin and postical, arising in the axils of the underleaves. They develop at some distance from the apex, starting just inside the cortical cells of the axis and forcing these apart as they elongate. Around the base of such a branch, it is possible for a long time to find the remains of these ruptured cells in the form of an indistinct sheath. In *Bazzania*, these intercalary branches are always specialized, sometimes as the very short sexual branches but more commonly as the long and slender root-like flagella with their rudimentary leaves. Both of the kinds of branching just described for *Bazzania* occur in the new genus as well, the ordinary vegetative branches (Fig. 3) and the sexual branches (Fig. 2) arising in precisely the same way in the two genera. In rare cases, nevertheless, the Hawaiian plant will show an ordinary leafy branch springing from the axil of an underleaf and therefore intercalary in nature like the vegetative branches of *Kantia* and of the typical species of *Cephalozia*.

The peculiar branches of the new genus are the flagella. These are similar in appearance to those of *Bazzania*, except that they bear small but distinct leaves near the base; but their place of origin is very different. Instead of developing in the axils of the underleaves, each flagellum arises at one side of an underleaf (Fig. 4); instead of being surrounded by an indistinct sheath, showing that it is endogenous in origin, it is naked at the base and is, therefore, exogenous in origin; the underleaf, finally, beside which a flagellum is situated, is much narrower than an ordinary underleaf. All of these conditions point to the fact that we have to do here with a terminal branching in one of the postical segments of the apical cell. This is made even more evident by a study of the apical region, and in this connection it is instructive to compare what we find in this plant with what is found in the apical region of the closely related *Bazzania*.

The early stages of the leaves and underleaves of *Bazzania trilobata* have been carefully figured and described by Leitgeb.† In this species he finds that the lateral segments cut off from the

---

* Leitgeb, *l. c.* 2: 30–33. *pl. 4. f. 7–9.*

† *L. c.* 2: 10, 11, 13. *pl. 4.*

apical cell divide in the usual way into one internal and two external cells. One of these two cells, however, and, apparently, in most cases, the postical one, grows wider than the other and redivides, so that the segment shows three external cells side by side. These three cells correspond with the three teeth at the apex of the mature leaf. In the Hawaiian plant, three external cells are likewise formed in the lateral segments (Fig. A, segment 7), but the mature leaf is subacute and undivided, the three cells, therefore, not giving rise to distinct teeth. This difference is probably not very significant as several species of *Bazzania* with undivided leaves have been described. In each postical segment of *B. trilobata*, one internal and two external cells are formed in the same way as in the lateral segments, but here each of the superficial cells grows wider and divides into two, and the segment shows, therefore, four cells side by side. Each of these cells gives rise to a primordial papilla,* and these four papillae are pushed out by the developing underleaves. The process is, however, irregular, and the lobes of the underleaves often grow out beyond the papillae, leaving them at some little distance from the apex. In each postical segment of the new genus, only three external cells are formed, just as in the lateral segments (Fig. A, segment 6). Each gives rise to a papilla and the three papillae are carried up side by side on the apex of the developing underleaf, which remains broad and undivided (Fig. A, segment 3; Fig. B, segment 4). These three primordial papillae enable us to distinguish at a glance a young underleaf from a young side-leaf, and traces of them may often be detected even in a mature underleaf.

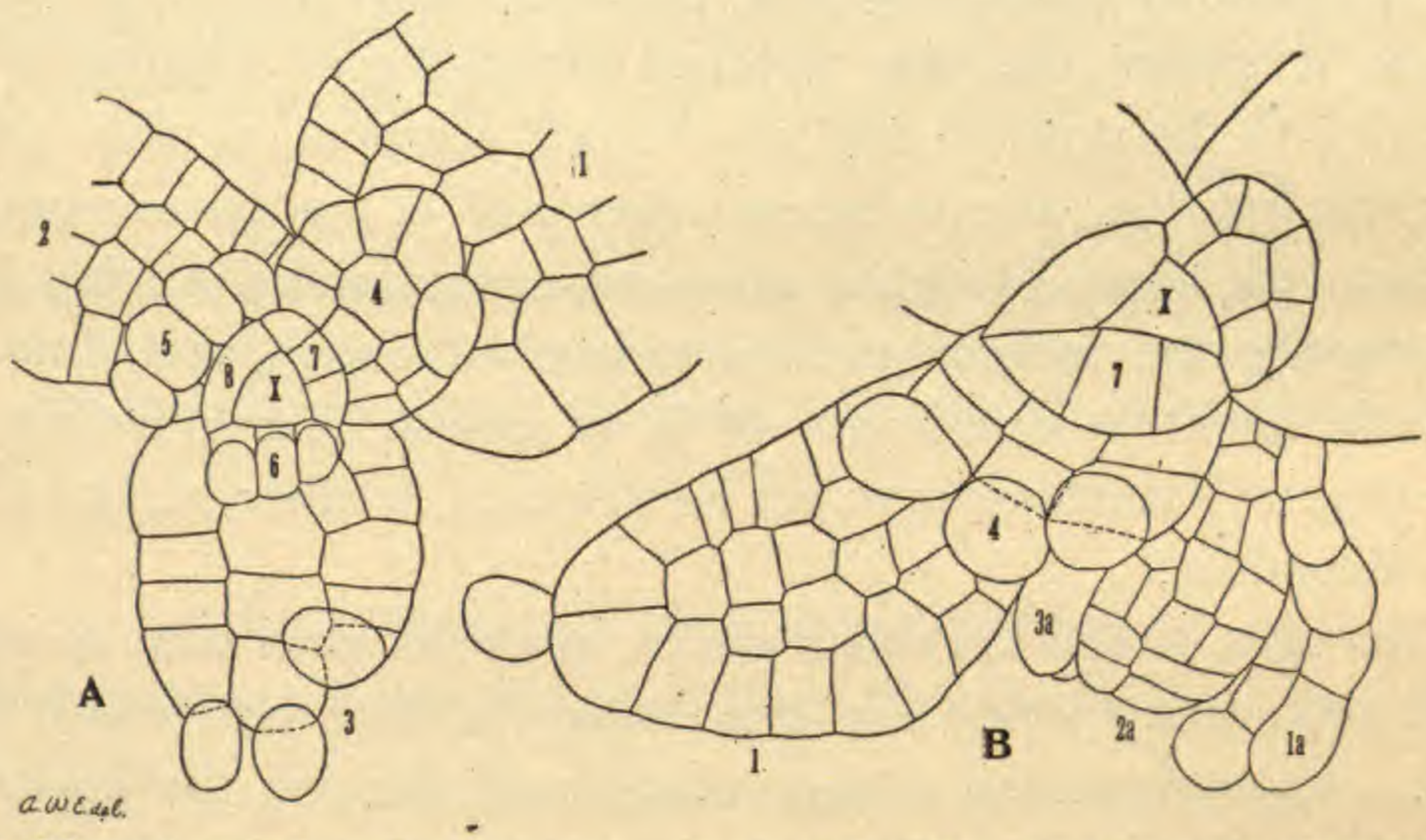
The branching from the lateral segments is the same in both genera and has been briefly described above. It may be remarked, however, that in a branch of this sort, the leaves always maintain a definite sequence; the first leaf is always an underleaf, the second leaf is a side-leaf on the side of the branch turned toward the main axis, and the third leaf is a side-leaf on the side of the branch turned away from the axis. The third leaf, therefore, bears the same relation to the branch that the narrow leaf does to the axis.

In my study of the new genus, I have been unable to find the

---

* Leitgeb, *l. c.* 2: 15.

very youngest stage of a flagelliform branch. An apical region, however, in which such a branch is found in the third postical segment from the apical cell, shows the following conditions (Fig. B): The underleaf developing from the segment (numbered 1), is narrow and bears a single primordial papilla at the apex; the branch already shows the rudiments of three leaves (numbered 1a, 2a, and 3a), the oldest being a side-leaf on the side away from the underleaf, the second a side-leaf on the side toward the underleaf and the third an underleaf, distinguishable by its three papillae



A. Normal apical region, × 235. *X* Apical cell. 1, 2, 3, etc. Segments in order of age, 3 and 6 showing the young underleaves, each tipped with three primordial papillae.

B. Apical region with young branch in third postical segment from apical cell, × 235. *X*. Apical cell of main axis. 1, 4, 7. Postical segments in order of age; the lateral segments are not numbered as some of the young side-leaves have been dissected away; 1 shows an underleaf with a single primordial papilla, at the side of the young branch. *1a*, *2a*, *3a*. Segments of branch, *3a* showing the first underleaf, with only two of its three primordial papillae visible.

(only two of which show in the drawing). In this case, therefore, as in the terminal branching from a lateral segment, the third leaf bears the same relation to the flagellum that the underleaf, beside which this specialized branch arises, does to the main axis, and the first two side-leaves are in a corresponding sequence. The same sequence can often be distinguished in an older flagellum (as in Fig. 4, where the second side-leaf is largely concealed), but in some cases the first few leaves are so crowded that it is difficult to make out their true sequence. From the preparation just described, it is clear, therefore, that the postical segment which is to give rise to a flagellum first divides in the usual way into one internal and two external cells, but that the external cell which normally broadens out and redivides, here develops at once into a branch, leaving only one cell to give rise to the primordial papilla and underleaf. It should be noted also that the flagellum sometimes occurs on the right side of the underleaf and sometimes on the left side, and that both conditions are occasionally found on the same stem.

The peculiar branching just described is of particular interest because it shows that the terminal branching of Leitgeb is not restricted to the postical half of a lateral segment, as that author supposed, but may also occur in either half of a postical segment. The fact that these branches are always specialized as flagella is undoubtedly due largely to their place of origin, and does not affect the point in question. It is, of course, possible that this same type of branching may yet be detected in other genera of the leafy Hepaticae.

The cells of the Hawaiian plant, as is the case with so many alpine and arctic species, are interesting for their extremely thick walls. The thickening is particularly well seen in the cuticle of the leaves. On both surfaces these are densely covered with verruculae which are very distinct on young leaves but become more or less obliterated with age. The trigones of the leaf-cells (Fig. 5) are also conspicuous and project out into the cell-cavities, which are usually distinctly stellate. The trigones are sometimes circular or oval in outline and sometimes tri- or quadri-lobed. Between the trigones the walls are less thickened and sometimes remain very thin, apparently functioning as pits. Along the edges of the leaves (Fig. 6) the cell-walls are irregularly thickened, and it is usually difficult to make out the boundary of the cell-cavity. In the cells of the axis the thickening is also very pronounced (Fig. 7). The superficial cells are here isodiametric, but the internal cells are several times as long as broad. Except for the strongly developed cuticle the thickening is irregular and the cells are provided with pits, which occur in both transverse and longitudinal walls.

The essential characters of Austin's species, both generic and specific, are given in the following description :

Acromastigum gen. nov.

Plants medium-sized, scattered among other hepatics, yellowish-green, becoming brownish with age: stems stiff and wiry, mostly ascending or erect, sparingly branched: vegetative branches of three kinds:—terminal branches from the lateral segments, terminal branches from the postical segments (flagella), intercalary branches axillary to the underleaves (very unusual): rhizoids not abundant: leaves distant or subimbricated, transversely inserted, undivided: underleaves a little smaller than the leaves, undivided: leaf-cells with thickened walls: sexual branches intercalary, arising singly in the axils of the underleaves: ♀ branch very short, its leaves re, duced to the three to five rows of bracts; perianth long and slender. hypogonianthous, the three keels distinct except at the cylindrical base, separated by grooves; unfertilized archegonia borne at the base of calyptra; ♂ spike oblong; bracts in several pairs, strongly concave; antheridia occurring singly; paraphyses wanting; bracteoles similar to the underleaves but smaller: sporophyte not seen. (Name from *ακρον*, summit, and *μαστιξ*, a whip or lash, alluding to the flagella and their place of origin.)

Acromastigum integrifolium (Aust.)

Mastigobryum? integrifolium Aust. Bot. Gazette, **1**: 32. 1875

Bazzania? integrifolia Evans, Trans. Conn. Acad. **8**: 225. 1892.

Dioicous: general characters of stems and branches given above: rhizoids whitish, simple or irregularly branched at the ends, very scanty on ordinary vegetative axes and occurring singly or in small clusters at the bases of some of the underleaves, more abundant on the flagella and less definite in position: leaves spreading widely from the stem, usually curved upward in the outer parts, ovate from a broad base, obtuse or more commonly acute, entire or nearly so, rarely with an indistinct angular tooth near apex: underleaves strongly squarrose, ovate or oblong, truncate or rounded at apex, entire or nearly so: leaf-cells with a very thick verruculose cuticle and conspicuous often confluent trigones but no intermediate thickenings: cell-cavities stellate: ♀ bracts very small and similar to ordinary leaves at base of branch but becoming rapidly larger toward perianth: innermost bracts broadly ovate, gradually narrowed from near the base, shortly dentate or laciniate at apex (usually less than one fourth the length) with slender teeth, otherwise entire or nearly so; innermost bracteole similar; perianth linear-fusiform, composed of a single layer of cells except at the very base, cells more uniformly thickened than the leaf-cells, mouth of perianth contracted, laciniate, the laciniae long and slender, straight or irregularly curved and distorted, sometimes denticulate, composed of a single row of cells above and usually of two or more toward the base: ♂ bracts in about six pairs, strongly concave, ovate, shortly bi- or tri-denticulate at the apex, the teeth one to three cells long, otherwise entire or nearly so; bracteoles similar to ordinary underleaves but smaller.

Stems 3–8 cm. long, 0.25 mm. in diameter; leaves 0.7 × 0.4 mm.; underleaves 0.5 × 0.3 mm.; leaf-cells at edge of leaf 14 μ in diameter, in the middle 18 μ, and at the base 28 × 23 μ; innermost ♀ bracts 1.7 × 1 mm. (on robust specimens with perianths), perianth 4 × 0.85 mm.; ♂ bracts 0.45 × 0.25 mm., bracteoles 0.35 × 0.15 mm., antheridia 0.15 mm. in diameter.

Mixed with other hepatics. West Maui (Baldwin, 1875); Konahuanui, Oahu (Cooke, 1899). Type specimen in Herb. W. H. Pearson.

YALE UNIVERSITY.

Explanation of Plate 1

1. Plant with perianth, natural size.
2. Part of plant with perianth, × 16.
3. Part of sterile plant, showing ordinary vegetative branching, antical view, × 32.
4. Part of sterile stem, showing base of flagellum, postical view, × 32.
5. Cells from middle of leaf, × 255.
6. Cells from apex of leaf, × 255.
7. Cells from stem in longitudinal section, × 255.
8. Innermost ♀ bracts, × 32.
9. Corresponding bracteole, × 32.
10. Laciniae from mouth of perianth, × 32.
11. Transverse section of perianth, × 32.

12, 13. ♂ bracts, × 32.

14. ♂ bracteole, × 32.

A Revision of the Species of Plantago commonly referred to Plantago Patagonica Jacquin

By E. L. Morris

Early in September, 1898, the writer received a labelled specimen of *Plantago* from Arizona. The characters of the specimen and the description in literature of the species, whose name was attached to the specimen, did not agree. Careful verification at the U. S. National Herbarium identified the specimen from Arizona as an undescribed species, but did not identify wholly the specimens of the species quoted. This circumstance suggested further study of the related species and their literature. With few exceptions in all American literature on the Plantaginaceae, the species here considered, when recognized, have been referred to *P. Patagonica* Jacq. or made varieties of the same. This fact led to the study of the original description and plate of Jacquin's *P. Patagonica* (Jacq. Coll. 5: 1796; and Jacq. Ic. Rar. *pl. 306.* 1781–93). As has been already recognized by many botanists, Jacquin's South American bright green, spreading plant, with its dark green, decurved, then upcurved scapes, and erect spikes, does not occur in North America.

The most recent study of the Plantaginaceae (Alida M. Cunningham, Proc. Ind. Acad. Sci. 1896: 190–207. 1897) was based mostly on observed seed characters, from herbarium material. But these seem to have been accommodated largely to the treatment of the order in Gray's Synoptical Flora; for the writer, in trying to verify the seed characters recorded by Miss Cunningham, has found said characters except color of each of her recorded species all occurring in mature pyxes of numerous herbarium specimens of *P. Purshii* alone, as well as several of them in other individual species.

It is a pleasure to acknowledge the kindness of the Curators of the U. S. National Herbarium, The Gray Herbarium, The Herbarium of the Missouri Botanical Garden, The Columbia University Herbarium, The Herbarium of the Field Columbian

Museum, the Herbarium of the California Academy of Sciences, and Dr. E. L. Greene, in allowing the use of their specimens and libraries.

In the key which follows, the synopsis of the genus is adapted from Gray's Synoptical Flora, except the group indicated by two asterisks (**) which is prepared for the identification of the species treated in this paper.

The species treated are from North America exclusive of Mexico and Central America.

PLANTAGO

§ 1. Flowers all perfect; lobes of the corolla not closed over the pyxis; stamens four.

* Root perennial, biennial, or annual in *P. decipiens*; flowers dichogamous, proterogynous; the style projecting from the apex of the unopened corolla; the anthers long-exserted on capillary filaments after the corolla has expanded; seeds two or more, not hollowed on the face except in *P. lanceolata*.

** Root annual; the petioles dilated at their bases; flowers heterogonous, in the majority of individuals cleistogamous; the lobes of the open corolla wide-spread, nearly equalling the tube; seeds solitary in the two cells, deeply hollowed on the face.

Bracts linear to lanceolate.
- Bracts aristate, two or more times as long as the flowers.
  - Spikes more or less compact; plant dark green.
    - Spikes large, 20–many flowered. 1. *P. aristata.*
    - Spike small, 2–20-flowered. 2. *P. aristata Nuttallii.*
  - Spikes more or less interrupted; plant light green. 3. *P. spinulosa.*
- Bracts not aristate, not over two times as long as the flowers.
  - Bracts linear-subulate to narrowly lanceolate, narrow at the base.
    - Spikes narrow-cylindrical; whole plant white-woolly, light green. 4. *P. Purshii.*
    - Spikes narrow-cylindrical, at length interrupted; whole plant silvery-silky, dark green. 5. *P. argyrea.*
    - Spikes thick, conspicuous on account of the large corollas; plant villous, dark green. 6. *P. Helleri.*
  - Bracts lanceolate or triangular, wide at the base.
    - Plant erect; spikes coarse.
      - Plant glabrous or nearly so, dark green. 7. *P. Wrightiana.*
      - Plant villous, bright green.
        - Bracts more than 3 mm. long; sepals scarious, with brown midribs. 8. *P. dura.*
        - Bracts not more than 3 mm. long; sepals herbaceous, green. 9. *P. inflexa.*
    - Plant spreading; spikes delicate. 10. *P. lanatifolia.*

Bracts oblong to ovate or orbicular.
- Plant villous; bracts as long as the sepals or (*in situ*) equalling the calyx.

Bracts with brown midribs; petals with longitudinal brown streaks.

Plant spreading, stout. 11. *P. insularis.*

Plant erect, slender. 12. *P. brunnea.*

Bracts with green midribs; petals white or tawny, darker at the base only.

Plant short-stemmed; spikes villous; seeds brown.

13. *P. fastigiata.*

Plant acaulescent; spikes pubescent; seeds yellow.

14. *P. scariosa.*

Plant pubescent or glabrate; bracts one half as long as the sepals or shorter.

Leaves linear, 3-ribbed; scapes dilated or stout; spikes several-flowered.

15. *P. erecta.*

Leaves linear-subulate, not ribbed; scapes filiform; spikes 2–4 (–5)-flowered.

16. *P. tetrantha.*

2. Flowers sub-dioecious or cleistogamous; the corolla in the fertile flowers remaining closed or closing over the pyxis, thereby forming a beak; stamens two or four, anthers not exserted; seeds flat or slightly hollowed on the face.

1. PLANTAGO ARISTATA Michx. Fl. Bor. Am. **1**: 95. 1803

P. gnaphalioides var. *aristata* Hook. Fl. **2**: 123. 1838.

P. Patagonica, var. *aristata* Gray, in part, Man. ed. 2. 269. 1856.

A *dark green annual*, with a *thick root*, with a *short erect stem*, varyingly glabrous to villous: *leaves* alternate, *ascending to erect*, several to numerous, *narrowly to broadly linear*, acute or acuminate at the apex, callous-tipped, entire, narrowed to the margined petiole having a semi-clasping base, 80–200 mm. by 1–5 mm., *3–5-nerved*, *glabrous to villous*: *peduncles* axillary, erect, *stout*, terete, solitary to numerous, *surpassing the leaves*, 70–200 mm. high, glabrous to pubescent: *spikes in glabrate forms, when young, triangular* by the long lower to the short upper bracts, *in villous forms, when young, top-shaped* by the short appressed lower to the long spreading upper bracts, erect, *short to long cylindrical*, 30–120 mm. by 5 mm. exclusive of the bracts, pubescent: *bracts aristate to foliaceous, ten or less times as long as the flowers, linear-subulate to linear*, acute, 3.5 mm. by 1–2 mm., glabrous to pubescent: flowers perfect, numerous: *calyx* glabrous to villous, its *divisions herbaceous, green, spatulate-oblong*, rounded, 2–5 mm. long: *corolla lobes* spreading, reflexed, the two laterals deflexed, nearly equalling the tube, *round-ovate, obtuse, sub-auriculate at the base*, 2 mm. by 2 mm., *white*: stamens four, barely exserted from the tube: *pyxis one third surpassing the calyx*, broadly oblong, obtuse, 3.5 mm. by 1.5 mm., *circumscissile at the middle*: seeds two, brown, oblong, finely pitted.

A very variable species, of which one hundred and seventy sheets or specimens have been examined from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, West Virginia, North Carolina, Georgia, Florida, Ohio, Kentucky, Tennessee, Alabama, Mississippi, Illinois, Iowa, Kansas, Missouri, Arkansas, Louisana, Northwest Territory, Yukon Territory, South Dakota, Nebraska, Indian Territory, Oklahoma Territory, Texas, New Mexico, Mexico, as follows: 39 in the U. S. National Herbarium, 37 in the Gray Herbarium, 58 in the Herbarium of the Missouri Botanical Garden, 27 in the Columbia University Herbarium, 7 in the Herbarium of the Field Columbian Museum, 1 in the Herbarium of the California Academy of Sciences, 1 in my own herbarium.

2. **Plantago aristata Nuttallii** (Rapin)

P. Nuttallii Rapin, Mem. Soc. Linn. Par. **6**: 470. 1827 (1828).

P. squarrosa Nutt. Trans. Am. Phil. Soc. n. s. **5**: 178. 1837; not Murr. Comm. Goett. *38. pl. 3.* 1781, from Mem. Soc. Linn. Par. **6**: 488. 1827.

P. filiformis Dcne.; DC. Prod. **13**: 714. 1852.

P. Patagonica, var. *aristata* Gray, in part, Man. ed. 2. 269. 1856.

A *bright or dark green annual*, with a *filiform root*, with a *short erect stem*, pubescent above, *with a row of white hairs at the nodes within each leaf-sheath*: *leaves* alternate, strictly *erect*, several, *filiform-linear to filiform*, callous-tipped, sometimes involute, *sessile* and sheathing at the base, 30–150 mm. long, glabrous: *peduncle terminal*, erect, *slender*, *solitary*, *two or more times as long as the leaves*, 60–280 mm. high, pubescent: *spike small*, *2–20-flowered*, erect, *capitate to oblong*, 4–25 mm. by 3–6 mm., pilous: *bracts* rigid, *herbaceous*, *with small scarious margins at the base only*, *two to three times as long as the flowers*, *linear-aristate*, *carinate at the base*, acute, 5–15 mm. long, glabrous or with a few hairs: flowers perfect: *calyx* pilous, its *divisions with narrow or wide scarious margins*, dark green or brown, oblong, obtuse, 2–5 mm. long: *corolla* equalling the calyx, its *lobes* spreading, *equal to the constricted neck*, *ovate to round-ovate*, obtuse, *subauriculate at the base*, 2 mm. by 1.5 mm., *white*: stamens four, long or short-exserted: *pyxis two times as long as the calyx*, oblong, obtuse, 3.5 mm. by 2 mm., *circumscissile at the middle*: seeds two, dark brown, oblong, rough.

This sub-species occurs only in parts of the range of *P. aristata*, frequently with it. Thirty-three sheets or specimens have been examined from Rhode Island, Connecticut, North Carolina, Illinois, Iowa, Missouri, Indian Territory, Oklahoma Territory, Texas, New Mexico, as follows: 7 in the U. S. National Herbarium, 8 in the Gray Herbarium, 15 in the Herbarium of the Missouri Botanical Garden, 2 in the Columbia University Herbarium, 1 in the Herbarium of the California Academy of Sciences.

3. PLANTAGO SPINULOSA Dcne.; DC. Prod. **13**: 713. 1852

P. Patagonica, var. *spinulosa* Gray, Man. ed. 2. 269. 1856.

This species is an aggregate. The following description and the annotations therefrom are to be considered temporary.

A *light or bright green annual*, with a *short, simple or branched stem, varyingly glabrate to villous: leaves* alternate, *ascending to erect*, few to numerous, *linear to linear-lanceolate*, acuminate and involute at the apex, callous-tipped, entire, narrowed to the margined sheathing *petiole in which three ribs remain free*, 80–125 mm. by 2–7 mm., *3–5-ribbed*, with fainter interposed nerves, *glabrate to villous: peduncles* axillary, ascending to erect, solitary to several, *surpassing the leaves or shorter*, 50–200 mm. high, pubescent: *spikes gradually interrupted after anthesis* till the internodes become 5 or more mm. long, ascending to erect, *long-cylindrical*, 50–100 or more mm. long, pubescent: *bracts rather rigid-herbaceous, two or more times as long as the flowers, linear-subulate to aristate*, acute, 7–12 or more mm. by 0.5 mm., glabrate to villous: *flowers* perfect, when old *verticillate in threes: calyx* pubescent, its *divisions scarious, with light-green midribs, or the outer ones nearly herbaceous*, spatulate-oblong, rounded, 2 mm. long: *corolla* one third surpassing the calyx, its *lobes* strongly reflexed, the two laterals deflexed, *two or more times as long as the constricted throat, ovate, obtuse, subauriculate at the base*, 1.5 mm. by 1 mm., *white:* stamens four, and, with the style, just exserted from the tube, or a little longer: *pyxis equalling or surpassing the calyx*, oval, rounded, 2 mm. by 1 mm. or larger, *circumscissile at the middle:* seeds two, dark brown, oblong, finely pitted.

Forty-one sheets or specimens have been examined from South Dakota, Nebraska, Oklahoma Territory, Texas, Montana, Wyoming, Colorado, New Mexico, Idaho, Utah, Arizona, Oregon, California, Lower California, as follows: 15 in the U. S. National Herbarium, 6 in the Gray Herbarium, 10 in the Herbarium of the Missouri

Botanical Garden, 8 in the Columbia University Herbarium, 2 in the Herbarium of the California Academy of Sciences.

4. PLANTAGO PURSHII R. & S. Syst. 3: 120. 20 Mh. 1818.

P. Lagopus Pursh, Fl. 1: 99. 1814; not L. Sp. Pl. 114. 1753.

P. gnaphaloides Nutt. Gen. I.: 100. 27 My. 1818.

P. Hookeriana F. & M. Ind. Sem. Petrop. 39. 1838.

P. Patagonica, var. *gnaphalioides* Gray, Man. ed. 2. 269. 1856.

This species is an aggregate. The following description and the annotations therefrom are to be considered temporary.

A very polymorphous species; a *light green annual*, with *acaulescent* base *or* a *very short*, simple or branched *stem*, generally *snow-white to tawny villous to thick-woolly*: *leaves* basal or alternate, *erect*, lax or rigid, several to numerous, *linear*, sometimes wider above the middle, *long-tapering to an acute apex*, callous-tipped, entire or with a few callous teeth, narrowed to the margined petiole having a semi-clasping base, 50–200 mm. by 2–18 mm., *3-ribbed* or with very faint ones interposed, rarely glabrate to *villous to very woolly*: *scapes* basal or axillary, erect, *stout*, numerous, *surpassed by or surpassing the leaves*, 50–400 mm. high, *villous or woolly*: *spikes hoary*, erect, *long-cylindrical*, 30–130 mm. by 5–7 mm., densely villous: *bracts* rigid, *herbaceous*, *slightly scarious-sided at the base*, *equalling to twice as long as the flowers*, *linear-subulate*, acute, 5–10 mm. long, villous: *calyx* villous, its *divisions herbaceous and scarious-sided*, *green*, oblong, rounded, 3 mm. long: *corolla* surpassing the calyx, its *lobes* reflexed-spreading, three or more times as long as the constricted throat, *broadly ovate*, *obtuse*, *sub-auriculate at the base*, 2 mm. by 2 mm., *white*: stamens four, just exserted from the tube or with long capillary filaments: *pyxis one third surpassing the calyx*, oval, rounded, 4 mm. by 2 mm., *circumscissile at the middle*: seeds two, light brown, oblong, finely pitted.

Two hundred and eleven sheets or specimens have been examined from Minnesota, Iowa, Missouri, Arkansas, North Dakota, South Dakota, Nebraska, Kansas, Indian Territory, Oklahoma Territory, Montana, Wyoming, Colorado, New Mexico, Texas, Northwest Territory, Assiniboia, Idaho, Utah, Arizona, British Columbia, Washington, Oregon, California, as follows: 74 in the U. S. National Herbarium, 30 in the Gray Herbarium, 52 in the Herbarium of the Missouri Botanical Garden, 39 in the Columbia University Herbarium, 2 in the Herbarium of the Field Columbian Museum, 12 in the Herbarium of the California Academy of Sciences, 2 in my own herbarium.

5. **Plantago argyrea** sp. nov.

A *dark green acaulescent annual*, generally *silvery-silky, in age becoming white silky-villous: leaves* basal, erect, numerous, *linear or slightly wider above the middle*, acute or tapering at the apex, callous-tipped, entire, narrowed to the petiole having a slightly expanded base, 50–100 mm. by 2–4 mm., *3-ribbed, silvery-silky when young to silky-villous when old: scapes* basal, erect, one to several, *surpassing the leaves*, 100–180 mm. high, *finely silver-pubescent: spikes* erect, *short to long-cylindrical, at length interrupted*, 15–60 mm. by 7 mm., *long-villous: bracts* rigid, *herbaceous and scarious-margined on one side or unequally on both sides, equalling the calyx or shorter, narrowly lanceolate*, acute, about 3 mm. long, *dark green or brown, villous: calyx* villous, its *divisions brown-herbaceous and widely scarious-sided*, oblong, rounded, 3 mm. long: *corolla* surpassing the calyx, its *lobes* reflexed-spreading, *two or more times as long as the constricted throat, ovate, acute or nearly obtuse, slightly sub-auriculate at the base*, 2 mm. by 2.5 mm., *white to tawny:* stamens four, just exserted from the tube or on long filaments: *pyxis one third surpassing the calyx*, oval, rounded, 3.5 mm. by 2 mm., *circumscissile just below the middle:* seeds two, dark brown, oblong, finely pitted.

Five sheets or specimens have been examined from Arizona, as follows: 2 in the U. S. National Herbarium, 2 in the Herbarium of the California Academy of Sciences, 1 in my own herbarium. Type specimen is J. W. Toumey's no. 355c, from Castle Creek, Arizona, June 21, 1892, in the U. S. National Herbarium.

6. PLANTAGO HELLERI Small, Bull. N. Y. Bot. Gard. **1**: 288. 1899

A low *deep green annual*, with a *short erect stem*, generally villous: *leaves* alternate, *ascending to erect*, several to numerous, *linear to linear-spatulate*, tapering to the acute apex, callous-tipped, entire, narrowed to the margined petiole having a semi-clasping base, 50–160 mm. by 2–5 mm., *3–5-ribbed or the ribs obsolete, loosely to sparingly villous to glabrate in age: peduncles* axillary, erect, *rather stout*, terete, solitary to several (then crowded), *when crowded surpassed by the leaves, when few equalling or surpassing them,* 20–50 mm. high, villous: *spikes thick, conspicuous on account of the relatively large corollas*, erect, *ovate to short-cylindrical*, 10–30 mm. by 5–10 mm., villous at the base to pilous at the apex: *bracts* rigid, *herbaceous and scarious-sided*, the lowest surpassing (by one half-length) the flowers to the uppermost equalling the calyx, *linear-subulate*, acute, 5–8 mm. long, villous: flowers perfect, numerous: *calyx* pubescent to villous, its *divisions herbaceous and scarious-sided, dark-green or brown*, spatulate-oblong, obtuse, 4 mm. long: *corolla* with the tube less than one third surpassing the calyx, its *lobes* strongly reflexed in fruit, *twice the length of the constricted throat, broadly ovate, obtuse*, 3–5 mm. by 3 mm., *white, with a deep brown throat:* stamens four, just exserted from the throat: *pyxis one third surpassing the calyx*, oblong, truncate at the apex, 4 mm. by 3 mm., *circumscissile at thelower third:* seeds two, brown, narrowly oblong, slightly constricted below the middle, finely pitted.

Eleven sheets or specimens have been examined from Texas and New Mexico, as follows: 5 in the U. S. National Herbarium, 5 in the Gray Herbarium, 6 in the Herbarium of the Missouri Botanical Garden, 1 in the Herbarium of the California Academy of Sciences.

7. PLANTAGO WRIGHTIANA Dcne.; DC. Prod. 13: 712. 1852

P. Patagonica, var. *nuda* Gray, Man. ed. 2. 269. 1856.

A relatively tall *dark green annual*, with an *erect stem, glabrous except the spikes and the upper part of the peduncles: leaves* alternate, erect, numerous, *linear, truncate and callous at the apex*, entire, occasionally involute near the apex, tapered to the narrow petiole having a semi-clasping base, 60–160 mm. by 3–4 mm., sometimes narrower, *3–5-nerved, glabrous or with a few hairs only: peduncles* axillary, *slender at the base and gradually dilated to the stout summit*, solitary to several, *surpassing the leaves*, 100–300 mm. high, appressed pubescent: *spikes* many-flowered, *conspicuous on account of the large corollas*, erect, *long-cylindrical*, 25–65 mm. by 6–8 mm., villous: *bracts* rigid, *herbaceous and with scarious margins, equalling or shorter than the sepals, triangular-lanceolate to ovate*, obtuse, 3 mm. by 1 mm., villous or less hairy: flowers perfect: *calyx thick* and rigid, pilous, its *divisions herbaceous, dark green or brownish*, narrowly obovate, rounded, 3 mm. long: *corolla lobes* spreading and reflexed, the two laterals deflexed, *triangular-ovate, obtuse*, 3 mm. by 2.5 mm., *white:* stamens four, long-exserted: *pyxis one third surpassing the calyx*, ovate, rounded, 4 mm.

by 2 mm., *circumscissile below the middle:* seeds two, brown, slightly constricted below the middle, finely pitted.

Twenty-one sheets or specimens have been examined from Texas and Arizona, as follows: 6 in the U. S. National Herbarium, 6 in the Gray Herbarium, 8 in the Herbarium of the Missouri Botanical Garden, 1 in the Herbarium of the California Academy of Sciences.

8. **Plantago dura** sp. nov.

A *green sub-caulescent annual*, with a *hard woody root*, generally *short-villous*, glabrous when very old: *leaves* crowded, erect, numerous, *linear*, tapering to the acute apex, callous-tipped, entire, narrowed a little to the slightly margined petiole having a semi-clasping base, about 150 mm. by 5 mm., *3-nerved, the outer very near the margin*, villous to glabrate: *scapes* erect, *stout*, terete, several to numerous, *equalling and surpassing the leaves*, 100–250 mm. high, pubescent to villous: *spikes* many-flowered, *conspicuous, coarse, thick*, erect, *cylindrical*, 30 mm. by 8 mm., villous: *bracts* rigid, herbaceous, *scarious-sided on the lower third*, two or less times as long as the calyx, *narrowly lanceolate, widest at the base, at least the lowest distinctly callous-tipped*, 6 mm. or less by 2 mm., *white villous:* flowers perfect: *calyx* villous on the midribs, its *divisions scarious, with brown rigid midribs*, narrowly obovate, obtuse, 3 mm. long: *corolla lobes* spreading and reflexed, *orbicular-ovate, obtuse*, 2 mm. by 2 mm., *white:* stamens four, about equalling the petals: *pyxis one third surpassing the calyx*, narrowly ovate, obtuse, 3 mm. by 2 mm., *circumscissile below the middle:* seeds two, dark brown, narrowly ovate, finely pitted.

Three specimens have been examined from Santa Catalina Island, Calif., as follows: 1 in the U. S. National Herbarium, 1 in the Gray Herbarium, 1 in the Herbarium of the Missouri Botanical Garden. Type specimen is from Blanche Trask's collection from Avalon, Santa Catalina Island, Calif., June, 1897, in the U. S. National Herbarium.

9. **Plantago inflexa** sp. nov.

A relatively tall, *bright green annual*, with a *short erect stem, generally villous: leaves* alternate, ascending to erect, several to numerous, *oblanceolate-linear*, acute at the apex, callous-tipped, often so involute near the apex as to appear acuminate, entire or with scattered callous teeth on the upper half, narrowed to the margined petiole having a semi-clasping base, 100–200 mm. by

5–10 mm., *5–7-nerved, the nerves continuing throughout the petiole*, villous: *peduncles* axillary, ascending to erect, *very stout*, terete, solitary to several, *surpassing the leaves*, 120–400 mm. high, appressed pubescent to villous: *spikes coarse*, many-flowered, erect, *long-cylindrical*, 35–100 mm. by 5–6 mm., *villous: bracts* rigid, *with scarious margins, from one half to two times as long as the sepals, triangular-subulate*, acute, 2.5–3 mm. by 0.75–1 mm., pubescent: flowers perfect: *calyx* villous, its *divisions herbaceous, green*, spatulate-oblong, rounded or retuse, 3 mm. long: *corolla lobes* spreading and reflexed, the two laterals deflexed, *broadly ovate, obtuse, sub-auriculate at the base*, 2.25 mm. by 2 mm., *white*, the neck of the tube short or none: stamens four, barely exserted from the tube: *pyxis one third surpassing the calyx*, slightly truncate at the apex, 4 mm. by 2.5 mm., *circumscissile at the middle:* seeds two, dark brown, oblong, finely pitted.

Twenty-one sheets have been examined from Texas, as follows: 3 in the U. S. National Herbarium, 8 in the Gray Herbarium, 7 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium, 2 in the Herbarium of the California Academy of Sciences. Type specimen is F. Lindheimer's "no. 163, Flora Texana exsiccata" from Cat Spring, Texas, April, 1844, of which there are two sheets in the Herbarium of the Missouri Botanical Garden.

10. **Plantago lanatifolia** (Coult. & Fish.) Small MS.

P. Patagonica, var. *lanatifolia* Coult. & Fish. Bot. Gaz. **18**: 303. 1883.

A *low spreading acaulescent annual*, generally villous and at *the base usually lanate: leaves basal, spreading*, several to numerous, *oblanceolate to spatulate-linear, abruptly short-acuminate*, sparingly denticulate, narrowed to the margined petiole having a semi-clasping base, 50–80 mm. by 4–6 mm., *5–7-nerved, villous to white woolly-lanate: scapes* basal, *spreading to ascending*, terete, several, *equalling and surpassing the leaves*, 30–50 mm. high, short-villous: *spikes* several-flowered, ascending to erect, *short-cylindrical*, 10–20 mm. by 6–10 mm.: *bracts* rigid, *herbaceous, scarious-sided at the base, two thirds to three quarters as long as the sepals, lanceolate-deltoid to linear-subulate*, acute, 2 mm. by 1 mm., slightly pubescent: flowers perfect: *calyx* pilous, its *divisions with narrow scarious margins, green and white*, narrowly oblong, obtuse or rounded, 2–5 mm. long: *corolla lobes* spreading and reflexed, *triangular-ovate, obtuse*, 2 mm. by 2 mm., *white, with small dark spots at the* *base:* stamens four, shorter than the petals or only just exserted from the tube: *pyxis circumscissile at the lower third.*

Nine sheets and specimens have been examined from Texas and New Mexico, as follows: 4 in the U. S. National Herbarium, 1 in the Gray Herbarium, 1 in the Herbarium of the Missouri Botanical Garden, 3 in the Columbia University Herbarium.

11. PLANTAGO INSULARIS Eastwood, Calif. Acad. Sci. III. 1: 112. 1898

A *low spreading green annual,* with a slender root, *with a short, simple or branched stem, generally lanate: leaves* alternate, *spreading or erect,* several to numerous, *linear-lanceolate,* acute at the apex or acuminate by the involute margins, callous-tipped, entire or callous-toothed, narrowed to the naked petiole having a semi-clasping base, 40–100 mm. by 4–12 mm., *3-ribbed, lanate: peduncles* axillary, *wide-spreading to ascending,* terete (occasionally stout), several to numerous, *surpassing the leaves,* 40–160 mm. long, canescent to pilous: *spikes thick,* many-flowered, *conspicuous by the dark longitudinal streaks in the petals,* erect, *oblong or in small forms capitate,* 7–20 mm. by 5–10 mm., villous: *bracts scarious, with brown midribs, equalling the calyx or slightly shorter, broadly ovate, rounded or retuse,* 3 mm. by 3 mm., pubescent or sometimes villous on the midribs: flowers perfect: *calyx* pubescent or villous on the midribs, its *divisions scarious, with brown midribs,* broadly oblong, obtuse, 3 mm. long: *corolla* with the tube equalling or somewhat surpassing the calyx, its *lobes* reflexed-spreading, three times as long as the constricted throat, *ovate, abruptly short-acuminate or acute,* 2 mm. by 1.25 mm., *brown* (at the base or) *in longitudinal streaks:* stamens shorter than or just equalling the petals; styles nearly equalling them: *pyxis two times as long as the calyx,* ovate, obtuse or truncate, 3 mm. by 2 mm., *circumscissile at the lower third, purple:* seeds two, brown, narrowly oblong, finely striate longitudinally, glossy.

Seventeen sheets or specimens have been examined from southern California and Lower California, as follows: 5 in the U. S. National Herbarium, 3 in the Herbarium of the Missouri Botanical Garden, 2 in the Columbia University Herbarium, 4 in the Herbarium of the California Academy of Sciences, 3 in Dr. E. L. Greene's Herbarium.

12. **Plantago brunnea** sp. nov.

A *low green slender-rooted annual,* generally villous: *leaves* basal, erect, several to numerous, *narrowly linear,* acute at the apex, callous-tipped, entire or with several brown callous teeth, narrowed to the margined petiole having a semi-clasping base, 50–120 mm. by 1.5–4 mm., *3-ribbed*, *villous*: *scapes* erect or ascending, *slender*, sometimes flattened, *two to numérous*, *surpassing the leaves*, 75–220 mm. high, sparingly pubescent to *tomentous below the spikes*: *spikes small*, many-flowered, *somewhat conspicuous on account of the dark longitudinal streaks in the petals*, erect, *capitate*, 6–10 mm. (occasionally longer) by 6 mm., pubescent to villous: *bracts* rigid, scarious, *with brown* (or rarely green) *midribs, as long as the sepals*, *ovate or broader*, obtuse (occasionally retuse), 2 mm. by 2 mm., pubescent on the midribs: flowers perfect: *calyx* pubescent, its *divisions scarious, with brown and green midribs*, broadly oblong, obtuse, 2 mm. long: *corolla* with the tube little surpassing the calyx, its *lobes* reflexed-spreading, *two times as long as the constricted throat*, *ovate*, *acute or obtuse*, 2 mm. by 1.5 mm., *white*, *with brown longitudinal streaks*, in some flowers white throughout: stamens four, equalling the corolla lobes; style nearly equalling them: *pyxis two times as long as the calyx*, ovate, rounded at the apex, 3.5 mm. by 2 mm., *circumscissile just below the middle*: seeds two, light brown, narrowly oblong, smooth and glossy.

Fourteen sheets or specimens have been examined from California and Lower California, as follows: 4 in the U. S. National Herbarium, 1 in the Gray Herbarium, 3 in the Herbarium of the Missouri Botanical Garden, 2 in the Columbia University Herbarium, 4 in the Herbarium of the California Academy of Sciences. Type specimen is Dr. Edward Palmer's no. 654, from San Quentin Bay, Lower California, January, 1889, in the U. S. National Herbarium.

13. **Plantago fastigiata** sp. nov.

A *low green annual*, with a short *erect stem or with short ascending branches*, generally densely villous and tomentous: *leaves* alternate, crowded on the branches, erect or ascending, numerous, *narrowly to lanceolate-linear*, tapering to the acute callous-tipped apex, entire or with scattered minute callous teeth, narrowed to the semi-clasping petiole, 40–120 mm. by 3–5 mm., *3-ribbed*, *densely white-villous*: *peduncles* axillary, erect or ascending, erete, several to numerous, *surpassing the leaves*, 70–170 mm. high, pilous to *tomentous below the spikes*: *spikes* many-flowered, erect, *short cylindrical*, 10–20 mm. by 5–7 mm., *villous to heavily tomentous* in smaller plants: *bracts* rigid, *with tawny to green midribs*, *equalling the calyx*, *oblong to ovate*, obtuse, 2.5 mm. by 2 mm., glabrate to pilous: flowers perfect: *calyx* villous or pubescent, its *divisions scarious, with green midribs*, broadly oblong, obtuse, 2.5 mm. long: *corolla* with the tube equalling the calyx, its *lobes* reflexed-spreading, *four times as long as the constricted throat, round-ovate, abruptly acute*, 2 mm. by 1.5 mm., *white to tawny, darker at the base*: stamens and style equalling the corolla lobes: *pyxis two times as long as the calyx*, oval, rounded at the apex, 4 mm. by 2 mm., *circumscissile just below the middle*: seeds two, brown, narrowly oblong, very finely pitted.

Eighteen sheets or specimens have been examined from Arizona and southern California, as follows: 8 in the U. S. National Herbarium, 1 in the Gray Herbarium, 4 in the Herbarium of the Missouri Botanical Garden, 1 in the Columbia University Herbarium, 3 in the Herbarium of the California Academy of Sciences, 1 in Dr. E. L. Greene's Herbarium. Type specimen is J. W. Toumey's no. 355a, from Tucson, Arizona, April, 1892, of which there are two sheets in the U. S. National Herbarium.

√ 14. **Plantago scariosa** nom. nov.

P. minima Alida M. Cunningham, Proc. Ind. Acad. Sci. 1896: 202. 1897; not *P. minima* DC. Fl. Fr. 3: 408. 1805; nor *P. minima* Less.; Barn. Monog. Plantag. 41. 1845.

A *low light green acaulescent annual, generally thick-villous*: *leaves* basal, erect, several to numerous, *linear to occasionally lanceolate-linear*, acute at the apex, callous-tipped, entire or with a few scattered callous teeth, narrowed to the semi-clasping petiole, 20–40 mm. by 2–4 mm., occasionally longer and equalling the scapes, *obscurely 3-ribbed, white-tomentous* to glabrate in age: *scapes* erect, *slender*, terete, two to several, *surpassing the leaves*, 30–120 mm. high, villous to *tomentous below the spikes*: *spikes* 6–20-flowered, erect, *capitate to oblong*, 5–18 mm. by 5–6 mm., *densely villous*: *bracts* rigid, *scarious, with green or purplish midribs, as long as the sepals, narrowly to broadly ovate*, obtuse, 3 mm. by 3 mm., glabrous or pubescent on the midribs: flowers perfect: *calyx* glabrate or pubescent, its *divisions scarious, with green or purplish midribs, obovate*, obtuse, 2.5 mm. long: *corolla* with the tube equalling the calyx, its *lobes* reflexed-spreading, *two and one half times as long as the constricted throat, round-ovate, acute or abruptly short-acuminate*, 2 mm. by 1.5 mm., *white, with a dark base*: stamens four, equalling the petals; style nearly equalling them: *pyxis two times as long as the sepals*, ovate, rounded at the apex, 4 mm. by 3 mm., *circumscissile just below the middle*: seeds two, yellow, narrowly oblong, smooth and glossy.

Twenty sheets or specimens have been examined from Utah, Nevada, Arizona, California, as follows: 7 in the U. S. National Herbarium, 2 in the Gray Herbarium, 2 in the Herbarium of the Missouri Botanical Garden, 4 in the Columbia University Herbarium, 3 in the Herbarium of the California Academy of Sciences, 1 in Dr. E. L. Greene's Herbarium.

15. **Plantago erecta** nom. nov.

P. Patagonica, var. *Californica* Greene, Man. Bay Reg. 236. 1894; not *P. Californica* Greene, Bull. Calif. Acad. Sci. **1**: 123. 1885.

This species is an aggregate. The following description and the annotations therefrom are to be considered temporary.

A *low bright or dark green acaulescent annual*, generally pubescent or sparingly villous: *leaves* basal, strict and erect or rarely spreading, rather slender, several to numerous, *narrowly linear, obtuse at the apex, almost truncately and brown callous-tipped*, entire, usually involute towards the apex, narrowed to the *long slightly clasping petiole*, 40–100 mm. by 1–2.5 mm., *3-ribbed*, the outer very near the margins and frequently forming a part of the involution, pubescent with spreading hairs: *scapes strictly erect* or rarely spreading, slender at the base, *gradually dilated* and tending to become stout at the base of the spikes, one to several, surpassing the leaves, 50–200 mm. high, occasionally higher, appressed pubescent: *spikes thick, four- to twenty-flowered*, sometimes many-flowered, *erect, oval-capitate to oblong-cylindrical*, 10–20 mm. by 6–8 mm., glabrous or pubescent: *bracts small*, rigid, *thick, herbaceous, scarious-sided, about one half as long as the sepals, ovate, obtuse or acute*, with a few spreading hairs to sparingly villous: flowers perfect: *calyx* with spreading hairs, its *divisions* thick, *herbaceous, scarious-sided, green to brownish*, oblong, obtuse, 3 mm. long: *corolla* with the tube just surpassing the calyx, its *lobes* strongly reflexed, *two to three times as long as the constricted dark brown throat, orbicular, obtuse or abruptly apiculate*, 2.25 mm. by 2 mm., *white*: stamens shorter than the petals or very long-exserted from the tube: *pyxis one third surpassing the calyx*, ovate, truncate or retuse, 4–5 mm. by 2 mm., *circumscissile at the lower third, purple*: seeds two, dark brown, oblong, finely pitted.

Seventy sheets or specimens have been examined from California, as follows: 18 in the U. S. National Herbarium, 11 in the Gray Herbarium, 9 in the Herbarium of the Missouri Botanical Garden, 2 in the Columbia University Herbarium, 5 in the Herbarium of the Field Columbian Museum, 21 in the Herbarium of the California Academy of Sciences, 4 in Dr. E. L. Greene's Herbarium.

16. **Plantago tetrantha** sp. nov.

A *low green and purplish acaulescent annual, with a filiform root,* glabrous to pubescent, depauperate forms villous: *leaves* basal, *strictly erect, very slender,* several, *linear-subulate, truncately callous-tipped,* entire and involute towards the apex, *sessile and slightly clasping,* 40 50 mm. by 1 mm., *without venation,* glabrous: *scapes* basal, *erect, filiform, one or two in number, surpassing the leaves,* 80–120 mm. high, puberulent at the summit: *spikes small, two- to four (to five)-flowered,* erect, *capitate,* 4–8 mm. by 3–6 mm., slightly pubescent: *bracts scarious, with rigid callous-tipped apex, onethird as long as the sepals, broadly ovate,* narrower in depauperate forms, *apiculate by the callous tip,* 1.5 mm. by 1.2 mm., pubescent or glabrate: *flowers* perfect, *opposite in pairs as in a short interrupted spike: calyx* puberulent, *with or without scarious margins,* green to purple, its *divisions* oblóng, *obtuse,* 3 mm. long: *corolla lobes* spreading, somewhat reflexed, *round-ovate, obtuse,* 3 mm. by 2.25 mm., *white, dark brown at the base:* stamens four, long-exserted; style equalling the petals: *pyxis circumscissile at the lower third.*

Seven sheets or specimens have been examined from northern California and Oregon, as follows: 4 in the U. S. National Herbarium, 2 in the Herbarium of the Missouri Botanical Garden, 1 in my own herbarium. Type specimen is R. A. Plaskett's no. 55, from the Santa Lucia Mountains, Monterey County, California, March, 1898, in the U. S. National Herbarium.

In several of the above species the differential characters are minute, but they are constant. In *P. aristata* the extremes would be somewhat puzzling without the intermediate forms. In all the species with oblong to ovate bracts, the habit and appearance of the plants alone (to say nothing of anatomical characters) suffice for their ready recognition.

DEPT. OF BIOLOGY, WASHINGTON, D. C., HIGH SCHOOLS.

Some Florida Fungi

By F. S. Earle

I have recently had the pleasure of examining two small lots of Florida fungi. The larger one was collected by P. H. Rolfs, and the smaller by S. M. Tracy. The following seem to be either new or noteworthy :

Asterina sabalicola sp. nov.

Mycelium widely effused, consisting of branching and anastomosing, septate, somewhat nodular and irregular, brownish hyphae from 3–5 μ in diameter : pseudo-perithecia 100–150 μ, formed by radiating septate hyphae about 3 μ in diameter, the free ends of which form a sterile fringe or subiculum, cells of these perithecial hyphae about 6 μ long : asci ovate, thin-walled, rather persistent, about 60 $\times$ 25 μ : ascospores sub-biseriate, oval, hyaline or faintly olivaceous, about equally uniseptate, 20 $\times$ 8 μ.

On living leaves of *Sabal* sp. Florida. P. H. Rolfs, no. 4.

The genus *Asterella* was proposed by Saccardo for the species of *Asterina* with hyaline spores, and it is recognized by Lindau (Engler & Prantl, 1^1: 340). It is possible that this species should be referred to the latter genus. The ascospores are, however, unmistakably tinted, and in older specimens it is probable that the color would be darker. This character at best is a very slender one for generic distinction when taken alone, and in this case the name *Asterella* is preoccupied by a genus of the Hepaticae, and is, therefore, untenable.

This is very different from the so-called *Asterina inquinans* E. & E. (N. A. F., no. 1785). The latter has no visible mycelium, and the naked sub-carbonaceous black perithecia are thickly scattered over the surface of the leaf. The ascospores seem to be uniformly continuous (Ellis says "faintly uniseptate ?") and hyaline or very faintly tinted. These characters would place it in the genus *Myiocopron* not in *Asterina* in which as now understood there is a superficial mycelium.

Ophiodothis atramentosa (B. & C.) Earle, nom. nov.

Hypocrea astramentosa B. & C. Jour. Linn. Soc. **10**: 377. 1868.

Epichloë Hypoxylon Peck, Reg. Rep. **27**: 108. D. 1875.

Dothidea vorax B. & C. Grevillea, **4**: 105. Mh. 1876.

Dothidea atramentaria B. & C. Grevillea, **4**: 105. Mh. 1876.

Ophiodothis vorax Sacc. Syll. Fung. **2**: 652. Je. 1883.

Dothichloë Hypoxylon Atk. Bull. Torr. Club, **21**: 223. My. 1894.

I refer here as being typical of this much named species, Rolf's no. 22, on an unknown grass from Lake City, Florida, Oct., 1896.

The stroma is crust like, often 2.3 cm. long and is slightly roughened throughout by the small, numerous, slightly papillate osteola.

A word is perhaps necessary in regard to the selection of the above name for this species. *Hypocrea atramentosa* B. & C. seems to have been founded on material from both Cuba and Alabama. There can be little question but that the Alabama material at least represented the same species that was later described as *Epichloë Hypoxylon* Peck and *Dothidea vorax* B. & C. If it should prove that the Cuban material differs from Peck's a specific name would have to be adopted for the form found in the United States. Atkinson's proposed genus *Dothichloë* has not been recognized by either Saccardo (Hedwigia, **35**: 34), nor by Lindau (Engler & Prantl. Nat. Pflanzfam.). The characters by which he seeks to separate it from *Ophiodothis* seem rather slight and even if, as he suggests, the character of the stroma of such species as *O. Haydeni* (B. & C.) Sacc. are sufficiently different to constitute a good generic distinction, the name *Ophiodothis* would, according to the method of generic types, now happily being somewhat widely recognized, have to remain with the present species, as it is the first one mentioned under this generic name. *Dothidea atramentaria* B. & C. and *D. pilulaeformis* B. & C. are recognized as varieties of this species by Saccardo. In the case of the former (see Rav. Fung. Amer. no. 100) there seems to be nothing on which to base a varietal distinction and it is therefore here included as a synonym. The latter (see Tracy's no. 167 on

Uniola, Ocean Springs, Mississippi, Sept., 1889) is quite distinct and is well worthy of varietal if indeed not of specific rank. The stroma is short, normally 1–2 mm. long (by confluence 1 cm. or more) but very much thickened, often seeming nearly globular. The perithecial cavities and osteola are much as in the type. The name for this latter fungus may be tentatively written as *Ophiodothis atramentosa pilulaeformis* (B. & C.).

Ophiodothis atramentosa Aristidae (Atk.)

Dothichloe Aristidae Atk. Bull. Torr. Club, **21** : 24.

On an unknown grass (probably *Aristida*), Lake City, Fla., June, 1895. P. H. Rolfs, no. 44.

This was given specific rank by Atkinson, and perhaps justly so, but as the following variety is intermediate in character between this and the type it seems best, for the present, to consider all of these forms as varieties, especially as they are so closely alike in their ascospores and asci. The distinguishing features of this form are the rongher more prominent ostioles and the interrupted or broken character of the fertile part of the stroma.

Ophiodothis atramentosa Cyperi var. nov.

Stroma interrupted, being formed of a thin sterile and of elevated fertile portions, the fertile tracts 1–2 mm. long by half as wide, perithecial cavities and ostioles as in the type.

On culms, leaves and bracts of *Cyperus ovularis*, Sneed's Island, Fla., Sept., 1899. S. M. Tracy, no. 6496.

DICHAENA STRUMOSA Fr.

On twigs of *Quercus*, St. Petersburg, Fla., July, 1894. P. H. Rolfs, no. 33.

This seems to be the first time that this interesting fungus has been taken with well-developed asci and ascospores; at least no description of these bodies has been published. The conidial form was distributed by Ellis, from New Jersey, as N. A. F. no. 3332. The Florida material agrees closely with this in the character of the distortions produced on the host and in general appearance, though the conidia seem slightly larger and broader. This conidial stage is referable to the form genus *Psilospora*, but it seems never to have been given a specific name under that genus.

I note the following characters from the Florida specimens:

Causing wart-like, often confluent distortions, 1 cm. in diameter: perithecia densely gregarious, innate-erumpent, black, carbonaceous, often flexed or irregular from crowding, lips somewhat widely open, about 1 × ⅓ mm.: conidia-bearing perithecia smaller and less distinctly hysteriform: conidia obovate, continuous, granular, hyaline to brownish, 28–30 × 12 μ: conidiophores about 20 × 4 μ, straight and stiff: asci nearly sessile, broadly oval, thin walled, 80–120 × 20–25 μ, paraphyses numerous, crowded, simple, the tips forming a brownish epithecium, about 120 × 3 μ: ascospores inordinate or partially biserrate, oval, continuous, minutely granular, light brown, closely packed in the ascus and often somewhat distorted by mutual pressure, 20–25 × 16–18 μ.

Lembosia camphorae sp. nov.

Epiphyllous: spots orbicular, nearly black with a narrow brownish border, 3–5 mm., in diameter, rarely confluent: perithecia thickly scattered over the central portion of the spot, often by confluence forming considerable crusts, single perithecia elongate, straight or slightly flexed, rather flat not prominent, lips somewhat widely open, averaging about 500 × 100 μ, surrounded by a rather scanty subiculum of slender occasionally septata, flexuous, anastamosing, brown threads about 3 μ, in diameter, the subiculum reaching 100 μ, in width: asci broadly oval, thin-walled, 8-spored, about 25 × 20 μ: ascospores inordinate, oval, slightly curved, about equally uniseptate, conspicuously constricted, ends subacute, faintly olivaceous, becoming light brown at full maturity, about 18 × 6 μ.

On living leaves of *Camphora officinalis*, Florida. P. H. Rolfs, no. 32.

Leptothyrium ? carbonaceum sp. nov.

Amphigenous but mostly epiphyllous, not spotting or discoloring the leaf: perithecia irregularly scattered, large, about 1 mm., black, shining, carbonaceous, not distinctly parenchymatous, scutellate, central fertile portion strongly elevated, with a minute, central papillate imperforate osteolum, bordered by a flat sterile margin, often confluent, two or three together: sporules numerous, irregularly oval, yellowish, continuous, rather thick-walled, about 16–20 × 8–10 μ.

On unknown living coriaceous leaf. Lemon City, Fla., Feb., 1898. P. H. Rolfs, no. 39.

This conspicuous fungus is doubtless the immature stage of some species of the Microthyriaceae. It has little in common with the minute membranous species usually referred to *Leptothyrium*.

An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXX

By H. H. Rusby

(Continued from Bull. Torr. Club, **27** : 84. 17 F. 1900.)

Salvia Bridgesii Britton, sp. nov.

Scurfy-tomentose, gray : stems erect or ascending, reddish, obtusely quadrangular, very leafy : petioles .5–1.5 cm. long, slender or stoutish : blades 3–6 cm. long, .7–1.5 cm. broad, lanceolate or lance-ovate, blunt to rounded at the base, acute or obtuse, finely crenate or crenate-dentate, thickish, above dark-green, minutely velutinous, finely bullate by the strongly impressed, finely reticulate venation, underneath bright-gray, the reddish midrib and 12–15 pairs of strongly ascending secondaries very prominent : bracts varying from ovate and 5 mm. long, to linear-attenuate and more than 1 cm. long : calyx (in flower) 1.5 cm. long, lipped one third of its length : corolla 2 cm. longer than the calyx, slender : stamens 5 mm. exserted, the nearly semicircularly curved anthers 3 mm. long, or nearly 4.5 mm. long if straightened, longer style-branch nearly 2 mm. long.

Vic. La Paz, 10000 ft., Apr., 1885 (no. 1496). The same as Mandon's no. 510. Dr. Britton says also collected by Bridges and Pearce, and nearest to *S. bullulata*.

Dr. Britton regards Rusby's no. 2439 as the same. Its leaves are much smaller, its calyx (in flower) 8 mm. long, its corolla 2 cm. long.

Perilomia ocimoides H.B.K. Nov. Gen. et Sp. **2** : 328. Yungas 4000 ft., 1885 (no. 2155).

Marrubium vulgare L. Sp. Pl. 583. Near Valparaiso, Chili, June, 1885 (no. 1063).

Stachys Bogotensis H.B.K. Nov. Gen. et Sp. **2** : 309. Unduavi, 8000 ft., Oct., 1885 (no. 1495), and Sorata, 10000 ft., Feb., 1886 (no. 1494).

Stachys repens Mart. et Gal. in Bull. Acad. Brux. **11** : 194. 1844. Sorata, 10000 ft., Feb., 1886 (no. 2413). The same as Mandon's no. 521.

PLANTAGINACEAE.

Plantago litorea Phil. Fl. Atac. 46. Sorata, 10000 ft., Feb., 1886 (no. 2607).

Plantago tomentosa Lam. Illustr. **1**: 340. Vic. La Paz, 10000 ft., April, 1885 (no. 666), Yungas, 4000 ft., 1885 (no. 667) and (?), Unduavi, 8000 ft., Oct., 1885 (no. 665).

Plantago major L. Sp. Pl. 112. Yungas, 6000 ft., 1885 (no, 668).

NYCTAGINACEAE

Oxybaphus bracteosus Griseb. in Goelt. Abh. **19**: 86. 1874. Yungas, 4000 ft., 1885 (no. 2688).

Oxybaphus micranthus Choisy in DC. Prod. **13**: 432. Vic. La Paz, 10000 ft., April, 1885 (no. 2868).

Boerhaavia viscosa Tag. & Rod. Anal. Cienc. Nat. **4**: 256, no. 12. Yungas, 6000 ft., 1885 (no. 906).

Boerhaavia erecta L. Sp. Pl. 3. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 904).

Collignoma parviflora (H.B.K.) Endl. Gen. 311. Unduavi, 8000 ft., Oct., 1885 (no. 2706), and Sorata, 10000 ft., Feb., 1886 (no. 2705). The same as Mandon's no. 1007. The plant climbs, by reclining, to the height of 8 or 10 ft. in hedges. Its white bracts render it both conspicuous and handsome.

Pisonia hirtella H.B.K. Nov. Gen. et Sp. **2**: 217. Mapiri, 25000 ft., May, 1886 (no. 2500). The same as Mandon's no. 1009.

Pisonia Boliviana Britton, sp. nov.

Younger portions, inflorescence, petioles, etc., sparsely ferruginous-pubescent; branchlets short, weak, flexuous, spreading or recurved, leafy at the summit: petioles .5–1 cm. long, broad: blades .6–1.5 cm. long, 3–8 cm. broad, oval, varying to ovate or obovate, inaequilateral, abruptly or cuneately narrowed at the base, shortly and obtusely abrupt-pointed at the apex, entire, dark-green above, pale underneath, rather thin, the 8–10 pairs of slender, straight principal secondaries diverging nearly at right angles, connecting near the margin, alternating with lesser ones: peduncles about 1 cm. long, weak: panicles 1 or 2 cm. long and broad, loosely branched: flowers sub-sessile: bracts whitish, thickish, 1 mm. long, oval-ovate, obtuse, strongly ciliate: perigone 4 mm. long, 2 mm. broad at the summit, campanulate-turbinate, the margin sinuately 5-lobed and plicate: stamens 10, exserted, the filaments thickened, united at the base: the anthers .5 mm. long and broad: pistillate flowers not seen.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2502). No. 2501, from the same place, is immature. Dr. Britton regards it as the same, but this cannot be definitely stated from the material at hand.

Neea longipedunculata Britton, sp. nov.

Younger portions of the stem and lower leaf-surfaces pubescent: branchlets stoutish, striate: petioles 2–5 mm. long, stout and broad: blades .5–1.5 dm. long, 2.5–5 cm. broad, obovate, mostly blunt or rounded at the base, abruptly short-acuminate and obtusish at the apex, entire, the venation very slender, inconspicuous both sides, the secondaries very irregular, communicating near the margin: flowers dioecious: peduncles of the pistillate flowers about .5–1.5 dm. long, sub-filiform: panicles 2–6 cm. broad, loosely flowered, triangular-subulate bracted, the bracts about 1 mm. long: flowers blackish as dried, sub-sessile, oblong with contracted mouth, 1 cm. long, 3 mm. broad, the lobes 2 mm. long, lightly recurved.

Reis, 1500 feet, June, 1886 (no. 2709).

Neea macrophylla Britton, sp. nov.

Glabrous, drying blackish: branchlets stout, terete or angular at the summit: petioles 1 or 2 cm. long, very stout, sharply margined: blades 1.5–2 dm. long, .75–1 dm. broad, oval, rather abruptly narrowed into the petiole, short-acuminate and very acute, entire, membranous, the midrib and 12–16 pairs of slender secondaries lightly prominent above, strongly so underneath, the latter interarching at some distance from the margin, connected by the rather few, coarse tertiaries: cyme compound, shortly and stoutly peduncled, 1 dm. broad, the branches minutely ferruginous, thick and flattened after pressure: flowers sub-sessile, rather densely grouped: bracts lance-linear, slenderly acuminate, 1–2 mm. long: flowers (only the staminate seen) scarcely 1 cm. long, 3–4 mm. broad as pressed, oblong, contracted toward the summit of the tube, the 5 lobes a little more than 1 mm. long and rather broader, ovate, obtuse, thickened, papillose: stamens 8, the longest less than half the length of the corolla, the filaments thickened but weak, the anthers nearly 1 mm. long, almost as broad, light yellow, with a large black connective: pistil none.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2119). Dr. Britton says: "also collected by Pearce at Monterico, 3000–4000 ft., March, 1867."

Species peculiar in having the staminate flowers elongated.

Cryptocarpus pyriformis H.B.K. Nov. Gen. et Sp. **2**: 188. *pl. 124.* Yungas, 6000 ft., 1885 (no. 2497).

ILLECEBRACEAE

Pentacaena ramosissima (Weinm.) H. & A. Hook. Bot. Misc. **3**: 338. 1833 (*Loeflingia ramosissima* Weinm. Flora, **2**: 608. 1820). Sorata, 8000 ft., Feb., 1886 (no. 1524).

Herniarca setigera Gill. Hook. Bot. Misc. **3**: 337. 1833. Yungas, 6000 ft., 1885 (no. 1791).

AMARANTACEAE

(All the specimens pertaining to this family were taken for study by Professor Dr. Hans Schinz. No report has been received and there are no specimens in hand for our enumeration.)

CHENOPODIACEAE

Chenopodium ambrosioides L. Sp. Pl. 219. Vic. La Paz, 10000 ft., Apr., 1885 (no. 1421).

Atriplex Rusbyi Britton, Mem. Torr. Club, **4**: 250. Yungas, 6000 ft., 1885 (no. 1529).

Atriplex sp. (?)

Glabrous: stems filiform, twining: petioles 5–7 mm. long-rather broad: blades 1–2 cm. long, 4–8 mm. broad, triangular, lanceolate, shallowly cordate at the base, acuminate and acute, entire, 3–5-nerved, the nerves rather conspicuous on both sides: upper leaves becoming linear: racemes 2 or 3 cm. long, the peduncles about 1 cm. long, filiform, remotely-flowered, the flowers clustered: bracts about 1 mm. long and broad, ovate, green with white-scarious, ciliate margins: pedicels less than 1 mm. long, about as long as the flower: flowers staminate, the purplish perianth deeply 6-lobed: stamens 6, the anthers didymous, with a broad connective.

Unduavi, 8000 ft., Oct., 1885 (no. 2545). With the slender, twining habit and inflorescence of *Boussingaultia*, this species presents the staminate flowers and didymous anthers of *Atriplex*.

Salicornia Peruviana H.B.K. Nov. Gen. et Sp. **2**: 193. Pisco, Peru, Feb., 1885 (no. 1528).

Boussingaultia marginata (Moq.) Britton (*Tandonia marginata* Moquin; DC. Prod. **13**: 226). Vic. La Paz, 10000 ft., Oct., 1885 (no. 2570). The same collected by Holton at Chauchi, June 18, 1854, and in Herb. Kew. sub "*T. cordifolia.*"

PHYTOLACCACEAE

Villamilla octandra (L.) Hook. f. in B. & H. f. Gen. **3**: 81 (*Rivina octandra* L. Cent. Pl. **2**: 9). Guanai, 2000 ft., May, 1886 (no. 1353), and Junc. Rivers Beni and Madre de Dios, Aug., 1886 (no. 741).

Villamilla racemosa Britton, Mem. Torr. Club, **4**: 261. Yungas, 6000 ft., 1885 (no. 743).

Petiveria alliacea L. Sp. Pl. 342. Mapiri, 5000 ft., Apr., 1886 (no. 1368).

Microtea Muypurensis (Kunth.) G. Don, Lond. Hort. Brit. ed. 2, 98, n. 6423 (*Ancistrocarpus Muypurensis* Kunth. Humb. et Bonp. Nov. Gen. et Sp. **2**: 186. n. 1. *pl. 122*). Beni River, July, 1886 (no. 1379).

Phytolacca octandra L. Sp. Pl. ed. 2. 631. Unduavi, 8000 ft., Oct., 1885 (no. 1961).

Phytolacca thyrsiflora Fenzl. West. Fl. Bras. **14^2**: 343. Mapiri, 5000 ft., Apr., 1886 (no. 742).

POLYGONACEAE

Rumex cuneifolius Campd. Monog. Rum. 66, 95. Vic. La Paz, 10000 ft., Apr., 1885 (no. 1526).

Rumex conglomeratus Murr. Prod. Fl. Gott. 52. Near Valparaiso, Chili, June, 1885 (no. 1525) and Sorata, 10000 ft., Feb., 1886 (no. 1525). The same as Mandon's no. 1036.

Sarcogonum Chilensis (Meissn.) (*Muhlenbeckia Chilensis* Meissn.; DC. Prod. **14**: 148). Vic. La Paz, 10000 ft., Apr., 1885 (no. 1026). The same as Lechler's no. 541.

Sarcogonum fruticulosum (Walp.) Rusby, Mem. Torr. Club, **4**: 251. Vic. La Paz, 10000 ft., Apr., 1885 (no. 1962). The same as no. 132.

Sarcogonum tamnifolium (H.B.K.) Rusby, Mem. Torr. Club, **6**: 111. Sorata, 8000 ft., Feb., 1886 (no. 628), and Unduavi, 8000 ft., Oct., 1885 (no. 1426).

Sarcogonum vulcanicum (Endl.) Rusby, Mem. Torr. Club, **4**: 252. Vic. La Paz, 10000 ft., Oct., 1885 (no. 630).

Uvifera Illhaensis (Wedd.) Kuntze, Rev. Gen. Pl. 561 (*Coccoloba Illhaensis* Wedd. Ann. Sci. Nat. III. **10**: 258. 1850. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 1380).

Uvifera strobibulifera (Meissn.) (*Coccoloba strobilulifera* Meissn.; Mart. Fl. Bras. **5**[1]: 25). Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2624).

Uvifera Meissneriana Britton, sp. nov.

Younger portions, inflorescence and lower leaf-surfaces pubescent and slightly ferruginous: branchlets stout, strongly striate or costate: petioles 5 mm. long, very stout and broad: blades 5–1.5 dm. long, 3–6 cm. broad, obovate, abruptly and acutely short-pointed, rigid, pale-green, the coarsely reticulate slender venation prominent on both sides: spikes sessile, 5–6 cm. long, the rachis stout, coarsely angled, densely flowered: catkins 6–8 cm. long, 5 or 6 mm. thick, densely flowered, deep-brown: pedicels 1–2 mm. long, stout: perianth 2 mm. long, the segments ovate or oval, obtuse: filaments about 1 mm. long, flattened and much broadened below, the anthers less than .5 mm. long: pistil about 1 mm. long, the ovary conical-ovoid, the style stout with slender branches.

Guanai, 2000 ft., May, 1886 (no. 1918).

Mr. Bang's no. 1595, probably collected at the same place, is the same, in fruit. The fruit is 5 mm. long, globular-ovoid, obtuse, lightly angled, deep-brown.

Triplaris hispida Britton, Mem. Torr. Club, **6**: 111. Guanai, 2000 ft., May, 1886 (no. 1309), and Beni River, July, 1886 (no. 1424).

Triplaris efistulifera sp. nov.

Pistillate plant, in fruit, only seen: glabrous, except the ferruginous tomentose inflorescence: branches, elongated, blackish, solid, the internodes about 2 cm. long: sheaths annular, about 1 cm. long: petioles .7–1 cm. long, very broad, blackish: blades 1.5 dm. long, 6 cm. broad, oval, blunt at the base, acuminate, thickish, lightly shining above, pale underneath, where the midrib and about 14 pairs of upwardly curved secondaries are very prominent, the venation very finely reticulate: spikes terminal, panicled,

.5–1 cm. long, 1 cm. thick, subtended by sheaths similar to those of the leaves: bracts sessile, nearly 1 cm. long, splitting through the lower side, hirsute: pedicel 3 mm. long, very stout, densely yellowish hirsute, lightly recurved, the fruit disarticulating from its blackish summit: tube of the perianth 1.5–2 cm. long, contracted toward the summit and above the fruit, somewhat dilated, pubescent, the outer lobes nearly 3 cm. long, nearly 1 cm. broad, oblanceolate, obtuse, red, strongly veined, the inner nearly 2 cm. long, linear, obtusish, thick and rigid, lying closely in the angles between the wings of the smooth fruit, which is 1.5 cm. long, inclusive of the styles, nearly 1 cm. broad, strongly winged, short beaked: the persistent styles 2–3 mm. long.

Yungas, 6000 ft., 1885 (no. 1425).

Triplaris Boliviana Britton, sp. nov.

Twigs and veins of the lower leaf-surface minutely puberulent, the inflorescence gray-tomentose: branchlets fistulous, very stout, reddish, the sheaths mere rings: petiole (but one seen) 1.5 cm. long, 4 mm. broad, very stout: blade 3.5 dm. long, 2 dm. broad, regularly ovate, rounded at the base, acute (?) at the apex, entire, thickish, the terete and very stout midrib, and about 25 pairs of nearly straight secondaries very prominent underneath, the latter spreading at an angle of about 60°, interarching near the margin, connected by the crooked tertiaries: spikes fascicled along the rachis, mostly branched at the base, .75–2.5 dm. long, 6 or 7 mm. thick, with the flowers not yet expanded, very densely flowered, gray-tomentose: bracts 3 mm. long, 5 mm. broad when flattened, densely white-hirsute, the bractlets similar but smaller: buds globoidal, a little more than 1 mm. in diameter: perianth hirsute, deeply parted, the lobes 1.25 mm. long, oblong, obtuse: stamens exserted, the anthers reddish, large: pistillate flowers not seen.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 1243).

PIPERACEAE.

Piper angustifolium Fl. Per. **1**: 38. Yungas, 6000 ft., 1885 (no. 2175).

Piper Blanchetii (Miq.) C. DC. Prod. **16**: 318 (*Artanthe Blanchetii* Miq. Syst. Pip. 473). Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2183).

Piper calocoma (Miq.) C. DC. Prod. **16**: 264 (*Artanthe calo-*

coma Miq.; Seem. Bot. Voy. Herald 199). Guanai, 2000 ft., May, 1886 (no. 2190).

Piper Hookeriana (Miq.) C. DC. Prod. **16**: 292 (*Artanthe Hookeriana* Miq.; Hook. Lond. Journ. Bot. **4**: 446. 1845). Mapiri, 2500 ft., May, 1886 (no. 2187).

Piper obliquum R. & P. Fl. Per. **1**: 37. *pl. 63. f. a.* Mapiri, 5000 ft., Apr., 1886 (no. 2174).

Piper lanceolatum R. & P. Fl. Per. **1**: 36. Unduavi, 8000 ft., Oct., 1885 (no. 2178).

Piper Gaudichaudianum Kunth in Linnaea, **13**: 639. 1839. Guanai, 2000 ft., May, 1886 (no. 2179).

Piper Mapirense C. DC. Bull. Torr. Club, **19**: 47. 1892. Mapiri, 2500 ft., May, 1886 (no. 2180).

Piper oxyphyllum C. DC. Bull. Torr. Club, **19**: 48. 1892. Yungas, 4000 ft., 1885 (no. 2176).

Piper Pavonii (Miq.) C. DC. Prod. **16**: 294. Mapiri, 5000 ft., April, 1886 (no. 2185). The same as Bang's no. 2642.

Piper psilophyllum C. DC. Bull. Torr. Club, **19**: 47. 1892. Unduavi, 8000 ft., Oct., 1885 (no. 2186).

Piper pseudo-peruvianum C. DC. Prod. **16**: 282. Mapiri, 2500 ft., May, 1886 (no. 2181).

Piper Rusbyi C. DC. Bull. Torr. Club, **19**: 47. 1892. Yungas, 4000 ft., 1885 (no. 2188).

Piper tenue H.B.K. Nov. Gen. et Sp. **1**: 560. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2184). The same as Mathew's no. 1708.

Piper tuberculatum Jacq. Ic. Pl. Par. **2**: 2. *pl. 21.* Guanai, 2000 ft., May, 1886 (no. 2177). The same as Holton's no. 239.

Piper umbellatum L. Sp. Pl. 30. Mapiri, 5000 ft., April, 1886 (no. 2173).

Piper Warakaboura (Miq.) C. DC. Prod. **16**: 257 (*Artanthe Warakaboura* Miq.; Hook. Lond. Journ. Bot. **4**: 469. 1845. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2182).

Piper sp. undeterminable. Yungas, 6000 ft., 1885 (no. 2189).

Peperomia ciliata H.B.K. Nov. Gen. et Sp. **1**: 68. Unduavi, 8000 ft., Oct., 1885 (no. 2169); Yungas, 4000 ft. (no. 2195) and 6000 ft. (no. 2193).

Peperomia circinata Link. Bot. Jahrb. **1**: 64. 1820. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2208).

Peperomia distachya (L.) A. Dietr. Sp. Pl. **1**: 156 (*Piper distachyon* L. Sp. Pl. 30). Mapiri, 2500 ft., May, 1886 (no. 2192).

Peperomia talinifolia longipetiolata C. D.C. Yungas, 6000 ft., 1885 (nos. 2200 and 2212) and Mapiri, 2500 ft., May, 1886 (no. 2215).

Peperomia galioides H.B.K. Nov. Gen. et Sp. **1**: 71. *pl. 17*. Mapiri, 5000 ft., Apr., 1886 (no. 2201).

Peperomia heterophylla Miq.; Hook. Lond. Journ. Bot. **4**: 415. 1845. Mapiri, 5000 ft., Apr., 1886 (no. 2209).

Peperomia heterostachya A. Dietr. Sp. Pl. **1**: 717 (index). Yungas, 6000 ft., 1885 (no. 2213).

Peperomia Hilariana Miq. Syst. 89? Yungas, 6000 ft., 1885 (no. 2211).

Peperomia Langsdorffii Miq. Syst. 116. Unduavi, 8000 ft., Oct., 1885 (no. 2197).

Peperomia Larecajana C. DC. Prod. **16**: 406. Yungas, 4000 ft., 1885 (no. 2210a).

Peperomia linearis C. DC. Journ. Bot. **4**: 145. 1866. Yungas, 6000 ft., 1885 (no. 2206).

Peperomia melanostigma Miq. Syst. 90. Yungas, 6000 ft., 1885 (nos. 2191 and 2199).

Peperomia myriocarpa Miq. Syst. 185. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2194).

Peperomia nummularifolia (Sw.) H.B.K. Nov. Gen. et Sp. **1**: 66 (*Piper nummularifolium* Sw. Prod. Veg. Ind. Occ. 16). Falls of Madeira, Brazil, Oct., 1886 (no. 2207).

Peperomia pseudo-furcata C. DC. Prod. **16**: 399. Mapiri, 5000 ft., Apr., 1886 (no. 2205).

Peperomia reflexa A. Dietr. Sp. **1**: 180. Yungas, 6000 ft., 1885 (no. 2203) (?) and Falls of Madeira, Brazil, Oct., 1886 (no. 2202).

Peperomia psilostachya C. DC. in M. DC. Phyll. Yungas, 6000 ft., 1885 (no. 2210).

Peperomia Rusbyi C. DC. Bull. Torr. Club, **19**: 49. 1892. Yungas, 6000 ft., 1885 (no. 2214).

Peperomia septemnervis R. & P. Pl. Per. **1**: 31. *pl. 47. f. c.* Yungas, 6000 ft., 1885 (no. 2198).

Nos. 2204, 2216 and 2588 are species of *Peperomia*, collected at Unduavi, Oct., 1885.

CHLORANTHACEAE

Tafallaea glabrata (H.B.K.) Rusby, Mem. Torr. Club, **4**: 252. Mapiri, 2500 ft., May, 1886 (no. 2499), and Yungas, 4000 ft., 1885 (no. 2498).

MYRISTICACEAE

Myristica sebifera (Aubl.) Sw. Fl. Ind. Occ. 1129. Mapiri, 2500 ft., May, 1886 (no. 1216) and Guanai, 2000 ft., May, 1886 (no. 1217).

MONIMIACEAE

Mollinedia Rusbyana Perkins. Mapiri, 2500 ft., May, 1886 (no. 2620). The same as Bang's no. 2430. Also collected by Pearce, Yungas, Jan., 1886.

Peumus Boldus Molino Sagg, Chili, 185. Near Valparaiso, Chili, June, 1885.

Siparuna limoniodora (R. & P.) A. DC. Prod. **16**: 646. Yungas, 6000 ft., 1885 (no. 2485). The same as Bang's no. 1183.

Siparuna obovata (Gardn.) A. DC. Prod. **16**: 644 (*Citrosma obovata* Gardn. Hook. Lond. Journ. Bot. **2**: 343. 1843). Yungas, 4000 ft., 1885 (no. 2586).

Siparuna Apiosyce (Mart.) A. DC. Prod. **16**: 645 (*Citrosma Apiosyce* Mart. ex Tul. Ann. Sci. Nat. IV. **4**: 34. 1855). Mapiri, 5000 ft., Apr., 1886 (no. 2486).

LAURACEAE

Aniba Amazonica (Meissn.) Mez. Jahrb. Berlin **5**: 69. 1889 (*Aydendron Amazonicum* Meissn. in DC. Prod. **15**: 89). Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 709).

Endlichera hirsuta (Schott.) Nees. in Linnaea **8**: 38. 1833 (*Cryptocarya hirsuta* Schott. in Spreng. Syst. **4**: App. 405). Yungas, 6000 ft., 1885 (no. 2506), and Beni River, July, 1886 (no. 710).

Endlichera dysodantha (R. & P.) Mez. Jahrb. Berlin, **5**: 119.

1889 (*Laurus dysodantha* R. & P. Fl. Per. **4**: *pl. 355*). Mapiri, 2500 ft., May, 1886 (no. 2671).

Persea gratissima Gaertn. Fruct. **2**: 222 (no. 2533).

Persea laevigata H.B.K. Nov. Gen. et Sp. **3**: 157. Yungas, 4000 ft., 1885 (no. 2505).

Persea scoparia Mez. Arb. Bot. Gart. Breslau, 115 (?). Mapiri, 2500 ft. (no. 2538).

Ocotea Guyanensis Aubl. Pl. Guy. **2**: 781. *pl. 310*. Guanai, 2000 ft., May, 1886 (no. 2639).

Ocotea Rusbyana Mez. Jahrb. Berlin, **5**: 303. 1889. Guanai, 2000 ft., May, 1886 (no. 2674).

Ocatea laxiflora (Meissn.) Mez. l. c. 371 (*Mespilodaphne laxiflora* Meissn; DC. Prod. **15**: 107. Guanai, 2000 ft., May, 1886 (no. 2672).

Nectandra Brittonii Mez. l. c. 435. Guanai, 2000 ft., May, 1886 (no. 2602).

Nectandra globosa (Aubl.) Mez. l. c. 415 (*Laurus globosus* Aubl. Pl. Gen. **1**: 364). Guanai, 2000 ft., May, 1886 (no. 706), and Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 708).

Nectandra laevis Mez. l. c. 451. Mapiri, 5000 ft., Apr., 1886 (no. 705).

Nectandra lanceolata Nees *et* Mart. Linnaea **8**: 47. 1833. Beni River, July, 1886 (no. 711).

Nectandra cuspidata Nees *et* Mart. Syst. Laurin, 330. Mapiri, 2500 ft., May, 1886 (no. 707).

Nectandra berchemifolia Meissn.; DC. Prod. **15**: 154. Mapiri, 2500 ft., May, 1886 (no. 712).

LORANTHACEAE

Phrygilanthus tetrandrus (R. & P.) Eichler; Mart. Fl. Bras. 5^2: 47 (*Loranthus tetrandrus* R. & P. Fl. Per. **3**: 46. *pl. 275*). Near Valparaiso, Chile, June, 1885 (nos. 1531 and 1532).

Phrygilanthus punctatus (R. & P.) Eichler, l. c. (*Loranthus punctatus* R. & P. l. c. 47. *pl. 277. f. a*). Mapiri, 10000 ft., Apr., 1886 (no. 1530).

Phrygilanthus eugenioides (H.B.K.) Eichler, l. c. 50 (*Loranthus eugenioides* H.B.K. Nov. Gen. et Sp. **3**: 435). Mapiri, 5000 ft., Apr., 1886 (no. 1823). The same as Mandon's no. 1470.

Struthanthus concinnus Mart. Flora, 1 : 104. 1830. Yungas, 6000 ft., 1885 (no. 1534). Apparently the same as Burchell's no. 3693.

Phthirusa pyrifolia (H.B.K.) Eichler, l. c. 63 (*Loranthus pyrifolius* H.B.K. Nov. Gen. et Sp. 3: 441. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (no. 1536).

Oryctanthes botryostachys Eichler, l. c. 89. *pl. 29.* (?) Reis, 1500 ft., June, 1885 (no. 1545). The same in Jenman's no. 2532 and Traill's no. 785 from the upper Amazon.

Loranthus (?) **cubeboides** sp. nov.

Glabrous: branches elongated, stoutish, mostly straight and little-branched, terete, striate, dark-colored, the internodes 3 or 4 cm. long, petioles 4–7 mm. long, stout: blades 3–6 cm. long, 2–3 cm. broad, ovate, rounded at the base, acuminate and acute, entire, moderately thick, the midrib and 9 or 10 irregular pairs of secondaries moderately prominent on the lower side; spikes 2–4 cm. long, short-peduncled, erect or ascending, slender, angled, the flowers about 3 or 4 cm. apart: pedicels 3 mm. long, stout, slightly thicker at the summit, angled, divergent, 2- or occasionally 3-flowered at the summit: calyx about 1 mm. long and broad, minutely and sharply toothed.

Mapiri, 5000 ft., Apr., 1886 (no. 1535).

Phoradendron acinacifolium Eichl., in Mart. Fl. Bras. 5^2: 117. Falls of Maderia, Brazil, Oct., 1886 (no. 1542).

Phoradendron Balleanum (Seem.) Eichl. l. c. 134 (*Viscum Balleanum* Seem. Bot. Voy. Herald, no. 295. *pl. 63*). Yungas, 6000 ft. 1885 (no. 1540) (?) The same as Mandon's no. 1468.

Phoradendron clavatum (Benth.) Eichl. l. c. 107 (*Viscum clavatum* Benth. Pl. Hartw. 189). Ingenio del Oro, 10000 ft., May, 1886 (no. 1541).

Phoradendron coriaceum Eichl. l. c. 121. Mapiri, 2500 ft., May, 1886 (no. 1546).

Phoradendron latifolium (Sw.) Griseb. Mem. Am. Acad. II. 8 : 191. 1861 (*Viscum latifolium* Sw. Fl. Ind. Occ. 1 : 268). Mapiri, 2500 ft., May, 1886 (no. 1547). It is the same as a specimen in Herb. Kew., numbered "904," from Santarem; also collected by Jenman.

Phoradendron Mandonii Eichl. in Mart. Fl. Bras. 5^2: 124 *in* *obs.* Yungas, 6000 ft., 1885 (no. 1387). The same as Mandon's no. 497.

Phoradendron mesembryanthemifolium Griseb.

Lechl. Berb. Amer. Austr. 59 (name only)

Glabrous, very greatly and harshly wrinkled in drying: stems much-branched, the branches sub-erect, rather slender for the genus, sparsely leafy, the leaves falling readily: leaves sessile, about 1.5 cm. long, 3–5 mm. broad, oblanceolate, broadest near the blunt apex, very thick and fleshy: spikes 1.5–3 cm. long, nearly as broad as the leaves, 2–3-jointed, the joints gradually and regularly broadening upward to about twice the width of the basal portion: bracts (the pair) about 3.5 mm. broad, the upper margin about horizontal, each equilaterally triangular in lateral outline, acute: flowers moderately numerous, mostly above the middle of the joint, moderately imbedded: perianth-segments triangular ovate, obtuse, nearly 1 mm. long and broad.

Sorata, 8000 ft., Feb., 1886 (no. 1537).

The same as Mandon's no. 1466 and Bang's nos. 1926 and 2035.

Phoradendron Pearcei sp. nov.

Plant drying of a deep yellow color: stems 1–1.5 dm. long, densely short-branched, hispid with sharp upwardly directed warts: petioles 2 mm. long, 1 mm. broad, strongly concave on the upper surface: blades 3 or 4 mm. long, 4 or 5 mm. broad, ovate, the outline rounded: spikes 3–5 mm. long, 1–5-flowered, short-peduncled, the lower bracts small, the upper semi-circular, connate: sepals nearly blood red in color, about 1 mm. long and rather broader: pistil globoidal, less than .25 mm. in diameter: staminate flowers not seen.

Unduavi, 8000 ft., Oct., 1885 (no. 1539). The same collected by Bang without number.

Phoradendron Rusbyi Britton, sp. nov.

Glabrous, the leaves finely papillose: stems stoutish but weak, terete, irregularly branched, the branches elongated: petioles about 1 cm. long, very stout: blades .75–1.25 dm. long, 4–7 cm. broad, inaequilaterally ovate, rather abruptly narrowed into the petiole, acuminate, the actual apex not present in the specimens, entire, very thick, slenderly 5-nerved, the venation inconspicuous: spikes loosely panicled, the rachis very strongly flattened, the divisions gradually broadened toward the summit, where it is sometimes 1–1.5 cm. broad, the branches elongated, divergent or sometimes slightly drooping: spikes 1.5–4 cm. long, about 5 mm. broad, the joints mostly 5–7 mm. long, irregular in number, mostly floriferous throughout their length, the flowers rather deeply immersed.

Mapiri, 5000 ft., April, 1886 (no. 1543).

Phoradendron inaequidentatum sp. nov.

Glabrous, the leaves finely papillose: branchlets short, stout, divergent: petioles .5–1 cm. long, very stout, margined: blades 5–7 cm. long, 3–4 cm. broad, obovate, abruptly contracted into the petiole, lightly, and for the most part very inaequilaterally retuse at the rounded or sub-truncate summit, entire, extremely thick: spikes mostly solitary or two together, simple, about 2 or 2.5 cm. long, 3 mm. broad, exclusive of the fruit: the joints 2–4 mm. long, 2-flowered at the summit, the flowers deeply immersed in pits having a sharply elevated light-colored, thin margin: fruit 4 mm. long, 3.5 mm. broad, conically ovoid, blunt or truncate, light-brown and granular, the summit lighter.

Guanai, 2000 ft., May, 1886 (no. 1544).

SANTALACEAE

Quinchemalium majus Brongn. Voy. Coquille. *pl. 51. f. a.* Near La Paz, 10000 ft., Apr., 1885 (no. 676). The same as Mandon's no. 1044.

EUPHORBIACEAE

Euphorbia geniculata Orteg. Hort. Matr. Dec. 18. Tacna, Chile, Mar., 1885 (no. 890); Guanai, 2000 ft., May, 1886 (no. 892); Falls of Madeira, Brazil, Oct., 1886 (no. 891). Also growing abundantly at Mapiri, in Cinchona plantations, as a weed.

Euphorbia chamaesyce L. Sp. Pl. 455? Vic. La Paz, 10000 ft., April, 1885 (no. 893).

Euphorbia hypericifolia L. Sp. Pl. 454? Vic. La Paz, 10000 ft., April, 1885 (no. 1375). The same as Mandon's no. 1063 and Bang's no. 2.

Euphorbia Peplus L. Sp. Pl. 456. Vic. La Paz, 10000 ft., April, 1885 (nos. 896, 898 and 899), and near Valparaiso, Chile, June, 1885 (no. 897). The same as Mandon's no. 1087. Grows very abundantly in cultivated ground, especially where irrigated, and on shaded, rocky banks.

Proceedings of the Club

ANNUAL MEETING, JANUARY 9, 1900

Vice-President Allen was in the chair, 33 persons present.

Three resignations were accepted, viz: Fredk. H. Comstock, 119 West 86th Street; Frank G. Hills, Canarsie, South Brooklyn, N. Y.; Henry W. Sackett, Tribune Building, New York.

Miscellaneous business included, 1st, The acceptance of an invitation from the American Geographical Society to send three delegates to unite in a commemorative meeting in honor of its late President, Charles P. Daly, the meeting to take place January 22d. The Club elected as such delegates, Dr. T. F. Allen, Dr. H. H. Rusby and Dr. N. L. Britton; 2d, The election to fill the one vacancy still existing in the Board of Associate Editors, of Dr. D. T. MacDougal as such Associate Editor; 3d, The conditional acceptance by the Club for a Decoration Day excursion of an invitation tendered by Dr. T. F. Allen to visit his country house at Litchfield, Conn., where his herbarium and the flora of Bantam Lake are among the attractions offered.

The committee appointed to consider a program for a Torrey Day in connection with the A. A. A. S. meeting here next summer reported through the Secretary, the following proposed program:

Historical Sketch of Botany in New York City, Dr. T. F. Allen; Personal Reminiscences of Dr. Torrey, Professor T. C. Porter; Work of Dr. Torrey as a Botanist with Bibliography, Dr. N. L. Britton; Exhibition of Botanical Material and of Letters Illustrative of Dr. Torrey's work, Miss A. M. Vail; Work of the Torrey Botanical Club, Professor Edward S. Burgess. Other features are under consideration.

Special business consisted, 1st, of Annual Reports. That of the Treasurer, Mr. Maturin L. Delafield, Jr., reported a cash balance in hand.

The Secretary, Professor Edward S. Burgess, reported an average attendance of 31 at the 15 meetings held during the year, one death, a present active membership of 237, corresponding membership 142, honorary membership 3, total membership 382. Among the 18 scientific papers presented 5 had been accompanied by lantern views; 4 papers related to ferns. Nine illustrative exhibits of photographs, plates and flower paintings, etc., had been held.

The Editor, Professor L. M. Underwood, reported the regular monthly issue of the *Bulletin*, forming the largest volume published to date, including 650 pages besides 23 heliotype plates and 38 figures in the text, and including 65 articles representing 39 authors. The publication of the *Memoirs* has been carried on with unusual activity, including Dr. M. A. Howe's monograph on the Californian Hepaticae (208 pages, 35 plates), Mr. Tracy E. Hazen's "Life History of *Sphaerella lacustris*" (*Haematococcus pluvialis*) (33 pages, 2 colored plates) and the beginning of Professor F. E. Lloyd's Comparative Embryology of the Rubiaceae (21 pages, 4 plates).

Miss Marie L. Sanial, as Secretary of the Excursion Committee, reported 38 excursions held, with the new feature of excursions for bryological and other collections in December, at one of which 15 persons were present.

The annual election was then held, and the previous board of officers were elected.

The scientific paper of the evening was by Professor Francis E. Lloyd, on "The Relationship of certain Rubiaceae," forming part of an investigation in the embryology of that order now in course of printing among the Memoirs of the Torrey Club. The ground of relationship considered was the ovary, which is classed as inferior, but developmentally proves to be a receptacle hollowed out. The flower seems to be derived from one with more separate corolla-lobes. The Rubiaceae are very polymorphic externally, and there is the greater need of discovery of stable internal characters. Such characters for the ovary of the Stellatae were discussed in detail. That of the common buttonbush, *Cephalanthus*, was alluded to as possessing certain ovary characters in form and relatively rapid and prolonged growth of the basal partition which accord most significantly with the unusually compressed position of the ovary.

Discussion followed regarding the passages of pollen-tube through tissues rather than loosely in the cavity of the ovary. In some Rubiaceae, said Professor Lloyd, these tubes seem stimulated by contact with the enlarged collar-cells of the funiculus and appear to owe their guidance into the micropyle to such stimulus. Dr. MacDougal remarked upon recent conclusions that pollen-tubes show negative reactions to oxygen, but positive to sugars, and to albuminoid substances in the ovary or near the embryo-sac.

EDWARD S. BURGESS,
Secretary.

31 JANUARY, 1900

Vice-President Rusby in the chair; 31 persons present. In the absence of the Secretary, L. M. Underwood was called to act *pro tem.*

Six persons who had been duly proposed for membership were elected, as follows:

Miss Violetta S. White, 560 Fifth Avenue.
Miss Louisa Bruckman, 1022 Lexington Avenue.
Miss Elise W. Kornmann, 1030 Park Avenue.
Miss Ida Clendenin, 67 Hancock Street, Brooklyn.
Professor A. W. Evans, Yale University, New Haven, Conn.
Dr. H. S. Washington, Locust, Monmouth County, N. J.

The program of the evening consisted of a paper on the "Cultivation of Palms," by Mr. Henry A. Siebrecht. After a general discussion of the palms as a botanical group and the various types represented in tropical regions, a full and interesting account was given of their cultivation in conservatories and as house plants; valuable suggestions were given for their treatment and care in the household. The characters of various species suitable for cultivation indoors were given, especially of the genera *Cocos*, *Kentia*, *Phoenix*, *Areca*, *Caryota*, *Licuala* and *Thrinax*, of which fine illustrations were shown from the writer's splendid nurseries. Among these were *Cocos Weddelliana*, *Phoenix Canariensis*, *P. rupicola*, *Areca lutescens*, and *Licuala grandis.*

An account of Mr. Siebrecht's extensive nurseries in the tropical regions of Trinidad was afterwards given by request of some of the members.

Discussion followed by Mr. Henshaw, Mr. Lighthipe and Dr. Rusby.

L. M. UNDERWOOD,
Secretary pro tem.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matter relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Baker, E. G. Notes on *Malvaviscus*. Jour. Bot. **37**: 344–348. Au. 1899.

M. Polakowskyi and *M. brevibracteatus*, sp. nov., from Central America, and notes on other species.

Boubier, A. M. Contributions à l'étude du Pyrenoïde. Bull. Herb. Boiss. 7: 451–458. 20 Je. 1899; 554–559. 25 Jl. 1899. [Illust.]

Briquet, J. Recherches anatomiques et biologiques sur le Fruit du Genre *Oenanthe*. Bull. Herb. Boiss. 7: 467–488. 20 Je. 1896.

Britton, E. G. Distribution of the eastern Species of *Mnium*. Bryologist, **3**: 4–6. Ja. 1900.

Britton, E. G. & Williams, R. S. A new species of *Mnium* from Idaho and Montana. Bryologist, **3**: 6, 7. Ja. 1900.

Mnium nudum R. S. Williams.

Britten, J. Bibliographical Notes. XXI. Fraser's Catalogues. Jour. Bot. **37**: 481–487. N. 1899.

Britten, J., & Baker, E. G. On some species of *Cracca*. Jour. Bot. **38**: 12–19. Ja. 1900.

Burt, E. A. Key to the Genera of Basidiomycetes of Vermont. 1–18. Middleburg, Vt., 1899.

Campbell, R. Botany in the Island of Montreal. Can. Rec. Sci. **8**: 84–90. 30 D. 1899.

Chabert, A. Étude sur le Genre *Rhinanthus* L. Bull. Herb. Boiss. **7**: 425–450. 20 Je. 1899; 497–516. 25 Jl. 1899.

Includes *R. Kyrollae*, *R. Groenlandicus*, and *R. rigidus*, sp. nov. from America.

Chodat, R. Plantae Hasslerianae soit Énumération des Plantes récoltées au Paraguay par le Dr. Émile Hassler. Bull. Herb. Boiss. **7**: (Appendix 1). 59–87. 30 S. 1899.

Includes descriptions of new species and varieties in *Aristolochia*, *Froelichia*, *Telanthera*, *Jussieua*, *OEnothera*, *Cuphea*, *Cissus*, *Passiflora*, *Hydrolea*, *Tournefortia*, *Oxypetalum*, and *Manettia*.

Chodat, R. *Pleurococcus* et *Pseudo-Pleurococcus*. Bull. Herb. Boiss. **7**: 827, 828. 30 N. 1899.

Coulter, J. M., & Rose, J. N. A Synopsis of Mexican and Central American Umbelliferae. Proc. Wash. Acad. Sci., **1**: 111–159. Ja. 1900.

New species in *Museniopsis* (9), *Tauschia* (4), *Arracacia* (7), *Cicuta*, *Ligusticum*, *Conioselinum*, *Angelica*, *Prionosciadium* (9), *Deanea* (5) and *Coulterophyllum* (3).

Coville, F. V. Report of the Botanist for 1899. Year Book, U. S. Dept. Agric. for 1899: 53–57. 1899.

Curtis, C. C. Turgidity in Mycelia. Bull. Torr. Club, **27**: 1–13. 24 Ja. 1900.

Eriksson, J. Nouvelles études sur la rouille brune des Céréales. Ann. Sci. Nat. VIII. **9**: 241–288. *pl. 11–13*. Au. 1899.

Farlow, W. G. Botanical Bibliography. Bot. Gaz. **29**: 64–67. 31 Ja. 1900.

Fron, M. G. Recherches anatomiques sur la racine et la tige des Chénopodiacées. Ann. Sci. Nat. VIII. **9**: 157–240. *pl. 5–10. f. 1–22*. Jl. 1899.

Gauchery, P. Recherches sur le nanisme végétal. Ann. Sci. Nat. VIII. **9**: 61–155. *pl. 1–4*. Jl. 1899.

Grout, A. J. Antherozoids of Mosses. Bryologist, **3**: 4. Ja. 1900.

Grout, A. J. How to mount Mosses. Bryologist, **3**: 7–8. Ja. 1900.

Grove, E. Diatoms of St. Vincent, West Indies. Jour. Bot. **37**: 411–417. O. 1899.

Guerin, P. Recherches sur le développment du tégument séminal et du péricarpe des Graminées. Ann. Sci. Nat. VIII. **9** : 1–59. Je. 1899.

Harper, R. A. Nuclear Phenomena in certain Stages in the Development of the Smuts. Trans. Wis. Acad. Sci. **12** : 475–498. O. 1899.

Heering, W. Über die Assimilationsorgane der Gattung *Baccharis*. Engler Bot. Jahrb. **27** : 446–484. 15 D. 1899.

Hiern, W. P. The *Capriola* of Adanson. Jour. Bot. **37** : 378, 379. S. 1899.

Hirsch, W. Untersuchungen über die Entwickelung der Harre bei den Pflanzen. Beitr. wiss. Bot. **4** : 1–36. 1900. [Illust.]

Hochreutiner, G. Dissémination des Graines par les Poissons. Bull. Herb. Boiss. **7** : 459–466. 20 Je. 1899.

Kraemer, H. The Crystals in *Datura Stramonium*. Bull. Torr. Club, **27** : 37–39. 24 Ja. 1900.

Krause, E. H. L. Nova Synopsis Ruborum Germaniae et Virginiae. Pars I. 4to. 1–105. *pl. 1–12*. Saarlouis, 1899.

Kukenthal, G. Die Carexvegetation des aussertropischen Südamerika (ausgenommen Paraguay und Südbrasilien). Engler Bot. Jahrb. **27** : 485–563. 15 D. 1899.

Description of species and synopsis.

Lister, A. Mycetozoa from the State of Washington. Jour. Bot. **37** : 463, 464. N. 1899.

Loesener, T. Plantae Selerianae ; die von Dr. Eduard Seler und Frau Caecilie Seler in Mexico und Centralamerica gesammelten Pflanzen. Bull. Herb. Boiss. **7** : 534–553. 25 Jl. 1899 ; 561–579. 30 Au. 1899.

Includes descriptions of new species in *Habenaria, Microstylis, Stelis, Epidendrum, Bauhinia, Cassia, Hippocratea, Cuphea, Loeselia, Scutellaria, Pseuderanthemum*, and *Cardiacanthus* (?).

Loew, O. The physiological Rôle of mineral Nutrients. Bull. U. S. Dept. Agric. (Div. Veg. Path.) 18 : 1–60. 1899.

Löfgren, A. *Rhipsalis megalantha* n. sp. Monatschr. für Kakteenkunde **9** : 134–139. *pl. 15*. S. 1899.

From Brazil.

Longyear, B. O. The Morels—*Morchella*. Rep. Mich. Board of Agric. 1898 : 95–98. 1899.

Longyear, B. O., & Wheeler, C. F. Preliminary List of certain Families of saprophytic Fungi of Michigan. Rep. Mich. Board of Agric., 1898 : 92–95. 1899.

Meehan, T. *Habenaria ciliaris.* Meehan's Monthly, **10** : 17. *pl. 2.* F. 1900.

Meyer, A. Ueber Geisseln, Reservestoffe, Kerne und Sporenbildung der Bacterien. Flora, **86** : 428–468. *pl. 21.* 19 D. 1899.

Morgan, A. P. The Myxomycetes of the Miami Valley. Jour. Cin. Soc. Nat. Hist., 111–130. 1900.
Review of systems of classification.

Nawaschin, S. Beobachtungen über den feineren Bau und Umwandlungen von Plasmodiophora Brassicae Woron. im Laufe ihres intracellularen Lebens. Flora, **86** : 404–427. *pl. 20.* 19 D. 1889.

Neger, F. W. Litteraturübersicht über die in den Jahren 1895–99, die Floren von Chile und Patagonien betreffend, veröffentlichen Arbeiten. Engler Bot. Jahrb. **27** : (Anhang) 17–32. 15 D. 1899.

Nelson, A. New Plants from Wyoming. XI. Bull. Torr. Club, **27** : 32–36. 24 Ja. 1900.
New species in *Potentilla*, *Erigeron* and *Artemisia*.

Nelson, A. Some native forage Plants for Alkali Soils. Bull. Wyo. Exp. Sta. **42** : 23–45. D. 1899. [Illust.]

Němec, B. Neue cytologische Untersuchungen. Beitr. wiss. Bot. **4** : 37–92. 1900. [Illust.]

Paratore, E. Ricerche istologische sui tubercoli radicali delle Leguminose. Malpighia, **13** : 211–236. *pl. 7.* D. 1899.

Peck, C. H. New Species of Fungi. Bull. Torr. Club, **27** : 14–21. 24 Ja. 1900.
New species in *Amanita*, *Lepiota*, *Agaricus*, *Stropharia*, *Boletus*, *Polyporus*, *Stereum*, *Guepinia*, *Hypomyces*, *Cordyceps*, and *Macrophoma*, and *Fistulina hepatica monstrosa* n. var.

Pollock, J. B. The Mechanism of Root Curvature. Bot. Gaz. **29** : 1–63. 31 Ja. 1900.

Reiche, K. Zur Kenntnis einiger chilenscher Umbelliferen-Gattungen. Engler Bot. Jahrb. **28** : 1–17. *pl. 1, 2.* 15 D. 1899.

Rendle, A. B. A Systematic Revision of the Genus *Najas.* Trans. Linn. Soc. **5** : 379–436. *pl. 39–42.* D. 1899.

Rendle, A. B. Notes on *Xyris.* Jour. Bot. **37** : 497–509. *pl. 403.* D. 1899.

Rose, J. N. Medicinal Plants of Mexico. Pharm. Review, **18** : 60–66. F. 1900.

Rothert, W. & Zalenski, U. Ueber eine besondere Kategorie von Krystallbehältern. Bot. Centralbl. **80** : 1–11. 27 Au.; 33–50.

5 O.; 97–116. 11 O.; 145–156. 18 O.; 193–204. 25 O.; 241–251. 1 N.; 1899. [Illust.]

Rothrock, J. T. Post Oak, Iron Oak, Barrens White Oak (*Quercus stellata* Wang). Forest Leaves, 7: 104. F. 1900. [Illust.]

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXVIII. Bull. Torr. Club, **27**: 22–31. 24 Ja. 1900.

Includes new species in *Cestrum*, *Nicotiana*, *Fagelia*, *Gerardia*, *Achimenes*, *Diastemma*, *Isoloma*, *Alloplectus*, and *Besleria*, proposed partly by Britton and partly by the author; also *Diplolegnon*, new genus of the Gesneriaceae, with one species, *D. Riceanum*, Rusby.

Salmon, E. S. On certain Structures in *Phyllactinia*, Lév. Jour. Bot. **37**: 449–454. *pl. 402*. N. 1899.

Sauvageau, C. Les Cutleriacèes et leur alternance de générations. Ann. Sci. Nat. VIII. **10**: 265–362. *pl. 9. f. 1–25*. D. 1899.

Schaible, F. Physiologische Experimente über des Wachstum und die Keimung einiger Pflanzen unter vermindertem Luftdruck. Beitr. wiss. Bot. **4**: 93–148. *pl. 1–8*. 1900. [Illust.]

Schumann, K. *Cereus Schumannii* Mathss. n. sp. Monatsch. für Kakteenkunde, **9**: 131, 132. 15 S. 1899.

Schumann, K. Die Frucht von *Phyllocactus biformis* Lab. Monatsch. für Kakteenkunde, **9**: 141. *f. 15*. S. 1899.

Schumann, K. Georg Engelmann. Monatschr. für Kakteenkunde, **9**: 145–148. 15 O. 1899.

Schumann, K. *Opuntia Rauppiana* n. sp. Monatschr. für Kakteenkunde, **9**: 118. 15 Au. 1899.

From South America.

Schumann, K. *Opuntia Schweriniana* K. Sch., eine neue Art. Monatschr. für Kakteenkunde, **9**: 148. 15 O. 1899.

From Colorado.

Schumann, K. *Rhipsalis Warmingiana* K. Sch. Monatschr. für Kakteenkunde, **9**: 154. *pl.* 15 O. 1899.

Speschneu, N. N. V. Über Parasitismus von *Phoma reniformis* V. et R. und seine Rolle in der Blackrot-Krankheit der Weintraube. Zeitsch. für Pflanzenkr. **9**: 257–260. 20 N. 1899.

Stephani, F. Species Hepaticarum. Bull. Herb. Boiss. **7**: 927–956. 30 D. 1899.

Includes descriptions of many new species of *Metzgeria* from America.

Tassi, F. Novae Micromycetum species descriptae et iconibus illustratae. Bull. Lab. Orto Bot. (Siena), **2**: 139–163. D. 1899.

New species in *Diplodina*, *Didymyella* and *Eutypa* from Brazil.

Teodoresco, E. Influence des différentes Radiations lumineuses sur la forme et la structure des Plantes. Ann. Sci. Nat. VIII. **10**: 141–264. *pl. 5–8.* O. 1899.

Teodoresco, E. C. Influence de l'acide carbonique sur la forme et la structure des Plantes. Rev. Gen. Bot. **11**: 445–470. *f. 104–122.* 15 D. 1899.

Urbina, M. Los Amoles Mexicanos. La Naturaleza, **3**: 244–256. *pl. 17.* 1899.

Van Tieghem, P. Sur les Fouquiériacées. Jour. de Bot. **13**: 293–301. O. 1899.

Van Tieghem, P. Sur les Parnassiacées. Jour. de Bot. **13**: 326–332. N. 1899.

Villada, M. M. Breve nota acerca de la *Bravoa geminiflora.* La Naturaleza, **3**: 257. *pl. 16.* 1899.

Villada, M. M. La *Spigelia longiflora.* La Naturaleza, **3**: 230–232. *pl. 15.* 1899.

Wanio, E. A. Lichenes novi rarioresque. Hedwigia (Beiblatt), **38**: (186)–(190). 10 O. 1899.

New species in *Sticta, Psoroma, Collema, Diploschistes, Mycocalicium, Cladonia*, and *Baeomyces.*

Ward, H. M. Some Methods for use in the Culture of Algae. Ann. Bot. **13**: 563–566. *pl. 28.* D. 1899.

Ward, H. M. Symbiosis. Ann. Bot. **13**: 549–562. D. 1899.

Watts, R. L. Persimmons. Bull. Tenn. Agric. Exper. Sta. **11**: 193–223. 1 Ap. 1899.

Account of native and Japanese persimmons.

Weber, H. *Cereus Spegazzinii*, eine neue Art. Monatsch. für Kakteenkunde, **9**: 102, 103. 15 Jl. 1899.

From Argentina.

Webster, H. *Lepiota rhacodes.* Rhodora, **1**: 224–227. *pl. 11.* D. 1899.

West, W. Some Oscillarioideae from the Plankton. Jour. Bot. **37**: 337, 338. *pl. 400 A.* Au. 1899.

Oscillatoria capitata West fil., sp. nov.

Wiegand, K. M. The Development of the Microsporangium and Microspores in *Convallaria* and *Potamogeton.* Bot. Gaz. **28**: 328–359. *pl. 24.* 30 N. 1899.

Wigdale, E. G. The structures of the Rhizome and Root of *Podophyllum peltatum* L. Pharm. Archives, **3**: 1–8. *pl. 1, 2.* Ja. 1900.


1
14
7
11
3
5
13
8
2
9
12
4
10
6
A. W. E. del.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—and Hon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

(*1*) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates. Price $2.00 per annum. For Europe 10 shillings. Dulau & Co, 37 Soho Square, London, are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898), are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(*2*) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume **1**, No. 1.—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume **2**, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. **3**. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. **4**. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents.

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No. 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. **5**. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S Price, $3.00.

Vol. **6**. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*) With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. **7**.—The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol. **8**. No 1, Part 1.—The Comparative Embryology of the Rubiaceae. With four plates. By Francis Ernest Lloyd. Price, 50 cents.

(*3*) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

Address: **L. M. UNDERWOOD,**
COLUMBIA UNIVERSITY, NEW YORK CITY

Vol. 27 APRIL, 1900. No. 4

BULLETIN

OF THE

Torrey Botanical Club

CONTENTS

PUBLISHED FOR THE CLUB

The New Era Printing Company
Lancaster, Pa.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL,
ARTHUR HOLLICK, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
BYRON D. HALSTED, Sc. D.
CARLTON C. CURTIS, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D.,
HELEN M. INGERSOLL,
MARIE L. SANIAL,
ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH,
MARIE L. SANIAL,
EUGENE SMITH,
W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY,
DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 4

BULLETIN

OF THE

TORREY BOTANICAL CLUB

APRIL 1900

A Review of the Species of Lycopodium of North America

BY FRANCIS E. LLOYD AND LUCIEN M. UNDERWOOD

(WITH PLATES 2, 3, AND 4.)

The genus *Lycopodium* as represented in North America has never received a careful revision. Various forms, mostly varietal, have been described from time to time but the treatment in the various manuals has been mainly that accepted by European writers, commencing with Linnaeus and closing with Milde. Meanwhile a large amount of material has accumulated and we are in the position to give the genus a preliminary survey and bring our knowledge of the American species up to the datum line of modern collections. Much still remains to be done to clear up certain outlying forms and limit the range and variations of certain species and, if possible, determine the causes involved.

The genus *Lycopodium* as treated by Baker * includes ninety-four species and this may be regarded as a very conservative estimate of its extent. Certain features of the range of species are of interest. Five species are circumboreal and are distributed more or less widely throughout the North Temperate Zone. Europe has seven species, viz, *L. Selago, inundatum, annotinum, clavatum, alpinum, complanatum*, and *chamaecyparissus*, all but the second and last being circumboreal and all being found in North America.

In extratropical North America, Baker recognized ten species. To these six must be added, of which three are here recognized as species for the first time. *L. cernuum*, a widely distributed

* Handbook of Fern Allies, 1887.

[Issued 21 April.]

tropical species, also enters our Gulf States. To these Mexico adds seven species, of which *L. serratum*, originally described from Japan, is very doubtfully Mexican, and the rest are species of the West Indies. These islands add six more, of which *L. rigidum* is endemic and the others are species of wider range through tropical America. South America has some forty-one species, of which twenty nine are endemic and of these twenty-one are confined to the Andean region; two are also African, two North American and the rest are neotropical.

Asia follows with twenty-six species, of which two are endemic in Japan and four in India; of the others, ten (including the five circumboreal species) are also found in the United States, nine in the East Indian Islands, and four in Polynesia. Africa has only thirteen species, of which eight are endemic; of these five are from the mountains of Madagascar. The East Indies have eighteen species, of which four are endemic; ten are species of the adjacent Asiatic mainland, and four are shared with Polynesia. Australasia has thirteen species, of which eight are endemic. Polynesia has nine species, of which only one, *L. polytrichoides*, is endemic in the Hawaiian Islands. Finally, the little island of Tristan d'Acunha has two species, both endemic.

The American species north of Mexico may be separated by the following key:

Plants with mostly upright stems with alternating zones of leaves and sporophylls (strobiles interrupted).
- Leaves hollow at their bases and appressed. 1. *L. Selago.*
- Leaves flattened at their bases and ultimately more or less reflexed.
  - Leaves linear or nearly so, entire or very minutely denticulate. 2. *L. porophilum.*
  - Leaves distinctly broadest above the middle and erose. 3. *L. lucidulum.*

Plants with more or less extended horizontal stems; the sporophylls aggregated into terminal strobiles.
- Sporangia subglobose; sporophylls similar to the foliar leaves.
  - Sporophylls short (5–6 mm.).
    - Sporophylls deltoid, mostly entire; plants small. 4. *L. inundatum.*
    - Sporophylls contracted above the base with a few teeth; plants large. 5. *L. adpressum.*
  - Sporophylls longer (8–10 mm.), usually much toothed.
    - Leaves in many rows, radially arranged; stems arching. 6. *L. alopecuroides.*

Leaves arranged so as to lie in nearly one plane; stems pinnately branching, prostrate. 7. *L. pinnatum.*

Sporangia transversely compressed, reniform; sporophylls entirely unlike the foliar leaves.

Leafy stems short (2–15 cm.), prostrate, leaves lying nearly in one plane, none beneath. 8. *L. Carolinianum.*

Stems with abundant erect or ascending leafy branches.

Leaves equal, radially arranged (except on the terminal branches of no. 11) in five or more rows.

Aerial portions dendroid.

Strobiles few, stout, erect. 11. *L. obscurum.*

Strobiles numerous, short, nodding. 12. *L. cernuum.*

Aerial portions extensively trailing, with clustered branches.

Leaves in five rows; stems and branches slender (2 mm.). 13. *L. Sitchense.*

Leaves in more than five rows.

Strobiles solitary, sessile. 9. *L. annotium.*

Strobiles 1–several on evident elongate peduncles. 10. *L. clavatum.*

Leaves in four rows on flattened aerial dorsiventral stems.

Branches convex on both sides; leaves alike in all four rows. 14. *L. sabinaefolium.*

Branches with under surface flat or concave.

Strobiles pedunculate, peduncles usually forked twice.

Leaves of under row scarcely reduced; terminal. 15. *L. chamaecyparissus.*

Leaves of under row much reduced to a subulate tip; terminal branches spreading, horizontally fan-shaped. 16. *L. complanatum.*

Strobiles sessile upon stronger leafy branches; leaves of the under row trowel-shaped. 17. *L. alpinum.*

1. L. SELAGO L. Sp. Pl. 1102. 1753

Prostrate portion of stem very short, abundantly rooting, soon curving upward and dichotomously branching to form compact tufts (4–17 cm. high) of vertically placed branches with dense foliage: leaves more or less appressed, or at least upwardly directed, triangular (1.5 × 4 mm.) to linear-acuminate (0.5 mm. × 5 mm.) or aciculate (1 mm. × 8 mm.), broadest at the hollow base, gradually tapering to the acuminate apex, entire: sporophylls shorter than the leaves, triangular: sporangia reniform: plant very frequently gemmiparous.

A boreal and arctic plant, showing a considerable degree of variability. Alaskan material shows a range of variation in its leaves which measure from 2 × 4 mm. to 1 × 8 mm., and this in the same habitat, judging from a series of specimens collected by Thos.

Howell, at Yes Bay, Aug. 21, 1895 (N), and another in the same locality Aug. 26, 1895, by M. W. Gorman. Slender-leaved material comes also from Kadiak Is. (B. J. Bretherton, July 23, 1894).

Specimens from the Cascade Mts., Washington, Macdonald Lake, Montana, and Twin Lakes show but little differences, the leaves ranging from 1.5 × 4–8 mm. to 0.8 mm. × 5 mm. Specimens from the Northeast, show considerable variation. The forms with the most slender leaves come from the mountains of Vermont, growing in a moist, shaded habitat (A. J. Grout, Mt. Mansfield). These facts, together with the variability found in the moist climate off the Alaskan coast, would indicate that the slender form of the leaf is induced by a wet, shaded habitat.

Other specimens collected by Dr. Grout, at Mt. Mansfield, whether in the shade or not is not stated, have somewhat broader leaves. Plants of Mr. G. G. Hinsdale's collection of the "summit of Mt. Mansfield" (1893) are typical in form, with shorter and broader leaves.

Distribution: Greenland, Labrador, Newfoundland, Maine, New Hampshire, Vermont, New York, North Carolina, Idaho, Washington, Alaska, St. George Island (Behring Sea). A plant with strongly reflexed leaves but otherwise not differing from *L. Selago* is represented by specimens as follows:

IDAHO: Little North Fork Basin "mountain woods," Sept., 1895, J. B. Leiberg (N).

ALASKA: Sitka, F. Bischoff (N).

CANADA: Mud Lake, July, 1891, F. F. Wood (N).

2. **L. porophilum** sp. nov.

Prostrate portion of stems short, abundantly rooting, curving upwards, then dichotomously branching 1–3 times to form a rather dense tuft (4–10 cm. high) of vertical stems, densely clothed with spreading or reflexed leaves: leaves (7–9 mm. × 1 mm.) very slightly broadened above the middle and similarly contracted toward the base, those between the strobilar regions shorter (6–7 mm.), broadest at the base but very gradually tapering, entire or very minutely denticulate: sporangia compressed reniform: sporophylls minutely denticulate above the middle or entire, acuminate (4–5 mm. × 1 mm. wide at base): plant often gemmiparous.

A plant intermediate in habit between *L. lucidulum* and *L. Selago*, having the leaves spreading or somewhat reflexed, with the alternation of long leaves and short sporophylls. Leaves not hollow at the base but flat as in *L. lucidulum.*

Of very limited range so far as known at present, and confined apparently to sandstone rocks. The plant varies no more than *L. lucidulum,* both differing in this respect from *L. Selago.*

INDIANA: Fern, Putnam Co., Oct., 1891,* L. M. Underwood (U): type.

WISCONSIN: Dells of the Wisconsin, Aug. 19, 1893, L. M. Underwood (U).

KENTUCKY: Mountains, Warren Co., "on the face of sandstone cliffs, June, 1898," S. F. Price (U). Green River, Warren Co., "on a sandstone cliff," June, 1896, S. F. Price (U).

ALABAMA: Winston Co. "under projecting sandstone rocks near Sipsey River," 1 June, 1896, L. M. Underwood (U). This plant differs slightly from the other and more northerly ones in having narrower sporangia.

3. L. LUCIDULUM Michx. Fl. Bor. Am. **2**: 284. 1803

Prostate portion of stems longer (5–15 cm.), frequently rooting, curving upward and dichotomously branching 1–3 times to form a loose cluster (10–20 cm. high) of a few densely leafy vertical stems, or the stems occasionally occur single: leaves reflexed (8–11 mm. × 1.5–2 mm.), linear-obovate, broadest above the middle, from which point they gradually taper to the 1 mm. wide base; margin erose denticulate above the middle, acute: sporophylls 3.5–8.5 mm. × 1.2–1.5 mm., linear, acute, entire or sometimes slightly denticulate: sporangia depressed reniform: plant often gemmiparous.

The rhythmic production of sporangia and the resulting alternation of long leaves and short sporophylls gives the foliage a wavy outline quite characteristic of this plant, with its shining dark green leaves.

Habitat in forests, more commonly in low ground.

Distribution: Newfoundland, Prince Edward Island, New Brunswick, Maine, New Hampshire, Vermont, Ontario, Massachu-

---

* At the Indiana station this species grows with *L. lucidulum,* the latter always in the low swampy ground bordering the small streams, while this species grows along the narrow ledges of the overhanging sandstone rocks. The range of *L. lucidulum* also includes the other stations.

setts, Connecticut, New York, New Jersey, Pennsylvania Maryland, Virginia, West Virginia, Tennessee, North Carolina, South Carolina, Indiana, Illinois, Missouri, Minnesota, Michigan, Wisconsin.

4. L. INUNDATUM L. Sp. Pl. 1102. 1753

Stems creeping horizontally or arching, about 10 cm. long, simple or once or twice forking, slender, 1.5 mm. in diameter, roots produced toward the end of the annual growth : leaves 5 mm. × 0.8 mm. linear-lanceolate, entire, acute, curved upward ; those of the peduncles straight, entire, more slender and tapering : peduncles 0.5–6 cm. long or the strobiles sessile : strobiles 0.8–4 cm. long : sporophylls about 5–6 mm. long, 1.5 mm. wide at the base, triangular, usually entire or sometimes toothed just above the base, then somewhat contracted : sporangia subglobose. European material shows denticulation of the sporophylls.

Specimens have been examined as follows :

NEWFOUNDLAND : Bally Haily Bog, St. John, Aug., 1894, B. L. Robinson and H. von Schrenk, no. 135 (N, G).*

NOVA SCOTIA : July, 1884, H. T. Meenan (G).

PRINCE EDWARD ISLAND : 1888, J. Macoun (G).

CAPE BRETON ISLAND : July, 1883, J. Macoun (G).

NEW BRUNSWICK : 1868, J. Fowler (G) ; Bass River, "rare," Oct., 1875, J. Fowler (N).

MAINE : Bog, Great Cranberry Isle, Sept. 1891, E. L. Rand (U) ; Mount Desert Island, Sept., 1890, E. L. Rand (U) ; Dead River, M. L. Fernald, 497 (G) ; Oxford Co., J. A. Allen (G, N).

ONTARIO : Hastings Co., July, 1876, J. Macoun (C).

NEW HAMPSHIRE : Mt. Willey, Aug., 1878 (Y) ; White Mts., E. Tuckerman (C, G) ; Seabrook, Sept., 1895, A. A. Eaton (N).

VERMONT : Hartland, Sept., 1893, W. W. Eggleston (C).

CONNECTICUT : Southington, Sept., 1898, C. H. Bissell (Y).

MASSACHUSETTS : Berkshire Co., July, 1890, A. K. Harrison (U) ; South Hadley, Oct., 1888, Alice Carter (U); Sudbury, Nov., 1890, L. M. Underwood (U).

NEW JERSEY : C. F. Austin (U).

PENNSYLVANIA : Luzerne Co., Sept., 1890. Small and Heller

---

* The letters N, G, C, Y, and U, refer to the National, Gray, Columbia, New York Botanical Garden, and Underwood herbaria in which the specimen cited may be found.

(N); Pocono Mt., T. Green (G); Tobyhanna, July, 1889, N. L. Britton (C).

NEW YORK: Herkimer Co., J. A. Paine (G).

ILLINOIS: Evanston, 1884, H. L. Boltwood (G).

MICHIGAN: Keeweenah Co., 1888, O. A. Farwell (G).

BRITISH COLUMBIA: Vancouver, Aug., 1893, J. Macoun (N).

ALASKA: Short Bay, July, 1895, M. W. Gorman, "wet bogs in upland meadows" (C, N); Aug., 1895, T. Howell, no. 1731 (Y).

4a. L. INUNDATUM BIGELOVII Tuck. Am. Jour. Sci. **45**: 47. 1843*

A larger plant with longer and more abundantly branching slender stems with slightly longer leaves which are entire or toothed. Sporophylls as in *L. inundatum.*

CAPE BRETON ISLAND: Peat bog, North Sidney, 1883, J. Macoun (C).

VERMONT: Stirling Mt., Aug., 1882, O. H. Butler (C); Stratton, July, 1894, A. J. Grout (U).

NOVA SCOTIA: Grand Lake, 1879, E. G. Knight (C).

MASSACHUSETTS: Ipswich, Oakes (C); New Bedford, T. A. Green (C); Plymouth, Oakes and Tuckerman (C); Tuckerman (G); Essex; Sept., 1896, A. A. Eaton (U); Oakes, "in Sphagnosis humidis Novae Angliae" (N).

RHODE ISLAND: Providence, "low, grassy land, July, 1892," J. F. Collins.

NEW JERSEY: Egg Harbor, E. G. Knight (C); Quaker Bridge, June 17, 1890, F. E. Lloyd (Y).

5. **L. adpressum** (Chapman)

L. inundatum, var. *elongatum* Chapm. Fl. So. States, ed. 2, 671. 1883. (Not *L. elongatum* Sw.)

L. inundatum, var. *adpressum* Chapm. Fl. So. States, ed. 2, 671. 1883.

L. alopecuroides var. *elongatum* Chapm. Fl. So. States, ed. 3, 638. 1897.

* The original description reads as follows: *β Bigelovii* (mihi): majus, ramis subramosis elongatis, foliis acuminatis sparsim denticulatis s. integris. *L. Carolinianum* Bigel. Fl. Bost. p. 384.

In the same paper *L. alopecurioides* (L.) follows as the var. *γ* of *Lycopodium inundatum.*

L. alopecuroides, var. *adpressum* Chapm. Fl. So. States, ed. 3, 638. 1897.

Stems prostrate and frequently rooting or slightly arching and rooting toward the end, 18–40 cm. long, simple or occasionally pinnately branching, thick (about 3 mm. in diameter): leaves 6–7 mm. long by 2 mm. broad, thicker and more rigid than in the last, lanceolate-acuminate, upwardly curving, the margin irregularly toothed, the teeth often compound below the middle of the leaf: peduncles 10–25 cm. long usually tall, slender (1.5–2.5 mm. in diameter), leafy with more or less appressed subulate-toothed leaves below and similar entire leaves above: strobiles narrow, about 3 mm. in diameter, and 1.8–7 cm. long: sporophylls 1 mm. × 5–6 mm. with a broad base, suddenly contracted above into a narrow subulate apex, usually more or less toothed near the base: sporangia subglobose.

Readily distinguishable from *L. inundatum* by the much thicker stems, toothed leaves, tall peduncles and long narrow spikes.

An abnormal condition occurs in which the strobiles fail to develop and the branches rise to an unusual height (35 cm.). Lake Worth, Florida, L. M. Underwood (U). One peduncle on the same sheet bears a strobile of unusual size (11 cm.)

In the northern part of its range, this plant is much smaller and is difficult to distinguish from *L. inundatum Bigelovii*, from which, however, it differs in its thicker stem, in the shape of its leaves, and in the degree of their denticulation which, however, is constant in the leaves of the prostrate stems, but the constancy frequently fails in the peduncular leaves.

Although the more southern plant is here regarded as a distinct species, and is believed to be entitled to such rank, it must be admitted that from the true boreal species, *L. inundatum*, to the large southern *L. adpressum* there are many forms which on account of variations in size of stem, denticulation and variations in the size and shape of leaf and sporophyll are difficult to place. It will, however, be found convenient to hold to the above arrangement as tentative in the hope that further and more careful field observations will help to clear up the whole matter. It is further of great interest to note that a single species which in Europe shows little variability is in America only a representative of a plexus of forms ranging from that species at one end of the series to the extremely curious plant, *L. alopecuroides*, at the other.

Specimens have been examined as follows :

MASSACHUSETTS : Plum Island, Newburyport, Oct., 1896, A. A. Eaton (U) ; Plymouth, Oakes (C, N).

RHODE ISLAND : Providence, July, 1892, J. F. Collins (N).

CONNECTICUT : New Haven, 1859, D. C. Eaton (C).

NEW YORK : Babylon, L. I., July and Sept., 1898, W. N. Clute (Y) ; Forbell's Landing, L. I., Oct., 1890, M. Timmerman (C).

NEW JERSEY : Hospitality Bridge, Aug., 1884, C. A. Gross (Y); Closter, Sept., 1865, C. F. Austin (U, C) ; Tom's River, July, 1898, W. N. Clute (Y) ; Ocean Co., Aug., 1889, N. L. Britton (C).

MARYLAND : Ammendale, May, 1897, G. A. Miller (N) ; Anne Arundel Co., Oct., 1894, and Sept., 1895, C. E. Walters (N); Branchville, Sept., 1899, W. R. Maxon (U).

DISTRICT OF COLUMBIA : near Washington, Sept., 1885, F. H. Knowlton (U).

VIRGINIA : Portsmouth, July, 1892, N. L. and E. G. Britton and A. M. Vail (C) ; Fredericksburg, Aug., 1893, T. C. Porter (C).

NORTH CAROLINA : Rowan Co., J. K. Small, Aug., 1894 (N, C) ; Southeastern N. Car., W. W. Ashe (N).

LOUISIANA : Lake Charles, Aug., 1897, S. M. Tracy (U).

ALABAMA : L. F. Ward, 1892 (N) ; Mobile, 1877, C. Mohr, (N).

GEORGIA : Sumter Co., Dec., 1895 and 1896, R. M. Harper (Y).

FLORIDA : Lake Worth, Mar., 1891, L. M. Underwood (U) ; Leesburg, 1891, L. M. Underwood (U) ; Jacksonville, Mrs. F. A. Curtis (U, G); Everglades, Mar., 1892, J. H. Simpson (N, G); " L. inundatum var. elongatum, S. Fl. ined." Herb. Chapman (N) (and similar sheet in C) ; Palma Sola Bay, Aug., 1890, J. H. Simpson (N) ; among these one specimen shows an entire absence of teeth on the leaves in one region of the stem, while the rest of the specimens on the sheet have normal leaves ; the specimen looks as if it had grown partly submerged.

6. **L. pinnatum** (Chapman)

L. inundatum, var. *pinnatum* Chapman, Fl. So. States, ed. 2, 671. 1883.

L. alopecuroides, var. *pinnatum* Chapman, Fl. So. States, ed. 3, 638. 1897.

Stems pinnately branching, elongate (20–30 cm.) and very slender (1–2 mm.) with evident dorsiventral character: leaves (8–9 mm. × 1 mm.) thin, linear-lanceolate, slightly curved, long-toothed, those of the upper side smaller, all somewhat contracted at the base; those of the peduncles similar but more gradually tapering to the apex: peduncles 25–40 cm. long, slender (1–2 mm. in diam.), very leafy: strobiles 3–12 cm. long, 5 mm. thick, with spreading sporophylls, similar to the peduncular leaves, but longer and more gradually tapering: sporangia sub-globose.

This very distinct species was made first a variety of *L. inundatum* and later of *L. alopecuroides*, but its dorsiventral habit and other marked characters clearly distinguish it from both; it is very clearly recognized. The lateral expanse of foliage ranges from 16 to 18 mm. Very rarely the denticulation appears to be nearly absent, as in a specimen seen from Jacksonville, Fla.

Specimens have been examined as follows:

MISSISSIPPI: Jackson, July, 1896, C. L. Pollard (N); Ocean Springs, June, 1896, L. M. Underwood (U); Aug., 1889, F. S. Earle (U); Aug., 1898, S. M. Tracy (Y).

ALABAMA: Spring Hill, Aug., 1897, B. F. Bush, 159 and 151 (Y, N); Auburn, Oct., 1896, C. F. Baker (C).

GEORGIA: McIntosh Co., June, 1895, J. K. Small (C).

FLORIDA: "Damp Pine Barrens" in Jacksonville, Sept., 1896, A. H. Curtis, nos. 3788 (C, N), 5783 (G); S. Fla., Herb. Chapman (N, C).

7. L. ALOPECUROIDES L. Sp. Pl. 1102. 1753

Stems elongate (50 cm. or more), thick (3–4 mm.), with an arching habit, rooting near the end, the vertical peduncles arising from the arches, densely leafy: leaves (5–7 mm. × 0.6–1.2 mm.) thicker than in the last, lanceolate-acuminate, spinulose on the sides of the stem to linear lanceolate on the upper and lower side, margin long toothed, and the lower surface near the base usually very hairy, especially on sides of the stem: those of the peduncles similar: peduncles long (20–30 cm.) densely leafy and scarcely distinguishable from the stems: strobiles 2–10.5 cm. long, 5 cm. thick, when ripe with reflexed sporophylls, these similar to the peduncular leaves but not hairy on the underside, longer (10–11 mm.), more gradually tapering and similar to those of the last species.

A number of mature specimens we have seen lead us to believe that the reflexion of the sporophylls at maturity is a constant feature in this species, but not in *L. pinnatum*. Further field observations are necessary to establish or refute this belief.

Specimens have been examined as follows:

NEW YORK: Babylon, L. I., Sept., 1898, W. N. Clute (Y).

NEW JERSEY: Landisville, C. A. Gross (Y), Hospitality Bridge, Sept., 1887, C. A. Gross (N), Pines, C. F. Austin (C).

DELAWARE: Ellendale, Sept., 1891, W. M. Canby (N).

NORTH CAROLINA: Hendersonville, Sept., 1898, Biltmore Herb., 595A (Y); Wilmington "in *Dionaea* savannah," June 25, 1890, F. V. Coville (N).

SOUTH CAROLINA: Santee Canal, Sept., Ravenel (G).

MISSISSIPPI: Ocean Springs, June, 1896, L. M. Underwood (C), F. S. Earle, Aug., 1889 (U); Biloxi, Aug., 1898, S. M. Tracy (U).

ALABAMA: Spring Hill, Aug., 1897, B. F. Bush, 153 (Y N).

GEORGIA: Lowndes Co., June, 1895, J. K. Small (C); 1840, A. Gray (C).

FLORIDA: Jacksonville, "moist pine barrens," Nov., 1894, A. H. Curtis, no. 5357 (C); Lake Co., Aug., 1894, G. V. Nash (N, C); S. Fla., Chapman (N, C); Appalachicola, Aug., 1891, Chapman (N, G); Hibernia, March, 1869, W. N. Canby (G); T. W. Webster (Y).

The stems of the four species just described differ not a little in certain details of stem structure. Certain features they all possess in common with one exception, noted below; these are more especially the gum canals and air spaces which occur in the cortex. A single gum canal occurs on the outside of each leaf trace, and runs up into the leaf. The air spaces are irregular schizogenous cavities in the cortex; they are very small, are few in number in *L. inundatum* and are absent in *L. pinnatum*; in *L. adpressum* they are more numerous and larger than in *L. inundatum*, while in *L. alopecuroides* they attain their maximum development both in size and number. Indeed, the cortex in this handsome plant is little more than a honeycomb, the walls of which are composed of a single layer of parenchyma cells. All four species store up toward the end of the growing season a large amount of reserve food, for the most part starch, and as a result of this habit the terminal portions of their horizontal stems become considerably thickened. The stele is also enlarged in these parts, and the air spaces are very much reduced, more so in *L. alopecuroides*, however, than in the others. These terminal parts of the stems serve to perpetuate the plants during the winter. There is also not a little difference in the size of the stems, *L. pinnatum* having the smallest, with *L. inundatum* next in order; *L. alopecuroides* has the thickest stem of the four.

8. L. CAROLINIANUM L. Sp. Pl. 1104. 1753

Stems short (1–15 cm.), slender (1–1.5 mm. diam.), prostrate, pinnately branching, rooting occasionally from the under side; leaves strongly dimorphic, the apparently lateral ones large (5–6 mm. × 1.5–2 mm.), ovate-lanceolate, falcate, recurved, broadest below the middle, with a midrib asymmetrically placed, thin, entire, acute: leaves of the upper side smaller (3–4 mm. × 0.8–1 mm.), subulate with a broad base: leaves of the peduncles reduced to small (2–3 mm.) subulate more or less appressed bracts: peduncles 5–22 cm. long, slender, with few usually whorled or scattered bracts: strobiles (1–5 cm. long × 2–2.5 mm.) with sporophylls (2 × 3 mm.), these triangular or somewhat contracted above the base, margin entire or erose: *sporangia* subglobose.

Habitat: In wet places, swamps.

A plant with a very pronounced dorsiventral character, in which the apparently large lateral leaves are really leaves of the under side, giving it a superficial resemblance to a liverwort. Although similar in some regards to *L. inundatum* and *L. pinnatum*, it is to be separated from them by its above just described dorsiventral character.

Specimens from the United States have been examined as follows:

NEW JERSEY: Atsion, Aug., 1897, J. A. Allen (G); Leed's Point, 1833, A. Gray (G); Quaker Bridge (N); Toms River, 1894, L. H. Lighthipe (?); Egg Harbor, Sept., 1884, L. M. Underwood (U); Hospitality Bridge, Aug., 1883, C. A. Gross (strobile 1.5 cm. long) (Y); Toms River, July, 1898, W. N. Clute (Y).

NORTH CAROLINA: Wilmington (G).

SOUTH CAROLINA: Aiken, Ravenel (N).

GEORGIA: Sumter Co., June, 1897, R. M. Harper (Y).

MISSISSIPPI: Ocean Springs, 1896, C. L. Pollard (N).

FLORIDA: Apalachicola, July, 1891; Chap. Herb. (G); Appalachicola, 1856, Chapman (strobile 14 cm. long) (C); Jacksonville, A. H. Curtis, 1896 (G); Eustis, G. V. Nash, July, 1894, no. 1451 (G, C); Lake Worth, Mar., 1891, L. M. Underwood (U); Orange Co., July, 1894, S. L. Lewton (Y); T. W. Webster (strobile 14 cm. long) (Y).

The species also extends through the tropics to Brazil.

9. L. ANNOTINUM L. Sp. Pl. 1103. 1753

Prostrate stems a meter or more long, extensively creeping along the surface, very rarely pinnately branching, stiff, rooting, leafy, with frequent aerial branches 15–25 cm. tall, which fork 1–3 times or not at all, producing slender erect branches, which are usually strobile-bearing: leaves 5–8.5 mm. × 1–1.5 mm., in 8 rows, uniform in shape throughout the plant, longest in the aerial parts where they spread horizontally or are finally somewhat reflexed with upwardly curving apices, lanceolate to linear-lanceolate, broadest at or above the middle, serrulate, acute or pungent: strobiles sessile upon the leafy vertical branches, thick (4 mm. × 1–3 cm.), with broadly ovate sporophylls, the latter with erose margins and subulate tips.

The so-called var. *pungens* with stiffer, shorter more erect leaves is a condition not at all confined to mountain forms.

Distribution: Alaska, Washington, Idaho, Montana, Lake Winnepeg, Colorado, Minnesota, Michigan, Pennsylvania, New York, Massachusetts, Vermont, New Hampshire, Maine, Newfoundland, Greenland.

10. L. CLAVATUM L. Sp. Pl. 1100. 1753

Prostrate stems 1–4 meters long, creeping extensively along the surface of the ground, very leafy, sparingly rooting, branching horizontally, with frequent aerial stems which are immediately ascending or at first prostrate, then ascending, producing pinnate branches of the second and third order, lax, some of them producing stout peduncles, 7–12 cm. long, with subulate, bristle-tipped whorled or scattered bracts and producing one, or frequently 3–4 strobiles: leaves linear or somewhat expanded at the middle, acute, denticulate, bristle-tipped, entire or minutely denticulate, those of the horizontal stems strongly denticulate: strobiles with deltoid sporophylls, erose, subulate tipped: sporangia reniform.

A widespread species or complex of species extending according to Baker's treatment* throughout the arctic and alpine zones of both hemispheres and in the mountains of tropical Asia, Africa and Polynesia. He reduces nine species under this name several of which will be found to be distinct. Some of the specimens from the Northwest and Alaska are very unlike the eastern forms and usually have much more forked strobiles and are commonly devoid of bristle tips to the leaves. In some particulars they resemble the east Asiatic and Siberian forms with larger suites of which they should be compared than are available in this country. Meanwhile careful field notes of the forms occurring from Oregon northward to Alaska are desirable.

Distribution: Labrador, Newfoundland, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Quebec, Ontario, Michigan, Wisconsin, Minnesota, Saskatchewan, Oregon, Washington, Alaska.

A large proportion of the material from the Northwest which has been examined differs materially from the eastern plant, the most striking feature being the absence of the bristle tip to the leaf. Plants from Alaska show a dwarfed condition, with shorter peduncles. The distribution of the plant in the Northwest is of interest and is shown here in more detail:

WASHINGTON: In damp woods, 4000–5000 ft. alt., Skamania Co., Aug. 28, 1890, W. N. Suksdorf, no. 1030 (C, G, N); 1889, G. R. Vasey, no. 32 (N, G); deep woods, Pierce Co., Aug., 1895, C. V. Piper (G); forest, Mt. Rainier Range, U. S. South Pac. Exp. Exped., 1838–42, Klickitat Pass, F. E. Lloyd (Y).

OREGON: Base of Mt. Hood, Nov., 1870, G. Howell (G); Bridal Vail, Aug., 1897, J. E. Kirkwood (Y).

BRITISH COLUMBIA: Mt. Benson, N. I., July 10, 1893, J. Macoun (N); 1859, Lyall, no. 1318 (C).

ALASKA: 1879, C. M. Turner (N) and 1881 (G); Kadiak Is., June 27, 1896, B. J. Bretherton (N).

The Mexican and Central American representatives of this spe-

* Handbook of Fern Allies, p. 26.

cies differ in having stems which merge into the peduncles as shown by the gradual reduction of the leaves from the typical foliar condition to that of small bracts, or, again, the peduncles may be entirely leafy. This is probably due to the influence of less abrupt seasonal changes. The forkings of the peduncles are sometimes more distant, and the whole plant has a more lax habit. Specimens have been examined from the following localities :

JAMAICA : Blue Mt. Peak, Dec. 14, 1890, A. S. Hitchcock (U); 1885 (N).

MEXICO : Orizaba, 1853 (C), Jalapa ; Vera Cruz, 4000–5000 feet, Dec., 1894, C. L. Smith, no. 2119 (N) ; Orizaba, 1855 Müller, no. 362 (C) ; Manzanilla, Mt. Chiapa, 2000 meters, Aug., 1890, J. N. Rovirosa (C).

GUATEMALA : San Miguel Uspantán, Quiche, 7000 feet, April, 1892, Heyde and Lux (C, N).

NICARAGUA : 1853–6, C. Wright (N).

11. L. OBSCURUM L. Sp. Pl. 1102. 1753

L. dendroideum Michx. Fl. Bor. Am. **2** : 282. 1803.

Horizontal stems extensively creeping undergound, giving off single vertical stems which by repeatedly branching produce a bushy mass of foliage 12–25 cm. high : leaves spreading and upwardly curving, linear-lanceolate and twisted, especially above so as to lie in a vertical plane, acute, mucronate, on the lower branches in 8 rows, on the terminal in 6 rows ; strobiles sessile : sporophylls broadly ovate, papery and erose-margined, acuminate with a subulate apex : sporangia reniform.

The form with a tendency to dorsiventrality in the terminal branches the upper and lower rows of leaves being shortened and appressed, is supposed to be the one to which the Linnaean name was originally given. It is unfortunate that Michaux's appropriate name could not hold for this miniature tree-like species.

Distribution : Newfoundland, Maine, Quebec, Ontario, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, Kentucky, Tennessee, Ohio, Minnesota, Michigan, Montana, Alaska.

12. L. CERNUUM L. Sp. Pl. 1103. 1753

Stems 20–35 cm. long, procumbent or arching, with clustered roots at points of contact with the ground, branching often in different planes, the terminal branchlets often strobile-bearing and nodding: leaves 3–5 mm. long, cylindric, slender, subulate, spreading and upwardly curving: strobiles sessile, 5 mm. long, with small sporophylls (1.5 mm. × 8 mm.) ovate-acuminate, thin with deeply fringed margins: sporangia minute, spherical, transversely compressed.

The plant of the Gulf region seems to differ in no respect from the more tropical form except in size, in the less pronounced upright habit, and in the length of the strobiles.

Specimens from the United States have been examined as follows:

MISSISSIPPI: Ocean Springs, July, 1889, F. S. Earle (U).

ALABAMA: "Springy clay banks," Mobile Co., June, 1889, C. Mohr (U, G, N); Spring Hill, "common in swamp," Aug., 1897, B. F. Bush (Y).

FLORIDA: Lake City, Dec., 1894, F. C. Straub, no. 42 (G); Prairie Creek, A. P. Garber (C, G, N); "moist pine barrens," near Jacksonville, Mrs. A. Curtiss (G); E. Fla., Chapman (G); Waldo, Jan., 1871, Chapman (C); Oneco, Dec., 1897, E. W. Reasoner (U).

Widely distributed through the tropics.

13. L. SITCHENSE Ruprecht. Beitr. z. Pflanzenk. d. Russ. Reich. 3: 30. 1845

Prostrate stems, 20–30 cm. long, creeping along the surface of the ground or a little buried, occasionally branching and rooting with scale-like leaves, sending up frequent aerial stems which branch dichotomously several (4–6) times to form compact masses of vertical terete branches, 5–7 cm. high, with occasional stronger strobile-bearing branches usually projecting above the tuft: leaves 2 mm. × 5 mm., lanceolate with a broad base, spreading and curving upward, thick, entire, acute, excurrent, in five rows on the branchlets; peduncles short (less than 1 cm.), very slender, with a few minute subulate bracts, or none, the strobiles then being sessile upon strong leafy branches: strobiles (0.8 × 2.5 cm.) with broadly ovate sporophylls with erose margins and long acuminate to subulate apices nearly equaling the sporophyll.

This form has been confused with *L. sabinaefolium* Willd. and Herr Ernst Pritzel, who has kindly examined Wildenow's type sheet for us at Berlin, and has sent some fragments of the sterile branches from the two specimens it contains, assures us that both this plant and what we here regard as true *L. sabinaefolium* are a part of Willdenow's original material from which he doubtless drew the description of *L. sabinaefolium.* The description of the latter with its expression "foliis lanceolatis acutis quadrifariis" indicates clearly the form Willdenow had in mind in naming the plant.

The plants of the Northeast are usually somewhat more slender and delicate in habit, with short (2–5 mm.) peduncles. The strobiles are sessile upon stronger leafy branches in the Northwestern forms ; these leafy branches may readily be mistaken for peduncles.

Specimens have been examined as follows :

ALASKA : Back Bay, July 28, 1895, M. W. Gorman (N) ; Yes Bay, Aug. 21, 1895, T. Howell, no. 1730 (N), 1732 (Y).

BRITISH COLUMBIA : 49° N. Lat. Ore. Bound. Sur., Dr. Lyall, 1859. (G, lower specimen only.)

WASHINGTON : Mt. Rainier, 5000 ft., Aug., 1895, C. V. Piper (N, G) ; Lilly Lake, Chehalis Co., 2500 ft., Aug., 1897, F. H. Lamb, 1396 (Y) ; Olympic Mts., 5500 ft., C. V. Piper (G) ; Mt. Rainier, 1890, E. C. Smith (G) ; Mt. Adams, 7000 ft., Aug., 1885, W. N. Suksdorf (N) ; Stevens Pass, 1200 m., Aug., 1893, Sandberg & Leiberg (N U).

IDAHO : Lower Clark Fork, Oct. 7, 1895, 1820 meters, J. B. Leiberg (N).

ONTARIO : Magpie River, N. of Lake Superior, Aug., 1885, J. Macoun.

NEW YORK : Adirondack Mts., C. H. Peck (U).

MAINE : Mt. Ktaadn, Aug., 1892, S. O. Briggs (G) ; St. Francis, dry knoll in pasture, Aug. 7, 1893, M. L. Fernald, no. 215. (G, a good specimen with three strobiles.) (N, a smaller sterile specimen.) (U, one strobile.) Fort Kent, dry hillside pastures, June 15, 1898, M. L. Fernald (G).

LABRADOR : Square Island, Lat. 52° 44′ N., Aug. 1882, J. A. Allen (C) ; St. Michaels, 1891, A. C. Waghorne (N, C).

14. L. SABINAEFOLIUM Willd. Sp. Pl. **5** : 20. 1810

Prostrate stems creeping along the surface, occasionally branching and rooting, with numerous aerial stems which soon branch 3–4 or 5 times to form a loose clump of erect or straggling dorsiventral branches : leaves 1.5–2 mm. long, subulate, slightly spreading, curved upwards, with thin apices, in four rows on the flattened terminal and subterminal branchlets, those of the lateral rows thicker and more curved than those of the upper and lower rows: peduncles (1–5 cm. long, 1 mm. thick) produced from stronger terete branches with their subulate bracts whorled or scattered: strobiles 2–3 cm. long, with broadly ovate sporophylls with short acute apices: sporangia reniform.

Specimens have been examined as follows:

MAINE: Fort Kent, "in shade," June 15, 1898, M. L. Fernald (G); Dover, "dry woods," Sept. 11, 1894, M. L. Fernald (G).

ONTARIO: Peninsular Harbor, "barren, open prairie," Sept. 16, 1896, G. S. Miller, Jr. (G).

PRINCE EDWARD ISLAND: Brackley Point, Aug., 1888, J. Macoun (U); Stanhope Road, Sept. 5, 1888, J. Macoun (C).

VERMONT: Rochester, "cold, mountain woods," Oct., 1892 (U, G); "cold, evergreen woods," Sept. 23, 1894, W. W. Eggleston (G, C).

15. L. CHAMAECYPARISSUS A. Br.; Doell. Rhein Fl. 36. 1843

16. L. COMPLANATUM L. Sp. Pl. 1104. 1753

These two species have been recently discussed and illustrated. *Cf.* Bull. Torr. Club, **26**: 559–567, *pl. 370*, 15. N. 1899.

The northwestern forms of *L. complanatum* lack the regular compact fan-like habit of the eastern plant, but spread loosely and irregularly and are apparently glaucous. The strobiles are often solitary and in the dwarfed arctic forms of Alaska are very small upon much reduced peduncles. There are, however, at present only insufficient reasons for giving distinct specific rank to these plants. *L. complanatum*, as it grows in Scandinavia, seems to parallel the northwestern condition of the American plant.

Material has been examined as follows:

LAKE SUPERIOR: (No. 22407).

MONTANA: Upper Flathead River, July, 1883, Canby no. 399 (G); MacDonald Lake, Aug., 1892, R. S. Williams (N).

IDAHO: Lake Pend d'Oreille, Sandberg, MacDougal and Heller, July, 1892 (Y, N); Heller, 770 (G).

WASHINGTON: Stampede Pass, Henderson, June, 1892 (G).

NORTHWEST TERRITORY: Red Deer River, 53° N. Lat., July, 1881, J. Macoun (G); Head of Yukon River, June, 1883, Schwatka (G).

ALASKA: Lake Lindeman, May, 1898, R. S. Williams. A very much stunted plant 5 cm. high with strobile 1 cm. long. Speci mens identical with these have been collected by Wm. Palmer in Labrador, Aug., 1887 (N).

The Mexican and Central American forms are much taller, more lax, spreading, with more irregular habit. They have been variously referred to *L. complanatum* and *L. thyoides* H. & B. (originally described from Venezuela). Without a larger array of material we hesitate to separate these plants from *L. complanatum*.

17. L. ALPINUM L. Sp. Pl. 1104. 1753

Prostrate stems (20–50 cm. long), creeping at or near the surface of the ground; aerial stems numerous and branching several times to form dense clumps (4–8 cm. high) of markedly dorsiventral branches with glaucous foliage; occasional strobile-bearing branches (the so-called peduncles) thicker, terete and usually projecting above the general mass: leaves of the strobile-bearing branches subulate, those of the purely vegetative branches trimorphic, those of the upper row narrowly ovate, acute, those of the lateral rows thick, with one nerve asymmetrically placed, laterally truncate, acute, falcate, curved toward the under side, those of the under row trowel-shaped: strobiles sessile (1–2 cm. long), with ovate acute sporophylls: sporangia reniform.

This plant varies not a little in the amount of spreading of the lateral leaves, although the characters otherwise are very constant. It is the most highly specialized plant of the whole genus.

Specimens have been examined as follows:

ALASKA: Disenchantment Bay, Aug., 1892, F. Funston (N); July, 1879, L. M. Turner (N); Bischoff (N); Yakutat Bay, Aug., 1892, 1175 M. F. Funston (G, C); Juneau, Aug., 1891, 3000 feet. Grace E. Cooley (C); Unalaska, July, 1872, M. W. Harrington (N, C, G), Oct., 1871 (G), Dr. Mertens (G).

BRITISH COLUMBIA: Cascade Mts., Ore. Bound. Comm., Dr. Lyall, 1859 (G upper specimen only), Griffin Lake, Aug., 1889, J. Macoun (U).

GREENLAND: Sakkertappen, July, 1886 (G); Frederickshaad, Aug., 1886; Kolderup-Rosenvinge (G).

Additional species from tropical North America are represented in American collections examined as follows:

18. L. REFLEXUM Lam. Encyc. Meth. Bot. 3: 653. 1789

MEXICO, *Vera Cruz:* Müller, 363 (C); Ex-Schlechlendal (C).
GUATEMALA: Tuerckheim (N); J. D. Smith, 504 (C, N).
NICARAGUA: Wright, 6 (N).
CUBA: Wright, 953 (C).
JAMAICA: Wilson (C); Ex-Bot. Garden (N).
PUERTO RICO: Sintenis, 6345 (N, Y).
GUADELOUPE: Perrin (C).
This species is a close ally of *L. lucidulum.*

19. [L. RIGIDUM Gmel. Syst. Nat. 8: 1289. 1796

Reported from mountains of Martinique and Guadeloupe, but not found in American collections.]

20. L. VERTICILLATUM L. fil. Suppl. 448. 1781

L. setaceum Lam. Encyc. Meth. Bot. 3: 653. 1789.
L. acerosum Sw. Fl. Ind. Occid. 3: 1575. 1806.

The type was described from Bourbon, but Old World material in our herbaria is insufficient to verify or disprove the above quoted citations.

MEXICO, *Vera Cruz:* Müller, 361 (C); *Oaxaca:* Pringle, 4994 (C, N).
CUBA: Wright, 935 (C, N).
MARTINIQUE: Pere Duss (Y).

21. L. FUNIFORME Chamisso; Spring Monog. 1: 50. 1842

CUBA: Wright, 943 (C, N).

22. [L. MOLLICOMUM Mart.; Spring Fl. Bras. 1: 113. 1840

Reported from Guatemala, but not seen in American collections.]

23. L. LINIFOLIUM L. Sp. Pl. 1100. 1753

MEXICO, *Vera Cruz:* Müller (C).
GUATEMALA: J. D. Smith, 959 (C).
CUBA: Wright, 934, 1825 (C, N).
PUERTO RICO: Sintenis, 1541 (N, Y); Eggers, 8654.

24. L. DICHOTOMUM Jacq. Hort. Vind. **3**: 26. *pl. 45.* 1776

MEXICO, *San Luis Potosi:* Pringle, 2976 (C, N, U), (distributed as *L. taxifolium*).

CUBA: Wright, 944 (C, N).

25. L. TAXIFOLIUM Swz. Fl. Ind. Occid. **3**: 1573. 1806

MEXICO, *Vera Cruz:* C. L. Smith, 2118 (N); Cordoba, Bourgeau (C). *Morelos:* Pringle, 7613.

CUBA: Wright, 937 (C, N).

JAMAICA: Caswell Grave, 3206; Ex Bot. Garden (N).

PUERTO RICO: Sintenis, 1538 (N, Y).

SANTO DOMINGO: Pere Duss (Y).

GRENADA: Sherring, 36 (C).

26. L. AQUALUPIANUM Spring, Monog. **1**: 68. 1842

CUBA: Wright, 936 (C).

PUERTO RICO: Sintenis, 5432 (N, Y).

TRINIDAD: Fendler, 107 (N).

27. [L. SUBULATUM Desv. Encyc. Bot. Suppl. **3**: 544. 1813

Reported from "all tropical America" but not seen in American collections.]

28. L. JUSSIAEI Desv. Encyc. Bot. Suppl. **3**: 543. 1813

JAMAICA: Purdie (C); Ex Herb. Bot. Gard. (N).

29. **Lycopodium Fawcettii** sp. nov.

Horizontal stems trailing giving off at intervals of 2–3 cm. lax clusters of much branched aerial stems (12–15 cm. high) of two sorts, vegetative and peduncular; the vegetative branches flattened, the ultimate divisions elongate slender and rigid (1.5 mm. wide) with four rows of appressed leaves, those of the under row reduced to a triangular tip; peduncular stems arising from near the ground, branching about six times, thick, terete, the ultimate branches the thinnest with 6–8 rows of triangular, thin, membranous tipped leaves; many of the peduncular stems produce ultimately sessile strobiles 2–3 cm. long which scarcely exceed the negative branches, sporophylls broader than long, very abruptly contracted into a subulate tip, sporangia reniform.

JAMAICA: ex herb. Botanical Garden, 1885 (N) (U. S. Nat. Herb 22368=type); Wilson, 1863 (C), a form with abnormal peduncular stems.

SANTO DOMINGO: Wright, Parry, and Brummel, no. 37, 1871 (N, C). Apparently a much more elongate and slender form; Eggers, no. 2270 (C), similar to Wilson's Jamaica form noted above.

This plant is related to *L. complanatum* but is entirely distinct from that species.

Explanation of Plates

PLATE 2

All the figures are drawn to the same scale.

FIG. 1. *Lycopodium sabinaefolium.* A portion of a branch, showing the spreading and incurved lateral leaves.

FIG. 2. The same, lateral view. The leaves of the upper and lower rows are seen to be equally developed and spreading.

FIG. 3. *L. alpinum.* Under side of a part of a branch.

FIG. 4. Lateral view of the same

FIG. 5. *L. Sitchense.* A portion of a branch. Leaves in five rows.

FIG. 6. *L. porophilum.* Sporophyll with sporangium.

FIG. 7. " Leaf.

FIG. 8. *L. Selago.* Leaf.

FIG. 9. " Leaf.

FIG. 10. " Sporophyll.

FIG. 11. *L. lucidulum.* Sporophyll.

FIG. 12. " "

FIG. 13. " Leaf.

PLATE 3

FIG. 14. *L. adpressum.* Transverse section of stem through hibernating region.

FIG. 15. " Transverse section of stem.

FIG. 16. " Leaf.

FIG. 17. " Leaf from peduncle.

FIG. 18. " Sporophyll.

FIG. 19. *L. alopecuroides.* Transverse section of stem.

FIG. 20. " Transverse section of stem through hibernating region.

FIG. 21. " Leaf.

FIG. 22. " Sporophyll.

FIG. 23. *L. inundatum.* Leaf.

FIG. 24. " Leaf.

FIG. 25. " Sporophyll.

FIG. 26. " Transverse section of stem.

FIG. 27. *L. pinnatum.* Transverse section of stem.

FIG. 28. " Leaf.

FIG. 29. " Sporophyll.

FIG. 30. " Leaf.

PLATE 4

L. pinnatum and *L. alopecuroides* from the Chapman Herbarium (C); the former representing Chapman's type specimen.

Studies on the Rocky Mountain Flora.—I*

By P. A. Rydberg

(With Plates 5 and 6.)

SPECIES OF SENECIO OF THE LOBATUS, AUREUS, SUBNUDUS AND TOMENTOSUS GROUPS

It may seem strange that I present here a paper on Senecio, when it is well known to me that Mr. Greenman is occupied in preparing a monograph of the genus in all North America, from the arctic regions to the Isthmus. My work was begun a year ago, and before I knew of Mr. Greenman's work. I have not been able to present my results in print before now, and I do it with the good will of the gentleman mentioned, and with the understanding that I confine myself to the Rocky Mountain region.

The four groups treated here are closely related and grade into each other. They might have been treated as a single group but even this would have been more or less artificial and ill-defined, because there are several intergradations with related groups. The more foliose species of the Aurei as *S. platylobus* and *S. Idahoensis* described below connect with the Eremophili; *S. cymbalarioides* with the Alpicolae, and *S. canovirens* with the Cani.

The work presented here is based on my own studies in the field and the specimens found in the herbaria of the New York Botanical Garden, Columbia University and College of Pharmacy, all in New York City.

LOBATI

Annuals or biennials or perennials with a taproot, perfectly glabrous in age or slightly floccose at the bases of the leaves, more or less leafy throughout, 3 dm. or more high: leaves, all except

*The author intends to publish under this title a series of papers on the Botany of the Rocky Mountain Region. The intention is not however to limit these studies to the botany of the mountains proper, but will include also the Great Plains to the eastward. They will comprise the following states and territories: eastern British Columbia, Alberta. Saskatchewan, Assiniboia, Montana, Idaho, Wyoming, Colorado, New Mexico, eastern Utah, and the extreme western portions of the Dakotas, of Nebraska, Kansas, Oklahoma and Texas.

the very first, pinnately divided: heads rather small and minutely calyculate. In habit resembling the AUREI and TOMENTOSI, to which the last two form a transition, but have more divided leaves and a root of less duration.

Leaves thin; root annual or biennial.
  Head about 1 cm. high; terminal segments of the basal leaves 3–5 cm. wide. 1. *S. sanguisorboides.*
  Head 5–8 mm. high; terminal segments of the basal leaves less than 2 cm. wide.
    Basal leaves with few segments; segments crenate or dentate. 2. *S. Greggii.*
    Basal leaves with numerous segments; segments lobed or cleft. 3. *S. millelobatus.*
Leaves rather thick; root perennial.
  Bracts thick, much shorter than the disk. 4. *S. multilobatus.*
  Bracts thin, almost equaling the disk. 5. *S. Nelsonii.*

1. **Senecio sanguisorboides** sp. nov.

Tall and simple, perfectly glabrous, annual or maybe biennial: stem terete, about 6 dm. high, leafy: basal leaves thin, 1–2 dm. long, petioled, pinnately divided with 3–5 segments; terminal segments reniform, 3–5 cm. wide, coarsely crenate; lateral segments almost orbicular, crenate: lower stem leaves similar; the upper with 7–11 segments, short-petioled or the uppermost subsessile; the base of the petioles with large round, laciniate auricles; terminal segment ovate, incised-crenate; the lateral ones obovate or broadly cuneate: cyme rather contracted: heads about 1 cm. high; bracts 12–16, linear-lanceolate, acute, about 1 mm. wide, with membranous margins; the calyculate ones very few and minute, lanceolate: rays about 10, 8 mm. long and 3 mm. wide, about 4-nerved: achenes glabrous and angled.

This has been referred to *S. Sanguisorbae* DC.; but a comparison with De Candolle's description shows several discrepancies. According to the description S. *Sanguisorbae* should have only 8–10 bracts and 5 rays, the leaves should be puberulent beneath and the terminal segment orbicular, characters not found in the present species. The latter grows at an altitude of 2500–3000 m. [Plate 5, f. 14.]

NEW MEXICO: Santa Fe Cañon, 1897, *A. A. & E. Gertrude Heller, 3820* (type in the herbarium of the N. Y. Botanical Garden); White Mountains, 1897, *E. O. Wooton, 494*.

2. **Senecio Greggii** sp. nov.

Senecio Tampicanus A. Gray, Pl. Fendl. 109. 1849; not DC., 1837; *S. lobatus* A. Gray, Pl. Wright. **2**: 99. 1852; not Pers. 1807.

Biennial or annual, with several stems from the base, perfectly glabrous in age: stems about 3 dm. high: leaves pinnately divided or the very first ones simple: basal leaves with 3–5 segments, the terminal one round and crenate, about 1 cm. in diameter; the lateral ones small, obovate; stem leaves with 7–9 small segments and more or less auricled at the base of the very short petiole: cyme compound: heads rather many, only 5–7 mm. high; bracts about 20, linear-acuminate; the calyculate ones minute and few: rays 8–10, about 3 mm. long and 1.5 mm. wide, 3-nerved: achenes angled and strigose.

This is nearest related to *S. lobatus* but smaller and characterized by the many stems from the same root, the few segments of the basal leaves, the small heads and the narrow bracts. Only Wright's specimens were collected in the region here treated. [Plate 5, f. 8.]

MEXICO: Santa Rosalia, *Dr. Gregg* (type in Torrey Herbarium).

TEXAS: Near El Paso, 1851–2, *C. Wright, 1413;* between Frio and Nueces Rivers, 1880, *E. Palmer, 754;* Loredo to Frontera, *Wright* (Mexican Boundery Survey), *659,* in part.

3. **Senecio millelobatus** sp. nov.

Senecio Tampicanus A. Gray, Pl. Wright. **2**: 99. 1852; not DC. 1837; *S. multilobatus* A. Gray, Syn. Fl. $\mathbf{1}^2$: 394, in part. 1884; not T. & G. 1849.

Annual or biennial, perfectly glabrous or slightly floccose at the base of the leaves: stem branched, 3–5 dm. high, very leafy: all leaves pinnately divided, 3–7 cm. long, lanceolate or oblanceolate in outline; segments 13–23, obovate, 3–10 mm. long, lobed or cleft into oblong or ovate lobes; the upper segments more or less confluent: cyme compound: heads about 8 mm. high; bracts oblong-lanceolate, acuminate, 12–15 in number; calyculate ones minute and few: rays 5–8 mm. long and 1.5–2 mm. wide: achenes very scabrous on the angles.

This is nearest related to the preceding and to *S. lobatus* but is easily distinguished by the numerous and lobed or cleft segments. It may be related to *S. Tampicanus* which I have not seen, but that species is described as having only 4 or 5 pairs of segments and glabrous achenes. [Plate 5, f. 11.]

NEW MEXICO: Hills on the Limpia, 1851–2, *C. Wright, 1287* (type in the Torrey herbarium); *P. V. Le Roy.*

TEXAS: Lower Rio Grande, 1852, *Parry* (Mexican Boundary Survey), *658*.

4. SENECIO MULTILOBATUS Torr. & Gray; Gray, Pl. Fend. 109. 1849

The type of this species is in the Torrey herbarium and very unlike the plant regarded by Gray as *S. multilobatus*. It is characterized by its fleshy leaves and stands perhaps nearer to *S. compactus* than to the group with which it was associated by Dr. Gray. I have placed it in this group on account of its pinnatifid basal leaves. The earliest of these are, however, entire, in the same manner as they occasionally are in *S. rosulatus*. This analogy and the close relationship to *S. compactus* undoubtedly made Prof. Greene name Baker, Earle and Tracy's specimens "*Senecio compactus* Rydb., verging towards *S. Fendleri*." These specimens differ from Fremont's plant only in the fact that the basal leaves are shorter and less divided. Eastwood's specimens are exactly like the type. The base of these specimens shows that the plant is a perennial rather than an annual as stated in the original description. It grows at an altitude of about 2000 m. [Plate 6, f. 11.]

UTAH: Uintah River (a tributary of Greene River), *Fremont, 549* (type in the Torrey herbarium); Ogden, 1871, *Hayden Survey;* South Utah, *J. E. Johnson*.

COLORADO: Grand Junction, 1892, *A. Eastwood;* Mancos, 1898, *Baker, Earle & Tracy, 446;* Dolores, 1892, *C. S. Crandall;* South Park, 1871, *W. M. Canby*.

5. SENECIO NELSONII Rydb. Bull. Torr. Club, ~~24~~ 26: 483. 1899

Prof. Greene in Pittonia, **4**: 112, devotes over a page to this species, claiming it to be the same as *S. Fendleri*, and criticises both Prof. Nelson and myself. We had, however, both investigated the matter thoroughly before the species was published. In claiming that the two species are the same, Prof. Greene must either not know one of the plants or both, or else do it for the purposes of finding fault. *S. Nelsonii* has the leaf form of *S. Fendleri*, but there ends the similarity. In the former the caudex is short, not woody, and with numerous fibrous roots, placing it nearer to *S. multilobatus* and *S. compactus*, while *S. Fendleri* has a very thick and woody rootstock. The heads of *S. Nelsonii* are larger, 8–10 mm. high, and the bracts are thin and in anthesis almost equal the disk, while in *S. Fendleri* they are thick and much shorter. The former also lacks the fine tomentum of the latter; it is merely floccose when young in the manner of *S. multilobatus* and *S. compactus*. *S. Nelsonii* is dark green while *S. Fendleri* is more or less yellowish. Neither of the species forms mats, as Prof. Greene states. Heller's specimens, from the type locality of *S. Fendleri*, agree fully with Gray's description of that species, except that they are more glabrate than the type. They represent a plant of several season's growth, but show nothing to indicate a matted plant. I think that Prof. Greene has here confused *S. rosulatus* with the two. Prof. Greene's conception of *S. Fendleri* must be very comprehensive, indeed, as he also includes in that such forms as *S. subcuneatus*, *S. canovirens*, and another species, nearly related to *S. fastigiatus* Nutt. This statement is founded on specimens determined by Prof. Greene only a year or two ago and found in the herbarium of the New York Botanical Garden. By comparing Plate 5, Fig. 6, and Plate 6, Figs. 1, 3, 4 and 9, with each other, one can get an idea of Prof. Greene's conception of *S. Fendleri*.

I have seen no specimens of *S. Nelsonii* except the type.

AUREI

Slender perennials, over 2 dm. high, with a short erect caudex or rootstalk, glabrous or slightly floccose when young, the wool remaining in age only at the base of the leaves: basal leaves entire, merely toothed: stem leaves more or less pinnatifid and the upper more or less reduced: heads small, cymose, with very small and few calyculate bracts.

Heads radiate.
- Leaves thick, more or less fleshy.
  - Basal leaves narrowly oblanceolate.
    - Plant low, less than 2 dm. high, often with several stems from the base; basal leaves short-petioled.
      - Cyme dense; upper leaves generally pinnatifid with narrow lobes. 6. *S. compactus*.
      - Cyme more open; stem leaves entire or merely crenate.
        - Basal leaves subentire or 3-toothed at the apex. 7. *S. tridenticulatus*.
        - Basal leaves crenate. 8. *S. oblanceolatus*.

Plant about 4–6 dm. high, simple.

Leaves serrate or subentire; basal leaves 1 cm. or more, slender-petioled. 9. *S. longipetiolatus.*

Stem leaves with long, triangular lobes; basal leaves 5 cm. or less. 10. *S. fulgens.*

Basal leaves cuneate, spatulate or broadly oblanceolate, subentire at the base.

Lower stem leaves spatulate with a broad-winged petiole; upper ones sessile and with much enlarged bases. 11. *S. crocatus.*

Stem leaves neither broad-winged nor with much enlarged bases.

Basal leaves crenate above the middle. 12. *S. cymbalarioides.*

Basal leaves angularly dentate. 13. *S. Jonesii.*

Basal leaves sharply dentate or serrate above the middle.

Lower stem leaves cuneate, plant 3–4 dm. high. 14. *S. subcuneatus.*

Lower stem leaves oblanceolate; plant about 2 dm. high. 15. *S. acutidens.*

Leaves thin.

Basal leaves ovate or more commonly cordate, serrate. 16. *S. pseudaureus.*

Basal leaves obovate or oval, crenate or sinuate-dentate.

Stem leaves ovate in outline, with broad segments. 17. *S. platylobus.*

Stem leaves lanceolate or oblanceolate in outline, with narrow segments. 18. *S. flavovirens.*

Stem leaves spatulate or oblanceolate in outline, with short and broad segments. 19. *S. aurellus.*

Head discoid.

First basal leaves reniform. 20. *S. nephrophyllus.*

None of the leaves reniform.

Plant stout; stem leaves with broad laciniate segments. 21. *S. Idahoensis.*

Plant slender; stem leaves with narrow segments.

Plant yellowish or light green; bracts not purple-tinged. 17. *S. flavovirens.*

Plant dark green.

Basal leaves crenate; head 8–10 mm. high; bracts purple-tinged, linear. 22. *S. pauciflorus.*

Basal leaves wavy; heads about 6 mm. high; bracts broadly lanceolate or oblong, not purple-tinged. 23. *S. fedifolius.*

6. SENECIO COMPACTUS (A. Gray) Rydb. Mem. Torr. Club, 5: 342. 1893

Senecio aureus var. *compactus* A. Gray, Syn. Fl. 1^2: 391. 1884.

Dr. Gray's description covers two if not three species. For which of these *S. compatus* should be used is a matter of question. I have adopted it for the plant of the plains with a dense cyme and usually pinnatifid-dentate stem leaves. Dr. Gray evidently had this plant in mind when he adopted the name *com-*

pactus. The description seems to indicate mostly this species, which also I had in mind when I raised the variety to specific rank and it is this that is described and figured in Britton and Brown's Illustrated Flora. On the other hand if synonomy and the citation of specimens are taken in consideration, the name may have been applied to the next, for the first synonym and the first specimen cited belong to that species. [Plate 5, f. 15.]

NEBRASKA : Valentine, *J. M. Bates, 34;* Lewellen, *G. D. Swezey, 82;* Fort Niobrara, 1888, *T. E. Wilcox;* Thedford, 1893, *P. A. Rydberg, 1311;* Platte Bottom, 1891, *211.*

COLORADO : Plains, 1882, *Allen & Brewster;* Colorado Springs, 1892, *Isabel Mulford.*

7. **Senecio tridenticulatus** sp. nov.

Senecio aureus var. *borealis* A. Gray, Pl. Wright. **1** : 125. 1852; not T. & G. 1843 ; *S. aureus* var. *compactus* A. Gray, Syn. Fl. $\mathbf{1}^2$: 391 ; in part.

Perennial with a branched caudex, in age perfectly glabrous, or slightly floccose at the base of the leaves : stems very slender, about 3 dm. high : basal leaves very narrowly oblanceolate, thick with a slender petiole, slightly 3-toothed at the apex or wholly entire, 4–8 cm. long and 4–5 mm. wide : stem leaves linear and subentire : cyme open and corymbiform : heads 7–8 mm. high : bracts lanceolate, acute ⅔ or ¾ as long as the disk : rays light yellow, about 8 mm. long and 1–1.5 mm. wide, 3-nerved ; achenes hispid-puberulent on the angles.

This species differs, from the preceding in the slender stem and the open cyme, and also in the form of the leaves. The latter character also separates it from the next following. It grows in wet sandy soil. The type was growing at an altitude of 2400 m. Wright's specimens are past blooming, and good characters could not be taken from them, wherefore I have made Sheldon's specimens the type. The latter were mixed with some of the next. [Plate 5, f. 12.]

COLORADO : Cottonwood Creek, Buena Vista, 1892, *C. S. Sheldon* (type in the herbarium of N. Y. Botanical Garden).

TEXAS : Mountains beyond the Limpia, 1849, *Wright, 403.* [illegible]

8. **Senecio oblanceolatus** sp. nov.

Perennial with several stems from a strong root, in age glabrous or rarely slightly floccose at the base of the leaves : stems short and stout, about 2 dm. high: basal leaves oblanceolate, thick and fleshy, 4–6 cm. long, obtuse, crenate with entire long tapering bases or the first subentire: stem leaves similar or reduced and linear in outline: cyme corymbiform, not compact: heads about 8 mm. high; bracts linear acute, yellowish green; the calyculate ones minute and few: rays 5–6 mm. long and about 1.5 mm. wide, 4-nerved: achenes minutely scabrous on the angles.

This species has also been included in *S. aureus compactus*, but lacks the dense inflorescence of *S. compactus* as here understood. The stem leaves never show any indication of being pinnatifid with narrow lobes as in that species. *S. compactus* is a plant of the Great Plains, while *S. oblanceolatus* is a mountain plant growing at an altitude of 1800–3000 m. [Plate 5, f. 9.]

COLORADO: Como, South Park, 1895, *C. S. Crandall* (type in the herbarium of N. Y. Botanical Garden); El Paso County, 1897, *A. A. & E. Gertrude Heller, 3508;* Cottonwood Creek, Buena Vista, 1892, *C. S. Sheldon.*

9. **Senecio longipetiolatus** sp. nov.

A tall, simple, perfectly glabrous perennial, with a short erect rootstock: stem strict, 3–6 dm. high, terete: basal leaves oblanceolate, 1–1.5 dm. long, with a slender petiole, from serrate to subentire: lower stem leaves similar; the upper reduced, lanceolate, sessile, sharply serrate, or laciniate-dentate, often auricled at the base: cyme dense, corymbiform: heads 8–9 mm. high: bracts about 20, linear, acute: the calyculate ones few, minute, subulate and crisp: rays dark orange, 4–7 mm. long and 1.5 mm. wide, 3–4-nerved: achenes strongly angled, glabrous.

In the type the basal leaves are strongly serrate, but in the Colorado plants they are indistinctly so or subentire. Baker, Earle & Tracy's specimens were named by Professor Greene, *Senecio crocatus* Rydb. but it is entirely distinct from anything collected by Hall & Harbour, and has nothing that fits any description of *S. aureus* var. *croceus*, except the dark rays. See further remarks under *S. crocatus*. *S. longipetiolatus* grows at an altitude of 2000–3000 m. [Plate 6, f. 10, 10a.]

WYOMING: Spread Creek, Teton Forest Reserve, 1897, *F. Tweedy, 585* (type in the herbarium of N. Y. Botanical Garden).

COLORADO: Medicine Bow Range, 1891, *C. S. Crandall;* Hamor's Lake, north of Durango, 1898, *Baker, Earle & Tracy, 625.*

10. **Senecio fulgens** sp. nov.

Simple and glabrous perennial with a very short caudex: stem about 3 cm. high: basal leaves oblanceolate, thick and somewhat fleshy, with the petiole about 5 cm. long, dentate or subentire: lower stem leaves spatulate with a winged petiole, coarsely dentate; upper stem leaves sessile with an auricled base, lobed with triangular or triangular lanceolate lobes, acute: cyme corymbose and rather dense: heads about 8 mm. high: bracts about 15, oblong, acute, with a broad membranous margin; the calyculate ones few, lanceolate: achene striate, glabrous: rays 4–5 mm. long and 2 mm. wide, dark orange.

Closely related to the preceding, but differing in the short basal leaves and the lobed upper stem leaves and also in the fewer and broader bracts. It grows at an altitude of about 2700 m. [Plate 6, f. 13.]

WYOMING: Grand Creek, Teton Forest Reserve, 1897, *F. Tweedy*, *584* (type in the herbarium of N. Y. Botanical Garden).

11. SENECIO CROCATUS Rydb. Bull. Torr. Club, **24**: 299. 1897

Senecio aureus var. *croceus* A. Gray, Proc. Acad. Nat. Sci. Phila. **1863**: 68, 1863; not *S. croceus* DC. 1837.

When the above name was published I did not know that this variety of Gray's was a complex one. Hall & Harbour's no. *332*, which is the type, consists of two different things; but as one of them is rayless it can not be taken as the type of the var. *crocatus*, which was named from its orange rays. That I did not draw a new diagnosis, I admit, was perhaps careless, but this blunder I think was not worth a page and a half of discussion as it was given by Professor Greene in Pittonia, **4**: 114–116. I committed just the same mistake as Professor Greene himself in establishing *Antennaria media* Greene, Pittonia, **3**: 286. What Professor Greene says of Mr. E. Nelson in Pittonia, **4**: 85 can be applied to himself. Gray's description of the var. *croceus* in the Proceedings of the Philadelphia Academy is perhaps not adequate, but this description is supplemented in the Synoptical Flora and elsewhere and I think that *Senecio aureus* var. *croceus* Gray is amply published according to all rules we have. If so, *Senecio croceus* Rydberg is not a nomen nudum, whatever Professor Greene may say. Professor Greene in 1897 or 1898 accepted my name, for he named Baker, Earle &

Tracy, no. 625, *S. crocatus* Rydberg. This mistake is just as unpardonable because that plant shows none of the characters, assigned to *S. aureus* var. *croceus* Gray, except the color of the rays, and this character Professor Greene, agrees with me in regarding as of little value. That Professor Greene and other botanists may know what I now mean by *S. crocatus* I shall give a diagnosis, here following Professors Greene's example in the case of *Antennaria media.*

A glabrous perennial with a short erect rootstock : stem 1.5–3 dm. high : basal leaves 2–3 cm. long, obovate or spatulate, crenate or subentire with a winged petiole : lower stem leaves similar but with broader, winged petioles which are somewhat auricled at the base, or else oblong without distinction between blade and petiole and then more auricled : upper stem leaves ovate or triangular with very large and large-toothed auricles : cyme small and compact with 2–5 mm. heads, which are 8–10 mm. high : bracts about 20, linear : rays 7–8 mm. long and 1.5–2 mm. wide, orange to pale yellow, achenes striate, glabrous. [Plate 5, f. 13.]

COLORADO : Middle Park, 1862, *Hall & Harbour, 332,* in part (type) ; *329,* in small part ; 1868, *Geo. Vasey* (Powell's Expedition), *340 B ;* South Cottonwood Gulch, 1892, *C. S. Sheldon ;* Gray's Peak, 1872, *John Torrey ;* (?) Little Kate Mine, 1898, *Baker, Earle & Tracy, 569 ;** South Park, 1871, *Canby ;* Long's Peak, 1886, *Letterman* (depauperate).

WYOMING : La Plata Mines, 1895, *Aven Nelson, 1769.* = S. dimorphophyllus

SENECIO DIMORPHOPHYLLUS Greene, Pittonia, 4 : 109. 1900

I have not seen any specimens of this species, and have not been able to include it in the key. It is described as being a foot (about 3 dm.) high, light green and with long golden-yellow rays. Otherwise the description reads much like that given above for *S. crocatus.* The type was collected about Pagosa Peak, Colo., in 1899, by C. F. Baker.

12. SENECIO CYMBALARIOIDES Nutt. Trans. Am. Phil. Soc. II., 7 : 412. 1841

Senecio aureus borealis Torr. & Gray, Fl. 2 : 442. 1843 ; *S. aureus obovatus* Eat. King's Exp. 5 : 190, in part. 1871.

* These specimens were named *Senecio heterodoxus* Greene n. sp., but I can not find any published description. They differ from the rest in being cespitose, with less marked differentiation in the leaves and with traces of floccose pubescence at the bases of the leaves and heads. The species may be distinct.

This has sometimes orange rays and has then been confused with *S. crocatus*, but it lacks the winged petioles of the lower leaves and the large auricles of the upper. It often reaches a height of 3 dm. and then many of the stem leaves are also spatulate. Such a form with more permanent woolliness is Watson's no. 669; otherwise I cannot distinguish it from *S. cymbalariodes*. [Plate 5, f. 1.]

BRITISH AMERICA: Mackenzie River, 1861–2, *I. S. Onion.*

MONTANA: Park Co., 1887, *Tweedy, 343*, in part; Silver Bow Co., *Mrs. Moore;* Jack Creek, 1897, *Rydberg & Bessey, 5266.*

WYOMING: Beaver Cañon, 1895, *Rydberg;* Bacon Creek, 1894, *Aven Nelson, 906.*

IDAHO: Mt. Chauvet, 1897, *Rydberg & Bessey, 5267.*

UTAH: Wasatch Mts., 1869, *S. Watson, 669.*

WASHINGTON: Mt. Paddo, 1882, *W. N. Suksdorf;* Columbia, *Nuttall* (type).

13. **Senecio Jonesii** sp. nov.

A glabrous perennial: stem about 3 dm. high, slender, terete: basal leaves rounded-obovate, sinuately toothed, sometimes with a pair of small lobes at the base; their petioles often tinged with red: stem leaves oblanceolate in outline, pinnatifid with oblong segments, generally short-petioled: cyme corymbiform: heads about 8 mm. long: bracts 12–15, lanceolate, acuminate, about ⅔ as long as the disk, membranous margined; calyculate ones few, linear: rays about 5 mm. long and 2 mm. wide, 4-nerved: achenes very strongly striate, glabrous.

Nearly related to the preceding, but differing in the toothing of the leaves and the form of the bracts. The type was collected at an altitude of 3300 m. [Plate 6, f. 5.]

UTAH: Alta, Wasatch Mountains, 1879, *M. E. Jones, 1125* (type in the Columbia Herbarium).

14. **Senecio subcuneatus** sp. nov. Co-type in NYBG

Perennial with a branched caudex, slightly floccose when young, glabrate in age: stems 3–4 dm. high: basal leaves about 5 cm. long, spatulate or cuneate, dentate or serrate above the middle, entire at the base and tapering into a short petiole, rather thick: lower stemleaves narrowly cuneate, short-petioled, dentate at the apex: upper ones linear and sessile, often sharply dentate: cyme corymbiform: heads about 8 mm. high: bracts about 15,

> S. cymbalarioides

lanceolate, acute, shorter than the disk: rays 4–5 mm. long and 1.5 wide, 4-nerved: achenes striate, glabrous.

This species is nearest related to *S. cymbalarioides* but is taller, with narrower basal leaves, which have sharper teeth; the heads are also much more numerous. It grows at an altitude of 2000–2500 m. Baker, Earle and Tracy's specimens were labeled by Prof. Greene *Senecio Fendleri*, approaching *S. compactus*. This is strange from one that claims that he has known *S. Fendleri* since 1870.* This plant has little in common with that species or with *S. Nelsonii* Rydb. [Plate 5, f. 6.]

COLORADO: Grizzly Creek, 1896, *C. F. Baker* (type in the herbarium of N. Y. Botanical Garden); Lake City, 1878, *H. W. Pease* (depauperate); Mancos, 1898, *Baker, Earle & Tracy, 63*.

15. **Senecio acutidens** sp. nov.

Perennial, with a thick woody rootstock and short caudex, in age glabrate or slightly floccose at the base of the leaves: stems several, about 2 dm. high, angled, more or less tinged with red: basal leaves about 5 cm. long, thick, fleshy and somewhat glaucous, obovate or spatulate: sharply dentate above the middle, at the base entire and abruptly contracted into a slender petiole: lower stem leaves similar or oblanceolate and acute; the upper reduced, linear, laciniate-dentate or somewhat pinnatifid: cymes corymbiform and rather dense: heads 8–10 mm. high: bracts broadly linear, acute, ⅔ or ¾ as long as the disk: rays about 5 mm. long and 1.5 mm. wide, 3–4-nerved: achenes slightly angled, glabrous.

Nearest related to *S. cymbalarioides* but the leaves are thicker, more glaucous and very acutely dentate. The perennial rootstock and caudex are also thicker and more woody. [Plate 5, f. 2.]

WYOMING: Union Pass, 1894, *Aven Nelson, 858* (type in the herbarium of N. Y. Botanical Garden).

16. SENECIO PSEUDAUREUS Rydberg, Bull. Torr. Club, **24**: 298. 1897

This is nearest related to the eastern *S. aureus* and has the same subcordate, thin, basal leaves, but these are distinctly serrate, instead of crenate. It is the most common species of the group in the Rockies, growing in wet meadows at an altitude of 1000–3000 m. [Plate 5, f. 10.]

* See Pittonia, **4**: 112.

MONTANA: Little Belt Mountains, 1896, *Flodman, 918* (type); Madison Co., *Mrs. McNulty*; Bear Gulch, 1887, *F. Tweedy, 340*; Columbia Falls, *Mrs. Kennedy, 9*; Spanish Basin, 1897, *Rydberg & Bessey, 5263*; Indian Creek, *5264*.

WYOMING: Lone Star Geyser Basin, Yellowstone Park, 1897, *Rydberg & Bessey, 5262*.

COLORADO: Grizzley Creek, 1896, *C. F. Baker*; Long's Peak, 1886, *G. W. Letterman*; Mancos, 1898, *Baker, Earle & Tracy, 45*.

NEW MEXICO: Pecos River, 8 miles east of Glorietta, 1897, *A. A. & E. Gertrude Heller, 3682*.

UTAH: E. Humbolt Mts., 1868, *S. Watson, 667*.

17. **Senecio platylobus** sp. nov.

S. aureus var. *croceus* D. C. Eaton, King's Exp. **5**: 190, in part. 1871; not Gray. 1863.

A stout, perfectly glabrous perennial: stem about 4 dm. high, rather leafy, striate and somewhat angled: basal leaves 6–10 cm. long, slender-petioled, obovate or broadly oval, sinuately crenate-dentate, thin: lower stem leaves oblanceolate, petioled, deeply lobed or divided with rounded lobes: upper stem leaves broadly ovate in outline, sessile, pinnately divided into broadly oblong or cuneate divisions which are more or less deeply sinuate-dentate: cyme compound; its branches corymbiform: heads about 8 mm. high; bracts broadly lanceolate, acute, membranous margined and slightly shorter than the disk: rays 6–7 mm. long, and 3 mm. wide, 5-nerved: achenes striate, glabrous.

Probably nearest related to the preceding, but easily distinguished by the form of the leaves and the broad rays. It grows at an altitude of about 1500 m. [Plate 6, f. 8.]

UTAH: Wasatch Mountains, 1869, *S. Watson, 671* (type in the Torrey Herbarium).

18. **Senecio flavovirens** sp. nov.

S. Balsamitae Rydberg, Mem. N. Y. Bot. Gard., **1**: 446, mainly; 1900; not Muhl. 1804.

Light or yellowish green, slender, perennial, in age glabrate or slightly floccose at the base of the leaves: stem 3–4 dm. high, striate, pale: basal leaves 3–8 cm. long, obovate or broadly oval, generally tapering into the petioles, but sometimes truncate at the bases, obtuse, crenate or sinuate, light green: lower stem leaves oblanceolate in outline and petioled; the upper lanceolate or linear in outline and sessile; all deeply pinnatifid with narrow, oblong or linear segments: cymes contracted, corymbiform: heads 7–8 mm. high; bracts linear, acute, yellowish-green, and occasionally with brownish tips, a little shorter than the disk; calyculate ones few, linear, small and crisp: rays pale yellow, about 6 mm. long and 1.5 mm. wide, 4-nerved, or very often lacking: achenes hispid-puberulent on the angles.

Nearest related to the eastern *S. Balsamitae*, but characterized by its yellowish green color and a more contracted cyme. It grows at an altitude of 2000–3000 m. [Plate 5, f. 4.]

IDAHO: Beaver Cañon, 1895, *Rydberg* (type in the herbarium of N. Y. Botanical Garden).

MONTANA: Deer Lodge, 1895, *Rydberg*, *2850* (rayless); Helena, 1887, *F. D. Kelsey*, *501*.

WYOMING: Buffalo Fork, 1897, *Tweedy*, *586*; Laramie Plains, 1889, *E. L. Greene* (rayless); Green River, 1894, *Aven Nelson*, *1036* (rayless).

= S. debilis Nutt.

19. Senecio aurellus sp. nov.

Perennial with a short rootstock, somewhat floccose when young, soon glabrate: stem striate, 4–5 dm. high: basal leaves spatulate or cuneate, dentate-serrate, about 5 cm. long, with a short petiole, soon glabrous: lower stem leaves long-petioled, cuneate or spatulate, lyrately lobed, the upper narrowly oblanceolate and subsessile, slightly auricled at the base: cyme compound but with rather few heads, which are about 8 mm. high: bracts 12–16, glabrous, yellowish-green, lanceolate, thin; calyculate ones minute, lanceolate: rays golden-yellow, 5–6 mm. long and 2 mm. wide, 4-nerved: achenes scabrous hispidulous on the angles.

In the form of the stem leaves this most resembles, perhaps, *S. rosulatus*, but these are thinner and perfectly green, only slightly floccose when young. Otherwise it is intermediate between the eastern *S. Balsamitae* and *S. multilobatus*. The type was determined by Professor Greene as "*S. pseudaureus* Rydb., not typical." To that species it does not have any close relationship. [Plate 6, f. 12, 12a.]

COLORADO: Mancos, 1898, *Baker*, *Earle & Tracy*, *998* (type in the herbarium of New York Botanical Garden).

Mo. Bot. Gard. Herb.

20. SENECIO NEPHROPHYLLUS Rydberg, Mem. N. Y. Bot. Garden, 1: 446. 1900 = S. debilis Nutt.

Related to the two preceding, but characterized by the rayless heads, the reniform first basal leaves which resemble those of *Oxyria digyna*, and the pinnatifid stem leaves with their oblong blunt segments. The Colorado specimens are much lower than the type, being about 2 dm. high. [Plate 6, f. 15.]

MONTANA: Big Blackfoot River, 1883, *Canby, 203*.

COLORADO: South Park, 1872, *T. C. Porter;* Middle Park, *Hall & Harbour, 332*, in part.

21. **Senecio Idahoensis** sp. nov.

Stout perennial, in age glabrate or slightly floccose at the base of the leaves: stem 4–5 dm. high, branched, striate, tinged with purplish: basal leaves obovate, serrate: lower stem leaves oblanceolate in outline, about 1 dm. long, petioled; the upper ovate or lanceolate in outline, sessile and auricled at the base; all bluish-green, pinnately divided into oblong or oblique-cuneate incised segments: heads numerous, about 1 cm. high; bracts about 25, very narrowly linear, equaling the disk: rays none: achenes striate, glabrous.

A species somewhat related to *S. aureus*, but characterized by its broad and laciniate leaves, rayless heads and numerous very narrow bracts. [Plate 6, f. 5.]

IDAHO: Granite Station, 1892, *Sandberg, McDougal & Heller, 803* (type in the N. Y. Botanical Garden herbarium).

22. SENECIO PAUCIFLORUS Pursh, Fl. Am. Sept. 529. 1814

This species, characterized by its few (2–6) rayless heads, linear purple tinged bracts, equaling the disk in length, and its small rounded-oval crenate basal leaves, has been collected several times in Labrador; but exactly similar specimens are in the Torrey herbarium and were collected by Burke in the Rocky Mountains, but the locality is not given. [Plate 5, f. 3.]

23. **Senecio fedifolius** sp. nov. S. debilis Nutt.

A delicate glabrous perennial with a very short caudex and a clump of fibrous roots: stem slender, weak, about 1.5 dm high: basal leaves 3–5 cm. long with a slender petiole; blade 1–2 cm. long, rounded-ovate or broadly oval, wavy or subentire: stem leaves mostly small, pinnately divided into short oblong segments: heads 2–3, about 6 mm. high, somewhat turbinate; bracts 12–15, broadly lanceolate, conspicuously membraneous margined: rays none: achene glabrous.

The species is named from the resemblance the basal leaves have to those of certain species of *Valerianella* which genus has also been known under the name *Fedia*. [Plate 5, f. 7.]

COLORADO: South Park, 1871, *W. M. Canby* (type in the herbarium of the College of Pharmacy, New York).

SUBNUDI

A slender perennial with a long slender horizontal rootstock, perfectly glabrous, sparingly leafy, monocephalous: basal leaves broadly obovate, coarsely crenate-dentate: heads decidedly turbinate with narrow linear-acuminate bracts; calyculate bracts, if present, few, and half as long as the main series. A single species.

24. SENECIO SUBNUDUS DC. Prod., **7**: 428. 1837

Senecio aureus var. *subnudus* Gray, Syn. Fl. **1**^{2}: 391. 1884.

This species has been included as a variety of *S. aureus*, but I think it should be regarded as the type of a distinct group. The long slender horizontal rootstock and the decidedly turbinate involucre is not found in any of the *aureus* allies. The latter characters would place it near *S. frigidus*. [Plate 6, f. 2.]

WASHINGTON: Chiquash Mountains, 1892, *Suksdorf, 2167;* Cascade Mountains, 1882, *Brandegee, 118.*

OREGON: 1882, *T. Howell;* 1871, *Elihu Hall, 304.*

CALIFORNIA: Butterfly Valley, 1874, *Mrs. R. M. Austin.*

MONTANA: Park Co., 1887, *Tweedy, 344;* Pony, 1897, *Rydberg & Bessey, 5270.*

WYOMING: Wind River, 1842, *Fremont;* Buffalo Fork, 1897, *Tweedy, 587;* Yellowstone Park, 1884, *Tweedy, 120.*

TOMENTOSI

Perennials, over 2 dm. high, with a short caudex or rootstock, which often is subligneous and cespitose, floccose when young, becoming more glabrate in age, but with some wool always remaining: basal leaves, except the very first ones, from serrate or dentate to pinnatifid: stem leaves always present, but often reduced, generally pinnatifid or pinnately lobed or toothed: heads cymose, small, with few and very small calyculate bracts.

The group is closely related to the AUREI and LOBATI with which it is connected through *S. Plattensis* and *S. Fendleri* respectively. *S. Nelsonii* and *S. multilobus* in young state may also be sought here.

Basal leaves mostly dentate or crenate.
  Basal leaves suborbicular, ovate or cordate; margins of the petioles arachnoid-tomentose. 25. *S. flavulus.*
  Basal leaves obovate or spatulate.
    Lower stem leaves acute; plant dark green. 26. *S. Plattensis.*
    Lower stem leaves obtuse; plant yellowish-green. 27. *S. Neo-Mexicanus.*
  Basal leaves lanceolate or oblanceolate.
    Basal leaves narrowly oblanceolate, serrate. 28. *S. salicinus.*
    Basal leaves lanceolate, sinuate-dentate. 29. *S. canovirens.*
Some of the basal leaves entire or dentate, the rest pinnatifid or pinnately lobed.
  Plant conspicuously rosulate-stoloniferous; stem leaves sinuately round-lobed. 30. *S. rosulatus.*
  Plant not stoloniferous; stem leaves pinnatifid with toothed lobes. 26. *S. Plattensis.*
All leaves pinnatifid with toothed segments.
  Caudex subligneous; plant tomentose; bracts shorter than the disk. 31. *S. Fendleri.*
  Caudex not subligneous; plant glabrate.
    Bracts almost equaling the disk. 5. *S. Nelsonii.*
    Bracts much shorter than the disk. 4. *S. multilobus.*

25. SENECIO FLAVULUS Greene, Pittonia, **4**: 108. 1900

I have seen no specimens of this species, but from the description it must be most nearly related to the next, differing in the more slender habit, the small leaves and their form and the peculiar arachnoid tomentum on the margins of the petioles. The type was collected by C. F. Baker at Aboles, Colo., in 1899.

26. SENECIO PLATTENSIS Nutt. Trans. Am. Phil. Soc. II. **7**: 413. 1841

This species is exceedingly variable as to the leaf form as well as to the pubescence; usually the basal leaves are merely serrate and obovate or oval in outline, but sometimes some of them are like the lower stem leaves, more or less lyrately pinnatifid. It is conspicuously floccose when young, but in age the leaves become almost glabrous and the wool remaining only on the lower part of the stem and petioles. The species belongs to the region of the plains. [Plate 6, f. 14.]

SOUTH DAKOTA: Brookings, 1897, *L. W. Carter;* Hot Springs, 1892, *P. A. Rydberg, 828.*

COLORADO: Fort Collins, 1895, *C. S. Crandall.*

INDIAN TERRITORY: Sapulpa, 1895, *B. F. Bush, 1249;* False Washita, 1868, *Edw. Palmer, 461.*

KANSAS: Riley Co., 1895, *J. B. Norton, 303;* Manhattan, 1887, *W. A. Kellerman;* Osborn Co., 1894, *C. L. Shear, 28;* Fort Riley, 1892, *E. E. Sayle, 452.*

NEBRASKA: Lincoln, 1887, *H. J. Webber;* Fort Niobrara, 1888, *T. E. Wilcox; Mrs. Austin;* Creete, *G. D. Sweezey.*

MISSOURI: St. Louis, 1843, *Riehl;* McDonald Co., 1891, *B. F. Bush.*

ILLINOIS: Oquawka, 1873, *H. N. Patterson.*

27. SENECIO NEO-MEXICANUS A. Gray, Syn. Fl. **1**²: 392. 1884

The original publication of this species is generally given as Proc. Amer. Acad. **19**: 55, but no description is there to be found. As far as I can find, the one in the Synoptical Flora is the first published. Probably more than one species is included in that description and in the specimens cited below there are apparently three different types, but it has been impossible for me to find any constant characters by which to distinguish them. In one of them the stem leaves are more or less lyrate-pinnatifid and even the basal ones occasionally have a few lobes on the petiole, while in the others the stem leaves are narrow and merely toothed. The tomentum is sometimes deciduous, sometimes almost persistent. It grows at an altitude of 1200–2500 m. [Plate 6, fig. 7.]

NEW MEXICO: Silver City, Pinos Altos Mts., 1880, *E. L. Greene;* between Santa Fe and Canoncito, 1897, *A. A. & E. Gertrude Heller, 3749;* Organ Mts., 1895, *E. O. Wooton; P. V. LeRoy.*

ARIZONA: Fort Huachuca, 1892, *T. E. Wilcox;* 1876, *E. Palmer, 614;* Santa Catalina Mts, 1883, *C. G. Pringle;* San Francisco Mts., 1881, *H. H. Rusby, 212;* Mogollon Mts., 1887, *E. A. Mearns, 58;* Squaw Creek, 1887, *E. A. Mearns, 171;* Santa Rita Mts., 1881, *C. G. Pringle.*

28. **Senecio salicinus** sp. nov. = S. Fendleri Gray

A floccose perennial, with a short cespitose caudex: stems several, about 4 dm. high, simple below, striate and floccose: basal leaves 5–10 cm. long, narrowly oblanceolate, the first ones subentire, but most of them serrate except at the tapering base, finely tomentose on both sides, but in age more glabrate above: stem leaves small, linear, sessile, dentate, slightly auricled at the base: cyme compound: the heads subumbellate at the ends of the branches, 7–8 mm. high, slightly floccose at the base: bracts yellowish, thin, lanceolate, shorter than the disk: rays light yellow, short and broad, 3–4 mm. long and 2 mm. wide: achenes striate, glabrous.

A species related to *S. Fendleri*, but characterized by the narrow, merely serrate basal leaves, the small subumbellate heads in a short, flat-topped inflorescence with widely spreading ultimate branches. It grows in the foothills at an altitude of about 1800 m. [Plate 6, f. 6.]

COLORADO: J. Laramie Co., 1895, *J. H. Cowen* (type in the herbarium of N. Y. Botanical Garden).

29. **Senecio canovirens** sp. nov.

Stout perennial with a short erect rootstock, dark green, floccose with more or less deciduous wool: stem 4–5 dm. high, loosely floccose: basal leaves 5–12 cm. long, short-petioled; blades lanceolate or oblanceolate, sinuately toothed, dark green, firmly floccose, in age almost glabrate above: lower stem leaves similar; upper ones linear, sinuately dentate with rather acute teeth: cyme with erect or ascending branches: heads 7–8 mm. high, turbinate campanulate; bracts 12–14, oblong, linear, floccose at the base and more or less villose, acute, brownish on the back and with yellowish margins: rays 5–6 mm. long and 2 mm. wide, at first orange, in age paler, 4–nerved: achenes glabrous, striate.

The type was determined by Prof. Greene as *Senecio Fendleri*, but it is very unlike the typical form of the aggregate that has been known under that name. The dark green color, the leaves which are merely toothed, never pinnatifid and still less bipinnatifid as they often are in *S. Fendleri* easily distinguish it from that species. The perennial caudex and rootstock are similar to that of *S. Fendleri* but less thick and less woody and, as far as seen from the specimens, not branched. It grows at an altitude of about 2000 m. [Plate 6, f. 9.]

NEW MEXICO: White Mountains, 1897, *E. O. Wooton, 244* (type in the herbarium of N. Y. Botanical Garden); Organ Mountains, *493*.

COLORADO: Pike's Peak, 1895, *Mrs. S. L. Clarke.*

SENECIO MUTABILIS Greene, Pittonia, 4: 113. 1900

As I have seen no specimens of this species I have not been able to include it in my key. It may be the same as the preceding, but several characters given in the description do not agree with it, especially the deeply tridentate rays. Professor Greene is always criticizing other botanists for drawing vague descriptions. No better example of just such a description can be given than the one here made by himself.

30. **Senecio rosulatus** sp. nov. = S. Fendleri Gray

Senecio aureus var. *Balsamitae* A. Gray, Proc. Acad. Nat. Sci. Phila. **1863**: 68, in part.

More or less tomentose perennial, with a branched rootstock and generally numerous underground stolons producing leafy offsets: stems 2–3 dm. high, floccose or sometimes becoming almost glabrate in age; first leaves of the offsets spatulate and entire; other basal leaves and lower stem leaves oblanceolate, finely white tomentose especially on the lower surface, occasionally becoming more glabrate in age, sinuately pinnatifid with rounded lobes, petioled: upper stem leaves lanceolate or linear, sessile, auricled at the base also with rounded lobes: cyme corymbiform, open: heads small, 5–6 mm. high, floccose at the base: bracts about 12, broadly lanceolate, acute, yellowish with rather broad membranous margins, much shorter than the disk: rays about 5 mm. long and 2 mm. wide, 4–5-nerved: achenes strongly striate, glabrous.

The species has been confused with *S. Fendleri*, but is distinguished by the more slender rootstock and the numerous branches forming offsets, the entire first leaves not seen in that species and the short rounded entire lobes of the stem leaves. The heads are usually also smaller. It grows at an altitude of 2500–4000 m. [Plate 6, f. 4, 4a.]

COLORADO: Georgetown, 1885, *N. H. Patterson 79* (type); Golden City, 1892, *E. L. Greene;* 1862, *Hall & Harbour, 333*, in part; 1871, *W. M. Canby;* Twin Lakes, 1873, *J. M. Coulter;* Pike's Peak, 1884, *G. W. Letterman, 260;* Caribou, 1891, *E. Penard, 228;* Fort Collins, 1896, *C. F. Baker;* Silver Plume, Gray's Peak, and Georgetown, 1895, *P. A. Rydberg.*

31. SENECIO FENDLERI Gray, Mem. Am. Acad. II, 4: 108. 1849

The typical *S. Fendleri* is a rather rare plant with a decidedly woody rootstock and caudex. None of the specimens seen show any sign of entire leaves nor of subterranean stolons. The leaves are often bipinnatifid or pinnatifid with oblong toothed, and acutish segments. See also the remarks given under *S. Nelsonii.* [Plate 6, f. 3.]

NEW MEXICO: Santa Fe Cañon, 1897, *A. A. & E. Gertrude Heller, 3774.*

COLORADO: 1873, *Brandegee, 546.*

UTAH: Salt Lake City, 1869, *S. Watson.*

Explanation of Plates

Unless otherwise stated, the drawings represent basal leaf, stem leaf selected a little above the middle of the stem and the head of each species. The leaves are reduced to one half and the heads are of natural size.

PLATE 5

1. *S. cymbalarioides* Nutt.
2. *S. acutidens* Rydb.
3. *S. pauciflorus* Pursh.
4. *S. flavovirens* Rydb.
5. *S. Jonesii* Rydb.
6. *S. subcuneatus* Rydb.
7. *S. fedifolius* Rydb.
8. *S. Greggii* Rydb.
9. *S. oblanceolatus* Rydb.
10. *S. pseudaureus* Rydb.
11. *S. millelobatus* Rydb.
12. *S. tridenticulatus* Rydb.
13. *S. crocatus* Rydb.
14. *S. sanguisoiboides* Rydb.
15. *S. compactus* (A. Gray) Rydb.

PLATE 6

1. *S. Nelsonii* Rydb.
2. *S. subnudus* DC.
3. *S. Fendleri* A. Gray.
4. *S. rosulatus* Rydb.

4*a*. An offset of the same.

5. *S. Idahoensis* Rydb.
6. *S. salicinus* Rydb.
7. *S. Neo-Mexicanus* A. Gray.
8. *S. platylobus* Rydb.
9. *S. canovirens* Rydb.
10. *S. longipetiolatus* Rydb. (from type).

10*a*. Basal leaf from *Baker, Earle & Tracy, 625.*

11. *S. multilobatus* Torr. & Gray.
12. *S. aurellus* Rydb.

12*a*. Lower stem leaf of the same.

13. *S. fulgens* Rydb.
14. *S. Plattensis* Nutt.
15. *S. nephrophyllus* Rydb.

A peculiar Case of contact Irritability

By F. Grace Smith

In connection with some experiments upon factors determining the radiation of shoots, several pots of bush-beans were grown in the dark. When the seedlings, perfectly etiolated, were about 20 inches high and had developed their first leaves, a peculiar adjustment was noticed in them. The petioles had arranged themselves in parallel planes. Another set of beans was planted in 6-inch pots, one pot kept in a black box, the control experiment in a propagating room of the greenhouse, which was lighted mostly from overhead but partly from the north. Each pot contained ten beans in sphagnum moss, planted in a circle, 2 cm. apart with the hypoctyl of each turned toward the center of the pot. The box, in which the experiment was carried on, was absolutely dark, except when the plants were watered and observed, a few minutes each day. In three weeks this parallel adjustment was seen in the pot kept in the dark (Fig. 1). There was but one exception in the eight seeds which germinated. No such adjustment could be seen in seedlings grown in light, or in succeeding experiments in the light.

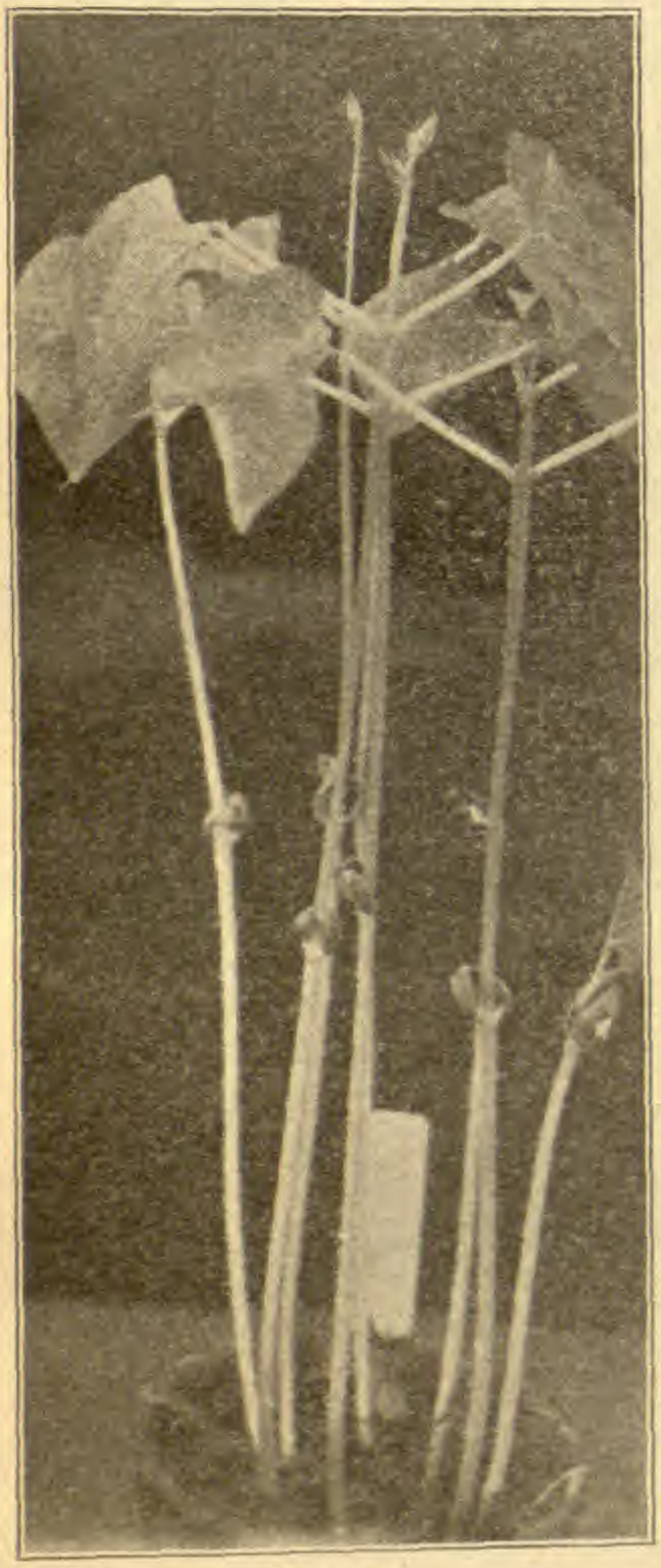


Fig. 1.

To determine if this position was constant, other pots were planted in the same way, using eight seeds to a pot in most cases. Not every pot showed so large a proportion of petioles, in parallel planes but in almost every case more than three, usually four or five, were in the same plane, whereas normally but two should be. In one pot all seven which germinated were in the same plane; in other cases five or six out of seven. Some in each pot had the epicotyl twisted, showing the adjustment was not the result of the position in which the seeds were planted. To investigate this more conclusively, sets of beans were planted in different ways.

(1) In a circle but with hypocotyl of each of the eight beans pointing in the same direction (Fig. 2). Of the six which had germinated on January 27th and unfolded their first leaves all were in the same plane (Fig. 3). January 30th, eight were large enough to be diagrammed; four were in the same plane, four others were in a plane at about an angle of 15° from this (Fig. 4).

(2) Twelve beans were planted in a cross, but with the hypocotyl of each turned in the same direction (Fig. 5). The resultant position is shown in Fig. 6. A 12-inch pot was used in this case.

(3) Nine beans were planted in a straight line, but with the hypocotyls turned in the same direction and toward each other (Fig. 7). The result is shown in Fig. 8. If a very large pot was used where no two seedlings could touch, there was no such adjustment (Fig. 9).

Other pots were planted with hypocotyl directed up or down, out or in, also with seeds on flatter surface and hypocotyls turned in different ways. There was no difference in the resultant positions. The position of planting, therefore, does not determine the adjustment, for good cases of parallelism in the petioles were found, whatever the original positions of the seeds. Therefore, the resultant plane is not brought about by internal causes, but is a response to external stimuli.

To test varying thermotropism and hydrotropism in the box, pots of beans were placed in different parts of the box. They continued to set their leaves in planes, bearing no constant relation to the sides of the box. Two pots also were placed in another case made of glass and darkened; one pot put on a clinostat revolving once in fifteen minutes, the other kept stationary. Of the eight beans which germinated on the clinostat six were in the same plane, although the leaves of one were not quite unfolded; one was not free from the cotyledons and one was at right angles.

The influence of the two stimuli, thermotropism and hydrotropism, must therefore be excepted.

Two pots were put into the same box with an electric fan keeping the air constantly in motion. The pot on the clinostat showed parallel adjustment very well (Fig. 10), also the stationary one (Fig. 11). The stillness of the air, therefore, makes no difference.

Chemotropism and hydrotropism, exerted by the leaves of neighboring seedlings, might furnish a stimulus but were not experimented with, because the stimulus to be described seemed sufficient to account for the phenomenon.

Of the mechanical forces, acting as irritable stimuli, pressure, strain and injury were not present, but certain observations made contact seem a possible factor and experiments were devised to test this.

Sets of beans were carefully matched and their positions plotted every other day. The plane of petioles and leaves was constantly changing but the final position was in a number of cases the position of the bean which first started from the cotyledon or at least the resultant position was the same for leaves which had been in contact. There was no chance for any contact in beans planted in 12-inch pots and the final positions showed no parallel adjustment.

Beans which were fully grown were placed so that the tip of the leaf of one seedling touched the leaf of another seedling. The diagrams 12, 13, 14 and 15 show the change of position.

The tendency as here shown is to take a parallel position. The movement is best seen when seedlings are not quite full grown. If contact can then change the position of the leaves, it must be possible to change the position at will. Paper leaves were fastened to standards and allowed to just barely touch the leaves of a seedling (Fig. 16, *a*). An angle of 25° was reached in all cases (Fig. 16, *b*). (Beans, kept in absolute darkness and watered by an outside tube did not unfold the plumule, but showed a movement of a quarter of an inch from the paper leaves.) Circumnutation alone, of course, could not bring about this definite fixed position.

Contact seems to work when light is present but is generally marked by the more noticeable light adjustment. One pot of beans, planted in a circle, was kept revolving upon a clinostat in light. Fig. 17 shows the final position. The parallel adjustment was not so plain at first, but became more definitely marked with the growth of the seedlings.

One seedling of this set was kept, when the others were destroyed and was irritated by two leaves of thin mica, fastened to a stick placed in the pot. The whole thing was then revolved upon a clinostat. By this means the direct influence of heliotropism was neutralized and all shading from leaves was prevented. With each of three trials the seedling cotyledons moved one half inch from the artificial leaves.

Under ordinary circumstances of growth the plants experimented upon try to expose as much surface to the light as possible for photosynthesis. Heliotropism is the stimulus for this exposure, but, when light is withdrawn or, perhaps, during the night, when growth is active, the plants must make use of some other stimulus to determine other positions. Contact is always present and is apparently the stimulus used by the plants. It is probable that this influence is a secondary one, acting in light as well as in darkness. The cases where currents of air were allowed to act upon the plants showed good adjustment, for by means of them the number of contacts of the leaves was increased.

Description of Figures

FIG. 1. Photograph showing parallel adjustment of petioles in bean seedlings grown in the dark.

FIGS. 2, 3, 4. Diagrams of positions of seeds as planted in Exp. I. and the resultant positions of petioles.

FIGS. 5, 6. Diagrams illustrating planting of seeds in Exp. II. and resultant positions of petioles.

FIGS. 7, 8. Diagrams illustrating 1st part of Exp. III.

FIG. 9. Diagram illustrating 2d part of Exp. III.

FIG. 10. Diagram of resultant positions of petioles in seedlings, grown in dark upon clinostat, acted upon by currents of air.

FIG. 11. Diagram of seedlings, grown in the dark and kept stationary, acted upon by currents of air.

FIGS. 12, 13, 14, 15. Diagrams of 4 examples of seedlings, whose leaves were placed in contact and the resultant changes in their positions.

FIG. 16. Diagram of seedlings, whose leaves were irritated by paper leaves and the consequent changes in their positions.

FIG. 17. Diagram of resultant position of petioles in seedlings, grown in light upon clinostat.


Fig. 2.
Fig. 3.
Fig. 4.
Fig. 10.
Fig. 5.
Fig. 6.
Fig. 9.
Fig. 7.
Fig. 8
Fig. 11
Fig. 17.
Fig. 12. a.
b.
Fig. 13. a.
b.
Fig. 14. a.
b.
Fig. 15. a.
b.
Fig. 16. a.
b.

What is Prunus insititia?

By P. A. Rydberg

In the February number of the *Botanical Gazette* Prof. Waugh says: "I am somewhat at a loss to understand the criticism which Dr. Rydberg offers in the December *Gazette* upon my conclusions regarding *Prunus insititia* Linn. as set forth in the *Gazette* of last June. He says: 'If Professor Waugh had said that *P. insititia* is the same as *P. domestica damascena* * * * I would have been the last to criticise.' This is precisely what I did say; and it is a conclusion upon which I still insist."

Prof. Waugh intentionally or unintentionally has omitted to cite the reasons that I gave for my statement. I added in my article in the December *Gazette*: "I have not the means to disprove the former." With the facilities that are afforded me by the combined libraries of Columbia University and the New York Botanical Garden and one of the largest herbaria found in America, I find myself unable to undertake the task, for it would require fieldwork done in Europe and access to all the literature on the subject. Prof. Waugh dared with much less facilities than I have to decide, as he says himself, 'that there is no such species as *P. insititia*,' notwithstanding the fact that nearly all European botanists hold a different opinion. The existence or non-existence of *P. insititia* as a species, and whether *P. insititia* and *P. domestica damascena* are the same or not, are questions that should be left to European botanists, who are much more able to settle these questions. I think that it is pretentious for an American to undertake such a work. American botanists have puzzles enough of their own to solve, so that they had better allow the Europeans to take care of their own flora. This is in plain words my criticism.

By leaving out initials, I have had the misfortune to be misinterpreted. When I said: "Koch, the acknowledged authority in Germany, recognized it," I meant, of course, William Daniel Joseph Koch, the great botanist, and not Karl Koch, the dendrologist. While the latter, perhaps, is better known in America on account of our lack of good general dendrologies, he has never had the reputation of the older Koch and never can claim in the same sense the title, "the acknowledged authority." Professor Waugh's remark on Karl Koch having changed his opinion has therefore no bearing on my statement.

When I spoke of the non-existence of *P. insititia* in America I meant, of course, in the wild state. The existence of a plant in an orchard, garden, greenhouse or in a pot on the window-sill, is to me, as a pure and simple field botanist, the same as non-existence.

A new Asplenium, hitherto referred to A. Trichomanes var. incisum Moore*

BY WILLIAM R. MAXON

Asplenium vespertinum

Rhizome short, sub-erect, rootlets rather coarsely fibrous: stipes purplish brown, shining, closely tufted, slender, terete, from 1.2–3.5 cm. long; scales small, those at base of stipe dark, lance-acuminate, serrate, those above blackish, filiform, scattered or almost wanting: lamina linear, 7.5–22.5 cm. long: pinnae 20–30 pairs, sub-opposite to alternate, sub-sessile, oblong-linear to oblong, or even rhomboidal, somewhat reduced, reflexed and cordate-clasping below, the margins regularly and coarsely crenate-serrate, each lobe containing a simple vein; pinnae more or less auricled above at the base, the vein once or twice forked: sori rather short, 8–12 to the pinna, an odd one often borne on the auricle; indusium glabrous, regularly crenate; sporangia cinnamon-brown; annulus with 20 or more joints; spores dark brown, ovoid, the winged ridges rather closely reticulated.

Type specimen in the U. S. National Herbarium, no. 201581, collected on San Miguel Mountain, near National City, San Diego County, California, about Feb. 1, 1900, by Miss Laura F. Kimball of National City. Other specimens which I have examined and would refer to this species are the following:

In U. S. Nat. Herb.: no 299603, "San Diego, Cal., D. Cleveland"; nos. 238082, 311552, "Santa Ysabel (San Diego Co.), Cal., April 29, 1893, H. W. Henshaw"; no. 220713, "Near San Rafæl (Lower California), Mexico, April 13, 1882, Marcus E. Jones, 3749."

In herb. D. C. Eaton: "San Diego, Cal., Miss Barbeck, 1879;" "Near Poway, San Diego County, Cal., Wm. Stout, 1878;" "Tufts under rocks, Cajon Pass (San Bernardino County), near San Diego Mission, California, Nov. 9, 1857, Dr. Newberry;" "1881, C. C. Parry," probably collected in the vicinity of San Diego.

In herb. A. A. Eaton, Seabrook, N. H.: "Witch Creek, San

* Published by permission of the Secretary of the Smithsonian Institution.

Diego County, California, 1895, R. D. Alderson;" "San Miguel Mountain, San Diego County, Cal., Laura F. Kimball."

In herb. A. J. McClatchie, Phœnix, Arizona: "San Gabriel Mountains, near Pasadena (Los Angeles County), Cal., A. McClatchie."*

In herb. Sadie F. Price, Bowling Green, Ky.: "Rancho de la Nacion, near National City, Cal., 1892, L. F. Kimball."

Its range then extends from Los Angeles and San Bernardino Counties, Cal., southward into the peninsula of Lower California. Miss Kimball finds it under overhanging rocks in the smaller cañons, mostly where there is considerable moisture, though occasionally in situations more exposed to the sun.

My attention was first called to this excellent species by observing several sheets of it in the National Herbarium labeled *Asplenium Trichomanes incisum* Moore. Upon examining Moore's figure of the variety *incisum*,† I was convinced that they were by no means referable to this variety; and a subsequent examination of typical *incisum* contributed by Moore to the Eaton Herbarium confirmed this belief. Since the Pacific coast "*incisum*" seems altogether distinct from any previously described species, I have ventured to assign to it the specific name *vespertinum*, in allusion to its distribution on the western coast.

The variety *incisum* of Moore is nothing more than an extremely foliose, deeply incised form of the common maidenhair spleenwort, comparable to the variety *cambricum* of *Polypodium vulgare*, and like that variety always sterile. The only true *incisum* I have seen from the United States is that collected by Mr. C. C. Frost, near West Brattleboro, Vermont, in 1874, fronds of which are preserved in the Eaton Herbarium and in the private herbarium of Dr. A. J. Grout. They agree closely with typical material of *incisum* and are not to be distinguished from it. Mr. A. A. Eaton has sent me specimens of *A. Trichomanes*, collected in Tennessee by Mr. J. H. Ferris, which show considerable approach toward *incisum*, but which, together with some fronds from Bethany, West Virginia, collected by Mr. G. Guttenberg in 1877, and preserved in the Eaton Herbarium, are merely incised forms of typical *A. Trichomanes*.

---

* Recorded by A. J. McClatchie, Erythea, **2**: 76. 1894.

† Thomas Moore, Nat. Pr. Brit. Ferns, **2**: 102. *pl.* 76. *f. A.* 1859.

Professor Eaton figures, as var. *incisum* Moore, one of Frost's fronds, but he remarks that this variety "is frequently collected near San Diego, Cal., where the type [*A. Trichomanes*] does not seem to occur" and adds that "it has slightly larger fronds and pinnae somewhat less incised."* As stated, it appears that *A. Trichomanes* does not occur in southern California; and how the material which *does* occur there could be referred to the var. *incisum* is hard to comprehend. Some of the stouter specimens of *vespertinum* in general appearance bear a certain resemblance to *Asplenium blepharodes* Eaton, described † from Lower California; but the long jointed cilia, which thickly fringe the indusium of that species, at once distinguish it from *vespertinum*, in which the indusium is smooth and merely crenate. In addition, *vespertinum* invariably has the pinnae much more coarsely serrate; and its sori are short, of a light color, and number from 6–12 (13), while *blepharodes* bears from 6–8 larger, more oblique sori. The spores of *vespertinum* appear to be more closely reticulated than those of *blepharodes*, and the winged ridges slightly narrower. The spores of both species present striking differences from those of *Trichomanes*, in which the winged ridges are greatly reduced or apparently lacking and the surface warty-puncticulate or papillose. The most noticeable feature, however, distinguishing *vespertinum* from *Trichomanes*, is the constancy of the coarse serrations of the pinnae.

In conclusion I desire to extend my thanks to those who have kindly loaned me specimens for study, to Professor L. M. Underwood and Mr. C. L. Pollard for a number of suggestions and references, and especially to Miss Laura F. Kimball for the excellent living plants of this species now growing in the Botanical Garden in this city and from which the greater part of the specific description has been drawn.

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

---

* Eaton, Ferns N. Am. 1: 271, 273, 274. *pl. 36. f. 3.* 1879.

† D. C. Eaton, Zoe, 1: 197. *pl.* 7. 1890. The type specimen, in Herb. D. C. Eaton, has been kindly loaned me by Professor A. W. Evans.

Autumnal Coloration of Leaves

By G. E. Stone

At the meeting of the Society for Plant Morphology and Physiology held at Columbia University in December, 1899, a paper by Dr. D. T. MacDougal was read entitled "Influence of Inversions of Temperature and varietal Currents of Air upon the Distribution of Plants."

The observations upon which the results were obtained were made in Arizona, and among other things brought out in this paper was the fact that the autumnal colorations of leaves first showed itself on the low elevations.

During a brief discussion of the paper some other observers took exception to this statement, and it was stated that in the Allegheny region the autumnal tints first showed themselves upon the mountains, or higher elevations.

Our observations here in Massachusetts have coincided with those of Dr. MacDougal in Arizona, namely that the autumnal tints are first seen in the lowlands and not upon the hills and mountains. Whether there exists a different state of affairs in the Alleghenies which causes autumnal coloration to appear first upon the higher elevation, thus offering an exception to the condition of affairs in New England and Arizona would be well worth knowing.

According to our experience the first trees to show color are the red maple and poison sumac of the swamps. These species, on account of their location, are subject to the frosts when those in the highlands are not, and this factor alone would hasten their coloration.

There are, however, many external influences which determine coloration in trees which should be taken into consideration.

The exceedingly dry season of '95–'96 caused many upland trees to exhibit premature coloration on account of drought, and in like manner did the wet season of '97 cause many swamp species to show their tints as early as the middle of August on account of extreme moisture. No two seasons seem to give rise to the same intensity of coloration. During seasons when there are no extreme differences in temperature intense scarlet colorations are lacking; on the other hand marked difference in temperature gives rise to an intense coloration of a great variety. The duration of coloration is also equally variable. Some seasons the color has a long period of duration while in others it is brief. The past season was one in which the transformation from green to yellow, scarlet and brown, and subsequent fall of the leaf was brief in the Connecticut Valley, a feature which, according to the writer, was hastened by excessive cloudy weather and rainfall during the period of transformation. The work of borers is also an important factor in the premature coloration of white and sugar maple trees. Borers however are generally confined to one or more limbs and the premature coloration of these, while the rest of the tree may still be green, is of common occurrence and they can be readily picked out at a glance.

In fact any abnormal condition of the limbs or tree whether brought about by insects or fungus intrusion or from purely physiological disorders are capable of giving rise to premature coloration in the leaves, which to the pathologist possess interest.

A Revision of the North American Species of the Genus Eleutera Beauv. (Neckera Hedw.)

By Stephen Conrad Stuntz

This work on the genus *Eleutera* was begun at the suggestion of Dr. C. R. Barnes, now of the University of Chicago, carried on in the Herbarium of the University of Wisconsin, and completed under the direction of Dr. R. H. True.

Thanks are due to the authorities of the following herbaria for loans of material in this genus—Herbarium of the Canadian Geological Survey, Herbarium of Columbia University, and the National Herbarium; to Dr. Julius Röll and M. Jules Cardot for specimens unobtainable in this country; to Dr. R. A. Harper for assistance in obtaining material; to Mrs. E. G. Britton and Dr. E. L. Greene for assistance in bibliographical details; to Dr. Barnes for helpful comment and criticism; and to Dr. True for general aid and advice.

There is a tendency among bryologists to begin with Hedwig, Muscorum Frondosorum, 1792, for purposes of nomenclature, but it has seemed best to adhere strictly to the rules adopted by the Madison Botanical Congress. Changes necessitated by the adoption of Hedwig as a starting point are noted.

ELEUTERA Beauv. Prodr. 30. 1805

(Neckeria Hedw. Fund. Musc. **2**: 93. 1782. Not Scopoli, Introd. 313. 1777.

Neckera Hedw. Musc. Frond. **3**: 52. 1792.

Eleuteria Beauv. Prodr. 56. 1805.

Cryptopodia Röhl. Deutsch. Fl. **3**: 82. 1813.

Neckera Distichia Brid. Bryol. Univ. **2**: 238. 1827.

Euneckera C. M. Syn. **2**: 41. 1850.

Distichia C. M. Flora, **73**: 489. 1890.)

Gametophyte large, spreading, on trunks of trees and rocks: primary stems short, creeping, often stoloniferous: secondary stems erect or pendent, pinnately or bi-pinnately branched: branches complanate, sometimes flagelliform: leaves complanate, usually transversely undulate, glossy: outer perichaetial leaves ovate, inner long-acuminate: cells rhomboidal at apex, becoming oblong at middle, and linear-oblong or sinuous at base, smooth: alar cells rounded-quadrate. *Sporophyte:* capsule immersed or exserted, symmetrical: calyptra cucullate: peristome double: teeth 16, lance-linear, closely articulate, thin: endostome a short basal membrane, 16-cleft, without cilia: annulus none. (From Greek *Eleuthera*, epithet applied to Diana.)

The genus includes 158 species, according to Paris, Index Bryologicus, distributed throughout the temperate zones and tropics.

The generic name, *Neckeria* of Hedwig, afterwards written *Neckera*, given in honor of N. J. Necker, the German bryologist, was antedated by *Neckeria* Scopoli, given to what is now known as *Corydalis* or *Capnoides*. In 1805 Palisot de Beauvois, in his *Prodrome des cinquième et sixième familles de l'Aethéogamie*, divides Hedwig's and Bridel's *Neckera* into *Neckera* and *Pilotrichum*, (generic characterizations and lists of included species on pp. 35 and 37), and, on p. 30 he gives "*Eleutera*" as a substitute for *Neckera*, which he would abolish because of its being given in honor of a man; on p. 56, in the "Table des Mousses," he gives "*Eleuteria*. *Eleuterie* (common name). Nom que je propose de donner au genre Neckera." This, in connection with the lists of species on pp. 35 and 77–8 amounts to generic publication, although no binomials were published. In his generic characterizations, and also under *Neckera* in "Table des Mousses," he gives "*Eleutrie*" as the common name which he proposes for the genus.

The genus *Eleutera* differs from the nearest North American genus, *Homalia*, in having narrow, not distinctly keeled segments, and no annulus.

The total number of North American species of the genus is six. Two of the species are sub-tropical; one of these is limited to Florida; the other occurs in Florida, Texas and New Mexico. Two species are northwestern, occurring from Alaska to northern Idaho and central California. One is limited to the Alleghanies. The remaining species, or one of its two varieties, is distributed from Newfoundland to Lake Athabasca and the Rocky Mountains, south to North Carolina, and in New Mexico (Fendler). All the species except the sub-tropical ones, which are found only on trees, grow on both trees and rocks.

No North American specimens of *E. fontinaloides* (*N. pumila*) have been seen, and it is likely that Bruch and Schimper were wrong in crediting it to North America. *N. Ludoviciae* and *N. cymbifolia* are referable to *Pilotrichum*, as is probably *N. Floridana* also, although all the specimens examined bearing this name in herbaria are really *E. disticha*.

Synopsis of the Species

Leaves acute or acuminate.	
Spinulose.	1. *E. Douglasii.*
Not spinulose.	2. *E. pennata.*
Leaves rounded or lingulate, apiculate or abruptly acuminate.	
Leaves undulate.	
Costa ⅓ length of leaf or less.	
Delicate, branched.	2a. *E. pennata oligocarpa.*
Robust, simple.	2b. *E. pennata pterantha.*
Costa ⅔ length of leaf.	
Long, loose, flagellate.	3. *E. Menziesii.*
Short, soft, no flagella.	3a. *E. Menziesii limnobioides.*
Leaves plane.	4. *E. ornithopodioides.*
Leaves obtuse.	
Base of leaves unsymmetrical, costa far to one side.	5. *E. disticha.*
Base of leaves symmetrical.	6. *E. Jamaicensis.*

1. **Eleutera Douglasii** (Hooker) nom. nov.

Gametophyte loosely spreading or pendent, pale or yellowish-green: primary stems 3–4 cm. long: secondary stems 10–20 cm., pinnately branched: branches long, attenuate to apex: leaves lanceolate-acuminate, spinulose at apex, wavy at base, thin, glossy, ecostate: dioicous: outer perichaetial leaves ovate, acute, denticulate at apex, inner leaves lanceolate, acute, reaching to base of capsule or rarely higher. *Sporophyte:* capsule oval, reddish-brown, becoming chestnut, entirely exserted: lid long-rostrate, oblique: teeth yellow, articulate: segments equaling teeth, the latter not divided between articulations. (In honor of David Douglas (1798–1834), an early northwestern collector, who collected the species on the Columbia River.)

Type locality, Columbia River.

Trees and shaded rocks, Alaska, Vancouver Island and Coast Range, B. C., east to Lake Pend d'Oreille, Idaho, south to San Mateo Co., California.

Syn.: Neckera Douglasii Hooker, Bot. Misc. **1**: 131. *pl. 35.* 1830. *Neckera Douglasii Macounii* Kdbg. Bull. Torr. Club, **17**: 275. 1890.

Illus.: Hooker, l. c.

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 394; Macoun, Can. Musc. 88, 104, 200, 241, 389 (var. *Macounii*); Ren. & Card. Musc. Am. Sept. Exsic. 77, 77*b*; Röll, 410, 411.

The Kindbergian variety, *Macounii*, described as having a turgid-oval capsule exserted on long pedicel and leaves less attenuate, cannot stand, as none of the specimens so labeled in the herbaria examined agree with the printed description or differ materially from Hooker's original description. Lesquereux and James' description of the species is incorrect in several minor details.

2. **Eleutera pennata** (L.) nom. nov.

Gametophyte bright green, glossy, large, spreading: primary stems short: secondary stems 7–10 cm., irregularly pinnate, sometimes simple: branches usually obtuse, sometimes attenuate: leaves narrowly ovate-lanceolate, acuminate, entire or sometimes denticulate above: costa indistinct, bifid or single: cells small, thin, at apex elongated-rhomboidal, at middle and base linear, sinuous, at angles irregularly quadrate: monoicous: outer perichaetial leaves short, ovate-acuminate, inner long-acuminate, entire, exceeding the capsule. *Sporophyte:* capsule, large, oval-oblong, reddish-brown, immersed: calyptra small, whitish, covering lid only: lid conical, short-beaked: teeth linear-subulate, connected at tips, densely articulate, irregularly divided: segments imperfect. (From Latin *pennata*, furnished with wings.)

Type, European.

On trees and rocks. Newfoundland and Nova Scotia, south in mountains to North Carolina, west to Manitoba; Mexico (Bescherelle).

Syn.: Muscus terrestris major, ramulis compressis, foliis superficie crispis Vaill. Bot. Par. 129. *pl. 27. f. 4.* 1727. *Sphagnum pennatum undulatum, vagina squamosa* Dill. Hist. Musc. 250. *pl. 32. f. 9.* 1741. *Sphagnum cauliferum et ramosum, foliis crispis, crebris per caulem capitulis* Hall. Enum. Stirp. Helv. 96. *pl. 3. f. 2.* 1742. *Fontinalis pennata* L. Sp. Pl. 1371. 1763. *Hypnum pennatum* Hall. Stirp. Helv. 1297. *pl. 45. f. 2.* 1768. *Weisia pennata* Schrank, Bayer. Fl. **2**: 445. 1789. *Neckera pennata* Hedw. Musc. Frond. **3**: 47. *pl. 19.* 1792. *Pilotrichum pennatum* Beauv. Prodr. 83. 1805. *Cryptopodia pennata* Röhl. Deutsch. Fl. **3**: 82.

1813. *Daltonia pennata* W. Arn. Disp. 54. 1825. *Neckera Distichia pennata* Brid. Bryol. Univ. 2: 238. 1827.

Illus.: Vaill. l. c.; Dill. l. c.; Hall. l. c.; Hedw. l. c.; Funck, Deutsch. Moose, *pl. 34. f. 1;* Schmied. Icon. Pl. Man. 3: *pl. 58. f. 2;* Grev. Scot. Crypt. Fl. *pl. 109;* Hooker & Taylor, Musc. Brit. Supp. *pl. 4;* Bruch & Schimp. Bryol. Eur. *pl. 440;* Wilson, Bryol. Brit. *pl. 34. f.;* Sull. Musc. & Hep. U. S. *pl. 5;* Lesq. & James, Manual, *pl. 5.*

Exsic.: Drummond, Musc. Bor. Am. 161; Sull. Musc. Allegh. 76; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 266, (Ed. 2) 392; Aust. Musci App. 255; Ren. & Card. Musc. Am. Sept. Exsic. 188; Macoun, Can. Musci, 80, 239, 345, 584, 654, 666, 794. In Herbarium University of Wisconsin, Sull. & Lesq. 266 and 392 of the different editions are the same, the number 392 being pasted over the number 266 on the original packet.

2a. **Eleutera pennata oligocarpa** (Bruch) nom. nov.

Gametophyte small, delicate, pale green: primary stems short: secondary stems 2–5 cm., slender, irregularly pinnate: branches attenuate to apex, sometimes flagelliform: paraphyllia none: leaves lingulate, abruptly acuminate, deeply undulate, subserrate at apex: costa short or indistinct: cells rhomboidal at apex, at base and middle linear, at edges quadrate or rounded: outer perichaetial leaves ovate-acuminate, inner narrow-acuminate, ecostate, exceeding the capsule. *Sporophyte:* capsule small, reddish-yellow: calyptra large: lid orange, short-beaked: teeth lance-linear, densely articulate: segments imperfect. (From Greek *oligos*, few, and *karpos*, fruit.)

Type, European.

Trees and rocks. Prince Edward Island, west to Lake Athabasca and the Rocky Mountains in British America, south to the Catskills; Santa Fé, New Mexico (Fendler).

Syn.: *Neckera pumila* Wahlenb. Fl. Lapp. 367. n. 653. 1812; not *N. pumila* Hedw. *Neckera oligocarpa* Bruch, Mscr. in Hartm. Skand. Fl. 338. 1849. (5th ed.) *Neckera pennata β tenera* C. M. Syn. 2: 50. 1850. *Neckera intermedia* Theden. in sched. *Neckera chlorocaulis* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) *268.*

Illus.: Bruch & Schimp. Bryol. Eur. *pl. 441.*

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 268 (as *N. chloro-*

caulis), (Ed. 2) 393; Aust. Musc. App. Supp. I., 528; Macoun, Can. Musci, 240, 797, 892.

2b. **Eleutera pennata pterantha** (C. M. & Kindb.) nom. nov.

Gametophyte: secondary stems nearly simple, about 1 dm. in length, rigid and robust, erect: one branch of costa often reaching to the middle of leaf: paraphyllia numerous. *Sporophyte:* capsule emergent. (From Greek *pteros*, wing, and *anthos*, flower.)

Type locality, rocks, Hector, B. C., the only locality from which it has been collected.

Syn.: Neckera oligocarpa var. *pterantha* Kdbg. in Herb. Can. Geol. Survey.

Neckera pterantha C. M. & Kindb. in Macoun, Cat. Can. Pl. Musci, 162. 1892.

Exsic.: Macoun, Can. Musci, 105, 494.

In case we begin with Hedwig, 1792, for nomenclature, the initial "L." in the species should be replaced by "Hedw."

On the original label in Herb. Can. Geol. Survey in what I take to be Kindberg's writing, the name of the variety is given as *pterantha;* for this reason that name is adopted instead of *peterantha*, which is evidently a slip, and quite meaningless.

All gradations occur between the species and what has been known as *N. oligocarpa*, so that we must recognize that as a mere variety. These slight and varying differences were recognized by C. F. Austin, who, on a label in the Columbia University Herbarium, says: "I am unable to find a single distinct *permanent* character for distinguishing between *oligocarpa* and *pennata*." Some of these gradations are: Coarse plants with very narrow leaves and attenuate branches; very robust plants with lingulate leaves; delicate plants with obtuse branches and narrow leaves.

Eastern American specimens of the var. *oligocarpa* agree with European specimens in having no paraphyllia, but specimens from Vermilion Lake, Minn., west to the Rocky Mountains have a few paraphyllia, tending toward var. *pterantha*.

3. **Eleutera Menziesii** (Drumm.) nom. nov.

Gametophyte large, yellowish-green, brown when old: primary stems 8–10 cm.: secondary stems 5–25 cm. in length, flat, densely pinnately branched: branches 1–10 cm., becoming flagellate at apex, often covered with lateral filiform flagella, forming a dense brush: leaves oblong, lingulate, apiculate or sometimes obtuse, undulate: more or less regularly denticulate half way to base: costa ½–⅔ length of leaf: cells at apex irregularly rhomboidal, at middle and base narrow-oblong: dioicous: perichaetial leaves small, long-acuminate, denticulate, costate to apex: cells linear. *Sporophyte:* capsule reddish-brown, immersed or emergent, seta length of capsule: calyptra with few hairs or none: lid oblique, acute: teeth slender, nodose, articulate: segments very slender, split between the few articulations. (In honor of Archibald Menzies (1754–1842), who collected the species in the Rocky Mountains.)

Type locality, Rocky Mountains.

On trees and rocks. Alaska and Vancouver Island to Banff and Flathead Lake, Montana, south to Yosemite and Russian Valleys and Marion Co., California.

Syn.: Neckera Menziesii Drummond, Musc. Bor. Am. 162. *Neckera Menziesii* Hook. in Drumm. Musc. Bor. Am. (Ed. 1) 162 (according to Paris, Ind. Bryol. 853). *Neckera Menziesii amblyclada* Kindb. in Macoun, Cat. Can. Pl. Musci, 162. 1892.

Illus.: Sull. Icon. Musc. Suppl. *pl. 62.*

Exsic.: Drumm. Musc. Bor. Am. 162 type; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 395; Macoun, Can. Musci, 106, 111, 169, 198, 238, 397, 796, 567 (var. *amblyclada*), 253, 927 (var. *eflagellosa*), 94 (approaching var. *limnobioides*); Röll, 496, 497.

3a. **Eleutera Menziesii limnobioides** (Ren. & Card.) nom. nov.

Gametophyte small, cespitose, soft and dilated, brownish-green: secondary stems but 1–2 cm. in length: habit of a *Limnobium;* no flagella. (From *Limnobium,* and *oidos,* like.)

Type locality, Mt. Hood, Oregon.

Rocks, Cascades, Easton, Washington; Mt. Hood, Oregon.

Syn.: Neckera Menziesii limnobioides Ren. & Card. Bot. Cent. **44**: 422. 1890.

There is no material difference between the so-called variety *amblyclada* and the species, the leaves on the same plant varying in length and in length of costa. As to flagella, all the specimens seen have more or fewer flagella.

Paris in Index Bryologicus 853, gives Hooker as the author of the species, but Drummond's original label in Herbarium Can. Geol. Survey gives description, and Hooker himself, Bot. Misc. **1**: 132, speaks of it as described by Drummond.

4. **Eleutera ornithopodioides** (Scop.) nom. nov.

Gametophyte small, soft, yellowish-green: secondary stems slender, 2–4 cm. in length, pendent, pinnately divided into short tapering branches, which are sometimes flagellate: leaves plane, unsymmetrical at base, elliptical, sharply and strongly apiculate, minutely serrulate at tip: costa short, indistinct: cells at tip rhomboidal, at middle and base linear, at angles very short and irregular: dioicous: perichaetial leaves narrow, long. *Sporophyte*: capsule small on long slender seta: lid narrowly oblique, rostrate, teeth pale, narrow: segments short from an enlarged base. (From *ornithos*, bird, *pous*, foot, *oidos*, like.)

Type, European.

Rocks, Newfoundland, south in mountains to Tennessee; rare.

Syn.: Muscus trichomanoides filicifolius splendens Vaill. Bot. Par. 139. *pl. 23. f. 4.* 1727. *Hypnum pennatum, compressum et splendens, capsulis ovatis* Dill. Hist. Musc. 268. *pl. 34. f. 7.* 1741. *Hypnum ornithopodioides* Scop. Fl. Carn. 164 1760. *Hypnum complanatum* L. Sp. Pl. 1588. 1763. *Leskia complanatum* Hedw. Fund. Musc. **2**: 93. *pl. 10. f. 62–65.* 1782. *Leskea Omalia complanata* Brid. Bryol. Univ. **2**: 327. 1827. *Neckera complanata* Hüb. Muscol. Germ. 576. 1832. *Homalia complanata* de Not. Epil. 199. 1869.

Illus.: Vaill. l. c.; Dill. l. c.; Hedw. l. c.; Smith & Sowerby, Eng. Bot. *pl. 1492*; Funck, Deutsch Moose, *pl. 35. f. 1;* Bruch & Schimper, Bryol. Eur. *pl. 444;* Wilson, Bryol. Brit. *pl. 24b.*

Exsic.: Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 267, (Ed. 2) 396.

All the American specimens seen are sterile; sporophyte description taken from European specimens.

In case Hedwig, 1792, is taken as starting point for nomenclature, replace "*ornithopodioides* (Scop.)" by "*complanta* (Hedw.)."

5. **Eleutera disticha** (Sw.) nom. nov.

Gametophyte small, soft, pale green: primary stems short: secondary stems 1–3 cm. in length, narrow, irregularly pinnate:

branches short: leaves broadly lingulate, rounded at apex, somewhat undulate, unsymmetrical, costa far to one side: tip somewhat wavy, minutely serrulate: costa slender, ¾ length of leaf: cells irregularly massed at tip, oblong at middle, narrowed at base: synoicous: outer perichaetial leaves ovate-acuminate, apical cells roughly triangular, basal and middle sinuous: inner perichaetial leaves narrow-acuminate, equaling or exceeding the capsule serrulate at apex, with narrow, sinuous cells. *Sporophyte:* capsule, immersed, or sub-emergent, urn-shaped: calyptra small, smooth; lid conical-acute, oblique: teeth pale, narrow lance-subulate, minutely wrinkled: segments equaling teeth, not keeled. (From Greek *distichos*, two-rowed.)

Type, West Indian.

Trees, coasts of Florida and throughout tropical America.

Syn.: Fontinalis disticha Sw. Pr. Fl. Ind. Occ. 138. 1788. *Neckera disticha* Hedw. Musc. Frond. **3**: 53. *pl.* 22. 1792. *Pilotrichum distichum* Beauv. Prodr. 83. 1805. *Pilotrichum truncatum* Beauv. Prodr. 83. 1805. *Daltonia disticha* W. Arn. Disp. 54. 1825. *Neckera Distichia retusa* Brid. Bryol. Univ. **2**: 243. 1847.

Illus.: Hedw. l. c.

Exsic.: Aust. Musc. App. Supp. I., 530.

This species is easily distinguished from the nearest North American species, *E. Jamaicensis*, by its smaller, very unsymmetrical leaves, as well as by its more slender stems and smooth calyptra.

Replace the "(Sw.)" by "(Hedw.)" if Hedwig be taken as the starting-point for nomenclature.

6. **Eleutera Jamaicensis** (Gmel.) nom. nov.

Gametophyte soft, yellowish-green: primary stems short: secondary stems short, 1–2 cm. in length, usually simple: leaves distichous, auriculate-clasping on the one side, nearly symmetrical, oblong-lingulate, truncate, transversely undulate, very minutely serrulate: costa slender, 4/5 length of leaf: cells at tip small and irregularly massed, in middle oblong, at base narrow: synoicous: outer perichaetial leaves ovate, abruptly acuminate, inner narrow, linear, ecostate or short-costate, sub-serrulate, equaling the capsule. *Sporophyte:* capsule small, sessile, cylindrical-oblong, immersed: calyptra small, covering lid only, with few hairs; lid conical, oblique, short-beaked: teeth and segments free to base, nodulose, punctulate. (From Latin, *of Jamaica.*)

On trees, western and southern Florida, Texas (Wright). New Mexico, and throughout tropical America.

Syn.: Sphagnum pennatum undulatum, vagina pilosa Dill, Hist. Musc. 294. *pl. 32. f. 8.* 1741. *Hypnum Jamaicensis* Gmel. L. Syst. Nat. 1341. 1791. *Neckera undulata* Hedw. Musc. Frond. **3**: 51. *pl. 21.* 1792. *Fontinalis crispa* Sw. Prodr. Fl. Ind. Occ. 138. 1788. *Pilotrichum undulatum* Beauv. Prodr. 83. 1805. *Daltonia undulata* W. Arn. Disp. 54. 1825. *Neckera Distichia undulata* Brid. Bryol. Univ. **2**: 241. 1827. *Neckeropsis undulata* Reichardt in Novara Exp. Bot. **1**: 181. 1871.

Illus.: Dill. l. c.; Hedwig l. c.; Bridel, Musc. Recent. **2**: *pl. 3. f. 21.*

Exsic.: Aust. Musc. App. Supp. I., 529.

Replace "*Jamaicensis* (*Gmel.*)" by "*undulata* (*Hedw.*)" if Hedwig, 1792, is taken as a starting-point.

UNIVERSITY OF WISCONSIN.

Proceedings of the Club

Tuesday Evening, February 13, 1900

President Brown in the chair. Eighteen persons present.

Dr. Rusby reported on the part of the Committee on Excursions an interesting field-day at Maplewood, N. J., with kind hospitalities enjoyed by the courtesy of Miss Idalette Carpenter, of Maplewood.

President Brown announced the Committees for the year 1900 as follows:

Committee on Finance, J. I. Kane, C. F. Cox; Committee on Admissions, Cornelius Van Brunt, Jeannette B. Greene, M.D., John K. Small, Ph.D.; Committee on Library and Herbarium, Per Axel Rydberg, Ph.D., Marie L. Sanial, Helen M. Ingersoll, Alice M. Isaacs; Committee on the Local Flora, Professor N. L. Britton, Ph.D.; Phanerogamia, Eugene P. Bicknell, H. H. Rusby, M.D., Rev. Geo. D. Hulst; Cryptogamia, Professor L. M. Underwood, Marshall A. Howe, Ph.D., Mrs. Elizabeth G. Britton; Committee on Excursions, Dr. L. Schoeney, Marie L. Sanial, Eugene Smith, George V. Nash, W. A. Bastedo; Committee on Program, Dr. H. H. Rusby, Dr. C. C. Curtis, Mrs. Elizabeth G. Britton.

The scientific program consisted of a paper by Dr. H. H. Rusby entitled "The Tendency of entomophilous Flowers to antero-posterior Irregularity." The paper was copiously illustrated by blackboard drawings, and its comparative review of floral irregularity in the various orders was aided by the distribution of printed lists with statistics.

The object of the paper was to show the distribution among and within the families of plants of cases of irregularity specially favoring insect-pollination. In this view, several types of irregularity were excluded from consideration as not having such origin. One such is irregularity in an ovary, as reflected in the fruit of *Mango.* Another is the necessary curving forward of such sessile flowers as those of *Piper*, closely pressed against, or even buried in their rachis. Still another is the enlargement of one perigone-segment, to act as a scale, and in its absence, to protect the flower of a catkin, spike or other dense inflorescence, as seen in some species of *Eriocaulon.*

Other forms of irregularity, those with which the paper had properly to deal, were classified and shown to represent different degrees of modification. The lowest form was regarded as the simple curving upward of a horizontal or declined androecium or gynaecium, as seen in *Mirabilis.* The next involved an accompanying curvature of perigone, as in *Cyrtanthus,* then successively an oblique base or mouth, as in many Gesneriaceae, the distinction of the tube in varying degrees, as seen in the same family, the exaggeration or reduction of the anterior or posterior portion of the limb, as in *Chioscographia* or *Pteropetalon,* and in bilabiate corollas, the arrangement of such corollas to form radiant inflorescences, as in many Umbelliferae, variations in size as well as direction of anterior and posterior stamens, as in *Cassia,* and numerous forms of appendaging.

These forms were traced among the Monocotyledons and Dicotyledons respectively. None were found among the 21 lowest of the 43 families of Monocotyledons. Of the 10 next highest, 5 show none, 4 show slight or doubtful forms, while the highest, Liliaceae, with 197 genera, twice as many as the other 9 families combined, shows, amidst general regularity a few highly irregular genera, two of them simulating Orchidaceous forms. Of the 12 highest families, only 3 are regular. Five of the highest 6 are very irregular indeed, the highest, Orchidaceae, phenomenally so. It thus appears that an increased tendency to irregularity is indicative of higher development, but it is liable to occur in families and groups of families usually distinguished for its absence.

This principle was then shown to be even more clearly illustrated by the Dicotyledons. In the 53 lowest families, but 4 show irregularity. Only 1 of these is found among the first 39, and this is Aristolochiaceae, with a single irregular genus. Among the next 120 families, 27 show irregularity, and these are rather uniformly distributed among the others. Then come 19, several showing slight irregularity and one very irregular indeed. The next 17 are, with one exception, highly irregular, one of them however, being so in only a few of its genera. The 11 highest families are very peculiar. While mostly regular, some of them are noted for irregularity, but this is so peculiarly adjusted in the inflorescence as to bring about the condition of regularity so far as the latter is concerned. Thus the daisy, while an inflorescence, is essentially a regular flower, by virtue of the arrangement of its irregular florets. It is also noticeable that as these ray flowers are usually pistallate, this arrangement reverses the position, so far as the head if concerned, of the distinctively pistillate portion. The various types of irregularity in composite flowers were discussed, and these were contrasted with other families exhibiting radiant inflorescences.

It was pointed out that irregularity was not a fundamental characteristic, but was readily called into existence by the exigencies of any group, or even species, and might be expected to develop anywhere. Special attention was called as illustrating this principle, to the marked irregularity of *Cotyledon gibbiflorum* and *Saxifraga sarmentosa*, species in notably regular genera. It was also noted as significant that the most irregular families, such as Leguminosae, might have extensive series of genera perfectly regular: also that almost exactly equal forms of irregularity might develop in families most widely separated, as the Liliaceae and the Capparidaceae. The fact that irregularity is more frequent in the higher families of the two classes is due to the fact that the essential property of such families is a greater power of adaptation, floral irregularity being only one manifestation of this character.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matter relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Arthur, J. C., & Stuart, W. Corn Smut. Rep. Indiana Agric. Exp. Sta., **12**: 84–135. *pl. 10–13.* F. 1900.

Averill, C. K. The Distribution of certain Trees and Shrubs in Western Connecticut. Rhodora, **2**: 34–38. Feb. 1900.

Beal, W. J. Notes on *Cabomba Caroliniana* A. Gray. Bull. Torr. Club, **27**: 86. 14 F. 1900.

Beal, W. J. Some Monstrosities in Spikelets of *Eragrostis* and *Setaria.* Bull. Torr. Club, **27**: 85, 86. 17 F. 1900.

Becker, K. *Cereus Peruvianus* Mill. Monatsch. für Kakteenkunde, **10**: 6. 15 Ja. 1900. [Illust.]

Bessey, C. E. One thousand Miles for a Fern. Asa Gray Bull. **8**: 2–6. F. 1900.

Brainerd, E. The Blackberries of New England. Rhodora, **2**: 23–29. F. 1900.

Mentions 13 species and varieties. *Rubus sativus* (Bailey) Brainerd raised from *R. nigrobaccus sativus* Bailey.

Brainerd, E. Typical *Goodyera repens* in New England. Rhodora, **2**: 22. Ja. 1900.

Burt, E. A. *Russula emetica* in Vermont. Rhodora, **2**: 71–73. Mh. 1900.

Camerarius, R. J. Das Geschlecht der Pflanzen. Leipzig, 1899.

Canby, W. M. *Coreopsis involucrata* on the Atlantic Coast. Rhodora, **2**: 34. F. 1900.

Carleton, M. A. Russian Cereals adapted for Cultivation in the United States. Bull. U. S. Dept. Agric. (Div. Bot.), 23: 1–42. *pl. 1, 2. f. 1, 2.* 1900.

Churchill, J. R. An unusual Form of *Drosera*. Rhodora, **2**: 70, 71. *pl. 15. f. 8.* M. 1900.

Clarke, C. B. Cyperaceae. Symb. Antillanae, **2**: 8–160. 15 Ja. 1900.

Descriptions of all West Indian species; many new.

Clendenin, I. Botanical Teaching in secondary Schools. Asa Gray Bull. **8**: 6–13. F. 1900.

Cockerell, T. D. A. Notes on some Southwestern Plants. Bull. Torr. Club, **27**: 87–89. 17 F. 1900.

Collins, F. S. Notes on Algae—II. Rhodora, **2**: 11–14. Ja. 1900.

One new variety and three new forms described.

Collins, F. S. Preliminary Lists of New England Plants—V. Marine Algae. Rhodora, **2**: 41–52. F. 1900.

Day, M. A. The local Floras of New England (Addenda). Rhodora, **2**: 73, 74. Mh. 1900.

Earle, F. S. Some Florida Fungi. Bull. Torr. Club, **27**: 120–123. 24 Mh. 1900.

New species in *Asterina*, *Lembosia*, and *Leptothyrium*.

Eastwood, A. Key and Flora [to Bergen's Elements of Botany]. Rocky Mountain Edition, 1–139. 1900.

Eggleston, W. W. Further Notes on the Distribution and Host Plants of *Arceuthobium pusillum*. Rhodora, **2**: 9, 10. Ja. 1900.

Eggleston, W. W. *Hudsonia ericoides* in New Hampshire. Rhodora, **2**: 22. Ja. 1900.

Eggleston, W. W. *Polymnia Canadensis* in Vermont. Rhodora, **2**: 70. Mh. 1900.

Ellis, J. B., & Everhart, B. M. New Species of Fungi from various Localities with Notes on some published Species. Bull. Torr. Club, **27**: 49–64. 17 F. 1900.

New species in *Corticium*, *Hymenochaete*, *Zygodesmus*, *Mucronoporus*, *Dacryomyces*, *Asterina*, *Melanomma*, *Amphisphaeria*, *Teichospora*, *Schizostoma*, *Mycosphaerella*, *Leptosphaeria*, *Thyridium*, *Hysterographium*, *Hypoderma*, *Phyllosticta* (2), *Phoma*, *Rhabdospora*, *Dothiorella*, *Sphaeropsis* (2), *Diplodia*, *Ascochyta*, *Stagonospora*, *Camarosporium*, *Septoria* (3), *Kellermania*, *Cylindrosporium*, *Pestalozzia*, *Diplocladium*,

Hadrotrichum, *Pilacre*, *Exosporium*, *Dasyscypha*, *Pyrenopeziza*, *Haematomyxa* and *Puccinia*.

Evans, A. W. A new Genus of Hepaticae from the Hawaiian Islands. Bull. Torr. Club, 27: 97–104. *pl. 1.* 24 Mh. 1900.

Acromastigum nov. gen.

Fernald, M. L. *Arceuthobium pusillum* in the St. John and St. Lawrence Valleys. Rhodora, 2: 10, 11. Ja. 1900.

Fernald, M. L. Is *Artemisia Stelleriana* a native of New England? Rhodora, 2: 38–40. F. 1900.

Fernald, M. L. Re-discovery of *Eleocharis diandra*. Rhodora, 2: 60. Mh. 1900.

Fernald, M. L. Some Northeastern Species of *Scirpus*. Rhodora, 2: 15–21. Ja. 1900.

S. pedicellatus, *S. atratus*, and *S. rubrotinctus*, sp. nov. *S. pedicellatus pullus*, *S. atrocinctus grandis*, *S. rubrotinctus confertus*, and *S. sylvaticus Bissellii*, var. nov. *S. cyperinus condensatus* and *S. cyperinus Andrewsii*, nom. nov.

Graves, C. B. A little-known New England Goldenrod. Rhodora, 2: 57–59. Mh. 1900.

Greenman, J. M. New Species and Varieties of Mexican Plants. Proc. Am. Acad. 35: 307–315. 16 Mh. 1900.

New species in *Spiranthes*, *Hosackia*, *Stemmadenia*, *Physalis*, *Lamourouxia*, *Coreopsis*, *Spilanthes*, *Dysodia*, and *Lygodesmia*.

Haberer, J. V. *Eleocharis diandra* in Central New York. Rhodora, 2: 61. Mh. 1900.

Halsted, B. D. The new Field Botany. Appleton's Pop. Sci. Month. 56: 98–105. N. 1899.

Harper, R. M. Further Additions to the Flora of Amherst. Rhodora, 2: 68–70. Mh. 1900.

Holm, T. Catalogue of Plants collected by Messrs. Schuchert, Stein and White on the East Coast of Baffin's Land and West Coast of Greenland. Bull. Torr. Club, 27: 65–68. 17 F. 1900.

Holmberg, E. L. Una critica sobre "La Flora Argentino." Anal. Soc. Cien. Argentina, 48: 257–293. N. 1899.

Hyams, C. W. The Flora of North Carolina from Ranunculaceae to Salviniaceae. Bull. N. C. Agric. Exper. Sta. 164: 289–365. 1899.

Jack, J. G. *Arceuthobium pusillum* in Massachusetts. Rhodora, 2: 6–8. *pl. 13*. Ja. 1900.

Jones, L. R. *Arceuthobium pusillum* on a new host in Vermont. Rhodora, 2: 8, 9. *pl. 14*. Ja. 1900.

Kofoid, C. A. A preliminary Account of some of the Results of the Plankton Work of the Illinois Biological Station. Science, II. 11: 255–258. 16 F. 1900.

Kurtz, F. Essai d'une Bibliographie botanique de l'Argentine. Bol. Acad. Nac. Ciencias de Cordoba, **16**: 117–208. 1900. [Separate, pp. 1–91.]

Leavitt, R. G. The Relation of certain Plants to atmospheric Moisture. Rhodora, **2**: 29–32. F. 1900; 63–68. Mh. 1900.

Lovell, J. H. The Visitors of the Caprifoliaceae. Am. Nat. **34**: 37–51. Ja. 1900.

MacDougal, D. T. The Nature and Work of Plants; An Introduction to the Study of Botany. i–xvii, 1–218. New York, 1900.

Mangin, L. Observations sur la membrane des Mucorinées. Jour. de Bot. **13**: 209–216; 276–287, 307–316; 339–348; 371–378. *pl. 7–8.* Jl.–D. 1899.

Meehan, T. *Mammillaria Missouriensis.* Meehan's Monthly, **10**: 33, 34. Mh. 1900.

Merrill, E. D. A list of Mosses collected at Katahdin Iron Works, Maine. Rhodora, **2**: 61–63. Mh. 1900.

Morris, E. L. A Revision of the Species of *Plantago* commonly referred to *Plantago Patagonica* Jacquin. Bull. Torr. Club, **27**: 105–119. 24 Mh. 1900.

Patterson, F. W. Some woody Fungi. Asa Gray Bull. **8**: 13–19. F. 1900.

Renauld, F., & Cardot, J. Musci exotici novi vel minus cogniti. Bull. Soc. Roy. de Bot. de Belgique, **38**[2]: 1–48. F. 1900.

New species in *Campylopus* (2), *Leptodontium*, *Mielichhoferia*, *Bryum* (2), *Mnium*, *Garovaglia* and *Papillaria* from Mexico and Costa Rica.

Rich, W. P. The Heather in New England. Rhodora, **2**: 53, 54. Mh. 1900.

Robinson, B. L. New Phanerogams, chiefly Gamopetalae, from Mexico and Central America. Proc. Amer. Acad. **35**: 323–342. 16 Mh. 1900.

New species in *Hechtia*, *Telanthera*, *Mimosa* (2), *Stevia* (5), *Piptothrix*, *Eupatorium* (19), *Porophyllum*, and *Perezia*.

Robinson, B. L. Synopses of the Genera *Jaegeria* and *Russellia.* Proc. Am. Acad. **35**: 315–321. 16 Mh. 1900.

Robinson, B. L. The dwarf Mistletoe in New England. Rhodora, **2**: 1, 2. Ja. 1900.

Rothrock, J. T. Post Oak, Iron Oak, Barrens White Oak (*Quercus stellata* Wang.). Forest Leaves, **7**: 104. F. 1900. [Illust.]

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXIX. Bull. Torr. Club, **27**: 69–84. 17 F. 1900.

New species in *Besleria*, *Bignonia* (4), *Macfadyena*, *Pleonotoma*, *Jacaranda*, *Ruellia* (2), *Lepidagathis, Aphelandra* (2), *Pseuderanthemum, Justicia* (2), *Jacobinia, Citharexylon, Aegiphila, Clerodendron* and *Bystropogon.*

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886, XXX. Bull. Torr. Club, **27**: 124–137. 24 Mh. 1900.

New species in *Salvia, Pisonia, Neea* (2), *Uvifera, Triplaris* (2), *Loranthus* and *Phoradendron* (4).

Saunders, D. A. Ferns and Flowering Plants of South Dakota. Bull. So. Dakota Exper. Sta. 64: 101–227. 1899.

Schrenk, H. von. Notes on *Arceuthobium pusillum.* Rhodora, **2**: 2–5. *pl. 12.* Ja. 1900.

Schumann, K. *Echinocactus clavatus* Söhrens. Monatschr. für Kakteenkunde, **10**: 27, 28. 15 F. 1900. [Illust.]

Scribner, F. L., & Merrill, E. D. Studies on American Grasses. The North American Species of *Chaetochloa.* Bull. U. S. Dept. Agric. (Div. Agrost.) 21: 1–44. *f. 1–24.* 8 Mh. 1900.

C. apiculata, gibbosa, hispida, leucopila, Australiensis, macrosperma, villosissima, and various new combinations in this and allied genera.

Stone, G. E. Luxuriant Development of *Spirogira crassa* in refilled Ponds. Rhodora, **2**: 33, 34. F. 1900.

Stone, G. E. The Walking Fern in Worcester County, Massachusetts. Rhodora, **2**: 14. Ja. 1900.

Suksdorf, [W.] N. Washingtonische Pflanzen. Deutsche Bot. Monatschrift, **18**: 26, 27. F. 1900.

New species and varieties in *Saxifraga.*

Trelease, W. Eleventh Annual Report of the Director. Rep. Mo. Bot. Gard. **11**: 12–21. 1900.

Ulme, E. B. New Dioscoreas from Mexico. Proc. Amer. Acad., **35**: 322, 323. 16 Mh. 1900.

D. pamicicola and *D. Oaxacensis,* new.

Urban, I. Bibliographia Indiae occidentalis botanica. Continuatio I. Symb. Antillanae, **2**: 1–7. 15 Ja. 1900.

Van Tieghem, P. Sur les Canellacées. Jour. de Bot. **13**: 266–276. S. 1899.

Wanio, E. A. Lichenes novi rarioresque. Ser. III. Beiblatt zur Hedwigia, **38**: (253)–(259). 25 Ja. 1900.

New species in *Pertusaria, Sticta, Leptogium, Graphis, Arthonia, Bottaria, Pyrenula, Thelenella, Porina, Arthopyrenia, Didymella,* and *Corella* from Guadeloupe, W. I.

Webster, H. Unusual Variations of two common Agarics. Rhodora, **2**: 32, 33. F. 1900.

Wildeman, E. de. Un *Theobroma* nouveau. Bull. Herb. Boiss. **7**: 957, 958. 30 D. 1899.

Theobroma Kalagua De Wild., from the United States of Colombia.

Williams, E. F. *Bartonia iodandra*, new to the United States. Rhodora, **2**: 55–57. *pl. 15. f. 1–7.* Mh. 1900.

Williams, F. N. Critical Notes on some Species of *Cerastium*. Jour. Bot. **36**: 341–344. S. 1898; 382–387. O. 1898; **37**: 116–124. Mr. 1899; 209–216. My. 1899; 310–315. Jl. 1899; 474–477. N. 1899.

Williams, T. A. *Poa Fendleriana* and its Allies. Circ. U. S. Dept. Agric. (Div. Agrost.) 10: 1–6. 15 Ap. 1899.

P. scabriuscula sp. nov. and several new varieties.

Williams, T. A. The velvet-stemmed Collybia. Asa Gray Bull., **8**: 1. *pl. 1.* F. 1900.

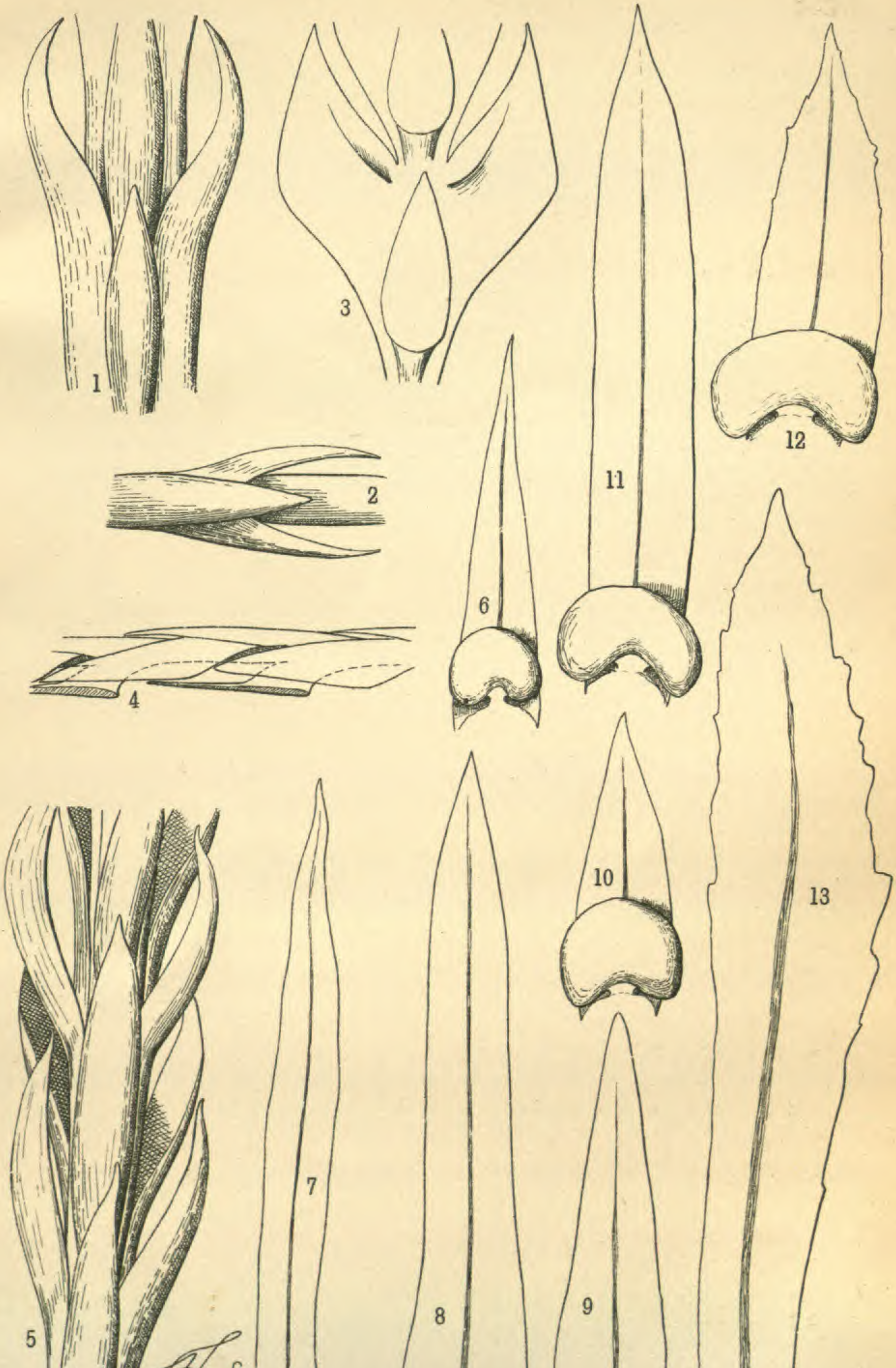
Woods, A. F. The Destruction of Chlorophyll by oxidizing Enzymes. Centralb. für Bakteriologie, **5**: 745–754. 1899.

Woods, A. F. Cultivation of Algae in Aquaria. Jour. App. Micros., **1**: 193. N. 1899.

Worsdell, W. C. Observations on the vascular System of the female "Flowers" of Coniferae. Ann. Bot. **13**: 527–548. *pl. 27.* D. 1899.

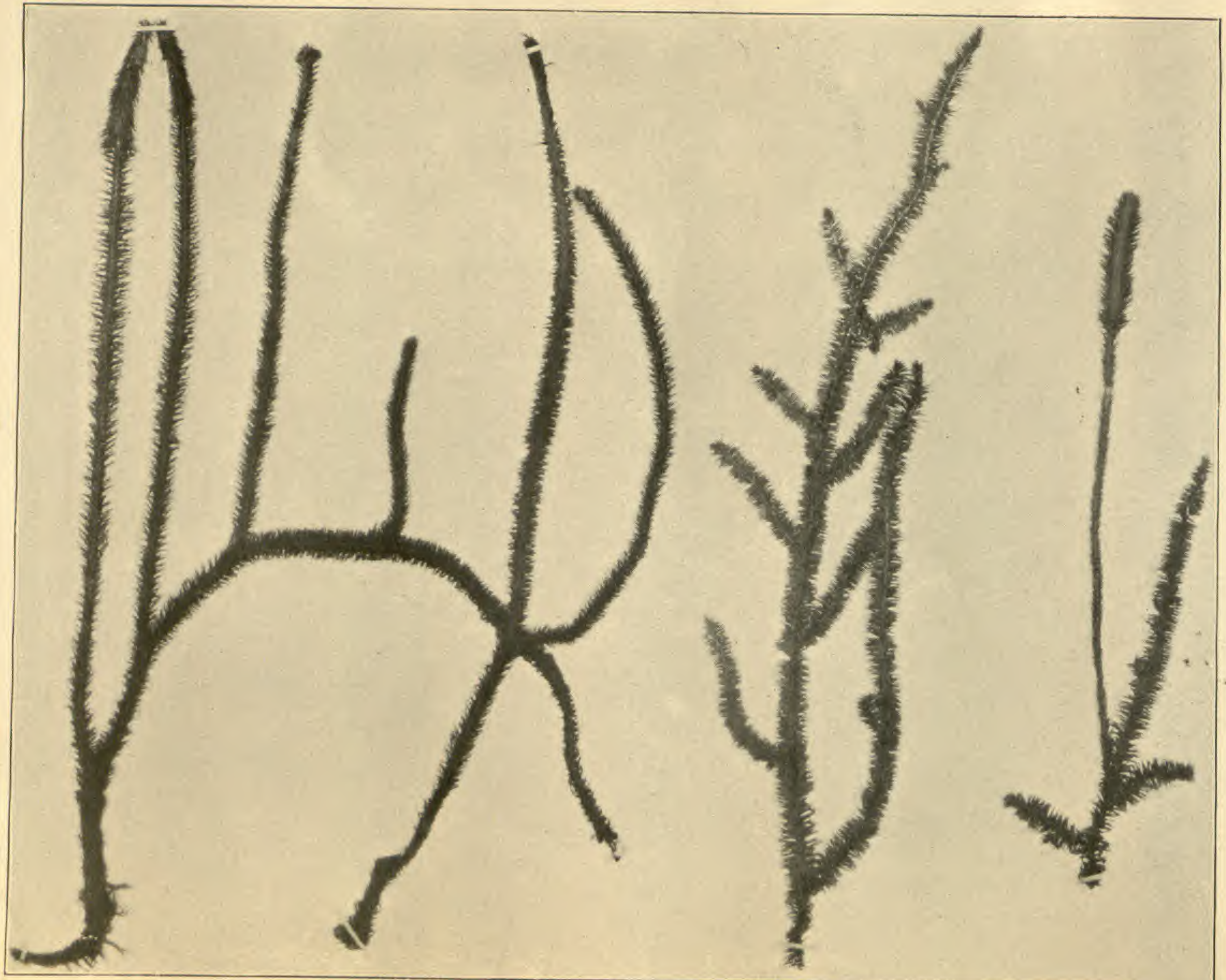
Zwaluwenburg, A. van, & Schlotterbeck. Developmental History of important Seeds. Pharm. Archives, **2**: 333–343. *pl. 1, 2.* N. 1899.

Studies on seeds of cotton and *Theobroma*.



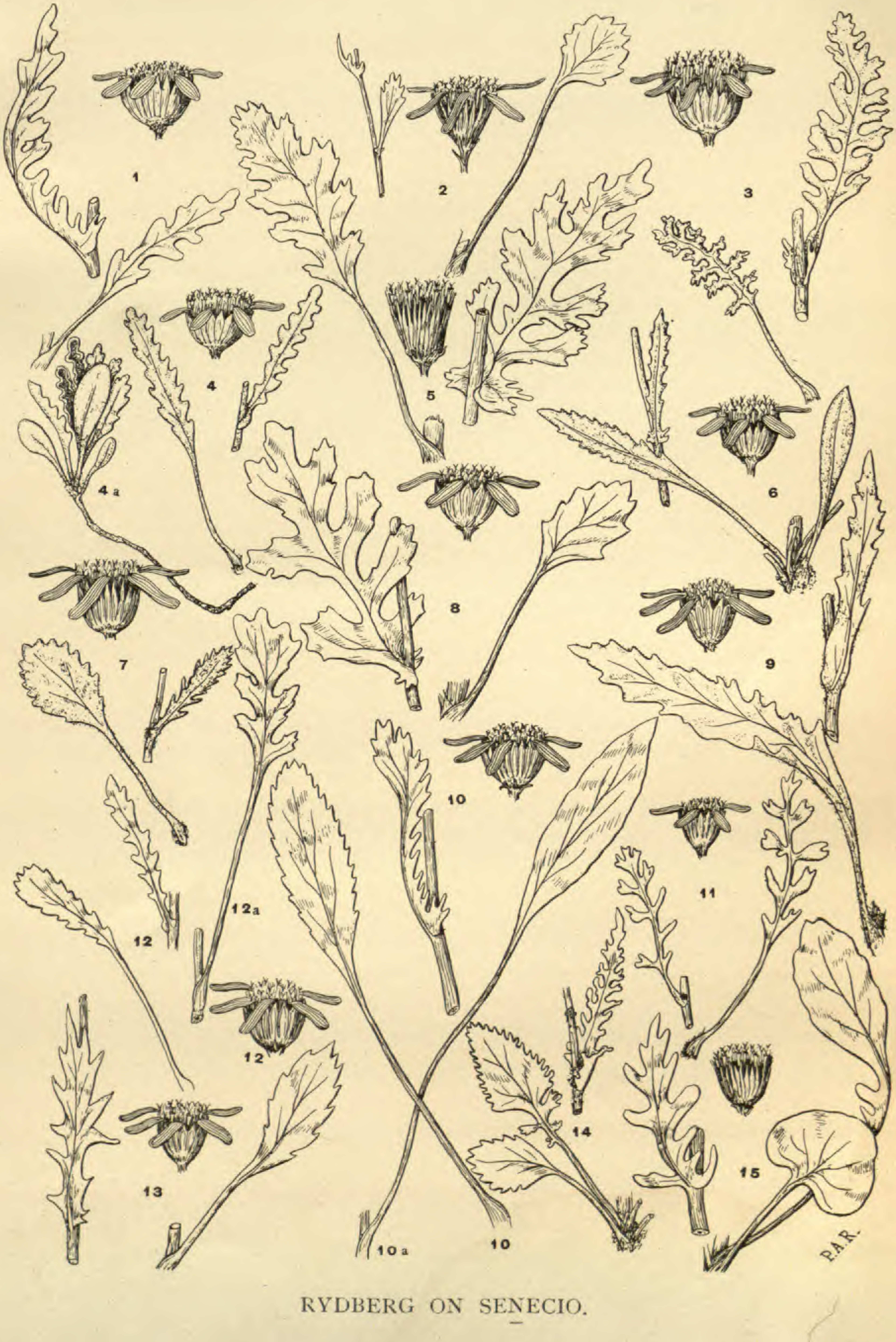
LLOYD AND UNDERWOOD ON LYCOPODIUM.

LLOYD AND UNDERWOOD ON LYCOPODIUM.



LYCOPODIUM ALOPECUROIDES AND LYCOPODIUM PINNATUM.

RYDBERG ON SENECIO.



RYDBERG ON SENECIO.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

VOL. 27 MAY, 1900. No. 5

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL,
BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D.,
CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D., MARIE L. SANIAL,
HELEN M. INGERSOLL, ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH, EUGENE SMITH,
MARIE L. SANIAL, W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 5*

BULLETIN

OF THE

TORREY BOTANICAL CLUB

MAY 1900

Revision of the North American Species of Pseudoleskea*

BY G. N. BEST

(PLATES 7 AND 8)

While it is true that some mosses are so fully differentiated as to fall readily in well-defined species there are others, probably a larger number, that do not behave in this way but appear in groups or series of closely intergrading forms. A satisfactory arrangement of these tries the skill of the systematist to the utmost. If such a group or series be taken as one species a description broad enough to cover the varying forms is generally too indefinite for practical purposes; if species be made of each of the extremes the intermediate forms are but poorly described, and if each of these forms be allowed specific rank nomenclature becomes burdensome to say the least. In general terms and within certain limits it may be stated that the more species made of such a series or group the more unstable are the characters by which they are separated, or supposed to be separated, and the more difficult it becomes to place a given plant. By a careful study however of considerable material it is usually possible to acquire a conception of a central type, which is of value in that it enables the systematist to fix a starting point from which he may gauge the variations.

What constitutes a species is indeed a vexed question, one not likely to be answered soon to the satisfaction of all. It may be safely said however, that a species should represent a fixed point in the evolution of a plant. In other words that it should mean

*The material on which this revision is based was furnished chiefly by Columbia University, the Geological Survey of Canada and Harvard University.

*no. 5 indexed for 5P

something, should possess an element of constancy and should not be founded on such variations as originate in the changing conditions by which all plants are more or less influenced. The fashionable tendency to multiply species on the pretext that this is the panacea for all systematic troubles, is not always the outcome of a fuller knowledge on the part of those who make them but often is due either to ignorance of what others have done along the same lines or a desire to appear to know more than their confrères. In the making of species, as with many other things, the better course lies between the extremes and, no matter how often we divide and subdivide our plants, it is quite possible to continue the process along the same lines and for the same reasons until each individual has a specific name of its own.

The members of the genus *Pseudoleskea* are mountain-loving plants which flourish best at high altitudes. When they appear at lower levels they not infrequently show their inability to adapt themselves to their environment by taking on atavistic or depauperate forms. But sparingly collected and then usually without fruit their consideration from a systematic standpoint is somewhat difficult. By an attentive study, however, of considerable material, American and European, it has been possible to acquire a fair conception of the central types that underlie them and to arrange them in accordance with more modern views of nomenclature.

Undesirable as it is in some respects, it becomes necessary to reduce *Lescuraea* to the rank of a subgenus. American plants efface the lines of separation between it and *Pseudoleskea*. The gametophyte characters of *P. radicosa* and *P. rigescens* connect so closely with those of the European *Lescuraeas* as to leave no doubt of their being congeneric. On the other hand the sporophyte characters of *P. radicosa* closely connect with those of *P. atrovirens* while those of *P. rigescens* do the same with the sporophyte characters of *Lescuraea striata*. Indeed, so closely related are these last that Schimper* refers to *P. rigescens* under *Lescuraea* as a "*species Americanae distinctissima*." Sullivant,† however, held that *P. rigescens* (*Leskea rigescens* Wils.) was simply a

* Syn. Musc. Eur. 2 : 621. 1876.

† Ms. Notes on *Pseudoleskea* in Gray herb.

variety, var. *gracilior*, of *P. radicosa* and that this species, "a good *Pseudoleskea*," connected *Pseudoleskea* with *Lescuraea*. As recognized in this Revision the *Pseudoleskeas* constitute an unbroken series more closely related, as they should be, by their sporophyte characters than by their gametophyte.

In this connection it is impossible to make mention of the many favors of which I have been the recipient while engaged in the preparation of this monograph. My grateful acknowledgments however are due Mrs. Britton for invaluable assistance and unnumbered kindnesses and Mr. R. S. Williams for the care with which he has executed the drawings. For valued contributions, types, specimens, notes, my sincere thanks are due Prof. John Macoun, Mr. H. N. Dixon, Mr. Jules Cardot, Dr. B. L. Robinson, Dr. M. A. Howe, M. Eugene Autran, Mr. A. Gepp, Mr. J. B. Leiberg, Rev. A. C. Waghorne, Prof. J. M. Holzinger, Mr. R. S. Williams and Mr. C. E. Faxon.

PSEUDOLESKEA Bryol. Eur. 5: 1852. In part

Plants small to medium size growing on rocks, stones, bases of trees, rarely on rotten wood or the ground, in mountainous regions. Stems radiculose, pinnately branched, central strand none or rudimentary; branches simple, usually recurved at tips; paraphyllia numerous, mostly linear-lanceolate; leaves papillose or smooth, entire or serrulate above, biplicate, ovate-lanceolate, acuminate, costate, margins more or less recurved; leaf cells quadrate-hexagonal to linear-rhomboidal; capsules erect or inclined, straight or curved, pachydermatic, air spaces none, stomata few at base and functionless; exostome well developed, teeth confluent at base into a colored basal band of the same texture; endostominal band $\frac{1}{3}$ to $\frac{1}{6}$ the length of the teeth; segments as long as the teeth; cilia poorly developed; calyptra cucullate.

Braithwaite* and some others reduce *Pseudoleskea* to a subgenus under *Leskea*. This reduction is probably based on insufficient data. The species of *Pseudoleskea* are usually stouter plants, the leaves more strongly recurved on their margins and the areolation longer and narrower. The peristomes moreover show a higher grade of development, the exostomes have a distinct basal band and the exothecial cells are quadrate and thick-walled.

---

* Brit. Moss. Flora, 3: 9. 1896.

Key to Species

Median cells of stem leaves usually not more than twice as long as wide.	
Leaves papillate on both surfaces.	1. *atrovirens.*
Leaves smooth or papillate on upper surface.	
Leaves long-acuminate.	2. *oligoclada.*
Leaves acute to short-acuminate.	3. *pallida.*
Median cells of stem leaves usually more than twice as long as wide.	
Stems long, branches few, without radicles.	4. *denudata.*
Stems short, radiculose, freely branching.	
Capsule curved when dry, segments oblong-lanceolate.	5. *radicosa.*
Capsule straight when dry, segments narrowly linear.	
Basal cells oblong-quadrate in several rows	6. *rigescens.*
Basal cells oblong-linear in two or three rows.	7. *substriata.*

§ EU-PSEUDOLESKEA: Plants rigid, papillose or smooth, median leaf cells not more than twice as long as wide, capsule asymmetric, endostomial band about ⅓ the length of the teeth.

1. PSEUDOLESKEA ATROVIRENS (Dicks.) Bryol. Eur. **5**: 2. *pl. 477.* 1852

Hypnum atrovirens Dickson *fasc. 2.* 10. 1790.

Leskea (?) *patens* Lindb. Soc. pro Fauna at Flora Fenn. 1880.

Pseudoleskea ticinensis Bott. Soc. Tosc. Sc. Nat. 1891.

Pseudoleskea atrovirens, var. *patens* (Lindb.) Hagen in Sched. 1894.

Pseudoleskea heterocladioides Kindb. Rev. Bryol. **22**: 83. 1895.

Pseudoleskea tenella Kindb. Eur. & N. Am. Bry. 50. 1896.

In loosely spreading tufts, dark green above, reddish brown below. Stems 3–5 cm. long, prostrate or prostrate-ascending, radiculose, simple or divided, sparingly branched below, irregularly pinnately above: branches simple, unequal, straight or curved, paraphyllia linear-lanceolate: stem leaves asymmetric, appressed-incurved when dry, erect-spreading on all sides when moist, the lower sometimes spreading-recurved, entire or serrate above; from an ovate or ovate-oblong subdecurrent base gradually acute to somewhat abruptly acuminate, sharply and obliquely pointed, straight or subsecund, margins recurved below, not rarely also at the base of the acumen, lightly biplicate, costate to ¾, .8–1.2 mm. long, .4–.55 mm. wide: cells of stem leaves nearly isodiametric, incrassate, chlorophyllose, unipapillate on both surfaces, papillae central, conic on upper surface, round and flat on lower: median cells quadrate-hexagonal, rarely suborbicular or oblong-hexagonal, .007–.009 mm. wide; also the basal quadrate, in several rows; apical oval-oblong. Dioicous: inner perichetial bracts whitish, loosely erect, narrowly acuminate, lightly costate: pedicels smooth, reddish brown, somewhat curved, 8–10 mm. long: capsule inclined to horizontal, broadly oval, asymmetric: exothecial cells thick-walled, roundish quadrate: urn 1.5 mm. long, 8 mm. wide, constricted when empty: annulus narrow: exostomial teeth yellowish brown, margined, confluent into a purplish red basal band 5 joints wide: lamellae numerous, well developed: endostomial band yellowish, papillate, ¼–⅓ the length of the teeth; segments as long as the teeth, not rarely slightly open on the keel: cilia one or two, poorly developed: spores rough, .012–.016 mm.; ripe in spring.

Type locality unknown, probably Scotland.

On rocks, rarely on the bases of trees or the ground. From Labrador and Newfoundland (Waghorne) to British Columbia, (Macoun) southward. Mt. Washington, N. H. (C. E. Faxon), Idaho (Lieberg, Sandberg), Montana (Williams), Washington (Röll, Suksdorf), California (Bolander), Greenland?

EXSIC.: Ren. & Card. Musc. Amer. Sept. 92; Husnot Musc. Gal. 343.

Like all wide-spread species *P. atrovirens* presents a number of forms, none however sufficiently distinct to be regarded as good varieties. Depauperate and diseased plants, in which the normal characters are more or less obscured, are easily referred to the type. One of these, *P. tenella* Kindb., collected on the Labrador, appears at first sight distinct in its nearly branchless stems and smaller leaves, but the leaf-cells and capsules suffice to locate it. On the other hand, stouter plants from the Northwest, with leaves more nearly symmetric, capsules slightly larger, cilia better developed and opercula often short beaked, represent the highest development of the species.

An examination of European material revealed the fact that at least two distinct species were passing as *P. atrovirens*. In order to ascertain which of these had priority, specimens were submitted to Mr. Gepp with a request that they be compared with the type in herb. Dickson in the British Museum. In reply he said, "I am able to tell you that Dickson's type agrees macroscopically and microscopically with No. 1, the leaf-cells in each are quadrate-hexagonal to oval hexagonal, nearly isodiametric, chlorophyllose and stoutly papillose." No. 1, to which Mr. Gepp refers, was collected by Greville on Ben Lawers. There is therefore no doubt as regards the identity of this species as the leaf-cells are distinctive.

Under *Pseudoleskea*, Limpricht* recognizes but two species, *P. patens* (Lindb.) and *P. atrovirens* (Dicks.), the last with var. *brachyclados* and var. *tenella*. While it is plain that *P. patens* is the same as Dickson's plant, it is not so plain as to what is to be understood by his *P. atrovirens*. Nor do the exsiccatae which he cites help matters much. As these appear in the herb. Jaeger, they but loosely fit the description he gives. In point of fact the exsiccatae belong to a species already referred to as passing for *P. atrovirens* and whose proper name must be ferreted out of the synonyms of this species. It is closely related to *P. oligoclada* Kindb. and is probably *Leskea incurvata* Hedw.

Leskea brachyclados Schwaegr.† usually considered a variety of *P. atrovirens*, has given rise to its share of confusion. Limpricht states that "diese varietat von den Autoren sehr verschieden gedeutet," as it certainly is if reliance can be placed on the type kindly loaned Mrs. Britton by M. Autran from herb. Boissier. This plainly shows that *Leskea brachyclados* is more closely related to *P. radicosa* (Mitt.) than to Dickson's plant, in fact it is scarcely distinct from it. Limpricht's var. *brachyclados* is probably a good species.

2. PSEUDOLESKEA OLIGOCLADA Kindberg, Bull. Torr. Club, 17: 277. 1890. [Pl. 6]

In rigid spreading tufts, yellow-green to reddish brown, usually with a subvitreous lustre. Stems 3–6 cm. long, prostrate-ascending, sparingly branched, curved at the tips: branches unequal, subjulaceous, recurved: paraphyllia numerous: stem leaves close, 6–8-ranked, appressed when dry, erect speading when moist, falcate-secund, biplicate, margins more or less recurved; from an oblong-ovate subdecurrent base, somewhat gradually narrowed into a long, serrate or entire acumen, 1.2–1.5 mm. long, .45–.6 mm. wide: costa stout, round, toothed on lower surface, disappearing in the acumen: cells of stem leaves not uniform, rather small and compact, with rounded-obtuse ends; primordial utricle usually distinct; median cells smooth on lower surface, lightly unipapil-

* Die Laubmoose, 2: 805. 1896.

† Schulte. Reise auf den Glockner, 2: 364. 1804.

late on upper, not rarely smooth on both, oval-rhombic to linear-oblong, .006–.008 mm. wide, 2 to 3 times as long: basal cells quadrate-oblong to sublinear; alar transversely oval, becoming roundish quadrate and extending well up the margins; apical small, oval to oval-oblong: branch leaves falcate, more distinctly serrulate, scarcely plicate. Dioicous: perichetial bracts erect, whitish, long and narrowly subfiliform acuminate, distantly toothed or entire, lightly costate: cells long linear, subvermicular: pedicels 9–11 mm. long, more or less curved: capsule oval-oblong, subsymmetric, cernuous, reddish brown: exothecial cells roundish oblong-quadrate; exostomial teeth reddish brown, confluent at base into a reddish band 5 joints wide: lamellae numerous, stout: endostomial band yellowish, scarcely papillose, about ⅓ the length of the teeth; segments as long but narrower than the teeth, open on the keel: cilia one to two, more or less developed; annulus narrow, indistinct: operculum conic: spores rough, .014–.016 mm.; matures in spring.

Type locality Vancouver Island; duplicate of type in Coll. Can. Geol. Surv.; collected by Prof. John Macoun, June 8, 1887.

On rocks and stones apparently at high altitudes. British Columbia (Macoun), Washington (Röll), Montana (Williams), Idaho (Leiberg), Colorado (Brandegee).

EXSIC.: Macoun, Can. Musc. 610.

P. oligoclada differs from *P. atrovirens* in its leaves being much longer acuminate (acumen longer than body), its polymorphous leaf cells, smooth or lightly papillate on upper surface; from *P. radicosa* in being more rigid, leaf cells smaller and capsule more symmetric. Forms occur with the margins of the leaves less strongly recurved, costa thinner and shorter and median cells somewhat longer; it appears to take on these characters in its advance eastward and southward.

3. **Pseudoleskea pallida** sp. nov. [Pl. 6]

In dense appressed tufts, pale olive green above, rusty brown below. Primary stems defoliate, secondary prostrate-ascending, 2–4 cm. long, often matted together below, sparingly branched above; branches straight or curved at tips, but slightly diverging: paraphyllia few, small: stem leaves asymmetric, deeply concave, biplicate, lightly costate to near apex, straight or subsecund, .7–.9 mm. long, .4–.5 mm. wide; from a roundish ovate base gradually acute to abruptly short-acuminate, acumen somewhat blunt pointed and serrate or narrow and semi-twisted: cells of stem leaves scarcely papillose, somewhat clear, primordial utricle usually distinct; basal cells rectangular-quadrate; alar quadrate to transversely oval; median rhombic-oval to hexagonal-oblong, .007 .009 mm. wide, about twice as long; apical oval-oblong. Dioicous: perichetial bracts erect, serrulate or entire, inner lightly costate: pedicels curved, 8 mm. long: capsule subsymmetric, oval-oblong, inclined, exothecial cells quadrate-oblong, irregular: urn 1.5 mm. long, .8 mm. wide: exostomial teeth yellowish confluent at base into a reddish basal band 3–4 joints wide: endostomial band pale yellow, ¼ the length of the teeth; segments as long as teeth, slightly open: cilia 2, rudimentary: annulus? operculum? spores rough, .013–.016 mm.

Type locality Colorado; type in coll. of Columbia University; collected by T. S. Brandegee.

Tenderfoot Creek, Belt Mts., Montana. R. S. Williams, Sept. 22, 1890. 4000 ft. altitude.

That there occurs in Colorado and Wyoming, and probably in the adjoining States, a *Pseudoleskea* distinct in its characters from the other species admits of but little doubt. It is, however, difficult to form a conception of its central type by reason of the scantiness and poor quality of the material at hand. It is just possible that the species in question is a derivative from *P. oligoclada*. Specimens collected by Earle & Tracy in southwestern Colorado, and by Elias Nelson in Wyoming, are intermediate between *P. pallida* and var. *filescens* and show a verging toward depauperate forms of *P. oligoclada*.

3a. **Pseudoleskea pallida filescens** var. nov.

Secondary stems filiform, simple, or with a few unequal branches: leaves ovate-lanceolate, gradually contracted to a narrowly acute or obtuse, serrate point, often serrulate above, .3–.4 mm. wide, .6–.8 mm. long: margins more or less recurved: costa shorter, disappearing above the middle: perichetial bracts erect, serrulate above, scarcely costate: capsule unknown.

Colorado; collected by T. S. Brandegee.

Differs from the type in being much more slender, leaves narrower and areolation somewhat longer and narrower, median cells oblong linear, and branch leaves longer acuminate and serrulate

§ RADICOSELLA: Plants rather soft, lightly papillose or smooth, median cells usually more than twice as long as wide, basal cells quadrate to oblong-quadrate in several rows: leaves falcate-secund.

4. **Pseudoleskea denudata** Kindberg, Eur. & N. Am. Bry. **2**: 52. 1896. [Pl. 6]

Pseudoleskea sciuroides, var. *denudata* Kindb. Cat. Can. Plants **6**: 181. 1892.

? *Ptychodium oligocladum* Limpricht, Die Laubmoose, **2**: 801. 1895.

In loose spreading tufts, pale yellow-green above, dirty white below; stems nearly destitute of branches, not radiculose, prostrate (zigzag-undulate), 6–10 cm. long, defoliate below; stems and branches hooked at tips: paraphyllia multiform, mostly long and narrowly linear-lanceolate: lower stem leaves broken, shreddy; upper loosely appressed and suberispate when dry, erect-spreading when moist, concave, more or less falcate-secund, lightly plicate, folds 2–4, margins broadly recurved to apex; from a decurrent base ovate-lanceolate, acuminate, narrowly and obliquely pointed, entire or serrulate above, 1.9–2.2 mm. long, .7–.9 mm. wide: costa narrow, yellowish, subpercurrent: cells of stem leaves yellowish at base, smooth, clear, narrow: median cells sublinear vermicular, .005–.007 mm. wide, 4–6 times as long: basal oblong-rectangular: alar quadrate-oblong: apical linear: branch leaves much smaller, distinctly serrulate above. Dioicous: capsule unknown.

Type locality, British Columbia; duplicate of type in Coll. of the Geol. Surv. of Can., no. 931; collected by Prof. John Macoun on rocks along the Asulcan Creek near a glacier of that name, Selkirk Mountains, alt. 6000 ft., Aug. 7, 1890; Can. Musc. no. 564.

4a. **Pseudoleskea denudata Holzingeri** var. nov.

In its gametophyte characters this differs from the type in its shorter and diffusely branched stems, in its somewhat smaller and more strongly falcate-secund leaves. Perichetial bracts small, thin, broadly ovate-oblong, abruptly and narrowly acuminate, serrulate above, tips spreading-recurved, inner subvaginant, costate: pedicels lightly curved, flattened and twisted above, 10–12 mm. long: capsules broadly oblong-oval, asymmetric, inclined, elongated and strongly contracted when dry and empty: urn 1.5–2 mm. long, 1 mm. wide: exothecial cells quadrate to quadrate-oblong, thick walled: exostomial teeth reddish brown, well developed and strongly lamellate, confluent into a purplish red band 4 joints wide: endostomial band yellowish papillose, ⅓ the length of the teeth: segments as long as teeth, carinate, open:

cilia 1–3, papillose: annulus narrow: operculum short conic: spores rough, .016–.020 mm.: ripens in spring.

On the ground at high altitudes; collected by J. M. Holzinger and J. B. Blake near Lake McDonald, northwestern Mont., July 28, 1898, and by R. S. Williams in fruit near Columbia Falls, Mont., Oct. 10, 1895. A smaller form of what appears to be the same by Dr. Bell at Cape Chudleigh, Hudsons Strait; in Professor Macoun's collection. Bryoth. Mont. no. 343, R. S. Williams.

P. denudata, the largest of our species of *Pseudoleskea*, is easily recognized by its being nearly destitute of branches. It is probable, however, that it will be but rarely found in this form, but that transitional forms will be the more common. Var. *Holzingeri* is distinguished from *P. radicosa* by its larger leaves, longer leaf cells and its freedom from radicles.

5. PSEUDOLESKEA RADICOSA (Mitt.) Lesq. & James. [Pl. 7]

Hypnum radicosum Mitten Jour. Linn. Soc. **8**: 31. 1864.

Hypnum (*Pseudoleskea*) *radicosum* Lesq. & James, N. A. Mosses. 320. 1884.

Macounia sciuroides Kindb. Enum. Bryin. Exot. 1888.

Pseudoleskea sciuroides Kindb. Bull. Torr. Club, **17**: 276. 1890.

Hypnum congestum Wils. Ms.

Hypnum congestum Hook. & Wils. in Drumm. N. A. Mosses, no. 225, in part.

In soft subsericeous tufts, yellow-green to dark green: stems 3–5 cm. long, somewhat densely radiculose, irregularly branched: branches usually recurved, simple: paraphyllia numerous, multiform: stem leaves loosely appressed when dry, spreading when moist, secund, subdecurrent, biplicate, margins narrowly recurved to base of acumen: costa stout, usually toothed, disappearing in the acumen, from an ovate to oval-oblong base gradually or abruptly contracted to a narrow, oblique, serrulate or entire acumen, 1.2–1.6 mm. long, .35–.5 mm. wide: cells of stem leaves somewhat loose, smooth on lower surface, lightly papillose on upper, not rarely smooth on both: primordial utricle usually distinct: basal cells oblong-quadrate, in several rows; medial oval-oblong to linear-rhomboidal, .008–.010 mm. wide, 2–4 times as long: alar cells quadrate; apical linear; branch leaves falcate-secund, serrate. Dioicous: perichetial bracts erect, thin, whitish, finely acuminate, inner subvaginant, lightly costate: pedicels 9–12 mm. long, curved: capsules oval to obovate-oblong, asymmetric, inclined to subpendant, elongated, contracted and arcuate when dry: urn 1.3–1.9 mm. long, .7–.9 mm. wide: exothecial cells thick-walled, oblong-quadrate: exostomial teeth reddish margined, confluent into a purplish red basal band 5 joints: endostomial band pale yellow, finely papillose, about ¼ the length of the teeth: segments oblong-lanceolate, carinate, somewhat open, as long but narrower than the teeth: cilia rudimentary: annulus narrow, indistinct: operculum conic, rarely short beaked: spores rough, .014–.018 mm.; ripe in spring and early summer.

Type locality, North America.

On rocks, stones, rotten wood, bases of trees and on the ground. From Labrador (Waghorne) and New Hampshire (Allen, Austin, C. E. Faxon) westward to British Columbia (Dawson, Macoun), probably failing in the central region. Idaho (Leiberg), Montana (Williams, Holzinger and Blake), Wyoming (Nelson), Washington (Piper, Röll).

Exsic.: Ren. & Card. Musc. Am. Sept. 93 as *P. rigescens* Lindb.; Macoun, Can. Musc. 627 and 665 as *P. atrovirens* var.

5a. **Pseudoleskea radicosa compacta** var. nov.

In intricate tufts or loose mats, dark green to blackish, branches often with yellow-green tips: stems 2–3 cm. long; branches short, turgid: stem leaves not rarely straight: median leaf cells oval-rhombic to oblong-hexagonal.

In general appearance quite distinct from the ordinary forms of the type but lacking specific charters. On rocks, Rocky Mts., B. C., Professor Macoun.

Mitten based *Hypnum radicosum* on Drumm. Musc. Am. 225, distributed as *Hypnum tenax*. Several sets of these were issued and no. 225 was not the same in all. Some packets contained simply *P. radicosa*, others a mixture of this and *P. rigescens*. As the capsules of the latter were in better condition than those of the former, one was made to supplement the other. Wilson appears to have been the first to discover that there were two distinct species in some of Drummond's 225, one of which he named *Hypnum congestum*, the other *Leskea rigescens*. He failed, however, to publish descriptions of either, and had not Lindberg rescued the latter, both would have been dropped as *nomina nuda*.

In the Sullivant collection are two interesting specimens both of which were sent to Sullivant by Schimper. One of these is *Hypnum radicosum* from Mitten, the other *Leskea rigescens* from Wilson. These are to be regarded as duplicates of the types and are of value in that they serve to fix the meaning of these species.

6. PSEUDOLESKEA RIGESCENS (Wils.) Lindb. Act. Soc. Fenn. **10**: 277. 1872. [Pl. 7]

Leskea rigescens Wils. Ms. Drumm. Musc. Am. 225 in part.

Lescuraea rigescens Bryol. Eur. **5**: 1851.

Hypnum radicosum, var. *gracile* Lesq. & James, N. A. Mosses. 320. 1884.

Pseudoleskea stenophylla Ren. & Card. Bot. Centralbl. **44**: 421. 1890.

Lescuraea imperfecta C. M. & K. Cat. Can. Plants, **6**: 170. 1892.

Lescuraea stenophylla Kindb. Eur. & N. A. Bry. **26**: 1897.

In soft, somewhat silky intricate tufts or mats, pale yellow-green. Stems prostrate, 2–4 cm. long, radiculose, irregularly branched: branches unequal, curved, attenuate: paraphyllia small, linear-lanceolate: stem leaves subcrispate and loose when dry, erect-spreading when moist, straight or subsecund, lanceolate to ovate-lanceolate, gradually long and narrowly acuminate, entire or serrulate above, lightly biplicate, thinly costate, margins plain or revolute below, .8–1.2 mm. long, .25–.35 mm. wide: cells of stem leaves smooth or lightly papillose on upper surface, rarely on both: basal cells quadrate oblong in several rows: alar-quadrate, extending well up the margins; median sublinear-rhomboidal .007–.008 mm. wide, 2–4 times as long; apical oval to oval-oblong or sublinear; branch leaves narrower, serrulate above. Dioicous: perichetial bracts long lanceolate, narrowly acuminate, thin, erect, whitish, inner sub-sheathing, scarcely costate: pedicels erect or slightly curved above, 6–8 mm. long: capsule small, oval-oblong, usually erect, subsymmetric, lightly contracted when dry: urn 1 mm. long, 7 mm. wide: exothecial cells thick-walled, quadrate: exostomial teeth yellow-red, confluent at base into a dark red band 3 joints wide: endostomial band pale yellow, one sixth the length of the teeth or less; segments narrowly linear, as long as the teeth, concave, joints stout, 6–8: cilia none; annulus indistinct or none: spores nearly smooth, .014–.018 mm.; ripe in spring.

Type locality, North America.

On bases of trees or shrubs, more commonly on *Alnus*, and on rotten wood and rocks, in damp places at high altitudes. Montana (Williams), Idaho (Leiberg), Washington (Röll), British Columbia (Macoun).

EXSIC: Macoun, Can. Musc. 580.

P. rigescens is somewhat variable. The stem leaves range from being entire to serrate on the acumen, smooth to lightly papillose on both surfaces, costa thin, disappearing above the middle, to rather stout, sometimes toothed and subpercurrent. These differences are not rarely noted in a single specimen.

From *P. radicosa* it differs in its narrower, and longer acuminate leaves (acumen longer than body), longer vaginule and perichetial bracts, and in its small, suberect capsule with linear segments. The gametophyte characters of depauperate forms of *P. radicosa* are so near the stouter forms of *P. rigescens* that it is sometimes almost impossible to make a satisfactory determination without the sporophyte.

6a. **Pseudoleskea rigescens Howei** var. nov.

Intricate, appressed, pale green silky tufts: stems and branches strongly recurved: stem leaves secund to falcate-secund, serrate at apex, .7–.9 mm. long, .25–.35 mm. wide; margins narrowly recurved: costa stout, disappearing in the acumen: areolation compact; basal and alar cells numerous, quadrate, filling one third of the body of the leaf: capsules not seen.

Collected by Dr. M. A. Howe, Mt. Shasta, Calif., Aug. 5, 1894.

§ LESCURAEA Sch.: Plants soft, leaves usually smooth, median leaf cells long and narrow, extending downward to nearly the line of insertion, capsule symmetric, segments linear, cilia none.

7. **Pseudoleskea substriata** sp. nov. [Pl. 7]

In appressed subshining tufts, yellowish green to golden-brown: stems prostrate, radiculose, 2–4 cm. long, pinnately branched: branches suberect, simple, scarcely curved: paraphyllia few, multiform: stem leaves erect-spreading, straight, deeply biplicate, oval-oblong, gradually acute or acuminate (acumen shorter than body), .8–1 mm. long, .3–.4 mm. wide: margins strongly recurved to nearly apex, serrate above: costa toothed, subpercurrent: stem leaves smooth, clear; basal oblong-linear in 2 or 3 rows: alar quadrate, rugose, thick-walled, filling the space between folds and margins, extending upwards and becoming oblong:

apical linear; median sublinear .006 mm. wide, 4–6 times as long. [Dioicous: perichetial bracts whitish, erect, inner sub-sheathing, finely acuminate, entire or serrulate above, lightly costate: pedicels 7–9 mm. long, straight or nearly so: capsules erect, symmetric, oval-oblong to subcylindric: urn 1.2 mm. long, .6 mm. wide: exothecial cells thick-walled, quadrate-oblong: exostomial teeth yellowish, linear-lanceolate, confluent at base into a reddish band 3 joints wide, scarcely lamellate: endostomial band about $\frac{1}{6}$ the length of the teeth; segments narrowly linear, somewhat shorter than the teeth: cilia none: annulus narrow, indistinct: operculum long conic: spores rough, .013–.016 mm.: from European specimens.]

Type locality, British Columbia; type in Coll. of Geol. Surv. of Canada; collected by Prof. John Macoun on rocks below Hector, Rocky Mts., Aug. 13, 1890. R. S. Williams, rocks on shores of Lake Lindeman, Northwest Territory, May 21, 1898. Sterile.

The basal cells which are oblong-linear in 2 to 3 rows, abruptly passing to the median, readily distinguished *Lescuraea* from the other two subgenera in which the basal cells are quadrate or oblong-quadrate in several rows passing somewhat gradually to the median.

Plants referable to this subgenus are evidently rare in North America. In Europe they are not uncommon, on the higher mountains, often in fruit. Limpricht* recognizes two species, *L. striata* (Schwaegr.) Br. & Sch. and *L. saxicola* (Br. & Sch.) Molendo, which represent the extremes of a series of intergrading forms. Between these are a number of intermediate forms some of which are sufficiently distinct to be recognized as species. *P. substriata* is one of these and differs from *L. striata* in being smaller and in having its smaller leaves shorter acuminate and the acumen more or less sharply serrate. In *L. striata* the leaves are usually entire, long and slenderly acuminate, 1.8 mm. long, .5 mm. wide.

EXCLUDED OR DOUBTFUL SPECIES

Pseudoleskea atricha Kindb. Eur. & N. A. Bry. 53. 1897.

Pseudoleskea atrovireus var. *atricha* Kindb. Cat. Can. Plants, 6: 180. 1892.

* Die Laubmoose, 2: 789. 1895.

"Leaves ovate-oblong, short acuminate, cells sublanceolate, conflated, irregularly sinuous; costa not excurrent. Capsule unknown, tufts brownish or olivaceous with green branch tips, loosely cohering, without rhizoids. Branches subjulaceous, irregularly divided; paraphyllia few."—Eur. & N. A. Bry. 53.

Type locality, Griffin Lake, B. C.

Duplicates of the type of this dubious species are in Prof. Macoun's collection, no. 385. As it has been apparently collected but once, and then in a poor condition, without fruit, it would be well perhaps to suspend judgment until more and better material is at hand.

PSEUDOLESKEA FALCICUSPIS C. M. & K. Cat. Can. Plants **6**: 182. 1892

In Prof. Macoun's collection are a few specimens bearing this name, some of which are *P. atrovirens*, the others *P. oligoclada*. The description in Macoun's catalogue, "leaves very papillose" and "cells rotundate" evidently applies to *P. atrovirens;* that in Eur. & N. A. Bry. "leaves faintly papillose and cells oval-oblong" to *P. oligoclada*. As both of these species antedate *P. falcicuspis* it matters little of which it is a synonym so that its true standing be recognized.

Pseudoleskea atrovirens filamentosa Boulay Musc. de la France, **1**: 162. 1884.

According to Barnes & Heald * this variety is found in Montana, Oregon and Washington. As I have seen no specimens of it from these localities I can neither confirm nor deny its occurrence there. From Boulay's description slender forms of *P. oligoclada* might be taken for it and the same is true of *P. denudata Holzingeri*. I am indebted to Mr. H. N. Dixon for a specimen collected and named by M. Boulay. It is a well-marked form of what passes as *P. atrovirens* with European bryologists, but it is entirely distinct from that species. The median cells of var. *filamentosa* closely resemble those of *P. substriata*, but the basal are oblong-quadrate in several rows and the capsule is arcuate.

* Analytic Keys to the Genera and Species of N. A. Mosses, 337. 1897.

Description of Plates

PLATE 6

Pseudoleskea atrovirens.—1. Upper and lower leaves. 2. Outer and inner perichetial leaves. 3. Paraphyllium. 4. Apex of leaf. 5. Median cell. 6. Alar cells. 7. Cross-section.

Pseudoleskea oligoclada.—8. Branch leaves. 9. Stem leaf. 10. Paraphyllium. 11. Apex of leaf. 12. Median cells. 13. Alar cells. 14. Cross-sections of leaf. 15. Capsule.

Pseudoleskea pallida.—16. Stem leaves. 17. Paraphyllium. 18. Apex of leaf. 19. Median cells. 20. Alar cells. 21. Back of apex of leaf, showing rough costa, and papillae on upper surface.

Pseudoleskea denudata.—22. Branch leaves. 23. Stem leaf. 24. Simple and divided paraphyllia. 25. Apex of leaf. 26. Median cells. 27. Alar cells.

PLATE 7

Pseudoleskea radicosa.—1. Branch leaf. 2. Stem leaf. 3. Perichetial leaf. 4. Apex of leaf. 5. Median cells. 6. Alar cells. 7. Cross-section of leaf. 8. Back of costa near apex. 9. Paraphyllium.

Pseudoleskea rigescens.—10. Stem leaves. 11. Perichetial leaf. 12. Paraphyllium. 13. Apex of leaf. 14. Median cells. 15. Alar cells. 16. Cross-section.

Pseudoleskea substriata.—17. Branch leaf. 18. Stem leaves 19. Paraphyllium. 20. Apex of leaf. 21. Median cells. 22. Basal half of leaf. 23. Cross-section. 24. Back of costa near the apex.

Pseudoleskea oligoclada.—25. Capsule with lid. 26. Capsules without lid. 27. Peristome.

Pseudoleskea denudata.—28. Horizontal and arcuate capsules. 29. Peristome.

Pseudoleskea radicosa.—30. Two curved capsules, with and without lid. 31. Peristome with oblong-lanceolate segments.

Pseudoleskea rigescens.—32. Two straight capsules, with and without lid. 33. Peristome with linear segments.

Leaves magnified about 25 diameters; cells and sections magnified up to 260 diameters.

Studies in Sisyrinchium.—VII: The Species of British America

By Eugene P. Bicknell

The examination of our larger collections of blue-eyed grasses has disclosed few specimens from north of the United States other than those contributed by Prof. John Macoun. For this reason it was a matter of the greatest interest to receive recently from Professor Macoun his entire British American collection or, more exactly, some thirty-three sheets representing the general result of many years of field-work covering the wide range of British American territory from Newfoundland to Vancouver. This collection, supplemented by such other material as has been brought together, presents so much that is new, especially in regard to the range of our species, that it has seemed well to make it the subject of a separate paper.

It should be said that the genus *Sisyrinchium* is here taken in a somewhat restricted sense to embrace only the homogeneous and very natural group of the blue-eyed grasses proper, thus excluding *Sisyrinchium grandiflorum* Douglas, which is clearly the type of a distinct genus, as recognized by Rafinesque, and should ✓ stand as *Olsynium Douglasii* (A. Dietr.), and omitting further the more closely allied yellow-flowered genus *Hydastylus* Salisbury, typified by *Sisyrinchium Californicum* Aiton.

As thus limited it appears that eight species of *Sisyrinchium* may be ascribed to British America and there is no doubt that this number may be increased. Certain more or less distinct forms of several of the species might, even now, be recognized but are passed over. It is further altogether probable that several northwardly ranging species of the United States cross over into Canadian territory and there is also evidence that new species yet remain to be discriminated.

The species which may be recognized at the present time as British American are the following, noting them from east to west:

S. graminoides Bicknell.	*S. septentrionale* Bicknell.
S. angustifolium Miller.	*S. Idahoense* Bicknell.
S. albidum Raf.	*S. littorale* Greene.
S. mucronatum Michx.	*S. Macouni* sp. nov.

Of these all but *S. littorale* and *S. Macouni* belong also to the United States, though *S. septentrionale* is all but exclusively British American.

Other species known to occur in states adjoining Canadian territory are the following:

S. Atlanticum Bicknell, Maine (North Berwick, York Co., June 21, 1891, J. C. Parlin, in Herb. Gray, not previously recorded from the state); New Hampshire; Vermont.

S. arenicola Bicknell, Nantucket; New York.

S. hastile Bicknell, Michigan.

S. Farwellii Bicknell, Michigan.

S. strictum Bicknell, Michigan.

S. apiculatum Bicknell, Michigan.

S. campestre Bicknell, Minnesota; North Dakota.

S. occidentale Bicknell, North Dakota; Montana; Idaho.

S. segetum Bicknell, Washington.

S. sarmentosum Suksdorf, Washington.

SISYRINCHIUM GRAMINOIDES Bicknell

This species is of interest as being the only normally branched species occurring north of the United States. Since it there extends northward to central and western New York and throughout the southern peninsula of Michigan its occurrence in the southwestern extremity of Ontario was to be expected, and it is only surprising that a single specimen alone attests its presence there. Elsewhere in Canada the plant was scarcely to be looked for and it is a matter of no little surprise to find it as far north and east as the coast of Gaspe in Quebec and on Newfoundland and Sable Island. These occurrences afford a most unexpected extension of range as the species appears to be unknown elsewhere in Canada east of Ontario nor in New England beyond eastern Massachusetts.

The specimens from Ontario and Gaspe are perfectly typical, while those from Newfoundland and Sable Island show departures from the ordinary plant so considerable as to give them some rank as insular forms. Indeed the Newfoundland plant would scarcely be taken at all for *S. graminoides* and has been distributed as *S. angustifolium* Miller (Robinson's & Schrenck's Flora of Newfoundland, No. 129) to which species I had myself doubtfully referred it (Bull. Torr. Club, **26**: 339).

A number of sheets of the distribution show the plant to be mostly only 6–10 cm. high, and simple-stemmed with somewhat prolonged outer bract, thus closely simulating *S. angustifolium*. It is, however, clearly a much reduced northern or insular form of *S. graminoides*, drying dark as in that species, and showing the weak and narrow proper stem and relatively broad thin rings with closely serrulate edges, and also its thin-walled sub-globose capsules or spreading pedicels. The leaves are also those of that species, unmistakably so in a few stouter examples where they become 4 mm. wide, although mostly not exceeding 1–1.5 mm.

The tendency of this little plant to develop more clearly the characters of *S. graminoides* is shown by two examples collected with the others which are three to four times taller and forked into two slender branches. These specimens show the extreme form of attenuation seen in the mainland plant and are nearly matched by the specimens from Sable Island, where Professor Macoun reports the plant as common. It is there uniformly very slender, the stems and leaves being but 1–2 mm. wide, and appears to have unusually small capsules, unlike the Newfoundland plant on pedicels scarcely spreading or exserted. It differs further from the latter in larger size (15–30 cm. high) rather broader spathes with less prolonged outer bract and in slenderly branched stem, only a few examples having the stem simple.

In Gaspe and Newfoundland, at the extreme northeastern limit of its habitat, this, the widest-ranging of all our species except *S. angustifolium*, flowers from late in July till the end of August, three to four months later than in the Gulf States, two to three months later than in the South Atlantic States, except at high altitudes, and one to two months later than in the latitude of New Jersey. In northern Michigan the species is equally late flowering. In Ontario it appears to flower about the same time as in central New York, and two or three weeks later than in southern Michigan and New Jersey.

The following specimens may be cited:

SABLE ISLAND: July 22, 1899, in flower; Aug. 4, 1899, immature fruit. John Macoun.

NEWFOUNDLAND: Banks of the Salmonier River, Aug. 26, 1899, B. L. Robinson and H. Schrenck, no. 129, Flora of Newfoundland, nearly mature fruit and some remaining flowers.

QUEBEC: Coast of Gaspe, Aug. 12, 1882, moist meadows, John Macoun; in flower and with young fruit.

ONTARIO: Near Niagara Falls, June 25, 1892, in grassy woods, John Macoun; flowers and young fruit.

SISYRINCHIUM ANGUSTIFOLIUM Miller

This is the most characteristic and generally distributed species of British America, ranging from Newfoundland quite across into British Columbia and north to the Mackenzie River. No eastern specimens have come to hand from farther north than Newfoundland and Riviere du Loup, Quebec. I have elsewhere pointed out that specimens from west of Ontario differ in some rather striking particulars from the more eastern plant, being stiffer and more glaucous with the edges of leaves and stem often quite smooth and with leaves of thicker texture and closer venation and with the primary bract usually more slenderly prolonged. Eastern specimens often show a discoloration on the herbarium sheet in marked contrast with most western examples. It is quite possible that these differences point to two distinct species which a full series of specimens with well-preserved flowers and mature fruit would make it possible to segregate. The western plant itself exhibits a great amount of variation, and certain specimens from Banff, Alberta, appear almost distinct. They are very glaucous and extremely slender and tall, becoming 50 cm. high with the narrow outer bract two to three times the length of the inner one, even becoming 6 cm. long; the slender pedicels become 28 mm. long, and are more than usually exserted; the flowers appear to be rather small and of very delicate texture with an unusual extension of the yellow center along the midvein of the segments.

The species crosses the Rocky mountains into British Columbia, extending further west than I have yet had it from the United States where Madison County, Montana (Rydberg), limits its western record as far as known.

In Newfoundland and Nova Scotia the species comes into flower from late in June till the middle of July, a month to six weeks later than in the neighborhood of New York, and earlier than *S. graminoides* by about the same length of time. In Ontario it comes into flower during the first half of June, while farther west, from Manitoba to British Columbia, the flowering period seems to be rather earlier, often beginning in the first days of June, or even before. The only example seen from as far north as the Mackenzie River was just in flower July 20th.

The following collections may be cited, all made by Professor Macoun unless not otherwise noted.

NEWFOUNDLAND: June 25, 1896, just in flower; July 12 and 15, 1897, in full flower, Rev. A. C. Waghorne.

NOVA SCOTIA: Louisburg, Cape Breton, July 17, 1883, moist meadows, just in full flower. Amherst Island, low grounds, July 30, 1880, just in flower, Richardson.

PRINCE EDWARD'S ISLAND: Brackley Point, meadows, July 3, 1887, full flower and young fruit; July 7, 1888, just in flower.

NEW BRUNSWICK: Campbellton, July, 1877, boggy meadows, R. Chalmers; St. John's River Valley, Woodstock, July 4, 1899, flowers and young fruit. Baie Vert, June 16, 1893, first flowers; Prof. W. L. Goodwin.

QUEBEC: Riviere du Loup, August 26, 1889, meadows, mature fruit, D. N. St. Cyr; Danville, June, 1894, first flowers, N. K. Berg; Montreal, F. W. Kelly.

ONTARIO: Belleville, June 16, 1876, moist meadows, first flowers; Jones Falls, June 11, 1895, fruit full size, J. Fowler; Nepigion River, July 7, 1884, moist meadows, fruit nearly mature; Toronto Island, June 10, 1893, full flower, C. W. Armstrong; Casselman, June 6, 1891, full flower, dampish ground, Jas. M. Macoun, Lambton, C. K. Dodge.

MANITOBA: Lake Winnipeg Valley, 1857, Bourgeau; Stonewall, June 2, 1896, full flower, amongst rocks, open prairie.

ASSINIBOIA: Moose Mountain Creek, June 6, 1883, first flowers, low ground, Jas. M. Macoun; Park Beg, June 23, 1896, fruit nearly mature, open prairie; Crane Lake, June 16, 1894, full flower, meadows.

SASKATCHEWAN: E. Bourgeau, 1858.

ALBERTA: Banff, July 14, 1891, flowers and young fruit.

BRITISH COLUMBIA: Kitamen River, Kootanie Valley, July

1883, fruit and last flowers, Dawson; Donald, Columbia Valley, July 7, 1885, fruit nearly mature; Lower Arrow Lake, June 4, 1890, first flowers. Latitude 54°, June 15, 1875, first flowers; "The exact locality is on the Machaco River, near Fort St. James, B. C." [J. M.].

MACKENZIE RIVER: Fort Wrigley, July 20, 1892, first flowers, Miss E. Taylor; the most northern point from which any species of the genus has been reported. Prof. Macoun writes: "Fort Wrigley is a new location, about half way between Fort Simpson and Fort Norman, on the right bank of the Mackenzie River, about latitude 63°."

SISYRINCHIUM ALBIDUM Raf.

This species must be admitted to the Canadian flora on the evidence of a single collection made at Sandwich, Ontario, by William Boott as far back as May 26, 1887. The specimens (Gray Herbarium) are in full bloom, thus showing the plant to be the earliest flowering of the British American species. The flowers are pale blue, as in most Michigan examples. Since the species is rather common in parts of southern Michigan, it is not surprising to find that it crosses the Detroit River into Ontario.

I have seen but a single specimen of this species from farther east—Stanley county, North Carolina (W. W. Ashe). Very possibly it may extend farther north and east in Ontario.

SISYRINCHIUM MUCRONATUM Michx.

Like *S. albidum* this species crosses the Detroit River into Ontario, having been collected at Sarnia, Lambton county, by Mr. C. K. Dodge in June, 1897. Specimens from farther north in the Province, Wingham, Huron county, have been distributed by Mr. J. A. Morton, collected in full flower June 5, 1895. Most specimens of this collection are much reduced and have very small pale green spathes and but little exserted pedicels only 10–15 mm. long. Mr. Dodge's specimens from Lambton county, have the spathes deep purple and are closely matched by examples from east Pennsylvania.

A material and most unexpected extension of the known range of the plant is afforded through a collection made at Prince Albert, Saskatchewan, by Professor Macoun, June 29, 1896. The specimens are in full flower and appear to differ in no material way from many Pennsylvania examples, having, however, rather long-bracted green spathes and with some of the pedicels more exserted than is usual and longer, 20–27 mm. in length.

The most northern and western point from which the species has been known hitherto is Port Huron, Michigan (C. K. Dodge).

Certain imperfect specimens of a *Sisyrinchium* from northern Minnesota, which I have elsewhere referred to under *S. angustifolium*, if not a distinct species may represent a stoutly developed form of *S. mucronatum*.

SISYRINCHIUM SEPTENTRIONALE Bicknell

Professor Macoun's collection affords a most interesting confirmation of the validity of this species previously described from only scant material. I am now able to record seven separate collections of the plant, giving it a range from western Manitoba north to Saskatchewan and west to British Columbia and Washington:

MANITOBA: west of Fort Ellice, June 29, 1879, flowers and young fruit, wet prairies, Macoun; east of Pipestone Creek, June 26, 1880, flowers and mature fruit, Macoun.

ASSINIBOIA: Moose Mountain Creek, June 16, 1883, full flower, low ground, Macoun.

SASKATCHEWAN: E. Bourgeau, 1858, Palliser's Brit. N. Am. Exploring Expedition.

ALBERTA: Banff, July 8, 1891, flowers and fruit, village street, Macoun.

BRITISH COLUMBIA: Kicking Horse River, Aug. 13, 1890, mature fruit, low gravelly banks, 4000 ft. alt., Jas. M. Macoun.

WASHINGTON: Wilkes' expedition, 1838–42, Spokane to Colville.

The specimens from Idaho elsewhere doubtfully referred here prove to be not this species.

Professor Macoun writes, "This is certainly a good species and seems to prefer drier situations than any of the others. To be more correct it seems to prefer arid spots where water has lain and dried up. Besides the specimens collected I saw it very frequently between Wood Mountain and the Rocky Mountains over

400 miles from east to west. Its white flowers make it easily seen although it is seldom tall."

The following particulars may now supplement the original description of this plant (Bull. Torr. Club, **26** : 452–3):

Plant becoming 35 cm. high, sometimes merely glaucescent: tufts often very close and narrow: primary bract sometimes 6 cm. long and surpassing the inner one 35 mm.: flowers frequently pure white: perianth 4–8 mm. long, column 3–4 mm. high: capsules obovoid-oblong to subglobose, usually thin-walled and corrugate: seeds very small, about .75 mm. in diameter, obovoid and irregularly angled, black, finely rugulose, becoming smooth or nearly so.

SISYRINCHIUM IDAHOENSE Bicknell

BRITISH COLUMBIA: Agassiz, May 8 and 14, 1889, full flower, meadows, Macoun; Lower Frazier River, 49° N. lat., Dr. Lyall, 1859; Vancouver Island, Victoria, June 10, 1893, full flower, Macoun; Nootka Sound, July, 1896, full flower, Jos. R. Anderson.

"This is the common species west of the Coast Range in British Columbia and on Vancouver Island" [J. M.].

The specimens from Agassiz and the Lower Frazier River are nearest to the Idaho type, but are more slender throughout, and with the leaves and stems smooth-edged or nearly so. The specimens from Nootka Sound are small and still more slender, appearing quite unlike the type, but they are imperfect and can be referred at present only to a reduced northern form. The specimens from Victoria are broader-leaved and more discolored besides having the stem distinctly serrulate. They are closely matched by certain specimens from western Washington and Oregon which are doubtless not the same as *S. Idahoense*, but while these latter differ notably from typical *S. Idahoense* in much stouter roots, the roots of the Vancouver plant are equally slender with those of the other British American specimens.

S. Idahoense is almost certainly an aggregate, but the component forms cannot be understood from present material.

It is worthy of note that the Agassiz plant appears to be earlier-flowering than the plant in Idaho, and also blooms decidedly earlier than does *S. angustifolium* anywhere in British America.

SISYRINCHIUM LITTORALE Greene

VANCOUVER ISLAND: Oak Bay, near Victoria, May 31, 1893, first flowers, Macoun.

The counterpart in appearance of many examples of the Alaskan plant, but apparently somewhat more glaucescent and with the stamineal column longer—7–9 mm. high as against a nearly uniform length of 6 mm. in such Alaskan specimens as have been examined. This difference is a suggestive one and its constancy should be especially noted when the plant is again collected.

"I cannot remember seeing this species anywhere else than at Oak Bay" [J. M.].

The Vancouver plant flowers about one month earlier than the species in Alaska.

Sisyrinchium Macounii sp. nov.

Becoming 50 cm. tall, the narrow grass-like tufts loosely disintegrate-fibrillose at base, the roots slender and nearly simple: pale dull green and glaucescent, somewhat discolored when dry. Leaves long and narrow, mostly 20–30 cm. long, 1.5–3 mm. wide, slenderly very acute, rather thin, the delicate nerves firm and distinct but not crowded, the edges smooth: stem single but sometimes bearing near the top a slender leaf subtending a simple peduncle, very slender, 1–1.5 mm. wide, with very narrow almost membranous margins, the edges smooth or obscurely denticulate-roughened towards the top, transversely constricted just below the spathe: spathes green or slightly purplish along the edges, often or usually abruptly deflected, long and narrow, the bracts thin and not prominently nerved; outer bract slenderly much elongated and tapering acute, 4–7 cm. long, surpassing the inner bract 1.5–4 cm., the extreme edge hyaline below, united-clasping for 4–7 mm. at base; inner bract 23–33 mm. long, tapering and slenderly acute, distinctly hyaline-margined, the keel often sparsely denticulate; interior scales silvery-white, tapering, short, about half the length of the inner bract: flowers large, few, apparently only 2–4, on slenderly exserted subspreading pedicels becoming 35 mm. long, perianth 18–22 mm. long, the emarginate segments very slenderly aristulate, deep purple with a very small yellow eye, the base abruptly broadened from its attachment on the ovary; stamineal-column 8–9 mm. high, anthers 2 mm. long.

"This species was not rare around Comox and was occasionally seen at Nanaimo and on the islands in the Gulf of Georgia" [J. M.].

VANCOUVER ISLAND: Comox, June 21, 1893, meadows, John Macoun.

Named in honor of Professor Macoun.

A handsome species, having the largest and most richly-colored flowers of any simple-stemmed species known to me. It is perhaps most nearly related to *S. segetum*, of Washington, but is much taller and larger, though relatively more slender, and differs notably from this, as well as from the stouter and paler-flowered *S. Idahoense*, in the greatly prolonged outer bract. Two specimens from Vancouver which appear to be reduced forms of this species are smaller flowered than the type with shorter bracts, the outer one much less elongated, and are suggestive of *S. segetum* or slender forms of *S. Idahoense*, although the type is clearly distinct from either. Professor Macoun writes further: "You are quite right in thinking this plant a striking species. Indeed so large were its flowers that I thought it was *S. grandiflorum* when I saw it first."

North American Willows

By W. W. Rowlee

(With Plate 9)

1. LONGIFOLIEAE

This group of species is clearly defined from the other sections of the genus. The presence of two glands in the staminate flower of most of the species and the pale deciduous scales show evident affinity with the pleiandrous willows. The uniform presence of two stamens led Anderson to place them with the diandrous sections. The same characters, however, would place some species of the section Fragiles in the diandrous group. The Longifolieae are evidently closely related genetically to the Fragiles.

The long-leaved willows are confined to North America. None of them are found in the arctic or subarctic regions; two occur in central and western Mexico; the others in the United States and southern Canada. The greatest number of species occur in the western part of the United States, where the great mountain ranges seem to limit to a considerable extent the range of the different species, the consequence being that each has a decidedly north and south range.

Two well-marked types occur in the group, one with smooth pistils, confined to the western part of the continent, the other with more or less hairy pistils found across the continent. In the states of the Pacific coast two distinct types may be recognized by the form of the stigmas, in one *S. argophylla*, etc., the stigmas are short and thick; in the other, *S. sessilifolia*, etc., they are long and slender. Again, the whole group diverges into two types on the character of the leaves, in *S. exigua*, *S. argophylla*, etc., the leaves are coriaceous and opaque, while in *S. interior*, *S. sessilifolia*, *S. melanopsis*, etc., they are thin and distinctly veiny. Using these, together with other characters, it has been possible to make the following synopsis.

The changes in taxonomy have involved the rehabilitation of all of Nuttall's species, a gratifying result which the writer did not anticipate when the work of comparison was under way. This necessitates the restriction of *S. fluviatilis* Nutt. to its original use as a name for the forms with long-pedicelled pistils. It is apparent that recent authors have interchanged the names *S. argophylla* and *S. sessilifolia*, thereby adding to the confusion of the Californian species. *S. brachycarpa* Nutt., usually referred as a synonym to some species of this group, does not belong here at all but is *S. stricta* (Anders.) Rydberg, *S. desertorum* Rich. of recent authors. Since Nuttall's is the oldest name it should stand.

Synopsis of Species

Leaves very small, 1 cm. long, awl-shaped; aments oval, 1 cm. long, gland in staminate flower one. — 1. *S. microphylla.*

Leaves larger, 2 cm. or more in length; aments more or less elongated, glands in staminate flower two or more (except in *S. Thurberi*).

- Capsules hairy, at least when young.
  - Aments densely flowered, species of the Pacific slope.
    - Stigma raised on a distinct style.
      - Leaves linear-lanceolate, coriaceous; aments on long leafy peduncles.
        - Aments small, 1–2 cm. in length and few-flowered, usually in threes at the ends of the branches. — 2. *S. taxifolia.*
        - Aments medium size, 3 cm. or more in length, cylindrical, many-flowered, usually solitary at the ends of the branches. — 3. *S. Parishiana.*
      - Leaves elliptical or elliptical-lanceolate, membranous; aments larger on shorter peduncle.
        - Leaves densely silky hairy throughout; aments medium size, 2–5 cm. long. — 4. *S. macrostachya.*
        - Leaves not densely silky; aments large, 6–8 cm. long. — 5. *S. sessilifolia.*
    - Stigmas sessile; leaves entire or nearly so, stipules wanting. — 6. *S. argophylla.*
  - Aments loosely flowered, species east of the Rocky Mountains.
    - Capsules silvery white with appressed silky hairs. — 7. *S. Thurberi.*
    - Capsules thinly pubescent. — 8. *S. interior.*
- Capsules strictly glabrous.
  - Leaves entire or spinulose-denticulate, coriaceous.
    - Capsules pedicelled; leaves denticulate. — 9. *S. fluviatilis.*
    - Capsules sessile; leaves entire. — 10. *S. exigua.*
  - Leaves closely and prominently serrate, not coriaceous.
    - Leaves distinctly glaucous and prominently veiny beneath. — 11. *S. melanopsis.*
    - Leaves not distinctly glaucous nor veiny beneath. — 12. *S. Bolanderiana.*

1. SALIX MICROPHYLLA Cham. and Schlecht. Linnaea, **6**: 354. 1831

Heretofore this species has been considered identical with *S. taxifolia* H.B.K. A comparison of the original descriptions, both of which were very carefully drawn, indicates that the two are distinct. The plate and description by Hooker and Arnott in Bot. of Beechy, Voy. 31. *pl. 70*, confirms the conclusion that this species is distinct. I have seen but one specimen: Palmer's no. 1193, "a shrub 4 ft. high growing on the bank of a river" at Colima, Mexico. It is well said in Hooker and Arnott's description that this is "a very remarkable species of *Salix* with leaves like those of some small *Lythrum*." So far the pistillate plant has not been seen.

2. SALIX TAXIFOLIA H.B.K. Nov. Gen. et Sp. **2**: 22

This species is well described and illustrated in Sargent's North American Sylva. It has been collected by Pringle and Tuomey in Arizona, also by Pringle in Chihuahua, Mexico. It is a large shrub or small tree.

3. **Salix Parishiana** sp. nov.

A slender shrub, one to three meters high, bark grayish or brown, young twigs cinereous strigose: leaves linear-lanceolate, minutely and remotely denticulate, 5–7 cm. long by 3 mm. wide, silky canescent when young, glabrous and somewhat coriaceous when mature, veins few but very prominent: stipules none: aments on long leafy peduncles, appearing about April 1, 2–3 cm. long by 1–2 cm. peduncles often 10 cm. long, the upper leaves of the branch much surpassing the ament: ament densely flowered, scales white densely villous all over, oblong, acute: filaments scantly hairy at the base: capsules densely villous, oblong, closely sessile: style distinct: stigmas linear, three times as long as thick.

A very peculiar form, differing from *S. taxifolia* by its larger leaves and cylindrical aments and quite distinct from other species with linear stigmas.

CALIFORNIA: Matilija Cañon, San BernardinoCo. (F. W. Hobby, nos. 54, 55), Springs Valley, Inyo Co. (F. V. Coville and F. Funston, no. 263).

Mr. S. B. Parish writes "that it is not uncommon near San Bernardino."

4. SALIX MACROSTACHYA Nutt.

S. sessilifolia villosa Anderss. DC. Prodr. **16**[2]: 215.

Shrub or small tree 1–6 meters high, often in dense thickets, bark light brown, cinereous, young branches villous : leaves 5 cm. long, 1 cm. wide, sessile, entire or nearly so, oblanceolate or narrowly elliptical, acute at both ends, more or less villous pubescent, sometimes (as in Brewer's no. 544) lanate all over : stipules obsolete: aments on short, leafy, lateral branches, 2–3 cm. long, densely flowered, oblong, scales densely villous all over, oblong, filaments crisp, villous upon the lower half: capsules clothed with long lax hairs, closely sessile : style evident: stigmas divided, linear.

Salix macrostachya leucodendroides var. nov.

One to three meters high, wood soft : leaves much larger, 10–12 cm. long, 1 cm. wide, densely white tomentose on both sides, largest remotely denticulate : aments larger, cylindrical, 4–5 cm. long, otherwise as in the type.

Extremely broad leaved forms occur with texture and vesture of *S. Bebbiana*, leaves 4–6 cm. long, 1–1.2 cm. wide, ovate on short but distinct petioles, twigs, leaves and capsules densely villous with whitish spreading hairs.

This species has not been reported beyond the limits of California and Oregon. San Bernardino (W. G. Wright, nos. 6, 7, 10 and 11), Santa Rosa to Ukiah (W. H. Brewer, no. 3854), Lake Co. (E. L. Greene, no. 229), Putah Creek, Solano Co. (W. L. Jepson), Narsismente River (W. H. Brewer, no. 544), Martin Co. (W. H. Brewer, no. 2360), Clear Lake (H. N. Bolander, no. 3854). Specimens in herbaria representing this species are frequently labelled *S. Hindsiana.* From Bentham's description of *S. Hindsiana*, which is ample and concise, there is little doubt that his specimen was *S. argophylla.*

S. integrifolia var. *leucodendroides* is a very striking form from southern California collected by Mr. S. B. Parish, nos. 2134, 2040 and 640. There does not seem to be enough difference to warrant its separation as a species although intergrading forms are wanting. It grows in wet soil.

5. SALIX SESSILIFOLIA Nuttall, Sylva, **1** : 68. 1842

Salix sessilifolia Bebb, et al. (in part).

Shrubby or often treelike, 2–10 meters high, older branches glabrous and brown : shoots very leafy, hoary puberulent : leaves membranous in texture, elliptical, acute at both ends, 5–10 cm. long, 1–2 cm. wide, closely sessile, obscurely and rather remotely denticulate, hoary with rather long pubescence when young, glabrous at maturity, veins prominent : aments large, upon lateral shoots 6–8 cm. long, .75–1 cm. thick, often three borne on a single branch, very densely flowered, six to ten leaves on the peduncle, flowering in July or late in June, scales oblong or obovate, rounded or retuse at the apex, nearly or quite glabrous, narrower in the pistillate ament, lower half of filaments very hairy, upper half minutely puberulent, capsule lanceolate, clothed with silky hairs when young becoming nearly glabrous at maturity, closely sessile : style evident : stigmas linear, several times longer than thick.

Shorter and relatively broader leaves, glabrous scales, pubescent capsule, evident style and linear stigmas are the distinguishing features of this species. The name was first applied to plants collected in the Columbia River valley.

OREGON : Sand Bars, Columbia River (T. J. Howell), Multnomah Co. (T. J. Howell).

6. SALIX ARGOPHYLLA Nuttall, Sylva, **1** : 71. *pl. 20.* 1842

Salix longifolia, var. *argophylla* Anderss. DC. Prod. **16**^{2} : 214. 1868.

Salix fluviatilis var. *argophylla* Sargent, Sylva, **9** : 124. 1896.

Salix Hindsiana Bentham, Pl. Hartw. 335. 1857.

Tree or large shrub usually 5 meters high forming dense thickets but not growing in clumps, at any rate each bush distinct so far as the parts above ground are concerned, young twigs puberulent, branches nearly glabrous and exceedingly tough, bark turning from brown to bright yellow or orange just before blooming making a thicket of it a most conspicuous object: leaves narrowly lanceolate, 5 cm. long, 1–2 cm. wide, closely sessile, entirely or rarely minutely and remotely denticulate, clothed equally on both sides with an appressed silky pubescence which more or less conceals the veins, stipules obsolete (rarely on very vigorous shoots minute ones occur. Occasionally the leaves remain upon the plant over winter, the young shoots appearing in their axils in spring : ament surpassed in length by its leafy peduncles, 3–5 cm. long, 1–2 cm. thick, six to eight leaves on the peduncle somewhat smaller than the leaves on the shoot otherwise like them, aments often in pairs or threes at the ends of the branches, appearing in May in Oregon and northern California and flowering intermittently all summer, scales oblong and obtuse in the staminate ament, narrower and more acute in the pistillate, glabrous on the back, crisp, hairy on the margin and toward the base, erose toward and at the apex, lower half of the filament densely crispy hairy: capsule lanceolate, covered with straight appressed silky hairs, closely sessile: stigmas sessile, oblong, about twice as long as thick, mature capsule often nearly glabrous.

This species is distinguished by its narrowly lanceolate entire leaves, obsolete stipules, small and rather narrow aments, erose scales and hairy capsules.

Salix argophylla occurs on the Pacific slope from southern California to British Columbia.

CALIFORNIA: Panamint Mountains (F. V. Coville and F. Funston, no. 788), Sierra Valley (J. G. Lemmon), North Idria (H. N. Bolander, no. 766), Yosemite Valley (Anderson), San Bernardino (W. G. Wright, nos. 3 and 4), Banks of the Merced (W. H. Brewer, no. 5031), Tulare Co. (F. V. Coville and F. Funston, no. 1267), San Bernardino (S. B. and W. F. Parish, nos. 640, 2140).

OREGON: Union Co. (W. C. Cusick, no. 1044), Hood River (J. and T. H. Howell).

WASHINGTON: Klickitat Co. (W. N. Suksdorf, no. 34), Sprague (Leiberg and Sandberg, no. 134); British Columbia: Spences Bridge, Thompson River (J. M. Macoun, no. 13).

7. **Salix Thurberi** sp. nov.

Slender shrub two or three meters high; bark of older branches brown and glabrous, younger branches puberulent: leaves linear-lanceolate, 6–8 cm. long, 2–3 mm. wide, sessile, evenly denticulate, thin, midrib prominent, silvery silky when young, becoming glabrate: stipules none: aments on long leafy peduncles 5–6 cm. in length: flowers borne in verticels, axis silvery canescent, scale lanceolate, acute, midvein prominent: capsule densely clothed with silvery white ascending hairs, very short pedicelled, gland about equaling the pedicel: style very short: stigmas divided: red, stamens with filaments hairy below, gland in staminate flower one.

This species occurs in southern and western Texas and was observed and collected there by Geo. Thurber many years ago. His specimens (nos. 2368, 95, and 2341) are in the Gray Herbarium. It has been referred heretofore to *S. interior;* it is easily distinguishable from that species by the long thin leaves, single gland in the staminate flower, silvery silky capsules, and red stigmas.

8. **Salix interior** nom. nov.

Salix rubra Rich. Franklin Journ. App. **7**: 765. 1823. Not Huds. 1762.

Salix longifolia Muhl. Neue Schrif. Gesell. Nat. Berl. **4**: 238. *pl. 6. f. 6.* 1803. Not Lam. 1778.

Salix fluviatilis of Sargent and other recent authors in part.

Varying in stature from a low shrub to a small tree, usually growing along streams and lake shores: twigs smooth and brown to densely tomentose and gray: buds plano-convex with an obtuse and rounded apex, very small: leaves nearly or quite smooth, sparsely canescent, to extremely canescent, sessile, linear-elliptical, ordinarily 8–10 cm. long and less than 1 cm. wide, varying to much wider in young vigorous shoots, remotely dentate, the teeth narrow, sometimes quite spinulose: stipules conspicuous, ear-shaped, obscurely denticulate, deciduous: aments of late spring on short lateral peduncles, which bear four to six leaves, those borne later in the season on much longer leafy branches, very loosely flowered, the flowers fascicled in clusters of two to five on the axis, a distinct interval between the fascicles, first appearing in May and often bearing a second set of aments in early summer; at anthesis, aments 2–4 cm. long and 1–2 cm. thick; scales usually glabrous or somewhat hairy toward the base, narrowly oblong, yellowish, deciduous, after flowering: glands large, two in the staminate, one in the pistillate flower: filaments crisp hairy below, smooth above: capsules sessile, clothed when young with appressed silvery hairs, becoming nearly smooth at maturity: stigmas short, sessile: style none.

The pistillate ament, lax at anthesis, becomes more so as the capsules mature and by this character the species can easily be distinguished from related species.

Salix interior Wheeleri var. nov.

Low shrub: young twigs whitened with appressed silky hairs, becoming glabrous toward the end of the first season's growth: leaves relatively short and broad, 7–8 cm. long by 1 cm. broad, minutely and evenly denticulate, closely sessile, densely silky on both sides, veins nevertheless evident, rather abruptly acute.

Throughout the Upper Mississippi valley and the basin of the Great Lakes. Also occasionally upon the eastern slopes of the

Allegheny Mts. Specimens representing the species have been seen as follows:

MISSOURI: St. Louis (H. von Schrenk).

ILLINOIS: Rockford and Fountaindale (M. S. Bebb).

MINNESOTA: Redstone (H. Mann).

MICHIGAN: Flint (D. Clarke).

OHIO: Painesville (H. C. Beardslee, nos. 48 and 73).

NEW YORK: Buffalo (G. W. Clinton); Cayuga Lake (W. R. Dudley).

PENNSYLVANIA: Easton (A. P. Garber), McCalls Ferry (T. C. Porter).

The variety *Wheeleri* is confined to the basin of the Great Lakes. Specimens have been seen from:

ILLINOIS: Fountaindale (M. S. Bebb, nos. 118 and 119).

MICHIGAN: Flint (D. Clarke), Black Lake, Choboygan Co. (C. F. Wheeler, no. 3).

OHIO: Painesville (H. C. Beardslee, no. 67).

ONTARIO: Point Abino (W. W. Rowlee).

PENNSYLVANIA: Presque Isle, Lake Erie (T. C. Porter).

NEW BRUNSWICK: Frederickton (J. Britten, nos. 4 and 6). The silvery vesture of this shrub is much like that of *S. argophylla* of the Pacific Coast.

Narrow-leaved individuals occur in the extreme western and southwestern range of the species, and seem to connect this species with the preceding:

MISSOURI: Courtney (B. F. Bush, no. 9).

NEBRASKA: Emerson (Clements, no. 2509). The vesture of the capsule, and the glands in the staminate flower afford a decisive distinction between them.

9. SALIX FLUVIATILIS Nutt. North Am. Sylva, **1**: 73. 1842

Salix longifolia pedicellata Anderss. Sven. Vet. Akad. Handl. IV. **6**: *f. 35*. 1867.

Distinguished from the next species to which it is closely related by its pedicelled capsules and by its remotely denticulate leaves. It has the same general range as *S. exigua* but seems to be much less frequent.

COLORADO (Hall and Harbour, no. 132) (Brandegee).

NEW MEXICO: Pecos River, San Miguel Co. (A. A. & E. G. Heller, no. 3684); North American Pacific Coast Flora, etc. (C. C. Parry, no. 306).

10. SALIX EXIGUA Nuttall N. Am. Sylva, **1**: 75. 1842

Salix Nevadensis Watson, Am. Nat. **7**: 302. 1873.

Variable in stature from a low slender shrub to a small tree: branches light brown, leaves 4 cm. by 1–2 cm., yellowish, closely sessile, opaque, entirely or nearly so, canescent when young, usually becoming quite glabrous at maturity, very narrowly elliptical, veins very indistinct, stipules none: aments 2–5 cm. long on peduncles about the same length, appearing with the leaves, rather densely and evenly flowered, sometimes the lower flowers remote, scales in the staminate ament oblong to obovate, in the pistillate narrower and longer, smooth or more or less crisp villous on the margins: capsule closely sessile, lanceolate, glabrous, light green: stigmas short and thick, sessile, sometimes even appearing slightly sunken in the apex of the capsule.

Readily distinguished from related species by its entire opaque leaves and glabrous capsules.

Salix exigua virens var. nov.

Leaves large, 10–12 cm. long, 1 cm. wide, nearly glabrous, veins conspicuous on both sides, distinctly denticulate: stipules large, oblong denticulate: aments large, the pistillate 4 cm. long, 1 cm. thick, sometimes borne in threes at the ends of the long leafy shoots.

Easily distinguished from the type by the size and texture of the leaves and the presence of stipules.

Salix exigua occurs throughout the Rocky Mountain region of the United States, but has not yet been reported from British America or Mexico. It seems probable, however, that it will be found both north and south of the range indicated. Prof. Aven Nelson observes that in Wyoming this species grows on positively the "worst alkali soil that can be imagined, where it is small, slender, and twig-like, but of dense growth."

CALIFORNIA: Surprise Cañon and Hot Springs, Inyo Co. (F. V. Coville and F. Funston, nos. 722 and 681), San Bernardino (W. G. Wright, no. 2), Cashewberry Springs, Mohave Desert (S. B.

Parish), Aqua Caliente, Colorado Desert (S. B. and W. F. Parish, no. 729).

ARIZONA: San Francisco Mountains (H. H. Rusby, no. 371), Tuçson (G. Vasey, no. 7); Nevada (S. Watson), Virginia City (Bloomer).

UTAH: Dirty Devil River (L. F. Ward, no. 399).

NEW MEXICO: Crow Agency (T. C. Porter, no. 5).

COLORADO: Platte River (T. C. Porter, no. 6), Ft. Collins (C. F. Baker, nos. 4 and 5), Headwaters of Clear Creek (H. N. Patterson).

WYOMING: Bitter Creek, Platte Cañon, Pine Bluffs, Ft. Steele, Laramie (A. Nelson, nos. 245, 2740, 2885, 3102, 3137), Yellowstone Park (J. N. Rose, no. 90), Ft. Bridger (T. C. Porter).

SOUTH DAKOTA: Hermosa, Black Hills (P. A. Rydberg, no. 1020).

MONTANA: Jefferson River (F. L. Scribner), Jacks River (W. M. Canby, no. 3) (Tweedy).

IDAHO: Lewiston (A. A. Heller, no. 3007).

WASHINGTON: Pullman (C. V. Piper, no. 1774).

OREGON: Umatilla River (J. and T. H. Howell).

The variety *virens* is quite distinct and may upon further investigation prove to be of specific rank. It is apparently confined to Arizona and southern California.

ARIZONA (J. T. Rothrock).

CALIFORNIA: San Bernardino (W. G. Wright, no. 2), Dos Cabesas (C. R. Orcutt, no. 2227); Kernerville (W. G. Wright; Santa Isabel Creek, San Diego Co. (R. D. Anderson, no. 700), A. Kellogg and W. G. Harford, no. 922), banks of the Merced, near Clarks (H. N. Bolander, no. 5031).

11. SALIX MELANOPSIS Nuttall, Sylva, 1: 1842

"Shrub or small tree, bark of old branches dark chestnut brown to nearly black, young branches puberulent, very leafy: leaves oblanceolate or elliptical, closely sessile, 5 cm. long, 1 cm. wide, on vigorous shoots, glabrous when mature, silky hairy when young, very distinctly veiny beneath, somewhat glaucous, the margin with rather low and close serrations: stipules lanceolate, few toothed: aments long and slender, often flexuous on peduncles which bear 5–8 leaves, 5–7 cm. long, 1–2 cm. thick, cylindrical, loosely flowered at the base, scales linear-oblong, more or less erose at the apex, filaments hairy to the middle, or rarely nearly glabrous: capsule lanceolate, glabrous, short-pedicelled, pedicel however not longer than the gland: style very short and stigmas short and thick: ovary smooth with four sessile stigmas." (Nuttall.)

Typical specimens show a strong resemblance to *Salix nigra*.

Salix melanopsis is confined to the western slope of the Rocky Mountains and occurs from British Columbia to Oregon. It is particularly abundant along the Columbia River where Nuttall saw it. Its leaves are very large especially upon young shoots. Specimens collected in Cowlitz Co., Washington, by Mr. Coville, have remarkably large leaves and pistillate aments. Specimens seen are as follows:

OREGON: Cow Valley, Eagle Creek Mountains (W. C. Cusick, Nos. 1800a, 1303), Blue Mountains (L. F. Henderson) (E. Hall).

WASHINGTON: Pehistin (Sandberg and Leiberg, no. 480), Klickitat Co. (W. N. Suksdorf, nos. 35, 36, 37, 38); Snoqueline Falls, King Co. (C. V. Piper and E. C. Smith, no. 614).

BRITISH COLUMBIA: Revelstoke, Long Arrow Lake, Upper Liaird River, wet places, Valley of Fraser River, Columbia River Valley (J. Macoun, nos. 6, 23, 26, 28, 28a).

12. **Salix Bolanderiana** sp. nov.

Bark of older branches nearly black: aments 4 cm. in length, the pistillate fully 1 cm. thick, borne on long leafy branches: leaves 8 cm. long, 1 cm. wide, closely and very finely serrate, scale spatulate, filaments crisp villous throughout: capsule ovate, closely sessile: stigmas minute, sessile.

In the Yosemite Valley in California (Bolander, nos. 49, 58, 4958, 5031).

Explanation of Plate ~~8~~ 9

1. *Salix microphylla.*
2. *S. taxifolia.*
3. *S. Parishiana.*
4. *S. macrostachya.*
5. *S. macrostachya Cusickii.*
6. *S. macrostachya leucodendroides.*
7. *S. argophylla.*
8. *S. sessilifolia.*
9. *S. Bolanderiana.*
11. *S. exigua virens.*
12, 13. *S. interior.*
14. *S. interior Wheeleri.*
15. *S. exigua.*
16. *S. melanopsis.*

New Plants from Wyoming—XII

By Aven Nelson

I. THE CORMOSE-ROOTED ROCKY MOUNTAIN CLAYTONIAS

The cormose-rooted species of *Claytonia* are certainly still in confusion; especially is this true of the forms that at various times have been called *C. lanceolata* Pursh; under this name and its supposed synonyms there seems to be more than one species. To clear up some of the difficulties, if possible, is the object of this discussion.

To begin with, the first factor of simplification is found in locating the *C. lanceolata* of Pursh. That Pursh's description as well as his figure was, through some error, drawn from two or more species, was first suggested by Torrey and Gray in Fl. N. A. **1**: 199. No specimens are in existence which have the combination of characters assigned by Pursh in his description and indicated in his figure. This led Dr. Torrey in Pac. R. Rep. **4**: 70, to speak of it as a "fictitious species" and to assign (to the same plant as he supposed) the name of *C. Caroliniana sessilifolia*. On the other hand, the characters that Dr. Torrey assigns to the plant from which he drew his description, and of which there are many recent collections, make it necessary to separate them, at least varietally, from the *C. lanceolata* of Hooker, Fl. Bor. Am. **1**: 224; T. & G. Fl. N. A. 1 c., and Syn. Fl. **1**: 271.

Since the name *C. lanceolata* Pursh must be retained it will have to apply to the plant of that name of Hooker, of Torrey and Gray and of the Syn. Fl. To make the distinctions between the species and the variety evident, descriptions of both are added.

Claytonia lanceolata Pursh

One dm. or more in height; root leaves rare (usually wanting) never more than one even when there are two or three stems as occasionally happens, the slender petiole 2–3 times as long as the oblong-lanceolate blade: stem leaves sessile, oblong-lanceolate to elliptic or even broader (venation much the same in all the species in the group), 2–3 cm. long: inflorescence few–several-flowered, appearing sessile between the paired leaves which nearly equal or more rarely exceed the raceme: peduncle short or none: the pedicels slender, more or less nodding, the lowest elongated: sepals elliptic, obtuse: petals obovate, retuse or emarginate, sometimes nearly obcordate.

The range of this species is the Rocky Mountains of British America, south as far as northern Wyoming; my no. 5608, Yellowstone Park, July 1, 1899, represents the most southern locality known to me.

The specimens cited from the Sierras of California and from the Wasatch of Utah, I suspect, belong to the following.

Claytonia lanceolata sessilifolia

C. Caroliniana sessilifolia Torrey, l. c., and of Brewer & Watson, Bot. Cal.

Corm and radical leaves similar to those of the preceding: stem leaves longer, usually oblong-lanceolate, 2–5 cm. long: peduncles longer, the racemes at length distinctly surpassing the leaves: sepals subacute: petals spatulate to obovate, entire, rounded-obtuse, pale rose color with purple veins.

This variety seems to range from California eastward to Colorado and Wyoming, in latitudes distinctly to the south of the species. That there are differences between the more eastern and the far western forms of it is certain. Also great variation in the plants of different altitudes, but these are so inconstant that, with our present knowledge of them, they may not be separated.

Claytonia multicaulis

Stems few–several (3–8) from each tuber, spreading loosely in all directions, with ascending inflorescence, 5–15 cm. long: root leaves probably always present, 1–several from each tuber, about equaling the stem proper, narrowly oblong to oblanceolate, the blade as long or longer than the petiole: the stem leaves narrowly oblong or lanceolate, obtusish, 2–4 cm. long, so situated as to divide the stem (including the inflorescence) into approximately equal parts: inflorescence 5–9-flowered, on a peduncle 1–2 cm. long, a broadly ovate, obtuse, green bract at the base of the lowest pedicel: pedicels slender, 2–3 cm. long, subumbellate, the tip nodding-recurved except in anthesis: sepals rhomboidal, obtuse, less than half as long as the petals, thin and drying a light yellow, as does also the base of the petals: petals broadly elliptic to oval, abruptly narrowed at base into a very short claw, 7–10 mm. long, white with pinkish or purplish veins.

An abundant species on gravelly, open slopes in Yellowstone Park. My no. 5553, June 28, 1809, near Golden Gate, is taken as the type. It is probably the *C. lanceolata* of Tweedy's Flora of the Park in part only as *C. Purshii* also occurs in the Park.

Claytonia aurea

Related to the preceding: corms somewhat larger, deep set: usually one root leaf present, rarely more, its petiole slender, nearly twice as long as the narrowly oblong or oblanceolate blade: stem leaves sessile by a narrowed base, linear-lanceolate, tapering gradually to both ends, 2–4 cm. long: stems 1–5 from each tuber, suberect, 1–2 dm. high, the paired leaves mostly below the middle (inflorescence included): peduncular part of the stem about equaling the stem leaves as does the stem proper the root leaves: the raceme many-flowered (7 or more), pedicels divaricate and becoming more or less reflexed, about 2 cm. long: sepals rhomboidal or suboval, subscarious and finely veined: petals golden yellow, 8–10 mm. long, broadly oval, abruptly narrowed into a claw about one fourth as long as the blade.

Yellow is anomalous not only in this genus but in this family, yet that it is a good *Claytonia* there can be no doubt. In the preceding species the xanthic tendency is shown in drying only while in this the yellow is most pronounced. The type specimens, no. 5488, were secured on low, wet flats near Henry's Lake, Idaho, June 22, 1899.

Oreobroma minima

Root short conical or napiform, from 5 to 20 mm. long, the leaves and scapes arising in a close cluster from the center of its somewhat truncate summit: leaves few–several, narrowly linear, 4–7 cm. long, moderately fleshy: scapes rarely equaling the leaves, mostly shorter, each with a small pair of bracts about ⅓ its length from the base, geniculately and divergently flexed near the single node: sepals sub-oval, abruptly acuminated into a short tooth, sometimes with one or two smaller lateral teeth, no glandulosity: petals white: capsule large, approaching 1 cm. in length: seeds smooth and shiny, 60–80 in each capsule.

The nearest ally of this is probably *O. Grayi* (Britton) Rydb., from which it is at once separated by its very different root-caudex, its slender leaves, its geniculate scapes, its glandless and not erose sepals, its large, many-seeded capsule and white flowers.

Collected on the wet grassy banks of a sub-alpine creek—a very different habitat from the dry gravelly banks and slopes occupied by *O. Grayi.* Obsidian Creek, Yellowstone Park, July 22, 1899, no. 6076.

II. MISCELLANEOUS SPECIES

Ranunculus Jovis

A diminutive alpine perennial, 3–4 cm. high: roots fascicled, fleshy, 2–several, nearly vertical, 1–3 cm. long: root leaves few (1–3), trifoliate or trifid, the leaflets broadly linear, about 15 mm. long: petioles 2–3 times as long as the leaflets: stem single, erect, about equaling the erect petioles, bearing a single flower and a sessile, trifoliate or trifid leaf similar to the root leaves (rarely a second petioled leaf): peduncle 7–15 mm. long: petals oblong-spatulate, 6–7 mm. long, slightly exceeding the somewhat broader sepals: akenes (immature ones only at hand) in a spherical head, oval, the beak stout, subulate, nearly straight, as long as the akene.

In many respects nearly allied to *R. pygmaeus* Wahl. but readily distinguishable by the uniform leaves, the longer, not reflexed petals and the straight beak of the akenes.

The type no. is 5817, collected on the Thunderer, Yellowstone Park, July 13, 1899, by Messrs. Elias Nelson and Leslie Goodding. Not abundant; growing on naked "slide soil" where snow drifts had but lately lain.

Delphinium occidentale reticulatum

Several- to many-stemmed from semi-woody roots, erect with usually somewhat decumbent bases, 6–12 dm. high: stems glaucous, strongly striate below: leaves finely pubescent especially upward, not glandular, 3–5-divided, the divisions broadly cuneate, 3-cleft into more or less toothed lobes, the ultimate segments lanceolate and tipped with a minute callosity: inflorescence mostly simple, the bracts linear and the lower leaf-like: the rachis pubescent, somewhat glandular: the pedicels densely glandular-pubescent, divaricate-ascending, with linear bractlets: flowers a dull or dark blue, more or less streaked with yellowish-white: sepals lightly pubescent, oblong, 12–14 mm. long: the straight spur about 15 mm. long, its ovate blade about 10 mm.: the lower petals with narrow claw equaling the ovate, bifid, dentate blade, 10 mm. long, either sparsely or densely bearded: follicles erect, 1 cm. long, conspicuously reticulated with dark lines: seeds evidently wing-margined.

It seems very doubtful if any true *D. occidentale* Wats. Bot. Calif. **2**: 428, comes within our range. Though it belongs in the interior, it is of the more western mountains rather than of the Rockies. Its limits seem to be well stated by Howell (Fl. N. W. Am. **1**: 24). The dense stiff glandular pubescence mentioned by Watson, the spatulate sepals mentioned by Howell, and the usually glabrous ovaries and spongy seeds are some of the points that distinguish it. The variety now proposed is described in detail since the descriptions of *D. occidentale* are most of them very brief and as a species it is not well known. It is probable that many of the Rocky Mountain plants labelled *D. occidentale*, *D. scopulorum*, *D. scopulorum glaucum*,* etc., belong to this variety. The type number is 6629, Bridge Bay, Yellowstone Park, Aug. 23, 1899. It was very abundant. Other collections are no. 6936, Dunraven Peak, 1899; no. 874, Union Pass, 1894.

Delphinium cucullatum

Stems numerous, from thick and semi-woody roots, 10–15 dm. high, striate, glaucous below and glabrous nearly to the inflorescence, rather leafy: leaves all finely pubescent, the uppermost densely so, orbicular in outline, 10–20 cm. in diameter, 3–7-divided, the divisions cuneate and very irregularly cleft and gashed at the apex: inflorescence dense, paniculately branched below, very closely and somewhat cinereously pubescent on rachis and pedicels: sepals yellowish-white or tinged with blue, finely but densely pubescent (no glandular pubescence on the plant), the four nearly alike, oblong-elliptic, about 1 cm. long, the spur 12–14 mm. long, all distinctly hooded in bud and in recently opened flowers, the crown of the hood brownish: petals a bright blue, the lower pair about 9 mm. long; the blade nearly at right angles to the claw, cleft to near the middle, the two lobes usually obscurely toothed; the claw with a conspicuous saccate gland or nectary at the base: ovaries densely white pubescent.

This species must represent in part the *D. occidentale* of the Rocky Mountains. In fact, Dr. Rydberg assures me that it is very similar to Dr. Watson's no. 38, which was included in the original description but later called *D. scopulorum glaucum* by Dr. Gray. It is also the same as Mr. Flodman's no. 455 from Montana. It

---

* *D. glaucum* Wats. Bot. Calif. **2**: 427 belongs exclusively to the mountain ranges of the far West.

need never be confused with *D. occidentale* nor its variety, nor with the recently described *D. glaucescens* Rydb., Mem. N. Y. Bot. Gard. **1**: 155. From all of these its fine, glandless pubescence, its dense inflorescence and especially the remarkable nectaries at the base of the lower petals distinguish it. The type is no. 6937, from the wet bottom lands, Snake River, near the southern boundary of Yellowstone Park, August 12, 1899.

Delphinium subalpinum (Gray)

Perennial from deep-set, woody roots, growing in large beds, —not merely several stems from each root but the plants aggregated in beds often several feet across—6–10 dm. high: stems simple, striate, pubescent for most of their length with a yellowish or tawny pubescence, more densely so upward and in the inflorescence becoming slightly viscid (not glandular): leaves large, suborbicular, deeply cleft into about 5 lobes, rarely divided nearly to the base, the segments variously incised and gash-toothed, nearly glabrous on the blade but minutely pubescent on the petiole and the base of the leaf, especially on the lower face: raceme simple, short, usually only about 1 dm. long, the pedicels longer than the rather long spur: flowers a very deep blue, the spur 15–20 mm. long, the other sepals narrowly oblong, about 15 mm. long, subacute; the lower petals with a narrow claw, about 10 mm. long, the blade oval, deeply notched and more or less dentate on both lobes: ovaries glabrous, blue but not so deeply so as the sepals and petals.

Only a few specimens of this are at hand yet I am satisfied that it is the *D. scopulorum subalpinum* Gray, Syn. Fl. **1**: 47 and Bot. Gaz. **12**: 52 but not the *D. occidentale* Wats. Bot. Calif. **2**: 428, though Gray cites the latter as a synonym. The habit of growth, the ample leaves, the deep uniform color of the flowers, the short raceme and the short spreading fulvous pubescence make it easily recognizable among all the other forms. It is, too, really subalpine, so far as known to me, occurring only in open grassy parks near the limit of trees. Collected twice in the Medicine Bow Mountains (La Plata Mines) and distributed under nos. 1761 and 5081, the latter by Elias Nelson.

Delphinium strictum

A strict perennial, 3–4 dm. high, from a small fascicle (sometimes but 1) of semi-woody, tuberous or cormose roots bearing fibrous rootlets: pubescence fine; that of the stem (especially below) of short, recurved hairs, becoming closer and more spreading above on the leaves and inflorescence: leaves trifoliate; the leaflets again 3-parted or variously lobed, the segments 1–3 cm. long, from narrowly oblong in the lower leaves to linear in the uppermost; the lower early deciduous, the uppermost sessile and greatly reduced: petioles erect or approximated to the stem, somewhat dilated at the base, the lower longer than the leaflets, gradually shorter upwards: inflorescence a dense spike, rarely much exceeding 1 dm. in length; the pedicels short, erect and rather stout: flowers from a deep to a dingy blue; the spur straight with merely a flexed tip, exceeding the petals and pedicels in length, standing nearly at right angles to the rachis; the lateral petals deeply cleft, about 1 cm. long, very sparsely long hairy: follicles 3, pubescent, ovate, acuminated into the short style, not divaricate, when mature 6–8 mm. long: seeds numerous, irregular, the coats smooth and sharply wing-angled.

That this is allied to the little known *D. simplex* Dougl. there can be little doubt but its smaller size, different pubescence, broader and shorter leaf segments, short (not acuminate) spike, the relatively shorter spur which is not subulate-pointed and probably different habitat will serve to distinguish it.

It occurs in abundance in a few of the meadows of the upper Jackson's Hole country, preferring wet, almost boggy places where grasses and sedges abound.

Type specimens from Snake River, August 13, 1899, no. 6442.

Draba saximontana

Caudex caespitose, profusely slender branched, branches more or less clothed with the imbricated dead leaves: leaves linear, 5–10 mm. long, imbricate on the crowns, sparsely stellate-pubescent on both sides, obscurely ciliolate, midrib evident: first flowers nearly sessile, raceme lengthening and becoming open, fruiting raceme (scape) 3–7 cm. long, glabrous: petals yellow, broadly spatulate, truncate or retuse, nearly twice as long as the elliptic, glabrate sepals: pods narrowly ovate, base rounded, apex sub-acute, glabrate or sparsely pubescent with short, simple hairs, 4–5 mm. long, 6–8 times as long as the style and only half as long as the longest pedicels: stigma not expanded: ovules few, 2–3 in each cell, only one or two maturing.

Probably specimens of this exist in the herbaria as *D. glacialis* Adams, but from that species its few-seeded pod and nearly glabrous inflorescence separate it, as do also the very numerous and slender branches of the caudex. *D. saximontana*, in many respects, is nearer to *D. oligosperma* Hook. but it seems to be seperated from the original arctic form of that by easily recognized characters. First, it is to be noted that that had white flowers, a fact stated not only in the original description (Hook Fl. Bor. Am. 1 : 51) but in an added note. *D. oligosperma, l. c.*, is compared to *D. hirta* L. as a petal and habit which is further evidence that that is very different from this plant. *D. oligosperma* also seems to have had a lobed ("sub-triplo") stigma and more numerous seeds.

D. saximontana is abundant in a few of the foothill slopes of the Laramie Plains, mostly on stony ledges that are partly sand-covered. Collected a number of times but no. 4323 may be cited as type.

Thlaspi parviflorum

Biennial or possibly more enduring, with a simple, vertical tap-root, glabrous throughout, 1–2 dm. high : stems few to several from the crown, simple, ascending or erect : crown leaves small, 5–10 mm. long, rather numerous, elliptic to oval, short-petioled : stem leaves 5–10, oblong, obtuse or sub-acute, sagittate-clasping, the sinus shallow : raceme simple (rarely a branch or two from the upper leaf axils : pedicels widely divaricate, scarcely longer than the capsule : sepals ovate, mostly obtuse, greenish with a white margin and purplish spot near the tip : petals white, spatulate, 2–3 mm. long, about twice as long as the sepals : capsule spatulate, in dried specimens often appearing unequilateral, barely emarginate, 5–7 mm. long, 8–10-seeded, only slightly flattened, not winged but rather strongly margined : style thick, only about .5 mm. long.

This is a peculiarly distinct species, and one not readily confounded with any of the numerous forms usually referred to *T. alpestre* L. The small flowers and rather slender tap-root and the narrow capsule will easily distinguish it even without reference to the shape of the floral parts. Seemingly abundant on open slopes in the northwestern part of Yellowstone Park. Glen Creek, June 28, 1899, no. 5554.

Potentilla virgulata

Root thick and subfleshy, its one or two crowns scaly : stems 1 only from each crown, simple, erect, 3–4 dm. high, lightly pubescent, no tomentum nor silkiness, very obscurely granulo-glandular as are also the leaves: root leaves few to several, dark green above with obscure pubescence, light green below with a close pubescence, erect, on petioles 8–16 cm. long, pinnate with 5–7 leaflets: leaflets obovate in outline, dissected, the segments linear and extending nearly to the thickened midrib, the margins obscurely revolute thickened; the terminal leaflet petiolulate; the paired ones approximate but not crowded, if three pair equidistant: stem leaves similar, only 2–4, with gradually shorter petioles, the uppermost usually sessile; the stipules ovate-lanceolate, often acuminate: cyme several-flowered, congested, the first two pedicels somewhat elongated, the succeeding ones short: hypanthium moderately pubescent: bracts linear, equaling the lanceolate sepals: petals small, orbicular, scarcely depressed at summit, only about 4 mm. long, a little shorter than the sepals: style glandular at base, terminal, not longer than the mature akene.

This is related to *P. Pennsylvanica* but that has leaves less dissected, more whitened or even tomentose below, stipules somewhat laciniate, the stems stouter and the leaves more lax, larger, obovate petals which equal or exceed the sepals. In character of pubescence the proposed species is nearer *P. atrovirens* but from that it is at once distinguished by its strict habit and congested inflorescence.

It has been secured but once, no. 6011, from a wet, grassy flat, near Mammoth Hot Springs, July 20, 1899.

Potentilla Monidensis

Perennial from a deep-set, woody root which is surmounted by a much branched, woody caudex; the branches of the caudex densely clothed with old, brown leaf-bases: stems numerous, 1–several from each crown, prostrate-assurgent, rather slender, silky-strigose, 1–2-leaved, 7–14 cm. long: leaves crowded on the crowns, petioled, 4–6 cm. long (including the petiole), silky-strigose above, white with dense, hirsute-silkiness below, pinnate, with 3–7 pairs of approximate leaflets (occasionally odd leaflets interspersed); the basal leaflets digitately cleft nearly to the rachis into oblong-linear segments; the obovate apical ones pinnately cleft to the midrib into similar segments: stem leaves much reduced, mostly cleft into linear segments: hypanthium silky-hirsute, the narrowly lanceolate bracts a little shorter and narrower than the lanceolate sepals: petals broadly elliptic or oval, somewhat exceeding the sepals, about 6 mm. long and 4 mm. broad: style slender, not glandular, attached above the middle of the akene, about 3 mm. long.

This strikingly caespitose species has no very near ally. It seems to be nearest *P. Macounii* though it may in some ways be compared with *P. saximontana* and *P. Plattensis.* From all of these it differs in the shape of the petals and its denser pubescence; from the two former in the absence of all tomentum and in the narrower leaf-segments; from the latter (which has no whitish pubescence) in the stouter, more branched and scaly caudex.

It was plentiful on the high, open slopes among the sage-brush, near Monida, Montana. Type no. 5414, June 16, 1899.

Anogra Buffumi

Annual, root slender, vertical: stem erect, 2–3 dm. high, simple or with two or more smaller, erect, accessory ones from the crown: pubescence of two kinds—some scattering, hispid-ciliate hairs and a fine puberulence, nearly glabrous upward: leaves numerous, linear-oblanceolate, from entire to repandly toothed, the radical slender petioled, 6–12 cm. long (including the petiole), the stem leaves shorter and shortening upward: inflorescence leafy: flowers axillary, at first crowded, becoming more open as the stem lengthens: calyx lobes about equaling the tube, 2 cm. long, shorter than the suborbicular, white petals: filaments very slender, as long as the calyx lobes: capsules linear-clavate, spreading and curved, 2–3 cm. long.

This seems to be a very rare plant. Though twice collected, both times on Wind River, in Fremont county, only single specimens were secured—the first by Prof. B. C. Buffum, August 2, 1892; the second by the writer in 1894, August 9, no. 779.

Those specimens were named *A. albicaulis* (Pursh) Britt., but their erect habit and nearly glabrous inflorescence show at once that that cannot be. It may be worth while noting that the large white petals dry the same color in herbarium specimens, but if left to dry on the plant in the field they turn pink, as commonly occurs in this genus, no matter how they are dried.

This with one or two other species must all in a general way be associated with *A. albicaulis*, but each shows characters in keeping with the duration of the plant.

Lappula desertorum foliosa

Habit of the species, *i. e.*, diffusely and profusely branched from the base: the rather slender branches very leafy throughout, 10–20 cm. long, floriferous nearly to the base but more remotely so downward; even the uppermost bracts leaflike: nutlets all alike, the aculeae connected at base and forming a narrow winglike margin, minute papillose on all sides.

The recent segregation of the allied forms of *L. occidentalis* (Wats.) Greene (Pittonia, 4: 93–97) seems the most rational treatment that this group has received. Probably as more specimens are accumulated, the descriptions as drawn may need to be made a little more elastic in order to include some forms that show environmental variations. The variety here proposed, however, seems to be more than that. It is a plant of the arid plains, in sandy soil, among the underbrush. No. 4502, Evanston, June 4, 1898, and 4685, June 13, 1898.

Lappula erecta

Annual, possibly sometimes biennial, with a vertical or ascending tap root: stems 2–5, more rarely only one, simple, erect, more or less paniculately branched above, 2–4 dm. high, cinereously strigose-pubescent, moderately appressed: crown leaves rather numerous, rosulate, oblanceolate, short-petioled, variable in size but rather small: stem leaves broadly linear or linear-oblong, sessile by a broadish base or tapering into a short petiole, 1–4 cm. long, pubescence a little harsher than that of the stem and the base of the hairs more distinctly pustulate: spikes panicled, from rather open to much crowded; bracts resembling the leaves, but smaller, somewhat ciliate on the margins: nutlets all alike, minutely and densely muricate-tuberculate on all sides with the muriculations in the median line of the dorsal face a little more prominent than the others, a single marginal series of about 10 aculeae which are distinct to an obscure marginal ridge.

On account of the confusion that has existed in regard to *L. Texana*, as understood by Dr. Greene (Pittonia, 4: 94), and *L. occidentalis*, according to the same authority (*l. c.*, 97), this species has long remained unnamed, though undoubtedly often collected. It has been ticketed at different times with both of the foregoing names, and perhaps as often as *L. Lappula*. To the latter it bears much resemblance as to habit, but the nutlets at once distinguish it. It may also be compared to the recent *L. collima* Greene, but from this it is also very distinct by the nutlets, a different pubescence, and the less noticeably rosulate leaves.

The following numbers represent it: 424, Uva, July 7, 1894; and Soda Butte, Yellowstone Park, July 15, 1899, 5872.

Mimulus thermalis

Annual, erect, simple stemmed, only a few cm. high (3–15), dull green and more or less tinged with red, glabrate below, puberulent upward, not viscid nor glandular: leaves 2–5 pairs, nearly orbicular, obscurely dentate, closely sessile or the lower on very short petioles, mostly obtuse, the uppermost abruptly short toothed, 3–5-nerved from the base, all small (3–9 mm.), often floriferous to the base: flowers in pairs in the axils, sometimes a single terminal flower or with the pair immediately below appearing cymose; the lower pedicels (in large plants) elongated and with a pair of leaf-like bracts above the middle, in small plants slender and not much longer than the calyx: calyx narrowly campanulate, strongly carinate-angled, somewhat oblique, in fruit 1 cm. long, its teeth short, the upper about twice as long as the others: corolla about 15 mm. long, funnelform, the tube nearly equaling the limb and but little exceeding the calyx, yellow, bilabiate, short pubescent on the lower lip: capsule shorter than the calyx, conspicuously stipitate; the seeds numerous, small, elliptic, the surface obscurely checkered by longitudinal and less distinct transverse lines.

I am unable to find a close ally for this species but its characters would place it into the section in which *M. nudatus*, *M. nassutus* and *M. microphyllus* are conspicuous members. It was secured in Yellowstone Park where it occurs more or less freely on the formations in the vicinity of the hot springs and geysers. The type is no. 6285, Upper Geyser Basin, Aug. 3, 1899.

Castilleja lauta

Perennial, from a short, thickened, woody caudex: stems several or sometimes numerous, simple, erect from a more or less curved ascending base, from yellowish-green to purplish, from smooth and shining to striate and granular-puberulent, 1–3 dm. high: leaves very variable, 2–5 cm. long or the lower much reduced, from linear-lanceolate, acuminate, entire to more broadly lanceolate to obtusish: upwardly becoming broadened at apex and toothed or cleft or with short lateral lobes, from glabrate-puberulent below to lanate-ciliate above: inflorescence at first short and dense, comparatively short even in fruit, gay or almost gaudy, the purple bracts large, lanate-ciliate, dilated upward, entire or 3-cleft, the middle lobe broadest, nearly equaling the flowers: calyx equally cleft to about the middle, the two lobes again cleft to about the middle into oblong-lanceolate lobes: corolla yellow and more or less streaked with purple on the lower side, 18–22 mm. long, galea about ½ as long as the tube, truncate and obscurely toothed at the apex, the middle tooth the largest: the lip short, its three teeth acuminate and inflexed, only about ¼ as long as the galea: style exceeding the galea, stigma obscurely two-lobed: capsule ovate, 1 cm. long.

It seems probable that specimens of this occur in herbaria as *C. pallida septentrionalis* Gray, a species which, now that Mr. Greenman has cleared up some of the difficulties connected with the *C. pallida* group,* had best be written *C. acuminata* (Pursh) Spreng. Though this latter is undoubtedly an aggregate, so far as specimens are concerned as *C. pallida* had long been, and while I shall not at present attempt to state the limits and characters of that species, there is enough unanimity among the earlier authors to justify the separation of the species now proposed. The two may be distinguished by the very marked difference of color, by the character of the bracts and leaves and by their different geographical range. *C. lauta* is, so far as known to the writer, a species of the central Rockies, where it occurs on moist slopes at sub-alpine to alpine stations.

Type no. 6708, Dunraven Peak, Yellowstone Park, Aug. 29, 1899.

Porterella eximia

Perennial (?): stems simple, about 1 dm. high, semi-fleshy, ascending or erect, the short internodes each bearing a single leaf, continued below the surface of the soil as an ascending or horizontal rootstock with numerous whorled roots at the nodes: leaves linear, gradually long-acuminate from the dilated base, 15–25 mm. long, the uppermost (floral) broader, almost lanceolate: flowers few, singly in the axils of the crowded uppermost leaves: peduncles short, usually less than half as long as the subtending leaf: sepals foliaceous, broadly linear, 6–8 mm. long, obtusish, slightly exceeding the tube of the corolla: corolla a deep blue, bilabiate; the upper lip (apparently) of two oblong, erectish lobes about equaling the tube; the lower (apparently) of three obovte lobes longer than the tube, somewhat depressed, with two narrow yellow plicae in the throat: capsule obconical, many-seeded.

There is little doubt that Dr. Rydberg† is justified in reëstablishing this genus, represented hitherto by but one North American species, *P. carnosula* (Hook. & Arn.) Torr. described by Gray in

* Bot. Gaz. 25: 265, 266. 1898.

† Mem. N. Y. Bot. Gar. 1: 482. 1900.

Bot. Calif. 7: 444 (under *Laurentia*) and by Torrey in Cat. Pl. Hayden Rep. 488, 1872. The flowers of the present species are unusually showy and handsome for the size of the plant. It was found in abundance on the muddy borders of shallow ponds near Jackson's Lake, Aug. 17, 1899.

Senecio perplexus

Rootstock very short, with numerous semi-fleshy roots; the single stem erect, rather stout, 2.5–5 dm. high, loosely arachnoid or floccose woolly when young as are also the leaves, becoming glabrate but usually some of the woolly or crinkeled hairs persisting, especially on the petioles, even at maturity, rather leafy below, *i. e.*, on the lower ⅓ of the stem: the lower leaves oblanceolate or broader or tapering uniformly to both ends, mostly obtuse, 5–10 cm. long, the margined petiole usually shorter than the blade; the middle leaves mostly sessile and narrower and becoming linear: the uppermost small and bract-like, all entire or at most remotely denticulate, sometimes with a slightly crisped margin: heads several (8–15), in a cymose corymb, 10–12 mm. high, the central peduncles very short, the lower or outermost elongating and often overtopping the others, the rays conspicuous, few (5–10); the involucral bracts linear, black-tipped, about 7 mm. long, scarcely thickened dorsally and with thin margins: akenes (mature) brownish, finely striate, glabrous, linear, equaling or longer than the fine soft pappus.

This species now proposed is a part of that Rocky Mountain aggregate long known as *S. lugens*. As has been shown by Dr. Greene (Pittonia 3: 170) *S. lugens* proper belongs to the far north and *S. lugens* of Hooker's Flora is a very different plant of British Columbia and the northwestern United States. This Dr. Greene, *l. c.*, characterizes and names *S. Columbianus* but it has more recently appeared as *S. atriapiculatus*.* The Rocky Mountain plant differs materially from this northwestern ally as it does also from another of the far West to which it is sometimes referred, viz, *S. exaltatus* Nutt.

Recently Dr. Rydberg, *l. c.*, has published some related species but none of them are closely allied except *S. arachnoides* which is distinguished from this by the sinuate-dentate leaves, the more copious pubescence, the auricled stem leaves and the thick involucral bracts.

---

* Rydb. Mem. N. Y. Bot. Gard. 1: 442. 1900.

It occurs probably throughout the middle Rockies, occupying dry, open slopes at moderate elevations (1800–2500 m.). Numerous collections of it are at hand; the following are cited as representative: 128, 1305, 3139, 5569 and 5656, the first three from southern Wyoming and the last two from Yellowstone Park.

Senecio dispar

Rootstock almost wanting, merely a crown for the numerous fibrous or semi-fleshy roots: the single stem erect, only moderately stout, 5–8 dm. high, striate, appearing almost smooth and sometimes somewhat shining but sparsely pubescent with flat, crisped hairs: leaves very variable, thin, entire or obscurely repand-denticulate, the mid-nerve prominent, delicately reticulate-veined; the root leaves narrow, the blade proper oblong-lanceolate and borne on a margined petiole equaling or exceeding it; the lower stem leaves oblong-spatulate, tapering gradually into a broad petiole which is shorter than the blade, 8–10 cm. long (including the petiole), somewhat exceeding the root leaves; the middle stem leaves sessile by a broadish base, tapering gradually to the acute apex; the uppermost similar or often long-acuminate, gradually smaller and becoming bract-like, giving the upper part of the stem a scape-like appearance: heads few to many (5–20), campanulate, 10–14 mm. high, somewhat umbellately clustered or when more numerous with some additional peduncles from the axils of the uppermost bracts: the peduncles very unequal, the earliest short and stout, some of the later ones often 7–12 cm. long and bearing 2–4 heads: involucral bracts linear-lanceolate, minutely black-tipped, 7–8 mm. long: rays conspicuous, 6–10, 12–15 mm. long, about 3 mm. broad: akenes flattened, obscurely striate, linear-oblong, smooth or very minutely and sparsely scabro-puberulent, about 4 mm. long, mostly exceeded by the soft white pappus.

Most nearly allied to *S. integerrimus* Nutt. which is to be distinguished from this by its glabrous condition, its rather fleshy leaves, and the less evidently margined petioles. In that the inflorescence is also rather simply cymose-umbellate while in *S. dispar* some accessory peduncles arise in the uppermost axils.

Occurs in the open woods among the undershrub, along the streams. Laramie Hills, June 16, 1897, no. 3162; Green Top, June 29, 1897, no. 3232 (type); Yellowstone Park, July 10, 1899, no. 5754.

Artemisia aromatica

Perennial from a woody, much branched caudex; the whole plant dark green and nearly or quite glabrous from the first, heavily but rather pleasantly aromatic scented; the numerous stems tufted, mostly simple, sometimes sparingly branched from the base, more or less branched above in respect to the inflorescence, striate, from spreading ascending to nearly erect, 4–8 dm. high: leaves nearly all entire, some of the lower 3-cleft, narrowly to broadly linear, 1–several cm. long, numerous, many produced on short, slender, sterile, axillary shoots: inflorescence paniculate, leafy; the heads numerous, nodding on short slender pedicels, 3–4 mm. in diameter: involucre glabrous, the bracts oblong-elliptic, obtuse, dark green with scarious margins: flowers numerous, the fertile 10–20, the sterile hermaphrodite about twice as many.

This species is *A. dracunculoides* of Gray's Syn. Fl. and of Britt. & Br. Ill. Fl. in part both as to description and range. That it is distinct from *A. dracunculoides* Pursh seems to me clear. His description was drawn from that Mississippi Valley plant, which is much larger, freely branched, the branches drooping (ramis nutantibus) and the heads fewer flowered. Pursh, as does also Nuttall, cites *A. nutans* of Frazer's Catalogue as a synonym. That Pursh's plant is also the *A. cernua* of Nuttall is evident not only in the substantial agreement of the descriptions in regards to habit, branching and flowers, but the type localities is evidently nearly the same. That the species now proposed is distinct from the varieties given in T. & G. Fl. 416 is evident from the characterizations; those varieties are rather forms of the original of *A. dracunculoides.* This fact also disposes of *A. Nuttalliana* Bess. in Hook. Fl. Bor. Am., as that seems to be equivalent to variety *brevifolia* of the T. & G. Fl. which is there characterized by the shorter, more freely cleft leaves). *A. inodora* Hook. & Arn. Bot. Beechy is not known to me, but it would seem probable that it is distinct from all the before mentioned. The fact that Pursh does not mention the odor and that Nuttall says "neither aromatic nor agreeably scented" puts *A. dracunculoides* in sharp contrast with *A. aromatica.* This Rocky Mountain plant is, as stated before, strongly (in some plants almost overpoweringly) aromatic scented. This is apparent even in dried specimens but of course becomes less apparent as they grow older so that in the herbarium they may finally be devoid of odor.

The range of this species, as represented by the material before me, is the north-central Rockies, but it probably is more widely distributed. Nos. of the past season may be cited as typical as follows: 6602, Yellowstone Lake; 6804, Henry's Lake, Idaho; 6903, Laramie Hills.

Artemisia nova

The shrubby base low, scraggy-branched, prostrate spreading, rarely 1–2 dm. high, with grayish, shreddy bark: the herbaceous stems (season's growth?) very numerous, fascicled, slender, simple, leafy below the inflorescence, 1–2 dm. high including the narrow spike-like panicle, grayish with a thin tomentum, or mere pubescence as also are the leaves: leaves very narrowly cuneate, 1–2 cm. long, 3-toothed at apex, the middle tooth usually longest: panicle leafy at base, naked above, strict and nearly simple: heads small, very numerous, only 3–4 mm. long, usually 3-flowered but often only one or two: involucral bracts closely imbricated, greenish, only slightly puberulent: akenes glabrous, resinous dots on the tube of the corolla only.

That this species has so long escaped detection can only be accounted for on the assumption that it was a depauperate form of the common sage-brush (*Artemisia tridentata*). That such was not the case has been a growing conviction with me for some time. A critical examination leaves no room for doubt. The impressions made in the field * that this is constantly a dwarf form with simple, slender, fascicled stems and greenish inflorescence, is confirmed by differences in floral characters. The few-flowered involucre and the differences in pubescence are conclusive and separate it also from *A. arbuscula*, from which it is equally well separated by its leaves. It occurs on hillsides and ridges either on the plains or in the foothills.

Collected as follows: 4095, Medicine Bow, Aug. 11, 1898; 5272, Centennial Valley, Aug. 30, 1898; 5334, Laramie, Sept. 14, 1898.

---

* Mr. Elias Nelson when collecting one of the numbers of this made the following field note: "Occurs on open hills and ridges, never in the draws but always in exposed places; very different from *A. tridentata* in habitat and general appearance, being greener in color and always a low shrub."

Notes and Descriptions of North American Plants.—II

BY JOHN K. SMALL

I. NOTEWORTHY SPECIES

HABENARIA GARBERI Porter, Bot. Gaz. **5**: 135. 1880

The original and second known stations for this interesting orchid are both near Manatee, Florida. A second locality can now be placed on record; this is Orange County, Florida, where Mr. F. L. Lewton discovered the species at several stations in the summer of 1894. His specimens are essentially the same as the type.

HABENARIA MACROCERATITIS Willd. Sp. Pl. **4**: 44. 1805

This remarkable tropical *Habenaria* has been found native in Florida, by Mr. Lewton. It is not rare in Sumter County, where he first met with it in 1894.

THERMOPSIS MOLLIS (Michx.) M. A. Curtis, Mem. Am. Acad. II. **3**: 47. *pl. 9.* 1848

Heretofore this comparatively rare species has been reported as growing in the mountains of Virginia and North Carolina. But its range is wider than this; in May, 1869, Mr. Canby collected it on Lookout Mountain, Tennessee, and on May 21, 1890, Professor Scribner rediscovered it at the same locality.

PLUCHEA IMBRICATA (Kearney) Nash, Bull. Torr. Club, **23**: 108. 1896

Excellent specimens of this *Pluchea* were collected in swamps about Forest City, Orange County, Florida, by Mr. F. L. Lewton in July, 1893. The specimens of this collection agree almost perfectly with the type.

HIERACIUM SCRIBNERI Small, Bull. Torr. Club, **21**: 20. 1894

Professor Ruth has sent me almost typical specimens of this rare member of *Hieracium* from near Knoxville, Tennessee, where he collected the plant in 1897.

SENECIO MILLIFOLIUM T. & G. Fl. N. A. **2**: 444. 1843

In 1887 Mr. E. R. Memminger rediscovered this rare *Senecio* in Henderson County, North Carolina, where it was collected many years ago by Buckley. In 1895 Mr. A. M. Huger sent me specimens from Macon and Jackson counties, North Carolina, where he found it growing plentifully on sloping cliffs at altitudes ranging from 1100–1400 meters.

II. HITHERTO UNDESCRIBED SPECIES

Allium arenicola

Bulbs nearly 1 cm. long, with fibrous outer coats. Leaves basal; blades very narrowly linear, becoming almost filiform, about as long as the scape or shorter: scapes erect, sometimes several together, 1–3 dm. tall, more or less curved: umbels erect, 10–30-flowered: pedicels 5–10 mm. long, slender: perianth deep pink; segments linear to narrowly linear-lanceolate, about 4 mm. long, very delicate: filaments dilated below: capsules not crested.

In sandy soil, Mississippi. Spring.

This species has been confused with *Allium mutabile* Michx. for nearly three quarters of a century. It is much more slender in habit and smaller in all its parts. The type specimens were collected by Martha B. Flint at Brookhaven, Mississippi, April 1, 1888.

Ranunculus cuneiformis

Foliage hirsute below the inflorescence. Roots thickened, clustered: stems usually several together, 2–3 dm. tall, erect or ascending, rather slender: leaves mainly basal; blades, at least some of them, twice-divided into cuneate rather obtuse segments, 5–10 cm. long, about as long as the petioles; upper stem leaves with blades 3-parted; segments narrow, often incised: flowers yellow, about 1.5 cm. broad, on strigillose peduncles: heads of fruit subglobose or ovoid-globose, about 1 cm. long: receptacle barely elongated: achenes 4 mm. long, conspicuously winged and with a triangular beak.

On prairies, near Kerrville, Texas. Spring. *Heller*, Pl. S. Tex. no. 1688. It differs from its relative as shown below:

RANUNCULUS CUNEIFORMIS	RANUNCULUS MACRANTHUS
Blades of lower leaves twice-divided : corollas 1.5 cm. broad : heads of achenes subglobose or ovoid-globose, receptacle barely elongated : achenes conspicuously winged, with triangular beaks.	Blades of lower leaves once-divided : corollas 3–5 cm. broad : heads of achenes oblong to cylindric : receptacle elongated : achenes narrowly margined, with subulate slightly curved beaks.

Ranunculus Mississippiensis

Perennial, stoloniferous, fleshy. Stems stout, about 2 dm. tall, more or less branched : leaves various ; basal or those on the lower part of the stem with ovate or ovate-lanceolate sinuate-dentate blades 1.5–4 cm. long, and elongated petioles, upper leaves with oblong or linear remotely-toothed blades 3–8 cm. long : flowers few : sepals oblong to suborbicular, sparingly pubescent : corollas about 1.5 cm. broad ; petals about 9, nearly oblong, deep yellow and lustrous within.

In low grounds, Arkansas and Mississippi. Spring.

ARKANSAS : Varner, Lincoln Co., April 28, 1898 ; *Bush*, no. 12.

MISSISSIPPI : "Alluvions." 1840 ; *Peck.*

Related to *Ranunculus oblongifolius*, but more robust, with truncate or cordate blades terminating the elongated petioles of the lower or basal leaves and much larger corollas consisting of about nine petals.

Thalictrum mirabile

Perennial, slender, glabrous, bright green. Stems erect, 1–3 dm. tall, wiry, dichotomously branched above : leaves various, basal usually ternately compound, with petioles about 2 cm. long ; upper leaves gradually more simple and shorter petioled : leaflets suborbicular or orbicular-reniform, 2–3 cm. broad, very thin, delicately nerved, glaucescent beneath, broadly crenate or shallowly crenate-lobed, truncate or subcordate at the base, longer than the petiolules : peduncles hair-like : flowers white : sepals spatulate or rhombic-spatulate, fully 1.5 mm. long : filaments fully 2 mm. long, club-shaped by an abrupt thickening about the middle : fruit spreading at right-angles to the peduncle ; body plump, about 2 mm. long, acute, not depressed along the upper side, as long as the filiform stalk or shorter.

Resembles *Thalictrum clavatum* but more delicate and smaller throughout, and with very short-petioled basal leaves. The fruit is only about one-half the size of that of *T. clavatum* and has a plump barely ribbed body not at all depressed along the upper side.

The original specimens were collected by Prof. F. S. Earle under sandstone bluffs on Little Mountain near Moulton, Alabama, June 25, 1899, no. 2212.

Phyllanthus Avicularia

Perennial, bright green. Stems branched at the base and throughout, 3–6 dm. long, puberulent, striate in age: leaves numerous, ascending: blades oblong, or slightly broadest above the middle, 8–18 mm. long, blunt or barely pointed, slightly paler beneath than above, rounded or truncate at the base: petioles 1 mm. long, or shorter: calices short-pedicelled; staminate delicate, barely 2 mm. broad, sepals orbicular-obovate or suborbicular: pistillate firmer, fully 2 mm. broad or barely 3 mm. broad at maturity; sepals oblong or oval, scarious-margined, persistent: capsules spheroidal, 3 mm. broad.

In dry soil, along the Brazos River, Texas. Type from Columbia, Texas, collected by B. F. Bush, October 26, 1899, no. 263.

Related to *Phyllanthus polygonoides*, but much more robust in all its parts. The leaves, too, are of an oblong type. The capsules conspicuously surpass the mature pistillate calyx, whereas those of *P. polygonoides* are at least equaled by the mature sepals.

OEnothera nyctaginiifolia

Apparently annual or biennial, sparingly pubescent. Stems branched at the base, branches spreading or decumbent, 2–5 dm. long, more or less branched: leaves rather few; blades lanceolate to ovate-lanceolate, 2–5.5 cm. long, acute or slightly acuminate, often somewhat crisped and twisted, undulate, ciliate, cuneate or truncate at the base; petioles 2–6 mm. long, pale, margined: flowers axillary: hypanthium bristly and with very slender hairs, especially about the ovary; tubular portion about as long as the ovary: sepals linear-lanceolate, fully 1.5 cm. long, thin and delicate: capsules 4–5 cm. long, club-shaped by the sterile basal portion which is slightly shorter than the fertile portion, about 4 mm. thick: seeds 1.5 mm. long, reticulated.

In dry soil, Flagstaff, Arizona, September 5, 1894, *J. W. Toumey.*

More closely related to *OEnothera laciniata* than any other species. It differs in the larger flowers and the club-shaped capsules, besides the conspicuous character of the leaves. These members are very suggestive of the leaves of *Nyctaginea* or the broad-leaved species of *Allionia.*

Phlox Brittonii

Perennial, deep green. Stems copiously branched; branched matted, forming wide tufts, glandular-pilose: leaves numerous, small ones often clustered in the axils of the larger; blades subulate or narrowly linear-subulate, 5–10 mm. long, ciliate, especially near the base: calices 5-6 mm. long, glandular-pubescent like the branches; segments subulate, about as long as the tube: corolla white: tube curved, about 1 cm. long; limb 12–13 mm. wide; segments cuneate, with 2 pale magenta spots near the base, cleft by a V-shaped sinus about 3 mm. deep, usually with a minute tooth in each sinus, tips acute or acutish.

On dry mountain slopes, Virginia and West Virginia to North Carolina. Spring and Summer.

A relative of *Phlox subulata* but more delicate in all its parts. The contrasting characters may be shown as follows:

PHLOX BRITTONII	PHLOX SUBULATA
Stems or branches glandular-pilose: leaf blades mostly 5–10 mm. long: calices 5–6 mm. long: limb of corolla less than 14 mm. broad; lobes usually with a minute tooth in each sinus.	Stems or branches not glandular: leaf-blades mostly 10–15 mm. long: calices 8–9 mm. long: limb of corolla over 15 mm. broad; lobes usually with toothless sinuses.

The specimens upon which the species is based were collected by Dr. N. L. Britton, at White Sulphur Springs, West Virginia, May, 1898. Dr. Britton then introduced the species in the herbaceous grounds of the New York Botanical Garden where the plants have become thoroughly established.

Vernonia interior

Perennial, finely and usually closely pubescent. Stems erect or ascending, 1–2 meters tall, simple below the inflorescence: leaves numerous; blades elliptic to elliptic-lanceolate, 6–20 cm. long, acuminate, sharply and rather finely serrate, sessile or nearly so: heads numerous, rather crowded: involucres campanulate, 6–7 mm. high, 4–5 mm. broad: bracts pubescent, sometimes hoary, acute or with short keel-like acuminations, the tips erect or slightly spreading: achenes pubescent: pappus purple.

On plains or prairies, Missouri and Kansas south to Texas. Spring to fall.

The species just described has heretofore been confused with *Vernonia Baldwinii* and *V. Drummondii.* It is readily separable from its nearest relative, *Vernonia Baldwinii* by the smaller involucres and their bracts which have erect or barely spreading tips. The following cited specimens belong here:

MISSOURI: Jackson County, *Bush*, no. 233A; McDonald County, *Bush*, no. 232.

NEBRASKA: Lincoln, *Webber*, September, 1888.

TEXAS: Kerrville, *Heller*, Pl. S. Tex. no. 1927.

This species has been raised from seed in the nurseries of the New York Botanical Garden and is now established in the herbaceous grounds.

Vernonia maxima

Foliage glabrous or sparingly pubescent. Stems erect, 1–3 meters tall, branching above: leaves rather numerous: blades narrowly elliptic to lanceolate or linear-lanceolate, 1–3 dm. long, acuminate, sharply serrate, narrowed into short petioles or the upper ones nearly sessile: corymbs 1–4 dm. broad: peduncles angled, barely enlarged upward: involucres hemispheric, 4 mm. to nearly 5 mm. high, rounded at the base: bracts ovate to oblong, acute to mucronate, ciliate, appressed: achenes 3 mm. long, upwardly barbed on the ribs: pappus light or deep purple.

In low ground, Ohio to Missouri, south to Alabama and Louisiana. Summer and fall.

For many years *Vernonia gigantea* or *V. altissima* has been an aggregate. The campestrian plant that has been known under both of those names is very distinct from the Carolinian and Floridian plant to which both the above cited names were originally applied.

The campestrian plant may easily be separated from the south-eastern species by the lower involucres with rounded bases and their proportionately broader appressed and compactly arranged bracts. The involucres of the related species are narrowed at the base and have narrower loosely spreading bracts. The following cited specimens belong here:

MISSOURI: Jackson County, *Bush*, no. 230.

OHIO: no locality, *Riddell*, 1834. Scioto, *Merriam*, September 28, 1891.

WEST VIRGINIA: Monongalia County, *Millspaugh*, no. 677.

KENTUCKY: no locality, *Short*, 1842. Harlan County, *Kearney*, no. 188.

TENNESSEE: Knoxville, *Ruth*, September, 1894.
MISSISSIPPI: Agricultural College, *Pollard*, no. 1267.

Lacinaria Halei

Perennial, glabrous or nearly so. Stems erect, 6–9 dm. tall, simple or sparingly branched: leaves various; lower with linear blades 1–2 dm. long, upper narrowly linear and much shorter, not ciliate near the base: heads short-peduncled or nearly sessile, not densely crowded: involucres becoming narrowly turbinate, 7–9 mm. high: bracts lanceolate to oblong-lanceolate, acuminate, ciliolate, rigid: pappus plumose: achenes closely pubescent.

On prairies, Louisiana. Summer.

This species has heretofore been included in *Lacinaria acidota*, with which it has little or nothing in common, and it may be separated by its fewer leaves and much smaller heads which are disposed in elongated interrupted spikes. The bracts of the involucre are much shorter than those of *L. acidota* and have less elongated tips.

The species is founded on Hale's no. 334.

Lacinaria platylepis

Perennial, bright green. Stems erect, 8–9 dm. tall, simple, glabrate below, pubescent with white hairs above: leaves not very numerous, narrowly linear, 2–10 cm. long, or longer at the base of the stem, glabrous or nearly so: heads rather approximate, sessile, surpassing the subtending bracts: involucres cylindric-campanulate, 7–9 mm. long; outer bracts often ovate, acute, inner larger and broader, broadest above the middle, rounded at the apex, ciliolate: pappus not plumose, pale.

In sandy soil, Louisiana.

Plants belonging here have been referred to *Lacinaria acidota*. although none of the several characters warrant such a disposition, The fewer and shorter leaves, the elongated more or less interrupted spikes and smaller heads and involucres with their broad rounded inner bracts, are some of the characters that separate *Lacinaria platylepis* from *L. acidota*. The pappus too is not plumose.

The original specimens were collected in Louisiana by Dr. Hale.

New Species of Fungi*

By Flora W. Patterson

Hendersonia oleae

Forming large marginal pallid patches, with brown border: perithecia black, membranous, immersed, amphigenous, globose, 100–150 μ: conidia light olivaceous, oblong-elliptical, with subacute ends, 3-septate, not constricted, straight or slightly curved, 10×3.5 μ.

On leaves of *Olea dioica*, Botanic Garden, Sydney, New South Wales, April, 1898, J. H. Maiden.

Leptothyrium nitidum

Not forming spots: perithecia superficial, densely gregarious, sometimes confluent, elliptical-dimidiate, black, shining, astomate, occasionally longitudinally striate, context radiately cellular: conidia cylindrical, straight or slightly curved, hyaline, $2.5–3 \times 1$ μ: sterigmata 6×2 μ, arising from a compact layer of hyaline, rectangular cells, which are filled with large guttulae.

On dry stems of *Heracleum lanatum*, Longpine, Nebraska, February 24, 1898, J. M. Bates, no. 769.

Gloeosporium cassiae

Spots alutaceous, irregular in outline, with a raised brown border: acervuli amphigenous, scattered throughout the spots, raising the epidermis in a pustuliform manner, then erumpent: conidia ovate, pointed at one end, straight or slightly inequilateral, $4–6 \times 1.5–2$ μ: basidia hyaline, continuous, 15×1.5 μ.

On living leaves of *Cinnamomum cassia*, greenhouse, U. S. Department of Agriculture, January, 1900, F. W. P.

Gloeosporium clausenae

Spots large, irregular, subochraceous, with wavy, darker border on the margin of the leaves, most especially involving the tips: acervuli generally epiphyllous, very numerous, at first covered by the epidermis, subochraceous, erumpent: conidia ovate-oblong,

* Type specimens of these species are in the herbarium of the Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture.

often inequilateral: ends obtuse or rounded, 15–17 × 5–6 μ: basidia filiform, hyaline, shorter than the conidia.

On living leaves of *Clausena wampi*, greenhouse, Department of Agriculture, January, 1900, F. W. P.

Gloeosporium ochraceum

Causing large arid spots of irregular shape, especially upon the ends of the leaves, alutaceous, with a dark brown border: acervuli amphigenous, raising the epidermis in dark pustules becoming erumpent: conidia ochraceous in the mass, ovate, somewhat pointed at one end, guttulate, 12–15 × 4–5 μ: basidia hyaline, 9–12 × 3 μ.

On living leaves of *Cinnamomum aromaticum*, greenhouse, Department of Agriculture, January, 1900, F. W. P.

It will be observed that while the general appearance produced by the presence of *Gloeosporium ochraceum* on *Cinnamomum aromaticum* is very similar to that of *Gloeosporium cassiae* on *Cinnamomum cassia*, they differ widely in microscopic details.

Gloeosporium oleae

Spots white, arid, with an inconspicuous brown border, large, sometimes occupying about one-fifth of the leaf's surface: acervuli epiphyllous, numerous, long, covered by the epidermis, erumpent, dark, almost black: conidia oblong or ovate-oblong, sometimes slightly inequilateral, often bi-guttulate, 9–15 × 4–5 μ.

On living leaves of *Olea fragrans*, greenhouse, Department of Agriculture, January, 1900, F. W. P.

Colletotrichum setosum

Spots large, irregular, arid, yellowish-white, with purple border: acervuli amphigenous, not erumpent, numerous, minute, 25–45 μ diameter: setae very dark brown, septate, slightly flexuous, obtuse, with somewhat enlarged base, 30–45 × 4 μ: conidia oblong, with rounded ends, 15–17 × 4–5 μ.

On *Tillandsia* sp., greenhouse, U. S. Department of Agriculture, received 1899 from Costa Rica, C. Werckle.

Libertella olivacea

Acervuli densely gregarious, subcutaneous, at length erumpent, sub-conical, .5–1 mm. diameter, olivaceous: conidia hyaline, filiform, curved, 5–6 × 1 μ: basidia filiform, 10–12 × 1 μ.

On dead branches of *Rhus glabra*, Ainsworth, Nebr., May 14, 1898, J. M. Bates, no. 814.

Aspergillus umbrinus

Sterile hyphae creeping, branched, septate, hyaline, fertile hyphae erect, simple, septate, hyaline or slightly colored, 150–300 × 6–8 μ, apex inflated, sub-globose, 15–24 μ, generally 18 μ: sterigmata club-shaped, 12 × 6 μ: conidia in chains, bright umber colored, verrucose, 6–9 μ diameter.

The description is for the typical form from which there are extreme variations. Fertile hyphae may be only 18 μ in length, having an apex but slightly and irregularly enlarged, which may bear but 3–6 sterigmata, which are sometimes flask-shaped, 9–18 × 6–8 μ, and occasionally septate. When cultivated upon sterilized potato the species grows with great luxuriance. Measurements of conidia and hyphae remain practically the same, but the vesiculose portion is more nearly spherical and ranges from 30–45 μ in diameter, with sterigmata averaging 15 μ.

Upon such cultures in about five weeks there have developed numerous snow-white sclerotia, 1–5 mm. in height and 1–3 mm. in breadth.

In Brazil nut, Washington, D. C., February, 1900, E. A. Bessey.

Sterigmatocystis castanea

Thinly effused: fertile hyphae erect, simple, continuous, hyaline, 400–550 × 12 μ: apex inflated to a spherical head, 30–40 μ, from which radiate clavulate basidia 16 μ in length: sterigmata 4, 6–7 × 2 μ: conidia in chains of 4 or 5, spherical, verrucose, brown, 4–5 μ.

On *Persoonia lanceolata*, New South Wales, March, 1898, J. H. Maiden.

Cladosporium aeruginosum

Tufts epiphyllous, verdigris green, densely fasciculate, distinct, upon light-colored arid spots: hyphae simple, septate, nodulose, very light green, 45–90 × 3–3.5 μ: conidia lateral and terminal, in chains of 5 or more, almost hyaline, generally oblong and continuous, sometimes oblong-elliptical and once or twice septate, 5–12 × 2–2.5 μ.

On living leaves of *Olea fragrans* affected by *Gloeosporium oleae*, greenhouse, Department of Agriculture, January, 1900, F. W. P.

Cladosporium fici

Not forming spots: tufts conspicuous, aggregated, sometimes confluent, olive green: hyphae long, erect, slightly wavy, very rarely branched, septate, $45–250 \times 4\ \mu$: conidia light olive, terminal and lateral, more especially borne near the tips of the hyphae, oblong continuous ones $6–9 \times 4\ \mu$, sometimes in chains of 4, those 1–3 septate, oblong-elliptical to cylindrical, $9–25 \times 4–5\ \mu$, somewhat thickened at the septa and the longer ones often equilateral.

On living leaves of *Ficus parcelli*, greenhouse, Department of Agriculture, January, 1900, F. W. P.

Helminthosporium solitarium

Sterile hyphae inconspicuous, generally subepidermal: fertile hyphae, but slightly fasciculate, often solitary, erect, dark sooty brown, septate, swollen at the base, the upper portion (about ⅓, upon which the spores are borne) wavy or twisted, usually lighter colored at the apex, $60–150 \times 6\ \mu$; conidia dark brown, at first 2–4-guttulate, then 3–5-septate, oblong-elliptical, sometimes slightly curved, $24–30 \times 8–9\ \mu$.

On leaves of *Iris* sp. affected with *Fusarium iridis* Oud., Minneapolis, Minn., October, 1898, J. M. Bates, no. 928.

Heterosporium oxybaphi

Sterile hyphae subcuticular: fertile hyphae erect, densely fasciculate, fuscous olivaceous, simple, septate, coarsely nodulose, $90–125 \times 6–7\ \mu$: conidia in short chains soon falling apart, fuscous-olivaceous, epispore echinulate, elliptical or ovoid, 1–2- rarely 3-septate, seldom constricted at the septa, $18–27 \times 9–12\ \mu$.

On dead stems of *Oxybaphus angustifolius*, Longpine, Nebraska, June 24, 1898, J. M. Bates, no. 821.

Stemphylium butyri

Hyphae decumbent, long, wavy, grayish black, closely septate, $3–4\ \mu$ in diameter: fertile branches often very short: conidia darker than hyphae, verrucose, constricted at the septa, very irregular in shape, sometimes almost spherical, generally elliptical or sub-pyriform, borne at the tip or sides of the branches, sometimes two or three connate and in clusters, $18–36 \times 9–18\ \mu$.

Butter affected with this fungus assumes a bluish-black color in isolated spots, and these gradually extend over the entire surface. The specific description is written from an examination of butter sent to the Division of Vegetable Physiology and Pathology from the Agricultural Experiment Station of Oregon, by D. W. Trine, and from cultures of the same made upon agar-agar. Mr. A. F. Woods reports having seen the same species, which he recognized as a new one, in butter from South Carolina and other localities.

Stemphylium elasticae

Effused, grayish-black, decumbent, intricately branched, closely septate, 3–3.5 μ in diameter: conidia borne in chains of 2–6 at or near the tips of the fertile branches, not soon falling apart: verrucose, muriformly many-septate, constricted at the septa, darker than the hyphae, irregular in shape, ovate and somewhat pyriform or cylindrical, 18–45 × 9–18 μ, isthmus cell almost hyaline, 2–3 μ.

On parts of leaves of *Ficus elastica* attacked by *Gloeosporium elasticae* Cke. and Mass., Washington, D. C., January, 1900, F. W. P.

Volutella allii

Sporodochia black, sessile, convex, elongated, 100–150 μ in diameter, gregarious and sometimes confluent, densely covered with rigid black setae that are smooth with pointed tips and are 60–175 × 6 μ; conidia fusiform-falcate, hyaline, 18–21 × 3–4 μ; conidiophores densely crowded, unbranched, hyaline or slightly olive tinged, 18–20 × 3 μ.

On scapes of *Allium Nuttallii*, Atkinson, Neb., June 22, 1898, J. M. Bates, no. 820.

DIVISION VEGETABLE PHYSIOLOGY AND PATHOLOGY,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

Variations in the Maturing of Plowrightia morbosa Spores

BY WM. A. RILEY

During the course of some work upon the black knot fungus, I was interested in noting the time of maturing of its ascospores, in the neighborhood of Ithaca. Between the actual date for this locality and the time which has been recorded for the New England and Middle States there is a decided discrepancy.

The first statements bearing upon this are those of Prof. C. H. Peck.* He notes that, "in specimens collected January 13th, spores were found in a few of the sacs but most of them were yet filled with their greenish contents." He states that he found spores as late as June.

Dr. W. G. Farlow † first found a few ripe spores on the 17th of January, and in the second week of February, most of the knots examined contained ripe spores. He found that late in the spring they were not so abundant or in such good condition. Dr. Humphrey,‡ who studied the fungus in the vicinity of Amherst, confirms Dr. Farlow's dates.

My observations commenced early in February of last year. On the 12th of that month I examined a large number of specimens and failed to find a trace of spores. My interest being aroused, I made throughout the term, two or more observations per week, usually examining a large number of knots from several different trees.

Not until March 7, after a week of mild weather, did I find a single ascus containing fully formed spores. March 22 specimens found on young shoots, where they had been protected and kept moist by snow, showed in the majority of the asci fully formed spores. Knots taken from the branches of the same tree showed that in most of the asci the spores were, at best, but faintly outlined. In only a very few asci were they nearly mature. By the middle of April the mature spores were fairly abundant but a

* Trans. Albany Inst. 7 : 199. 1872.

† Bull. Bussey Inst., 442. 1876.

‡ Rep. Mass. Agr. Exp. Sta. 8 : 206. 1890.

thorough examination as late as May 9 showed that fully three fourths of the spores were immature.

The possibility of exceptional exposure of the knots examined is precluded by the fact that I had under observation a number of trees, growing in diverse situations. It occurred to me that the winter might have been an unusually severe one. On this point, fortunately, the records of the weather station, located here, furnish reliable data. Until January, the winter was mild. Considering as normal the mean temperature for twenty years, the average for the months of January and February, 1899, was two and seven tenths degrees below the normal. On the other hand, the mean temperature for March was slightly above while that for April was four and two tenths degrees above normal. Moreover, "It's a poor rule which will not work both ways"; the present winter has been an unusually mild one. The mean temperature for January was three degrees above the normal. So far, the temperature this month has been unusually mild. Yet, up to the present (Feb. 17), I have found no fully outlined spores. That exceptional weather may affect the maturation of the spores is undoubted. It is, however, evident that, for this locality, the ascospores of *Plowrightia morbosa* normally mature considerably later than the time recorded by Dr. Farlow and others.

I find that a similar instance of slow development in the vicinity of Ann Arbor has been reported by A. A. Crozier.*

BOTANICAL DEPARTMENT, CORNELL UNIVERSITY.

---

* Botanical Gazette, 10: 368. 1885.

Darluca upon Carnation Rust.—A preliminary Note

BY FREDERICK H. BLODGETT

On December 28 last, while examining a commercial carnation house, specimens of diseased leaves were secured which when examined carefully revealed the presence of the rust (*Uromyces caryophyllinus* Schr.) parasitized with *Darluca filum* Carst. Since that time the *Darluca* has been found in considerable abundance on a number of varieties of carnations.

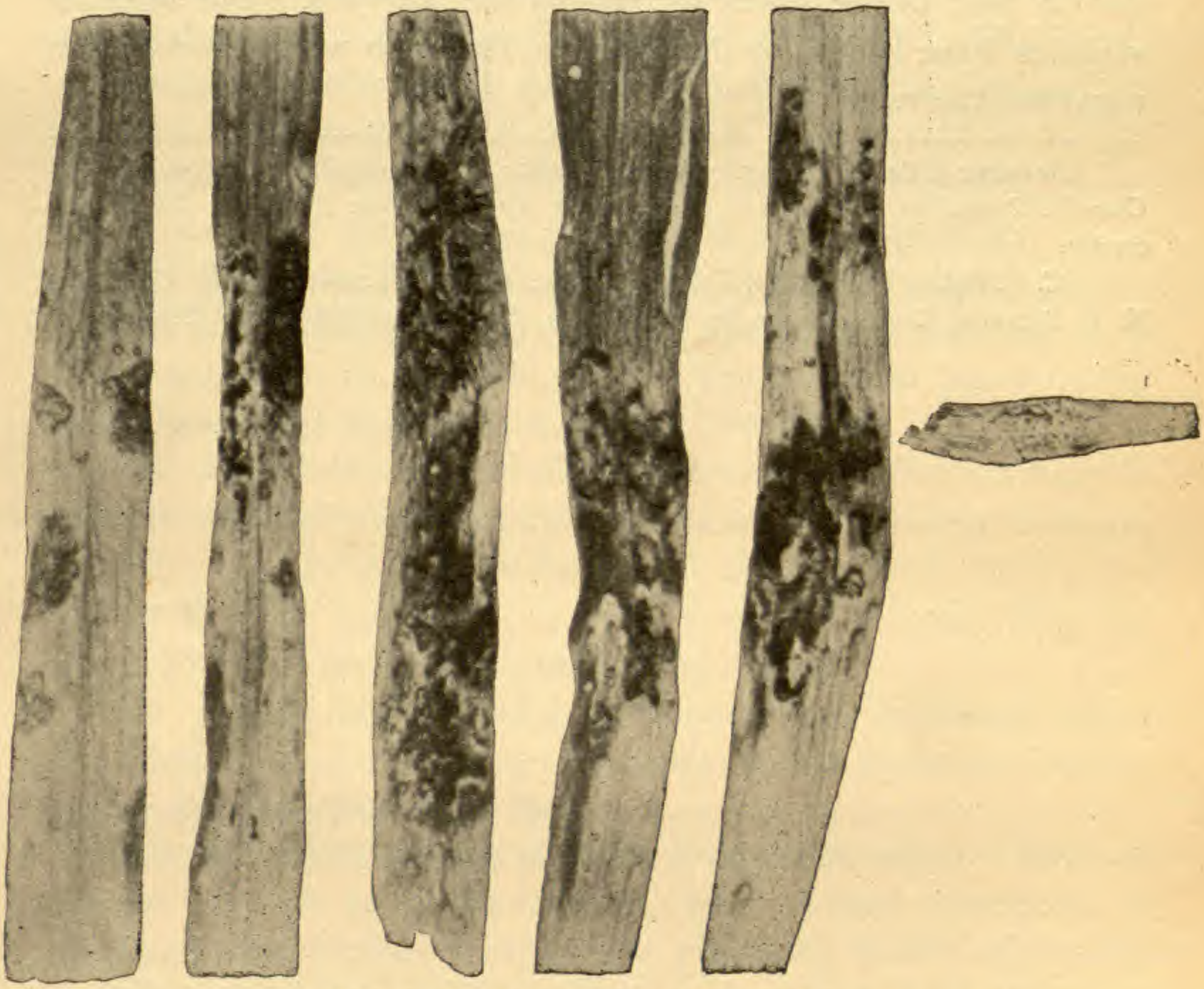


FIG. 1. *Darluca* on Carnation rust × 2.

On dark flowered kinds there is often present a dark colored area, blue- or red-purple in color, which is associated at times with the *Darluca*, but not a regular accompaniment of it. The more frequent appearance is of a dark area, very irregular in outline, but extending some little distance along the leaf. A few pustules of the rust are usually present upon this area, and such are infested as a rule, by the pycnidia of *Darluca.* Occasionally pustules show the pycnidia when examined carefully, when there is no external evidence of their presence. Upon dead leaves, or dead areas at least, the *Darluca* appears in rare instances as very fine black specks, with no rust pustule closely associated with them.

It is of interest to note that while no mention seems to have been made of the fact, the *Darluca* was parasitic upon this rust as early as 1893,* two years after the rust appeared. It may be that the decrease in seriousness of the rust during the past few years is due in part to the check offered by the *Darluca.* But resistant varieties have helped to diminish the fear with which florists first regarded the rust.† .

---

* Seymour & Earle, Economic Fungi, no. 460; *U. caryophyllinus* collected 1895 by Clara E. Cummings, at Wellesley, Mass. Part of the specimen shows the *Darluca* distinctly.

† C. F. Baker, Ft. Collins, Colorado, June, 1893.—The specimen in Herbarium N. Y. Botanical Garden shows *Darluca* no. 59, *Uromyces caryophyllinus* Schrank.

Proceedings of the Club

WEDNESDAY EVENING, FEBRUARY 28, 1900

Vice-President Allen was in the chair; thirty-two persons were present.

The Secretary announced the offer of the annual grant of $50.00 from the Newberry Fund, open to candidates from the Scientific Alliance in Botany or Geology. Dr. Britton spoke relative to the coming meeting of the A. A. A. S. in New York. He suggested that it might be well instead of our usual Fourth of July excursion to provide an excursion to the Pine Barrens, which would follow the A. A. A. S. meeting, which closes June 30. The Torrey Club might provide during such an excursion for the personal expenses of such members of the A. A. A. S. as should be invited. A committee of five was appointed to secure contributions, select the personnel of the excursion and make all arrangements.

Dr. Britton read a letter from Miss Julia G. Noll, of 309 La Grande ave., Plainfield, N. J., inviting the Club to take one of its May excursions to Plainfield, N. J. The invitation was accepted with thanks and referred to the Field Committee.

Dr. Allen read a letter to the Club from Mrs. Allen, inviting the Club to visit their home, Hazelwood, Conn., as a Torrey Club excursion. The hospitable invitation was accepted with thanks, as a Decoration Day excursion; to leave New York Tuesday, May 29, and referred to the Field Committee for action.

Dr. Britton reported that on February 9, *Helleborus niger*, the Christmas rose, expanded its petals at the Botanical Garden, and is still flowering under hay.

The first subject on the scientific programme was a "Note on *Apeiba*" by Dr. D. T. MacDougal, who showed specimens of leafy branches of this Tiliaceous tree, exhibiting flowers apparently seated on the leaves, an accidental but frequently quite stable position, due to abundant blossoms dropping from above, piercing lower leaves and lodging there. Dr. MacDougal witnessed this peculiarity in trees cultivated in Jamaica, originally from British Guiana.

The principal paper of the evening was a discussion by Dr. N.

L. Britton "On the Flowering Plants collected by Mr. R. S. Williams in the Yukon Territory, 1898–1899." Dr. Britton exhibited the plants collected, and by means of a sketch map of the region he compared the diverse floras of the Alaskan region.

TUESDAY EVENING, MARCH 13, 1900

President Brown in the chair; twenty-six persons were present.

The paper of the evening was by Dr. P. A. Rydberg, on the "Phytogeography of Montana." He divided Montana into three regions, the Great Plains, constituting about one half of the State, and the subalpine and the alpine regions, the last constituting those isolated peaks which exceed 9000 feet. The characteristic plant-coverings of each region, termed formations, were classed under the usual groups as Xerophytic, Mesophytic, Hydrophytic and Halophytic and include, as Xerophytes:

1. The Buffalo-grass formation, the chief Xerophytic formation of the Great Plains, where high, dry plains are covered with low self-curing grasses giving excellent winter pasture; including *Bouteloua oligostachya*, *B. hirsuta*, *Buchloe dactyloides*, and *Carex filifolia*.

2. The Cactus formation, with *Opuntia polyacantha*, *O. humifusa*, *Cactus viviparus*, *C. Missouriensis*, and *Lepidium apetalum*.

3. The Sage-brush formation, with *Artemisia tridentata*, *A. cana*, *A. tripartita*, *A. arbuscula*, together with species of *Chrysothamnus*, *Eurota*, and *Tetradynia*.

4. Bad-land formation, species of *Eriogonum* and *Astragalus*.

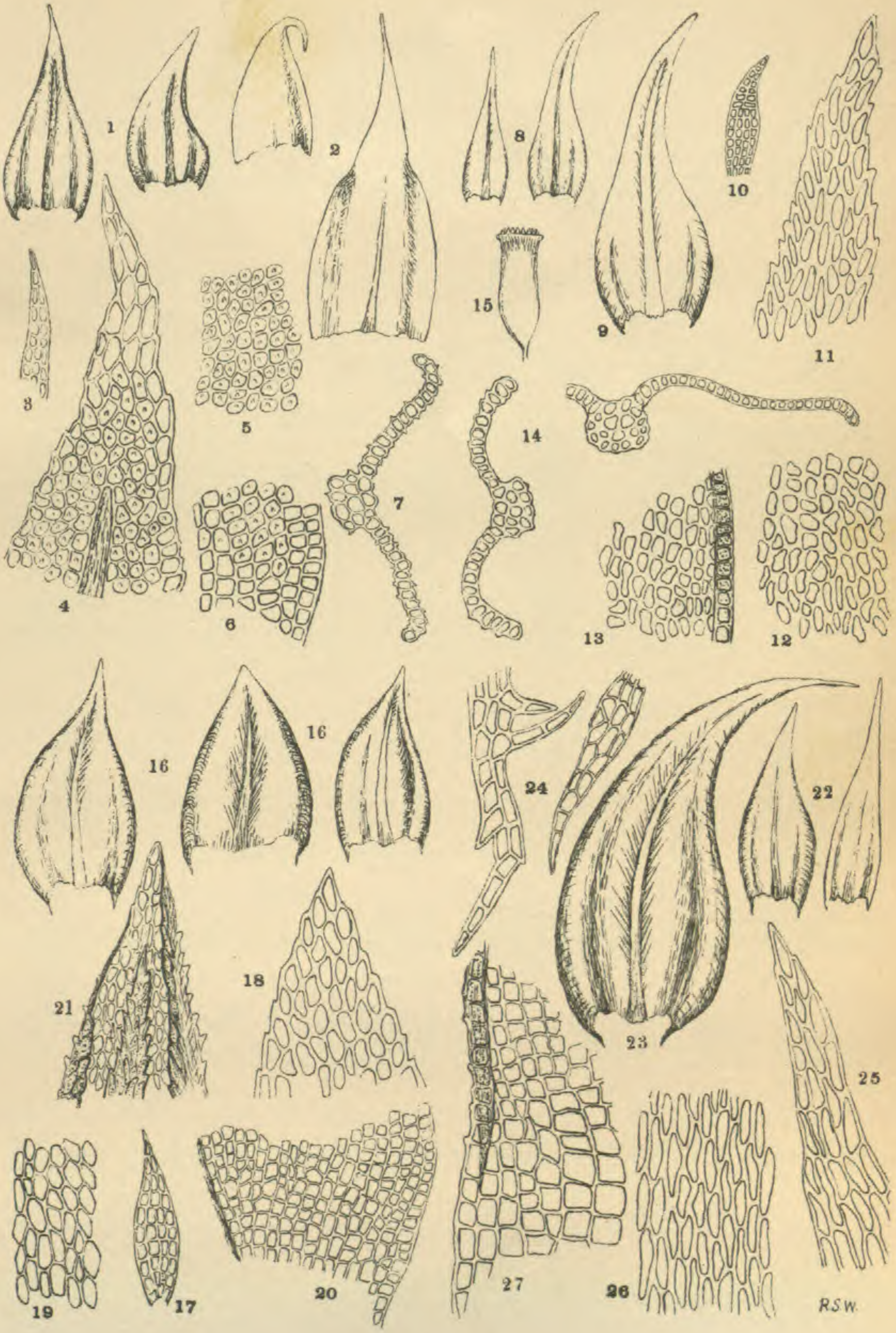
5. Pine-ridge formation, with *Pinus scopulorum* and *Juniperus occidentalis*.

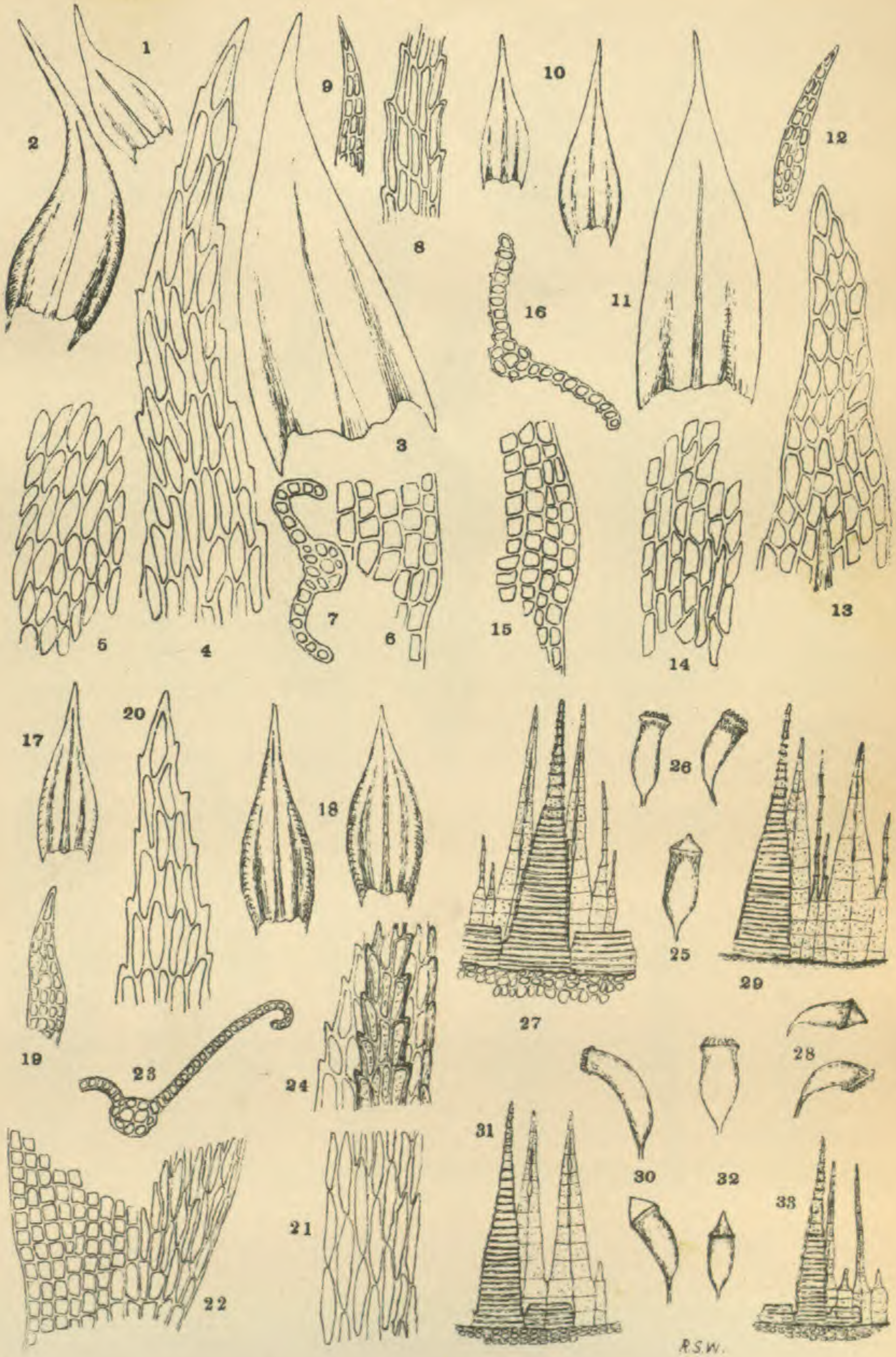
Mesophytic formations of the Great Plains.

The Prairie formation, the most important, forming the grasslands in the river-valleys, its species belonging to the prairie region, and include species of *Agropyron*, *Elymus*, *Andropogon* and *Poa*.

7. The Dog-town formation; four plants are found in all prairie-dog towns: *Chenopodium incanum*, *Solanum triflorum*, *Cryptanthe crassisepala* and *Munroa squarrosa*.

8. The Sand-draw formation, with *Cleome trachysperma* and species of *Euphorbia*. In this connection were mentioned the weeds of the region, *Helianthus annuus*, *Chenopodium album* and *Avena fatua*, all introduced, and *Helianthus petiolaris*, *Chenopodium*


1
2
8
10
11
3
4
5
15
9
6
7
14
13
12
16
16
24
22
21
18
23
25
19
17
20
27
26
RSW.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
R.S.W.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

leptophyllum, *Eriocoma cuspidata*, *Phacelia linearis*, *Lygodesmia juncea*, natives.

Hydrophytic formations of the Great Plains include :

9. The Wet-meadows, covered with grasses and sedges, with species of *Calamagrostis*, *Poa*, *Agrostis*, *Spartina* and *Alopecurus*.

10. The Sand-bar formation, with *Salix fluviatilis* and *Shepherdia argentea*.

11. Purely aquatic plants, species of *Lemna*, *Potamogeton*, *Batrachium* and *Nymphaea*.

Halophytic formations of the Great Plains include :

12. Salt-marsh formation, with *Spartina gracilis*, and two species of *Triglochin*.

13. The Alkali-flat formation, with *Agropyron Smithii*, and several Chenopodiaceous plants, as *Atriplex*, *Sarcobatus*, *Dondia*, etc.

Subalpine formations follow : first, the Xerophytes :

14. The Grass-covered Foothills and Bench lands ; with *Festuca ovina*, *Agropyrum spicatum*, *Elymus condensatus*, and *Avena Americana*.

15. Rock-crest formation, with species of *Heuchera* and *Erigeron* ; and with the Bitter-root, *Lewisia rediviva*, the Montana state flower.

Mesophytic subalpine formations are :

16. The Poophytic, covering the drier valleys and grassy hillsides ; the same grasses as in the drier foothills, with addition of more valuable species, especially of *Poa*, as *P. Nevadensis*, *P. Buckleyana* and *P. lucida*.

17. The Hylophytic or Forest formation, the covering of wooded mountain-sides and pine flats ; all conifers, as *Pinus Murrayana*, *P. flexilis*, *P. albicaulis*, *Picea Engelmanni*, *P. Columbiana*, *Abies grandis*, *A. amabilis*, *Pseudotsuga mucronata* ; besides which occur along streams, *Alnus tenuifolia*, *A. sinuata*, *Betula occidentalis*, *B. glandulosa* and several species of *Salix*.

18. The chief Hydrophytic subalpine formation, that of the wet mountain-meadows, luxuriant in grasses and sedges. The most valuable hay plants there are *Phleum alpinum* (nearly related to the cultivated timothy), *Alopecurus occidentalis*, a foxtail grass, and two clovers, *Trifolium Beckwithii*, and *T. Rydbergii*.

The water plants of the mountain region are practically the same in the plains ; as are the halophytes.

There are also:

19. A Mountain-bog formation, with several species of *Phyllodoce*, *Kalmia microphylla*, *Ledum glandulosum* and *Salix chlorophylla*.

20. The Geyser formation peculiar to geyser and thermal waters are *Spraguea multiceps*, *Panicum thermale*, *Mentha rubella* and *Eleocharis thermale;* the latter growing in water hot enough to be unpleasant to the touch.

In the alpine region the differentiation into xerophytic, mesophytic and hydrophytic formations is less marked; halophytes are wanting, and the hylophytes are stunted specimens of *Pinus albicaulis* and *Abies subalpina*.

The peculiar alpine formations are:

21. Alpine clover-fields, with species of *Trifolium* only a few centimeters high, as *T. nanum*, *T. montanum*, *T. dasyphyllum*, and *T. Haydeni*.

22. The Alpine-willow formation, made up of *Salix nivalis S. petrophila*, *S. tenera*, *S. glaucopis*, and *S. Dodgeana*, the last one the smallest willow in the world, no specimen being two inches high. It was discovered on Electric Peak in the north border of the Yellowstone Park, at an altitude of 3300 m., and was named in honor of Mr. Wm. E. Dodge, of New York, through whose liberality this botanical exploration was prosecuted.

23. Finally the Rock-slide formation, with curious flora, consisting of *Claytonia megarrhiza*, *Alsine Americana*, *Arenaria Nuttallii* and *Gilia debilis*.

Dr. Rydberg's paper was followed by remarks by Judge Brown on the beauty of the mountain flora, and by Dr. Britton on the Dodge expedition of 1897, of which the paper is a result.

Professor Britton announced that the keys of the Museum building of the New York Botanical Garden had been turned over to him, and that the museums were immediately opened to the public. The installation of the temporary exhibit is going rapidly forward. President Brown added that the Torrey Club congratulates itself on the progress of the Botanical Garden, progress which is in large part the outcome of the Club's influence.

Adjournment followed.

EDWARD S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matter relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Anheisser, R. Ueber die aruncoide Blattspreite. Flora, **87**: 64–94. *pl. 4.* 1900.
A contribution to the biology of leaves.

Barnes, C. R. Outlines of Plant Life. 12mo, pp. 308. New York, 1900.

Barnes, C. R. The Progress and Problems of Plant Physiology. Proc. A. A. A. S. **48**: 263–288. D. 1899.

Bennett, A. Notes on *Potamogeton*. Jour. Bot. **38**: 125–130. Ap. 1900.

Best, G. N. *Claopodium pellucinerve* (Mitt.). Bryologist, **3**: 19. Ap. 1900.

Bissell, C. H. *Eragrostis Frankii* in Connecticut. Rhodora, **2**: 87. Ap. 1900.

Britten, J. Note on *Cosmia*. Jour. Bot. **38**: 76, 77. Mr. 1900.

Britten, J. & Baker, E. G. *Cracca Virginiana*. Jour. Bot. **38**: 53. F. 1900.

Britton, E. G. How to know some of the common Bryums. Bryologist, **3**: 16–19. Ap. 1900.

Brown, N. E. *Cereus Mojavensis.* Curtis's Bot. Mag. **56**: *pl. 7705.* Mr. 1900.

Native of California.

Churchill, J. R. Lists of New England Plants, VI. Leguminosae. Rhodora, **2**: 89–92. Ap. 1900.

Clute, W. N. *Pteris aquilina* and its Allies in North America· Fern Bull. **8**: 37–39. Ap. 1900.

Copeland, E. B. Studies on the Geotropism of Stems. Bot. Gaz. **29**: 185–196. 26 Mr. 1900.

Corbett, L. C. A Study of the Effect of incandescent Gas Light on Plant Growth. Bull. W. Va. Agric. Exp. Sta. 62: O. 1899.

Eaton, A. A. *Isoetes Howellii* and *Isoetes Nuttalli.* Fern Bull. **8**: 32, 33. Ap. 1900.

Evans, A. W. The Hawaiian Hepaticae of the Tribe Jubuloideae. Trans. Conn. Acad. **10**: 387–462. *pl. 44–59.* Mh. 1900.

New species in *Frullania*, *Marchesinia*, *Harpalejeunea*, *Trachylejeunea*, *Cololejeunea* (3) and *Colurolejeunea.*

Fairman, C. E. Puff-balls, Slime-moulds and Cup Fungi of Orleans county, New York. Proc. Rochester Acad. Sci. **3**: 206–220. *f. 1–3.* Mh. 1900.

Tapesia rhois, sp. nov.

Familler, J. Der verschiedener Blattformen von *Campanula rotundifolia* L. Flora, **87**: 95–97. *pl. 1–3.* 1900.

A description of various causes inducing the recurrence of primitive forms of the leaf.

Fernald, M. L. Notes on *Echinacea.* Rhodora, **2**: 84–87. Ap. 1900.

Flett, J. B. Some Washington Ferns. Fern Bull. **8**: 40, 41. Ap. 1900.

Garman, H. The Elms and their Diseases. Bull. Ky. Agric. Exp. Sta. 84: N. 1899.

Greene, E. L. Necker's Genera of Ferns, I. Pittonia, **4**: 103–107. 2 Ja. 1900.

Griffiths, D. A Study in Spore Dissemination. Asa Gray Bull. **8**: 27–32. *pl. 2.* Ap. 1900.

Grout, A. J. Key to *Bryum.* Bryologist, **3**: 13–15. Ap. 1900.

Grout, A. J. New American Mosses. Bryologist, **3**: 8, 9. Ja. 1900.

Grout, A. J. Notes on Vermont Plants. Rhodora, **2**: 88. Ap. 1900.

Hill, E. J. *Pellaea gracilis* in Illinois. Fern Bull. **8**: 31, 32. Ap. 1900.

Holzinger, J. M. *Grimmia teretinervis* Limpr. in North America. Bryologist, **3**: 20–22. Ap. 1900.

Holzinger, J. M. The geographical Distribution of the Teretifolium Group of *Talinum*. Asa Gray Bull. **8**: 36–39. Ap. 1900.

H[ooker,] J. D. *Macleania insignis.* Curtis's Bot. Mag. **56**: *pl. 7694.* Ja. 1900.
Native of Mexico.

H[ooker], J. D. *Coryanthes macrantha.* Curtis's Bot. Mag. **56**: *pl. 7692.* Ja. 1900.
Native of Guiana and Venezuela.

H[ooker], J. D. *Haylockia pusilla.* Curtis's Bot. Mag. **56**: *pl. 7693.* Ja. 1900.
Native of Uruguay.

H[ooker], J. D. *Diostea juncea.* Curtis's Bot. Mag. **56**: *pl. 7695.* Ja. 1900.
Native of Chile.

House, H. D. Ophioglossums resting. Fern Bull. **8**: 40. Ap. 1900.

Jewell, H. W. A pink-flowered form of *Rubus triflorus.* Rhodora, **2**: 87. Ap. 1900.

Juel, H. O. Untersuchungen ueber den Rheotropismus der Wurzeln. Jahrb. wiss. Bot. **34**: 507–538. *f. 1–7.* 1900.

Kennedy, G. G. *Carex Novae-Angliae* in eastern Massachusetts. Rhodora, **2**: 83, 84. Ap. 1900.

Klebahn, H. Kulturversuche mit Rostpilze. Jahrb. wiss. Bot. **34**: 347–404. *f. 1–8.* 1900.

Kohl, F. G. Die paratonischen Wachstumsverkummungen der Gelenkpflanzen. Bot. Zeit., **58**: 1–28. *pl. 1, 2.* 1900.

Kuntze, O. A Plea for my 1737 Proposal. Jour. Bot. **38**: 47–50 F. 1900.

Leisering, B. Ueber die Entwicklungsgeschichte des interxylären Leptoms bei den Dicotyledonen. Bot. Centralb. **80**: 289–296. *pl. 1–3.*

Macbride, T. H. The Slime Moulds. Rhodora, **2**: 75–81. *pl. 16.* Ap. 1900.

Masters, M. T. *Taxodium* and *Glyptostrobus.* Jour. Bot. **38**: 37–40. F. 1900.

Maxon, W. R. Notes on American Ferns: I. Fern Bull. **8**: 29–31. Ap. 1900.

McDonald, F. E. Southern Range of *Equisetum palustre.* Fern Bull. **8**: 34. Ap. 1900.

Meehan, T. John Howard Redfield. Fern Bull. **8**: 25, 26. Ap. 1900.

Negler, F. W. Pflanzengeographisches aus den südlichen Anden und Patagonien. Engler's Bot. Jahrb. **28**: 231–272. 9 Mr. 1900.

Nelson, A. Some Notes upon the Flora of Yellowstone National Park. Asa Gray Bull. **8**: 32–35. Ap. 1900.

Noll, F. Ueber Geotropismus. Jahrb. wiss. Bot. **34**: 457–506. 1900.

Osterhout, W. J. V. Befruchtung bei *Batrachospermum.* Flora, **87**: 109–115. *pl. 5.* 1900.

Parish, S. B. The growing Period of the Southern Californian Ferns. Fern Bull. **8**: 26–29. Ap. 1900.

Planchon, M. L. Influence des divers milieux chimiques sur quelques champignons du groupe Dematiees. Ann. Sc. Nat. VIII. **19**: 1–248. *f. 1–17.* 1900.

Pollard, C. L. Eight new Species of North American Plants. Proc. Biol. Soc. Wash. **13**: 129–132. 6 Ap. 1900.

New species in *Lupinus*, *Vio'a* (2), *Gentiana* (3), *Chrysopsis*, and *Solidago*.

Pollard, C. L. & Ball, C. R. Some new or noteworthy Louisiana Plants. Proc. Biol. Soc. Wash. **13**: 133–135. 6 Ap. 1900.

Physalis rigida sp. nov.

Popovici, A. P. Der Influss der Vegetationsbedingungen auf die Länge der wachsenden Zone. Bot. Centralbl. **81**: 33–40. 4 Ja. 1900; 87–97. 10 Ja. 1900.

Posternak, S. Contribution a l'etude chimique de l'assimilation chlorophyllene. Rev. Gen. de Bot. **12**: 5–25. 1900.

Robinson, B. L. A blue-fruited Huckleberry. Rhodora, **2**: 81–83. Ap. 1900.

Gaylussacia resinosa glaucocarpa n. var.

Rolfe, R. A. *Stanhopea Rodiguesiana.* Curtis's Bot. Mag. **56**: *pl. 7702.* Mr. 1900.

Native of New Grenada.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT :

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895 ; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT :

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth) ; $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896 ; Emeritus Professor 1896,—and Hon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages ; Vol. 2 642 pages ; Vol. 3, 588 pages ; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes ; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895 ; Tutor in Botany, 1895–.

Octavo, 360 pages ; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

VOL. 27 JUNE, 1900. No. 6

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

Vol. 27 No. 6

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JUNE 1900

Three new Charas from California

By T. F. Allen

(With Plates 10–15)

Chara Hornemanni **Nordhoffiae**

Euchara: haplostephana bistipulata diplosticha dioica major.

Plant large, branched, growing to greatest perfection in deeper water, 25–30 cm. long: in shallower water becoming stouter but shorter and more condensed. Stem usually elongated, 2–3 mm. in diameter, covered with acutely pointed spines, whose length is 2–3 times the diameter of the stem; diameter of the spines 160 μ: cortex of the stem "diplosticha," the cortex tubes uneven, the primary series more prominent, but not larger; the tubes of the secondary series unite obliquely. (In the type species *Chara Hornemanni* Wallm., the cortex tubes are much more regular and uniform in size.) Spines scattered, isolated, cylindrical in form, in length more than double the diameter of the stem, about 160 μ in diameter; in younger internodes, these spines are much shorter, often even triangular in shape: verticils somewhat remote, the internodes about equal the length of the leaves; the verticils consist of about 9 leaves: leaves spreading or partly reflexed, 6–8 cm. long, 325 μ in diameter at lowest segment, consisting of 4 or 5 nodes: stipules subtending the verticils, arranged *in a single series of cells, double the number of the leaves;* stipule cells well developed, attaining a length of 15–20 mm., very similar in form and size to the spines, though a trifle stouter (25 μ in diameter).

The stiffly spreading stipules in the growing plant give a peculiar appearance, which prominently distinguishes the plant from all other adjoining vegetation, by the stiff "beard" about the stem, beneath the verticils of leaves.

The leaves are not corticated, but their nodes are provided with whorls of bracts, similar in shape to the spines and stipules. The leaf terminates in a single cell which much exceeds the length of the bracts of the ultimate node. The male and female fruit are born *on separate plants;* the male plants are usually larger, especially more elongated and diffusely branched; the female shorter and usually found in quite shallow water. The foliae, bearing antheridia, have nodes bearing 6 verticillate bracts without an antheridium: but on a node bearing an antheridum will be found 5 nodal cells bearing bracts; while the antheridium clearly occupies a nodal cell, replacing a bract. In the spore-bearing leaves, however, one finds a normal number of bracts and also a sub-sporal bract, developed (often imperfectly) from a cell, which would in a normally developed, monoecious chara bear an antheridium. This pre-bracteole or sub-sporal bract is frequently developed no farther than a swollen cell or a minutely protruding elongation, but all degrees of development may be noticed, as shown in the engraving; even to a pre-bracteole quite as long as the entire sporophydium. The antheridium is 710 to 720 μ in diameter. The oöspore is black, about 700 μ long (650–780) and 400 μ broad *with 7 prominent but not acute ridges.* The coronula of the sporophydium is rounded in outline and consists of 5 connivent cells.

The type of the species, *Chara Hornemanni* Wallm., is also tropical or sub-tropical in habitat; it was first collected near Caraças, South America, and is known from the West Indian islands, Florida (Key West), Texas (collected by Wright), Lower California (San Ramon), collected by Mrs. Brandegee, etc. It is distinguished by its broader and more inflated bracts, stipules and spines; its *cortex-tubes* are much more regular and evenly developed but well rounded out, Diplosticha; the spines of the stem are rather inflated than cylindrical, 4–5 mm. long, 400–500 μ in diameter, abruptly pointed, often paired, one longer by one shorter. The stipules and bracts similar in appearance to the spines. In this species the development of *a pre-bracteole cell* is also noted. The oöspore is reported by Braun as *dark-brown* with 10 striae, coronula blunt with connivent cells. A Mexican form is also noted with 8 leaves, 12 stipules and 4 nodes. Antheridium 1000–1200 μ in diameter; oöspore 800 μ long, 450–480 μ broad.

Miss Nordhoff's *Chara* was collected in the small lake at Lakeside in San Diego Co., Calif., where it grows luxuriantly, quite monopolizing one end of the lake, the other end equally occupied by *Chara hirsuta* Allen. The numerous "sinks" in the surrounding country, kept supplied during the long "dry season" by subterranean waters, are also well stocked with this species. The species has a fresh, light green color and is very noticeable by the peculiar beard of stipules which surrounds the stem at intervals. Fertile spore-bearing plants were found only in very shallow water; the large and diffuse plants growing in deep water were all of the male form. Collected by Miss Nordhoff in August, 1898.

The appearance of this variety differs strikingly from *Chara Hornemanni* A. Br.; the latter is stouter with more nodes on the leaves: the spines of the stem numerous and very broad, diameter 400–500 μ (*Nordhoffiae* 160 μ in diam.); the difference in size of stipules and bracts equally great.

Chara hirsuta

Euchara: corticata diplostephana haplosticha-vera monoica contigua.

Plants slender, elongated, sparingly branched, the branches rivalling the main stem in length and appearance, 5–6 cm. in length (varying with the depth of the water); rarely of greater length, for the plant does not frequent a great depth of water and seems to extend to the surface. A single stem from the root sends out 5 or 6 long shoots, though when growing in shallow water a stem may have quite a "tuft" of shoots near the apex. The stem is extremely hairy; seeming larger than it really is, owing to the long and dense hairs which cover it. The stem is from 450 to 500 μ in diameter; the spines (hairs) arising from it, slender and more than twice as long as the diameter of the stem; 1000–1400 μ long × 75–80 in diameter. The stem is, when mature, singly and quite regularly corticated, though, in the younger portions, the cortex cells do not always quite unite, leaving spaces, which may or may not become occupied by imperfectly developed secondary cortex tubes; this imperfect development of the cortex is frequently noticed in the leaves which are at times quite imperfectly corticated. The spines are quite numerous and very slender, usually developed in pairs from the nodal cortex-cells. These paired cortex-spines are very unequal; often the second cell is developed only as a mere "knob" and not produced as a spine;

but even when deveolped it is very slender and rarely reaches half the length of its better developed fellow. In the upper, younger portion of the stem the cortex tubes are sometimes quite imperfectly developed and very decided spaces may result, which are not filled by a secondary cortex-system ; nor does any secondary cortex system attempt to develop ; but elongated open spaces are left between the primary cortex-cells which are not contiguous ; the spines are also imperfectly developed and simulate the stipular cells. The *stipules* are *double ;* the upper cell much longer than the lower, often exceeding the first (lowest) segment of the leaf. The stipules are in appearance quite similar to the spines of the stems and the bracts of the foliae. The leaves (foliae) arise from the nodes of the stem in whorls of about 10, subtended by stipules which are double ; one cell extending upward, usually longer than the basal node of the leaf; the lower stipular cell rather less than half the length of the upper ; extending downward but not appressed against the stem. A leaf generally bears 5 or 6 nodes, of which 2 or 3 are fertile. The leaves are short and connivent, not at all spreading ; they bear fruit abundantly. In some very hairy specimens the whorls of leaves seem scarcely longer than the hairs of the stem. In the older stems the verticils become remote ; the internodes often 15–20 mm. ; in younger internodes the whorls of short leaves almost touch, and the plant appears moniliform. The bracts at the nodes of the leaf are verticillate, the posterior being very little shorter than the anterior ; usually 8 bracts develop at each node ; the anterior decidedly longer than the oösporangium. All bracts are linear in shape, resembling the spines of the stem. The leaves are singly corticated and terminate in a "tuft" of nodal bracts generally 4 in number. The plant is monoecious, fruiting very freely. The antheridia mature while the oöspores are still very young, and so far noticed only on quite immature leaves : they are about 30 μ in diameter. The oögonia are very frequently paired on the first and second nodes of the leaf, subtended by linear bracts which are much longer than the entire oögonium and coronula.

The coronula is composed of closely-connivent, square-shaped cells ; the whole coronula about 24 μ high by 36 μ broad. The entire oögonium (without the coronula) averaging 2 mm. in height by 0.8 mm. broad ; the *oöspore* is black, long and narrow, 650 μ long, 260 μ broad, with 14 or 15 striae, ridges *not prominent.*

The nearest allies, systematically, are doubtless *C. crinita* Wallr., *C. altaica* A. Br. and *C. evoluta* Allen ; the former Asiatic, the latter American (northwestern); like these, this plant is singly corticated (stem and leaves), with a tendency to irregularity in the cortex, though no tendency to the formation of a secondary cortex is seen in this species. This plant bears abundant oöspores like the dioecious species *C. crinita* A. Br.; and the development of spines and bracts is similar to *C. crinita;* also in size it approaches that species though it is much larger than *C. crinita*, which grows in salt or brackish water in the eastern part of the country while *C. hirsuta* A. grows in fresh water in California. There seems no doubt as to its distinctness, though when gathered it seemed possibly a monstrous form of *C. evoluta* Allen, which has been found in several places in northern California and British America, extending eastward into Montana and Dakota; but this species is only an inch or two high and in the northwest Provinces, especially in the Saskatchewan preferring the brackish water pools, which abound there. *C. hirsuta* abounds in one extremity of the pond at Lakeside, San Diego Co., Calif., the other end of which is entirely monopolized by *C. Nordhoffiae* Allen. This species was not noticed in other small pools in the neighborhood nor indeed elsewhere in California. Lakeside is about twenty-five miles inland from the coast; its small lake is a favorite resort in the fall of ducks which seem to be attracted by the immense masses of a profusely fruiting *Potamogeton* (*pectinatus*) which, after a few days, disappears entirely, devoured by the wild ducks, who in turn vanish under the continuous fire of the hunters who flock in swarms after the canvas-backs.

CHARA GYMNOPUS **Sanctae-Margaritae**

The number of sub-species of this widely-different and variable species extending from Africa to the warmer portions of America is already large, but the form now noted cannot be assigned to any hitherto known, and must be described as new.

These plants grow in dense masses or "tufts" 75–100 cm. long, are bright green and moderately incrusted; .75–1 mm. in diameter; *spines* very numerous near the terminal portions of the stem, more scattered or absent entirely on the older stems; rather slender; in length, less than half the diameter of the stem, about 450–700 μ long by 70 μ in diameter.

Verticils of leaves becoming crowded near the apex of the stems, where they overlap, forming dense masses of crowded leaves, consist of 12 leaves: *stipules*, of the upper series, about 700 μ

long, of the lower, 400 μ long about 125 μ broad at the base, tapering to a sharp point; upper series much exceeding the length of lowest leaf-node.

Leaves consist of 8 to 10 nodes, of which the ultimate segment is naked, also *lowest* internode (gymnopus); the 3 or 4 lowest nodes are fertile, *the lowest node always so. The bracts of the leaf-nodes are verticillate*, or the posterior bracts only slightly shorter than the anterior; the latter are often as much as 1200 μ long by 70 μ broad; the posterior bacts 400–500 μ long by 68–70 μ broad; the anterior bracts are generally twice as long as the oösporangium. The lowest node is always fertile; the lowest segment of the leaf is not contracted, about 450 μ in diameter, by about 600 μ in length; the antheridia about 350 μ in diameter, the nucleus oösporangium 680 μ long by 290 μ broad, with 14 ridges.

The nearest allied species is *C. gymnopus* A. Br., var. *elegans* A. Br., from which it is distinguished by the size of the spines (in *elegans*, 100 μ in diameter by 1350 μ long, also thickly covering the upper portion of the stems), the stipules and bracts also are much longer; in *elegans* the stipules 1300 μ long by 50 μ diameter. The relative breadth of the *spines*, *stipules* and *bracts* is greater in var. *sanctae-margaritae* than in *elegans*. At Fig. 5 a comparison is made between the lowest (naked) leaf-node of var. *elegans* and *sanctae-Margaritae*, Fig. 2.

Explanation of Plates

PLATE 10. *Chara hirsuta* Allen. Plant nat. size.

PLATE 11. *Chara hirsuta* Allen. Figs. 1, 2 × 25; 3 × 200; 4, 5 × 50.

PLATE 12. *Chara Hornemanni Nordhoffiae* Allen. Plant ½ nat. size.

PLATE 13. *Chara Hornemanni Nordhoffiae* Allen. Figs. 1, 3, 6 × 25; 2, 4, 5 × 12½.

PLATE 14. *Chara gymnopus Sanctae-Margaritae* Allen. Plant nat. size.

PLATE 15. *Chara gymnopus Sanctae-Margaritae* Allen. Figs. 1, 4 × 50; 2, 3, 4 × 25.

Vegetative Reproduction and Multiplication in Erythronium *

BY FREDERICK H. BLODGETT

(WITH PLATES 16–18)

John Burroughs, in Riverby, speaking of the yellow *Erythronium* as he found it in grass-covered meadows, calls attention to the brittle white threads which often appear above the turf. These he found were connected with the immature bulbs, from which they penetrate the soil in various directions.

The nature and purpose of these threads were studied in 1893 and 1894.† They are smooth, scaleless offshoots or subterranean runners, heavily charged with starch. The tip encloses a bud which will become a bulb upon the death of the parent bulb. In this species, and in *E. albidum* the runners arise from the base of the parent bulb, differing in this respect from *E. propullans* Gray, which produces the offshoots from the side of the stem above the bulb.‡

The bulbs formed at the distant end of the runners repeat the process indefinitely, producing annual crops of runners and runner-bulbs until the conditions are met which result in flowering plants. When the necessary vigor, depth and size are reached which cause the development of a flower bud in addition to the leaf bud within the bulb, the annual runners cease to be produced; but when the flowering bulb is removed from those conditions, runners are again produced. The runners are first produced from the bulbs which are formed during the growth of the seedling; the last crop gives rise to flowering bulbs four years or more after the seed has ripened. After the runners cease to be produced, annual bulbs are formed within the mature bulb, resembling the runners in their structure save that there is no lengthening between the terminal bud and the point of origin.

---

* Read in abstract before the Society for Plant Morphology and Physiology, New Haven, Dec. 27, 1899.

† Bot. Gaz. **19**: 61. 1894; and **20**: 172. 1895; with illustrations.

‡ Am. Nat., July, 1871. A new Species of *Erythronium*. Dr. Gray mentions also the function of the offshoots in the species *Dens-canis*, *Americanum* and *propullans*.

The mature bulbs are usually in good flower about the middle of April, and the seeds ripen in June. They must be looked for among the leaves upon the surface of the ground, as the entire plant becomes withered and prostrate soon after the fall of the flowers. The ripe seeds are about 6 mm. long, half as wide, and in shape resemble, distantly, a segment of an orange, on account of a prominent raphe and spur along one side (Fig. 1). In texture the seed is firm and hard; in color, brown darkening with age and exposure. The surface is strongly convex, and smooth, though hardly shining. The raphe and spur are absent in seeds which have lain in the soil over winter. In *Erythronium Dens-canis* the raphe is less developed, the spur is present as a slender curved hook or beak from the apex of the seed.*

The seeds remain dormant for nine months—from June to April, when they germinate (Fig. 4), reaching their best development as seedlings (Fig. 7), about the time that the flowers are in their prime. The young plant elongates in opposite directions: the upper end, the tip of the cotyledon, contains a gland (Fig. 6, *g*) by which the food substance of the seed is absorbed. The lower end is protected by a root cap during the first stage of its growth. While the tip of the cotyledon advances the length of the seed, the opposite end penetrates the soil for an inch or more. About the time that the food is absorbed from the seed and the cotyledon frees itself from the empty testa, the descending part changes also. From one side of this portion, close to the tip (*r*, Fig. 5), the radicle is produced, and penetrates farther into the soil. It is plentifully supplied at its base with root hairs (Fig. 9).

The cotyledon is supplied, for the greater portion of its length, with stomata, and functionally it is a cylindrical leaf. Starch is scattered through it, being in all portions of the tissue at *a* (Fig. 23), mostly epidermal in the guard cells of the stomata at *b*, usually near the fibrovascular bundles at *c*, and general again at *d*. Close to the tip (*d*) there is a local deposit of starch, as if provided for the growing cells just within the root cap (*S*, Fig. 5). The part from which the radicle springs enlarges, becomes charged with starch, and forms a bulb (Fig. 9), which is usually forced

*Irmisch: Beiträge zur verg. Morphologie der Pflanzen. Abhand. d. Natur. Gesell. zu Halle, 17^3: 184–195. 1863.

deeper into the soil at the end of a short vertical runner, but may develop without such elongation. Within this bulb the plumule is formed (Figs. 10, 11) and with its formation the first step in the vegetative life of the plant is completed. The second step appears the next spring with the first leaf—the plumule leaf, and ends when the first crop of runner bulbs is formed in May.* From the plumule-bulb only one or two runners are generally produced, but from the larger bulbs three is the more common number (Fig. 12), thus increasing three-fold the number of immature bulbs at each successive crop of runners.

A flowering bulb cannot be produced from seed in less than four years. In the first year the parent bulb would bloom, and ripen its crop of seeds, from six or seven to twenty or more. In the spring of the second year some of these seeds would germinate and form plumule-bulbs. From each of the plumule-bulbs there would appear in the third year a single leaf, and the first runners would be produced at the distant ends of which runner-bulbs would be formed. Some one of these runner-bulbs might be formed under the conditions necessary to produce a flowering bulb, but this is very unlikely; so that one or more years would elapse before a blossom would be formed, thus making a cycle of five or more years. This cycle is shown at Fig. 14, with the forms assumed at each step. At Fig. 26 the multiplication which takes place during the same cycle is shown diagrammatically: one seed; one seedling and plumule-bulb; one runner bulb; three runners with their bulbs; and from each of these three there are produced three more the fifth year, nine in all. Some of the nine will probably produce a flower; those which do not will continue to produce runners in most cases, although a bulb is occasionally found which is apparently recuperating, for the depth is that of the mature bulbs, but only one leaf is produced, and no runners are present.

The following table illustrates the number of plants of different ages during each of five years, supposing that five seeds from each fruit ripen and survive the cycle. Each step is one line lower

* No bulbs of plumule size were found this spring (1900) with runners. The stiff clay soil in which most of them were found may have some influence upon the absence of runners.

than the next preceding one, thus the five "seeds" of 1899, become "5 plumule-bulbs" in 1900, giving a total of 75 plants in 1903.

1899	1900	1901	1902	1903
5 seeds	5 seeds	5 seeds	5 seeds	5 seeds
	5 plumule-bulbs	5 plumule-bulbs	5 plumule-bulbs	5 plumule-bulbs
		5 yearlings	5 yearlings	5 yearlings
			15 2 years old	15 2 years old
				45 flowers
			Total	75 plants

There is very little chance that there will be forty-five blossoms at the end of five years, but as some of the bulbs will probably flower then it is convenient to call the entire number by one name, when they are of the same crop or age.

The seed resembles that of *Iris* in structure.* The walls of the cells are thickened; at certain points the walls of adjacent cells retain their normal thin nature, so that a thin membrane only separates the cell cavities. The cells are arranged with their longer axes nearly perpendicular to the surface of the seed, and in this way form lines which extend to the central portion of the endosperm. Through the center of the seed a mass of dense reserve cellulose extends (Fig. 19) with a few cell cavities scattered through it. In the apex of the seed, and at the beginning of this mass of dense material lies the embryo (Fig. 20). At germination the embryo elongates, pushing the tip of the cotyledon along the center of the seed, absorbing the dense cellulose as it advances. From the cavity thus formed in the center, the solvent action extends toward the surface of the seed, following the lines of the cells, and producing a honey-comb effect (Fig. 8). This honey-combing is the more easily produced on account of the cell arrangement which in a longitudinal section appears as in Fig. 18, *a*; in a horizontal one, as at *b*. The thin wall separating the depressions in the thickened walls of adjacent cells readily dissolves under the action of the absorbing gland of the cotyledon, thus opening a passage for the movement of food materials from cell to cell, as the solvent action extends. The dissolved material moves along the channels so made toward the tip of the cotyledon. The absorbing organ (Fig. 6, *g*) is quite similar in structure, and probably

* Haberlandt, Pflanzen Anatomie, 298.

in action also, to the glands in the hairs of *Drosera*.* One or two layers of cells cover the end of the fibro-vascular bundle which is slightly larger than in the body of the cotyledon. No starch is present in the seed, except in the raphe and spur, where a few grains are scattered through the thin-walled cells (Fig. 18, *c*). During the growth of the seedling starch is found just within the glandular tip of the cotyledon, and in other portions as already stated.

When the food material has been exhausted the cotyledon "elbows" its way to the surface and functions as a leaf. At this stage it resembles an onion seedling, but unlike the onion no further development of foliage occurs until a year later. The plumule-bulb is now forming and is complete, as a bulb, about the time the seedlings wither early in May. The plumule is formed at the base of the swelling at the origin of the radicle (*p*, Fig. 10). At first a mere line of division separates the plumule cells from the other cells of the young bulb. Later the plumule appears as a protuberance at the bottom of a small cavity in the base of the bulb (*p*, Fig. 11). After the cotyledon withers the plumule continues to develop, until a small leaf is formed by the first of November. The plumule-bulb becomes heavily charged with starch early in its development, and thereafter the subterranean portions, except the shoots inside the bulbs are starch bearing.

Runners have their origin at the base of the stem, as a bud in the axil of the inner bulb-scale. From this point (Figs. 13, 15) they push out irregular distances, and at the completion of their growth form bulbs from their terminal buds. Mature bulbs are annually renewed from similar buds (Fig. 17), which develop inside of the parent, beginning as buds in December; the new bulb being full size just after the blossoms fall, in late April. Fig. 30 shows the new bulb at the time that the parent is in prime flower.

The runner and annual bulbs begin to form the buds for the next spring's leaves and flowers, in May. The first evidence is a discolored line or streak extending upward from close to the bottom of the bulb; soon there appears a cavity at the lower end of this streak, in which a short sprout is visible in June or July (Fig. 16). This sprout continues to develop until in November and

* Kerner, Nat. Hist. of Plants, 2: 145. *f. 126*.

December the floral parts are all present and well developed including the ovules and the pollen mother-cells, and the perianth is often tinged with yellow. As the spring advances the bulbs push their sprouts further and further toward the surface, and when the frost is fairly out of the ground the short distance remaining is quickly passed, and the flowers open while there may still be snow on shaded hillsides. The sprout penetrates the soil in the manner of an awl, piercing leaves and decayed wood which may lie in its path,* rather than growing around, or lifting them. For this awl-like work the sprout is protected by a hard tip, which forms the apex of the leaf when the latter expands.

In Fig. 22 the successive steps are shown, by which the flower becomes freed from the enclosing leaves, and assumes its nodding position on the pedicel. At the left (*a*) the sprout has fully penetrated the soil and the leaves have begun to relax their tight clasp upon the bud. The outer and larger leaf expands gradually, while the inner one remains close to the bud as shown at *b*. Next the two leaves bend downward toward their final position, the bud still held by the margins of the inner leaf, *c*. When the leaves have reached nearly their normal position, the bud is released *d*, and it then stands erect between the leaves, as at *e*. In a short time the stem begins to bend near the bud, as at *f*, and as the bud begins to open it has assumed the position shown at *g*.

The last two positions alternate while the plant remains in flower, position *f* being assumed on bright days, when the open flower, with strongly recurved petals, is turned upward, returning to the nodding position at night and on less warm or less sunny days. With the fall of the flower the enlarging fruit assumes an erect position upon the stem, which is retained until the whole plant is withered and lies prostrate on the ground; the ripe seeds remain quite close to the open capsule.

Erythronium Americanum in its mature development normally bears two unequal leaves and a single flower. During the past two or three seasons a number of unusual cases have been observed, in one of which two flowers were borne on an otherwise normal plant. More frequently one leaf only was present in a plant otherwise normal. Over a dozen plants showing the latter

* Bessey, C. E., A vegetable Awl, Plant World, 1: 132.

form of variation were found in an hours' collection in New Jersey. A plant collected at Washington, D. C., had one leaf (Fig. 28) eight stamens and seven petals ; the flower is shown at Fig. 27. Plants having three leaves, with one flower ; and four leaves, with two flowers ; have been found at long intervals. Fig. 31 shows also three rosettes formed by the root fibers, which indicates the minimum age of the bulb at the depth at which it was found, that is, three years.

Bulbs and runners also have unusual developments, such as surface buds or stimulation growths. The latter seems to have started after a rain or other stimulation, and bursting through the partly formed runner bulb, has grown further into the soil. Fig. 31 shows one in which the nearly formed bulb is burst in two directions, sending a continuation downward, and attempting to produce leaves through the upper opening. These rudimentary leaves showed a trace of yellowish green when first gathered. In bulbs which have been injured, so that the sprout from the center of the bulb fails to develop, a surface bud may be formed. Two such bulbs were recently observed and are illustrated at Fig. 24.

The starch which is very abundant in the bulbs is very finely banded, the fine lines being accompanied at intervals by coarser ones. Fig. 21 shows some of the more common shapes assumed by the starch. Occasional grains are found which are greatly elongated. Often there is a crack or fissure running through the nucleus of the grain but this is not constant, especially in small or medium sized grains.

So far as known, a satisfactory explanation of the common name of *Erythronium* has not been given. Many plants have for their common names the translation of their Latin designation, and the common name will remain through many changes in nomenclature of the scientific descriptions. People seeing in a new country a plant closely resembling one familiar near their homes, usually give the new plant the name of the one already known. Hence when *Erythronium Americanum* was seen, so closely resembling the European species, it received the common name of hat better known plant, dog's-tooth violet.

In the library of the U. S. Department of Agriculture at Washington, there is a copy of Leonard Fuchs' herbal : De historia stirpium insignes * * * Basileae, 1542. When examining this and several other volumes in December, 1897, a description, and excellent illustration were found of the European *Erythronium*, named *Viola Dens-canis.* The *Viola* part of the name is probably due to coincidence in time and place of flowering: *Dens-canis* refers either to the shape of the bulbs, or to the dentations at the base of the petals. In another part of the same volume a number of violets are figured bearing the generic name *Viola* as now.

During the examination of old botanical works in the search for the above reference the following names were found, applied to what has been known since Linnaeus as *Erythronium Dens-canis.*

Pliny: (Historia Mundi; Froben, ed. Basillae 1554), lib. 26, ch. x., p. 472, speaks of "another *Satyrion* (called *Erythriacon*), seeds like *vitex* but larger, smooth; root hard, cortex red, enclosing white within; sweet juice; occurring in mountains."

Dioscorides (Pedacii; Saracenius, ed. 1598), lib. 3, ch. 144, p. 232.

"*Satyrion Erythronium* or *erythraicum* has seeds resembling *linum*, but larger, firm, shining or dull. * * * The cortex of the root rather delicate, and red; the internal portion white, juice sweet, pleasant to the mouth."

Dodoen's Erundeboeck, Antwerp, 1554, gives an illustration of *Satyrion erythronium*, which is probably meant to be one of the *Alliums* as some of the herbalists consider that *Allium ursinum* is referred to by Dioscorides' *Satyrion erythronium.*

Camerarius' Kreuterbuch, Frankfort, A. M., 1586, page 389. In this herbal *Hermodactylus* and *Pseudohermodactylus*, are figured side by side and represent *Iris* and *Erythronium* respectively. The two names are often given by the old botanists as synonyms of *Dens-canis*, or dog's-tooth, as they most frequently called it.

"*Pseudohermodactylus* is a beautiful plant, it brings two, or rarely three leaves much like the lily. It is spotted with many brown spots. Its flower grows upon a yellowish-brown stem, light purple with brown stamens (fasemen) and a white pistil (stiftlin), in the center. The little leaves [petals] unfold when the sun shines warm upon it, but when, however, they have fallen away, a three-angled knob develops full of yellow seeds. The root is longish, thicker below than above, which are often clustered together. * *

While it does not bloom it brings only one flower. It is called Dentali by Apotheckers in Stiermarck."

In Lobelius' Stirpium, Antwerp, 1576, there is a good cut on page 64 of *Erythronium* with the brief description: "*Erythronium* with colored flowers and unequal leaves." *Satyrion Dens caninus*, *Hermodactylus* and *Pseudohermodactylus* are given as synonyms used in different regions. " * * * Flowers either purple-red or white, or purple and white mixed."

Plunkenetius (Phytographia, 1692, **3**: 130).

"*Dens caninus*, flowers yellow, *Virginianus*." *

Salmon's Herbal, 1710.

"Dogs tooth * * * the same as 'satyrion having red cortex on the root,' in Dioscorides, lib. 3, ch. 144." Three color forms are described having white, red and purple flowers respectively.

Roberto Morrison, of London, in his Plantarum Historia Oxonienis, 1715, page 343, says that the name "*Dens canis* is from the shape of the oblong tuberous root imitating the figure of a dog's tooth, the name is good." "It has a capsule of three distinct valves. * * * When the flower is red the leaves are red spotted, when white the spots are milky."

Gronovius (Flora Virginica, 1739, 151, 1st edition).

"*Erythronium*, leaves oval or oblong, glabrous, dark-spotted, flowers yellow." † (Cited in Linnaeus Spec. Pl. 1753, as var. γ, under *E. Dens-canis*).

Gronovius' Flore Virginia, Lugdonum, 1762, 51 (2d edition), contains a description of our native species. "*Erythronium* with ovate oblong leaves, smooth, dark-spotted. *Dens-caninus aquatalis*, flower yellow, pendulous, leaves ovate-oblong, prostrate, two upon a stalk, glabrous, dark-spotted. Blooming toward the end of March."

The reproduction by offshoots or runners, is mentioned in Miller's Gardener's Dictionary, London, 1754, Vol. I., "*Dens-canis* —Dog's tooth. * * * These plants are propagated by seeds, as

---

* *Virginianus* is italicized, as are authors cited on the same page, but here it may be a typographical error for a reference to Virginia, since the European form has purple or red flowers.

† This is probably the first description of the American species; especially interesting, as it has the modern genus name. See previous note.

also by offsets from the old roots. * * * The offsets, which these plants produce but sparingly, should be taken off at the time that the old roots are transplanted, * * * toward the latter end of May."

Linnaeus cites descriptions from a number of the early botanists, giving them as synonyms of his *E. Dens-canis*, or as varieties of it. Thus Dodonaeus (Stirpium historiae pemptades, 1616, 203) gives "*Dens caninus*" which Linnaeus regards as synonymous with *Erythronium Dens-canis*, as is also "*Dens-canis* with broad and rotund leaves," of Bauhinus (Pinax, Basiliae, 1671). But "*Dens-canis* with narrow and elongated leaves," of the same author is regarded as variety β under *E. Dens-canis*, and Gronovius's description given in a preceding paragraph, is ranked as variety γ in Species Plantarum, 1753.

Among names used or proposed for use as non-Latin designations of *Erythronium*, Trout Lily and Fawn Lily, have been suggested by John Burroughs in Riverby, on account of the spotted leaves, and because of the alert position which the two leaves often assume. Spring Lily has been proposed, on account of its early flowering, and the lily-shaped blossom. But as a colloquial name, "Roosters" is the least suggestive of the plant meant. This name is used in central New York, among the children especially, because of the custom of "fighting roosters" with the nodding flowers or buds, as is done with violets in New Jersey.

Explanation of Plates

PLATE 16

1. Surface of ripe seeds, June and March, $\times$ 3.
2. Longitudinal and cross sections of seed (June), $\times$ 3.
3. Cross sections of ovary, April and May, $\times$ 12 and $\times$ 5.
4. Successive steps in germination, $\times$ 1½ and $\times$ 3.
5. Longitudinal section of tip of seedling. *f*, fibrovascular bundle. *r*, point of origin of radicle. *s*, deposit of starch.
6. Tip of the cotyledon, showing the absorbing gland, $\times$ 10.
7. Full grown seedlings and "elbows," $\times$ 1.
8. Tip of cotyledon in partly absorbed seed, $\times$ 6.
9. Base of cotyledon showing the enlarged portion which becomes a bulb (plumule-bulb), $\times$ 5.

10, 11. Sections of young plumule bulb, plumule at *p*, $\times$ 5.

12. Runners, and the developing runner bulbs, $\times$ 1½.

13–15. Axillary buds, from which runners will develop. Slightly enlarged.

16. The first stages of the flower-and-leaves shoot (July 1).

PLATE 17

17. Bud of annual bulb (May), $\times$ 1.

18. Three sections of seed tissue. *a*, longitudinal. *b*, transverse of endosperm. *c*, cells from raphe, containing scattered starch grains.

19. Longitudinal section of seed, $\times$ 15.

20. Embryo in endosperm, $\times$ 50.

21. Starch grains from bulb, $\times$ 225.

22. Successive steps in the liberation and orientation of the flower, $\times$ 1.

23. Seedling, showing the starch-bearing regions, $\times$ 1.

PLATE 18

24. Surface buds on bulbs after the sprouts have been destroyed, $\times$ 1.

25. Life cycle of five years, showing the successive forms assumed.

26. Diagrammatic life cycle, showing multiplication of one seed in five years.

27. Abnormal flower, petals, 7; stamens, 8; leaf, 1 (Fig. 28).

28. Leaf of 27.

29. Abnormal bulb, twinned by surface bud, $\times$ 1.

30. Annual bulb turned aside to show the relation of old and new growth.

31. Mature bulb which has been three years in one place, rosettes of rcot fibers indicate the age, $\times$ 1.

32. Stimulation growth of runner, $\times$ 1.

Two new Species of Grimmia from Montana

By R. S. Williams

(With Plates 19, 20)

Grimmia (Eugrimmia) Brittoniae

Growing in dense hemispherical tufts up to 3.5 cm. high. Stems slender, usually bearing long branches. Outer perichaetial and upper stem leaves with blade 1 mm. in length, oblong, somewhat lanceolate pointed, concave, flat on the borders with nearly smooth hair point up to 3 times the length of blade: lower leaves a little smaller with hair point scarcely equaling blade, more concave and somewhat recurved: inner perichaetial leaves minute, triangular, with hair point 8 to 10 times the length of the blade: upper cells irregular, roundish or quadratic, about .006 mm. in diameter, gradually becoming elongated below, toward base 3 or 4 times longer than broad near costa and 1½ to 2 times longer than broad near margin: cells but slightly sinuous walled when filled with chlorophyl, later on the walls becoming distinctly sinuous both above and below: sections of costa show two large cells on ventral side with usually 5 or 6 surrounding cells, in single row, on dorsal side: leaf lamina is of a single row of cells with sometimes a doubling of one row in one or both margins: apparently dioicous: fruit unknown.

Growing on shaded perpendicular walls, partly calcareous, in rather dry places. Collected for several seasons in Bad Rock Cañon, Flathead River, Mont.

This species is dedicated to Mrs. Elizabeth G. Britton, to whom all students and lovers of our mosses will ever be indebted.

Grimmia (Eugrimmia?) tenuicaulis

In compact tufts up to 6 cm. high. Stems very slender, often thread-like, with few simple, mostly short branches: perichaetial and upper stem leaves rather broadly ovate-lanceolate, concave, revolute on borders, blade 1⅓ mm. long, with rough hair point about ⅔ blade in length, the papillae of point spreading, often recurved: moistened leaves erect-spreading: upper cells irregular, somewhat transversely or vertically elongated, mingled with rounded cells .004–.006 mm. in diameter: cells toward base more or less elongated rectangular, those near margin from nearly quadratic to twice longer than broad, towards costa becoming 2–4 times longer than broad : cells apparently never distinctly sinuous walled : sections of leaf show costa with two large cells on ventral side and two rows of somewhat smaller cells on dorsal side : lamina of leaf is of one thickness of cells, usually with one or two rows doubled near costa, or sometimes somewhat distant from costa, but not doubled in margin : occasionally the leaf is hyaline nearly ¼ down from apex, the hyaline cells always elongated : evidently dioicous : sporophyte not seen.

Specimens of type collected near Neihart, Belt Mts., Mont., Sept. 21, 1891, also obtained at Marsh Lake and Dawson on the Yukon River.

Explanation of Plates

PLATE 19. *Grimmia Brittoniae*

1. Plant about natural size.
2. Upper leaf, × about 35 diam.
3. Lower stem leaf, × 35 diam.
4. Section of leaf, × 175 diam.
5. Part of perichaetium.
6. Median cells, × 350 diam.
7. Basal cells.
8. Apex of leaf from upper side, × 175 diam.
9. Inner perichaetial leaf.

PLATE 20. *Grimmia tenuicaulis*

1. Plants about natural size.
2. Upper stem leaf, × about 35 diam.
3. Lower stem leaf, × about 35 diam.
4. Part of perichaetium.
5. Median cells, × 350 diam.
6. Basal cells, × 350 diam.
7. Apex of leaf from below, × 175 diam.
8. Section of leaf, × 175 diam.
9. Section of leaf lower down, × 175 diam.

Pohlia (Cacodon) porosa sp. nov.

By Harold Lindberg

(With Plate 21)

Dioica : caespitosa : caulis ad 2 cm. usque altus, in sectione transversa rotundus, 0.25 mm. in diam., cellulae corticales parvae, incrassatae, brunneae, cellulae interiores majores, luteae, fasciculus centralis a cellulis minimis hyalinis formatus, inferna rufo-radiculosus, radicellis papillulosis : folia ovato-lanceolata, acuta, rigida, imbricata, viridia, concava, sicca adpressa, non nitida nec limbata, aetate brunnescentia, inferiora parva, 0.6–1 mm. longa, marginibus planis, superiora sensim sensimque parum majora et densiora, marginibus reflexis, crenulatis, nervo crasso, in media parte 0.075–0.1 mm. lato, basi et aetate brunneolo, infra apicem dissoluto, biconvexo, dorso prominente, cellulae parvae, incrassatae, inter se porosae, irregulares, apicales rhomboideae, 0.02–0.03 mm. longae et 0.005–0.009 mm. latae mediae rectangulares vel subserpentinae, ad 0.05 mm. longae, basilares rectangulares vel quadratae, ad 0.01 mm. latae : bracteae perichetii majores, circa 2 mm. longae et circa 0.55 mm. latae, e basi oblonga acutae, marginibus ubique reflexis et crenulatis, nervo in apice dissoluto, crasso, ad basin valde explanato, laminae ad basin a cellulis 2–3 teratosis formatae, cellulis ut in caeteris ; bracteae interiores obtusiusculae, parvae, 0.5–1.4 mm. longae, marginibus planis, crenulatis, cellulae optime inter se porosae, incrassatae : seta 1.5 mm. alta, rubra, 0.23 mm. crassa, ad basin geniculata, laevissima, sicca flexuosa : theca subcylindrica, erecta et regularis, 2.5 mm. alta et 1 mm. crassa, brunnea, sicca et deoperculata sub ore leniter contracta, cellulis exothecia irregulariter quadratis et rectangularibus, parietibus plus minusve flexuosis, non incrassatis, 0.02 mm. latis ; stomatibus superficialibus ; annulus latus, revolubilis : exostomii dentes 0.33 mm. alti, anguste dolabriformes, acutissimi, pallide lutei, in apice marginati, minutissime papillulosi, lamellis circa 25 : endostomium male evolutum, hyalinum, laevissimum, ciliis nullis vel rudimentariis, processubus angustis, perforatis, rarius dentibus aequilongis : spori pellucidi, virides, laevissimi, 0.017 (0.015–0.019) mm.: operculum 0.4 mm. altum, e basi convexa conicum et obtusum.

Planta mascula ignota.

Species pulcherrima *Pohliae* erectae, Lindb. Rev. bryol., 1883, p. f., proxima, sed differt endostomeo melius evoluto, theca majore, nervocrassiore, cellulis minoribus, incrassatis, inter se porosis, etc.

Hab. in America septentrionalis, Washington, Mt. Rainier, 8 Sept. 1898, ab J. A. Allen in terra humida alt. 6,500 p. s. m. lecta et mihi benevole a Mrs. E. G. Britton communicata.

Explicatio Tabulae 21

FIG. 1. Theca et operculum, $\times$ 24.
FIG. 2. Stoma, $\times$ 365.
FIG. 3. Cellulae exothecii, $\times$ 365.
FIG. 4. Pars peristomii extra visa.
FIG. 5. Pars peristomii, $\times$ 260, intus visa, $\times$ 260.
FIG. 6. Apex dentis exostomii, $\times$ 560.
FIG. 7. Pars annuli, $\times$ 260.
FIGS. 8 et 9. Bracteae interiores, $\times$ 80.
FIG. 10. Cellulae bracteae interiores, $\times$ 365.
FIGS. 11 et 12. Bracteae perichaetii, $\times$ 35.
FIGS. 13–15. Folia inferiora caulis feminini, $\times$ 35.
FIG. 16. Folia superiora caulis sterilis, $\times$ 80.
FIG. 17. Folium caulis sterilis, $\times$ 80.
FIG. 18. Areolatio apicis ejusdem folii, $\times$ 560.
FIG. 19. Areolatio medii ejusdem folii, $\times$ 560.
FIG. 20. Areolatio basis ejusdem folii, $\times$ 560.
FIG. 21. Sectio transversa laminae ad basin ejusdem folii, $\times$ 560.
FIG. 22. Apex bracteae perichaetii (Fig. 12), $\times$ 365.
FIG. 23. Areolatio medii ejusdem folii, 560.
FIG. 24. Sectiones transversae bracteae perichaetii, $\times$ 110.
FIG. 25. Sectio transversa ad basin bracteae perichaetii (Fig. 12), $\times$ 365.
FIGS. 26–29. Sectiones transversae foliorum, $\times$ 365.

HELSINGFORS, FINLAND, 19 January, 1900.

Notes on the Flora of Middle Georgia

BY ROLAND M. HARPER

(WITH PLATE 22)

During part of three years spent at the University of Georgia, which is located in Athens, I had opportunity to make a somewhat extensive study of the interesting flora of that vicinity; and in the following notes I have brought together briefly some of the results of my observations on this flora. Although there have been other local botanists in Athens for many years, apparently no observations made since Elliott's time on this immediate region have been mentioned in botanical literature. In Elliott's Botany of South Carolina and Georgia (1816–1821) many plants, some of them types, are mentioned as having been collected in or near Athens by a Mr. Green, and I have been enabled to verify a number of Mr. Green's stations which had been overlooked by later authors after a lapse of nearly eighty years.

Athens, the county-seat of Clarke County, is situated in that section of the state known as Middle Georgia, a region well defined geologically from the two newer sections, north and south Georgia. Middle Georgia occupies about one third of the area of the state, and is distinguished by its geological formation being wholly Archaean or metamorphic. My botanical explorations of this region, in the spring and fall of 1895 and 1896, and the spring of 1897, were confined mainly to the western half of Clarke County, and portions of the neighboring counties of Jackson, Oconee, Walton and Morgan. This territory which I explored lies in the lower foothills of the Blue Ridge, being entirely south of latitude 34°N., and east of longitude 83° 31′W., and ranging from 500 to 800 feet above sea-level.

Taking Clarke County as typical of the surrounding region, its characteristic features of soil, topography, etc., may be briefly described. The predominating soil consists largely of red clay, derived from the disintegration of the granitic rocks which underlie the surface everywhere in this region and outcrop in many places, especially in the valleys. With the clay are mixed sand, organic matter, and numerous other constituents in proportions varying according to the local conditions.

Topographically, the country is quite hilly. The two branches of the Oconee River, known respectively as the Oconee and Middle Oconee, which traverse Clarke County from north to south, are joined by countless smaller creeks and "branches," and all these streams flow in rather deep and narrow valleys between broad rounded ridges.

The average annual temperature of Athens, which corresponds very closely with the average for middle Georgia, is about 63°F., with the following averages for the four seasons: spring, 62°; summer, 80°; autumn, 64°; winter, 46°. The average annual rainfall is about 55 inches, distributed among the seasons as fofows: spring, 14 inches; summer, 13 inches; autumn, 10 inches; winter, 18 inches.

It has been estimated that about one-half the area of Clarke County is covered with forest, of which one-fifth is original and four-fifths second growth. The adjoining counties, which are not so thickly populated, would no doubt show a larger proportion of forest. The original forest is now mostly confined to the steep sides of the valleys, while the second-growth is found on the more level land along the ridge-tops.

The flora of this region is quite similar in general character to that of the whole belt of country lying at the same elevation along the eastern slope of the Appalachian range from New England to Alabama. A comparison of the flora of Middle Georgia with that of southern New England shows that at least half of the species of each region are common to both. There is less similarity between the flora of Middle Georgia and that of South Georgia, which, although much nearer, belongs to an entirely different floral province.

In the cool shady primeval forests on the northern slopes of the ridges in Clarke and adjoining counties are found many species which are supposed to be strictly Alleghanian in distribution, some of which are mentioned below. On the other hand, the number of species which reach their northern limits in this region is very small. Of the species which I have collected in Middle Georgia, about 95% are known from the region of the northern manuals, and the remaining 5% are mostly either recently described or recently introduced, or species of very restricted range.

A little study of the plants of the region under consideration shows that they may be divided according to habitat into seven or eight well-marked principal groups. These groups overlap each other somewhat, but not as much as might be expected. In the following lists of plants I have prefixed an asterisk to those species which are mentioned in more than one list, to give some idea of the extent of overlapping.

Taking up the various floral areas in the order of their humidity, the swamps, bogs, meadows and marshes may be considered first. In the region about Athens these are of very small extent, owing chiefly to the narrowness and steepness of the valleys, and the number of hydrophytic species is correspondingly small. The following have been observed mostly in the meadows along Tanyard Branch in Athens and in the Sandy Creek marsh just north of the city:

**Selaginella apus* (L.) Spring.
Typha latifolia L.
Sparganium androcladum (Engelm.) Morong.
Potamogeton diversifolius Raf.
Alisma Plantago-aquatica L.
Sagittaria latifolia Willd.
Paspalum laeve Mx.
Homalocenchrus oryzoides (L.) Poll.
Eragrostis hypnoides (Lam.) B. S.P.
Cyperus flavescens L.
  strigosus L.
Kyllingia pumila Mx.
Eleocharis obtusa (Willd.) Schult.
  tenuis (Willd.) Schult.
  acicularis (L.) R. & S.
Scirpus lacustris L.
Carex lurida Wahl.
  vulpinoidea Mx.
**Peltandra Virginica* (L.) Kunth.
Juncus effusus L.
  dichotomus Ell.
  acuminatus Mx.
Polygonum sagittatum L.
Nymphaea advena Soland.
Ranunculus pusillus Poir.
Agrimonia parviflora Soland.
Callitriche palustris L.
Viola cucullata Ait.
Ludwigia alternifolia L.
Isnardia palustris L.
Lysimachia Nummularia L.
Hydrolea quadrivalvis Walt.
Lycopus Virginicus L.
Mimulus ringens L.
Gratiola sphaerocarpa Ell.
**Ilysanthes refracta* (Ell.) Benth.
Veronica serpyllifolia L.
Galium trifidum L.
Vernonia Noveboracensis (L.) Willd.
**Mikania scandens* (L.) Willd.
Eclipta alba (L.) Hassk.
Adopogon Dandelion (L.) Kuntze.

Eleocharis acicularis and *Scirpus lacustris* do not seem to have been reported from Georgia, at least within recent years, and they are probably rather rare in the state. I collected both in a small bog near the Middle Oconee River in Clarke County on May 28, 1897. The latter is mentioned in Dr. Feay's "Catalogue of Phaenogamous Plants growing spontaneously within thirty miles of Savannah, Ga." (Atlanta Med. Jour., 3: 167–217. 1860), but might have been collected in South Carolina.

Certain species, particularly trees and shrubs, seem to flourish best on river banks, and are rarely or never found in other situations. The following is a partial list of such species:

Uniola latifolia Mx.
Danthonia sericea Nutt.
Arundinaria tecta (Walt.) Muhl.
Uvularia sessilifolia L.
Allium mutabile Mx.
Smilax rotundifolia L.
Salix nigra Marsh.
Carpinus Caroliniana Walt.
Ostrya Virginiana (Mill.) Willd.
Betula nigra L.
Alnus rugosa (DuRoi) Koch.
Fagus Americana Sweet.
Quercus nigra L. (*Q. aquatica* Walt.).
Ulmus Americana L.
Morus rubra L.
Liriodendron Tulipifera L.
Ranunculus recurvatus Poir.
Thalictrum polygamum Muhl.
Podophyllum peltatum L.
Calycanthus floridus L.
Arabis Canadensis L.
Platanus occidentalis L.
Philadelphus grandiflorus Willd.
Porteranthus trifoliatus (L.) Britton.
Pyrus angustifolia Ait.
Amelanchier Canadensis (L.) Medic.
Asimina triloba (L.) Dunal.
Ptelea trifoliata L.
Acer rubrum L.
Negundo L.
Tilia pubescens Ait.
Cornus Amonum Mill.
Azalea nudiflora L.
Kalmia latifolia L.
Leucothoë Catesbei (Walt.) Gray.
Vaccinium arboreum Marsh.
Symplocos tinctoria (L.) L'Her.
Mohrodendron Carolinum (L.) Britton.
Styrax Americana Lam.
Fraxinus Americana L.
Chionanthus Virginica L.
Ipomoea lacunosa L.
Bignonia capreolata L.
Catalpa bignonioides Walt.
Cephalanthus occidentalis L.
Lonicera sempervirens L.
Actinomeris alternifolia (L.) DC.

I have found the *Arundinaria* in fruit but once, on May 4, 1897, at Tallasee Shoals on the Middle Oconee River.

In the wet woods, which have some species in common with the river banks on one hand and the rich woods on the other, I have collected the following plants of interest:

Botrychium obliquum Muhl.
Woodwardia areolata (L.) Moore.
Asplenium Filix-foemina (L.) Bernh.
Onoclea sensibilis L.
Osmunda regalis L.
cinnamomea L.
* *Selaginella apus* (L.) Spring.
Carex intumescens Rudge.
crinita Lam.
tenuis Rudge.
leptalea Wahl.
sterilis Willd.
* *Peltandra Virginica* (L.) Kunth.
Arisaema triphyllum (L.) Torr.
Adicea pumila (L.) Raf.
Boehmeria cylindrica (L.) Willd.
Habenaria flava (L.) Gray.
* *Alnus rugosa* (DuRoi) Koch.
* *Liriodendron Tulipifera* L.
* *Xanthorrhiza apiifolia* L'Her.
* *Ranunculus recurvatus* Poir.
Trautvetteria Carolinensis (Walt.) Vail.
Lindera Benzoin (L.) Blume.
Penthorum sedoides L.
Tiarella cordifolia L.
Parnassia asarifolia Vent.
Decumaria Barbara L.
Itea Virginica L.
* *Acer rubrum* L.
Falcata comosa (L.) Kuntze.
Phyllanthus Carolinensis Walt.
Impatiens biflora Walt.
Viola obliqua Hall.
primulaefolia L.
Oxypolis rigidus (L.) Britton.
* *Azalea nudiflora* L.
Xolisma ligustrina (L.) Britton.
Steironema ciliatum (L.) Baudo.
Gentiana Elliottii Chapm.
Chelone glabra L.
* *Mitchella repens* L.
Sambucus Canadensis L.
Mikania scandens (L.) Willd.
Pluchea petiolata Cass.

Of greatest interest perhaps are those species which inhabit the rich shady primeval forests on the north sides of hills. Among these may be mentioned the following:

Botrychium Virginianum (L.) Sw.
Adiantum pedatum L.
Asplenium platyneuron (L.) Oakes.
Polystichum acrostichoides (Mx.) Schott.
Poa brevifolia Muhl.
Carex laxiflora Lam.
Tradescantia montana Shuttl.
Juncoides campestre (L.) Kuntze.
pilosum (L.) Kuntze.
Chamaelirium luteum (L.) Gray.
Uvularia perfoliata L.
puberula Mx.
Vagnera racemosa (L.) Morong.
Polygonatum biflorum (Walt.) Ell.
Medeola Virginiana L.
Trillium stylosum Nutt.
Smilax ecirrhata (Engelm.) Wats.
Dioscorea villosa L.
Tipularia unifolia (Muhl.) B. S. P.
Corylus rostrata Ait.

Castanea dentata (Marsh.) Borkh.
Quercus rubra L.
Pyrularia pubera Mx.
Silene stellata (L.) Ait. f.
Alsine pubera (Mx.) Britton.
**Liriodendron Tulipifera* L.
Cimicifuga racemosa (L.) Nutt.
**Xanthorrhiza apiifolia* L'Her.
Anemone quinquefolia L.
Hepatica triloba Chaix.
Syndesmon thalictroides (L.) Hoffmg.
Sanguinaria Canadensis L.
Dentaria laciniata Muhl.
Heuchera Americana L.
Hydrangea arborescens L.
**Hamamelis Virginiana* L.
Waldsteinia parviflora Small.
Geranium maculatum L.
Acer leucoderme Small.
Rhamnus Caroliniana Walt.
Viola palmata L.
  **obliqua* Hill.
  hastata Mx.
  tripartita Ell.
Panax quinquefolium L.
Oxydendrum arboreum (L.) DC.
Pedicularis Canadensis L.
Thalesia uniflora (L.) Britton.
**Mitchella repens* L.
Viburnum acerifolium L.
Eupatorium aromaticum L.
Solidago caesia L.
Nabalus altissimus (L.) Hook.

Several of the above species reach the southern limit of their ranges in this region. *Juncoides pilosum*, *Corylus rostrata*, *Pyrularia pubera*, *Silene stellata*, *Anemone quinquefolia*, *Hydrangea arborescens*, *Viola hastata*, and *Solidago caesia* have been collected by Dr. J. K. Small in the vicinity of Stone Mountain, a few miles farther south but at a higher altitude than my stations for the same species. A few others extend down along the foothills to about the same altitude in eastern Alabama. Some of those which seem to have never been collected farther south than I have found them will be mentioned more in detail at the end of this paper.

In the drier and more open woods, including those on the south sides of hills and the second-growth oak woods which are frequent on the broad summits of the ridges, the flora is quite different from that of the rich shady original woods, although it is in some places difficult to draw a sharp line between them, and a few species are common to both. The following are some of the characteristic species of dry woods:

Panicum commutatum Schult.
Stipa avenacea L.
Melica mutica Walt.
Uniola latifolia Mx.
Danthonia sericea Nutt.
Carex Pennsylvanica Lam.
Tradescantia reflexa Raf.
Juncus tenuis Willd.
**Smilax rotundifolia* L.
  herbacea L.

Hypoxis erecta L.
Sisyrinchium Carolinianum Bicknell.
Juglans nigra L.
Hicoria alba (L.) Britton (*Carya tomentosa* Nutt.).
glabra (Mill.) Britton (*C. porcina* Nutt.).
Castanea pumila (L.) Mill.
Quercus digitata (Marsh.) Sudw.
coccinea Wang.
Marylandica Muench.
alba L.
minor (Marsh.) Sargent.
Prinus L.
Silene Virginica L.
Asimina parviflora (Mx.) Dunal.
**Anemone Virginiana* L.
Ranunculus fascicularis Muhl.
Crataegus spathulata Mx.
Boyntoni Beadle.
Prunus serotina Ehrh.
umbellata Ell.
Cercis Canadensis L.
Baptisia bracteata Ell.
**Trifolium reflexum* L.
Psoralea pedunculata (Mill.) Vail.
Stylosanthes riparia Kearney.
Lespedeza hirta (L.) Ell.
Vicia Hugeri Small.
Linum Virginianum L.
Jatropha stimulosa Mx.
Rhus glabra L.
Euonymus Americanus L.
Aesculus octandra Marsh.
Ceanothus Americanus L.
Vitis aestivalis Mx.
cordifolia Mx.
rotundifolia Mx.
Parthenocissus quinquefolia (L.) Planch.
Viola pedata L.
villosa Walt.
multicaulis (T. & G.) Britton.
Ligusticum Canadense (L.) Britton.
Sanicula Canadensis L.
Marylandica L.
Zizia cordata (Walt.) DC.
Cornus florida L.
Chimaphila maculata (L.) Pursh.
Vaccinium stamineum L.
corymbosum L.
Gelsemium sempervirens (L.) Ait. f.
Gentiana villosa L.
Amsonia Tabernaemontana Walt.
Asclepias variegata L.
Vincetoxicum hirsutum (Mx.) Britton.
Convolvulus repens L.
Phlox amoena Sims.
Onosmodium Virginianum (L.) A. DC.
Hedeoma pulegioides (L.) Pers.
Calamintha Caroliniana Sweet.
Salvia urticaefolia L.
Blephilia ciliata (L.) Raf.
Scutellaria integrifolia L.
pilosa Mx.
Trichostema dichotomum L.
lineare Nutt.
Dasystoma Virginica (L.) Britton.
Gerardia tenuifolia Vahl.
**Bignonia capreolata* L.
Ruellia ciliosa Pursh.
strepens L.
Houstonia purpurea L.
Viburnum rufotomentosum Small.
Elephantopus Carolinianus Willd.
Solidago brachyphylla Chapm.
petiolaris Ait.
erecta Pursh.
Sericocarpus asteroides (L.) B.S.P.
Aster patens Ait.
Erigeron pulchellus Mx.
annuus (L.) Pers.
Antennaria plantaginea (L.) R. Br.

Chrysogonum Virginianum L.
Heliopsis helianthoides (L.) B.S.P.
Verbesina Virginica L.
occidentalis (L.) Walt.
Coreopsis major Walt.
Mesadenia atriplicifolia (L.) Raf.
Carduus altissimus L.
Hieracium venosum L.

Another interesting area in middle Georgia may be called the dry fields, or the unforested portions of what are known as the gray gravelly and sandy lands (the latter designation including also those dry woods which have a soil of similar character). The soil of these dry fields consists mostly of gneissoid granite in all stages of disintegration, from large fragments to fine sand and clay. The flora of these fields, while somewhat poor in individuals, is quite rich in species, as may be seen from the following list:

Andropogon scoparius Mx.
Commelina Virginica L.
Tradescantia hirsuticaulis Small.
* *Yucca filamentosa* L.
Smilax glauca Walt.
Silene antirrhina L.
* *Anemone Virginiana* L.
Delphinium Carolinianum Walt.
Cebatha Carolina (L.) Britton.
Sassafras officinale Nees & Eberm.
Crataegus uniflora Muench.
Rubus trivialis Mx.
Fragaria Virginiana Duchesne.
Potentilla Canadensis L.
Prunus angustifolia Marsh.
Morongia angustata (T. & G.) Britton.
Crotalaria rotundifolia (Walt.) Poir.
* *Trifolium reflexum* L.
Cracca spicata (Walt.) Kuntze.
Virginiana L.
Clitoria Mariana L.
Rhynchosia tomentosa (L.) H. & A.
Oxalis recurva Ell.
Acalypha Virginica L.
Tragia urticaefolia Mx.
Euphorbia corollata L.
Rhus copallina L.
Hypericum maculatum Walt.
Passiflora incarnata L.
Kneiffia fruticosa (L.) Raimann.
Daucus pusillus Mx.
Diospyros Virginiana L.
Apocynum cannabinum L.
Asclepias tuberosa L.
obtusifolia Mx.
Acerates viridiflora (Raf.) Eaton.
Ipomoea pandurata (L.) Meyer.
Gilia rubra (L.) Heller.
Phacelia hirsuta Nutt.
Verbena Canadensis (L.) Britton.
Salvia lyrata L.
Scutellaria multiglandulosa (Kearney) Small.
Physalis heterophylla nyctaginea Rydb.
Virginiana Mill.
Linaria Canadensis (L.) Dumont.
Pentstemon hirsutus (L.) Willd.
Plantago Virginica L.
Houstonia longifolia Gaertn.
Eupatorium compositifolium Walt.
Kuhnia eupatorioides L.
Aster ericoides L.
Gnaphalium obtusifolium L.

Silphium Asteriscus L.
Coreopsis grandiflora Hogg.
Senecio Smallii Britton.
Adopogon Carolinianum (Walt.) Britton.

Many of the above species are more common southward and westward, and do not range much farther northeast than Athens.

At many points in the gray gravelly and sandy lands the underlying rock is hard enough to resist disintegration and becomes exposed on the surface. On these granite outcrops, and particularly around their edges, where there is apt to be more or less moisture, are found some rather interesting plants, among them being the following:

Cheilanthes lanosa (Mx.) Watt.
Woodsia obtusa (Spreng.) Torr.
Fimbristylis autumnalis (L.) R. & S.
Carex cephalophora Muhl.
Juncus marginatus Rostk.
Nothoscordum bivalve (L.) Britton.
Agave Virginica L.
Talinum teretifolium Pursh.
Cerastium brachypodum (Engelm.) Robinson.
Arenaria brevifolia Nutt.
Arabis Virginica (L.) Trel.
Diamorpha pusilla Nutt.
Saxifraga Virginiensis Mx.
Trifolium Carolinianum Mx.
Oxalis violacea L.
Crotonopsis linearis Mx.
Sarothra gentianoides L.
**Opuntia vulgaris* Mill.
Myosotis verna Nutt.
**Ilysanthes refracta* (Ell.) Benth.
Plantago elongata Pursh.
Valerianella radiata (L.) Dufr.

Still another peculiar flora is found in deposits of dry sand along the rivers at a few points. The species frequenting this sand are quite few, on account of the very small relative extent of these deposits. I have noticed the following psammophilous species along the two rivers in Clarke Co.:

Pteris aquilina L.
**Yucca filamentosa* L.
Lupinus perennis L.
Ascyrum hypericoides L.
**Opuntia vulgaris* Mill.
**Vaccinium arboreum* Marsh.
Breweria humistrata (Walt.) Gray.
Monarda punctata L.
Chrysopsis graminifolia (Mx.) Nutt.

I have found all of these, with the exception of *Lupinus*, much more abundant in south Georgia, where the soil is nearly all sand.

Lastly may be considered the plants of fields, roadsides and pastures, including the native and introduced weeds. The following is a partial list of such species:

Rumex crispus L.
obtusifolius L.
Acetosella L.
Polygonum Convolvulus L.
Amarantus spinosus L.
retroflexus L.
Phytolacca decandra L.
Boerhaavia erecta L.
Mollugo verticillata L.
Portulaca oleracea L.
Agrostemma Githago L.
Alsine media L.
Cerastium viscosum L.
Anychia dichotoma Mx.
Ranunculus parviflorus L.
abortivus L.
Lepidium Virginicum L.
Coronopus didymus (L.) J. E. Smith.
Sisymbrium officinale (L.) Scop.
Cardamine hirsuta L.
Capsella Bursa-pastoris (L.) Medic.
Draba verna L.
Stenophragma Thaliana (L.) Celak.
Rubus nigrobaccus Bailey.
Duchesnea Indica (Andr.) Focke.
Alchemilla arvensis (L.) Scop.
Rosa rubiginosa L.
bracteata Wendl.
Medicago Arabica (L.) All.
Melilotus alba Lam.
Trifolium procumbens L.
Trifolium arvense L.
pratense L.
repens L.
Vicia hirsuta (L.) Koch.
sativa L.
Geranium Carolinianum L.
Oxalis stricta L.
Melia Azederach L.
Acalypha ostryaefolia Riddell.
Euphorbia maculata L.
Preslii Guss.
Modiola Caroliniana (L.) Don.
Oenothera laciniata Hill.
Hartmannia speciosa (Nutt.) Small.
Daucus Carota L.
Chaerophyllum Teinturieri Hook.
Anagallis arvensis L.
Heliotropium Indicum L.
Lithospermum arvense L.
Verbena bracteosa Mx.
Lamium amplexicaule L.
Solanum nigrum L.
Carolinense L.
Datura Tatula L.
Verbascum Thapsus L.
Blattaria L.
Veronica peregrina L.
arvensis L.
Plantago major L.
lanceolata L.
aristata Mx.
heterophylla Nutt.
Houstonia coerulea L.
Legouzia perfoliata (L.) Britton.
Solidago Canadensis L.
Erigeron Canadensis L.
Filago nivea Small.
Ambrosia artemisiaefolia L.
trifida L.
Xanthium strumarium L.
Bidens frondosa L.
bipinnata L.
Helenium tenuifolium Nutt.
Achillea Millefolium L.
Anthemis Cotula L.
Chrysanthemum Leucanthemum L.
Arctium Lappa L.
Carduus lanceolatus L.
Taraxacum officinale Weber.

I have not attempted to make all the above lists complete, and have purposely omitted from them several species which are rare or not characteristic of any of these areas. As my observations in this region have not extended over the summer months, I have doubtless omitted many species which are characteristic of the several areas, especially in the first group, that of hydrophytic plants.

In this connection it might be of interest to note what plants do not occur in middle Georgia. The genera *Lycopodium* and *Polygala*, for instance, which are represented by several species both in south Georgia and in the Northern States, seem to be wanting in middle Georgia. Some species of these two genera inhabit the northern forests, while others are found mostly near the coast, and the northern species do not seem to extend quite so far south, or the coast species so far inland, as middle Georgia. Also the genera *Xyris*, *Eriocaulon*, *Lilium*, *Iris*, *Limodorum*, *Castalia*, *Sarracenia*, *Drosera*, *Triadenum*, *Proserpinaca*, *Myriophyllum*, *Bartonia*, *Limnanthemum* and *Utricularia*, which are represented north and south, seem to be rare or absent in middle Georgia. The same might be said also of many species of several other genera, such as *Rhynchospora*, *Ludwigia* and *Sabbatia*. The Orchidaceae, Hypericaceae and Asclepiadaceae are represented by fewer species in middle Georgia than in other parts of the country.

Below I append an annotated list of some of the more rare or noteworthy species of this region which have come under my observation. As no topographical map of the region of my explorations in middle Georgia has yet been made, the altitudes given below are only approximate, but it is believed that none of them are more than 50 feet in error.

POLYPODIUM VULGARE L. Sp. Pl. 1085. 1753

There is a station for this species on the south side of Bobbin Mill Creek, Clarke Co., where it grows on the brow of a high granite cliff and some adjacent smaller rocks, in company with its congener, *P. polypodioides*. The altitude is about 620 ft. This is probably the southern limit of *P. vulgare* in eastern North America.

POA BREVIFOLIA Muhl. Gram. 138. 1817

In rich woods along Bobbin Mill Creek, flowering in March.

Altitude 610 feet. This species does not seem to have been reported from as far south as Georgia before.

Scirpus Georgianus sp. nov. (Plate 22)

Culm erect, about 5 dm. tall, terete or nearly so, 3–4-leaved. Leaves smooth, the lower ones about 2 dm. longand 1 cm. wide; sheaths green; involucral leaves about 3, the longest exceeding the umbel; umbel thrice compound, many-rayed, the longest rays about 1 dm. long, rather stiff and ascending, the shorter and secondary rays most spreading at right angles; spikelets green, about 3 mm. long, 10–15-flowered, in glomerules of 5–10; scales orbicular-ovate, about 1.5 mm. long, with somewhat loosely-spreading awns; margins thin and membranous, colorless or slightly tinged with brown; midrib green, with a narrow whitish keel, prolonged into an awn about half as long as the body of the scale with 3 or 4 short scarious teeth at its apex, giving the whole spikelet a characteristic striate and bristly appearance: stamens 3: style 3-cleft: achene oblong, about 0.8 mm. long, short-beaked, compressed-triangular: bristles none.

A unique species, allied to *S. atrovirens* and *S. polyphyllus* (neither of which is known in middle Georgia), but differing from both in its greener spikes, peculiar scales, and absence of bristles. Another distinguishing character is found in the sheaths of the leaves. In the two related species an elongated triangular portion of the summit of the sheath opposite the insertion of the leaf is thin and membranous, while in *S. Georgianus* this portion is represented by only a narrow horizontal brownish band, as shown in the accompanying plate.

Scirpus Georgianus is further distinguished from *S. atrovirens* by its more numerous glomerules of fewer spikelets, and from *S. polyphyllus* by its fever and broader leaves.

Collected in muddy alluvial soil on the bank of the Middle Oconee River, Clarke Co., May 23, 1897. Accompanied by *Ranunculus recurvatus* and *Thalictrum polygamum*. One specimen has been placed in the herbarium of the New York Botanical Garden.

Explanation of Plate 22

1. Portion of plant, × ⅔.
2. Single spikelet, × 10.
3. A scale, × 20.
4. Achene and style, × 20.

Of the genus *Tradescantia*, as revised by Dr. J. K. Small,* I have collected the three following species in Clarke Co.:

T. REFLEXA Raf. New Fl. N. A. 2: 87. 1836

In dry woods, Athens, flowering in May. This seems to be one of its easternmost known stations.

T. HIRSUTICAULIS Small, *l. c.*, 233

Dr. Small cites three stations for this species, and I can now add a fourth and northernmost, viz: Athens, where I collected it in dry fields near the Oconee River in 1895, 1896 and 1897. It flowers there in April. About half of the specimens observed have pink-purple petals, while the rest have bright blue ones like most other species of the genus. There seem to be none with intermediate colors, and the two forms make a pleasing contrast when growing side by side.

T. MONTANA Shuttl.; Britton, Ill. Fl. 1: 377. 1896

In rich woods, Athens, flowering in May. Altitude about 650 ft. This station is farther south and at a lower altitude than any previously known.

JUNCOIDES PILOSUM (L.) Kuntze, Rev. Gen. Pl. 725. 1891

In rich shady woods, Athens; with *J. campestre*, and flowering at the same time (March and April). Altitude about 650 ft.

UVULARIA SESSILIFOLIA L. Sp. Pl. 305. 1753

Alluvial soil on banks of Middle Oconee River, between Tallasee Shoals and Princeton. Altitudes 600–650 ft. This is near its southern limit.

UVULARIA PUBERULA Mx. Fl. Bor. Am. 1: 199. 1803

In rich woods in Athens and near Bobbin Mill Creek, altitudes 610–650 ft. This species has not been reported from so far south by recent authors, but Elliott (Bot. S. C. & Ga. 1: 391) describes a *Uvularia* "from specimens sent * * * from Athens, by Mr. Green," and asks "Do they belong to this species?" His uncertainty is probably due to immature material. The description applies very well to the flowering state of *U. puberula*, and as I have collected this species in fruit also, with leaves fully expanded,

* Bull. Torr. Club, 24: 228–236, May 29, 1897.

probably in the identical locality from which Mr. Green secured his specimens, there can no longer be any doubt as to the identity of Elliott's plant.

SISYRINCHIUM CAROLINIANUM Bicknell, Bull. Torr. Club, **26**: 221. My. 1899

Common in dry soil, Clarke Co. My specimens, collected near the Middle Oconee River, April, 1897, have been identified by Mr. Bicknell.

CYPRIPEDIUM PARVIFLORUM Sal. Trans. Linn. Soc. **1**: 77. 1791

Collected in dry woods near Middle Oconee River at Tallasee Shoals, May 4–7, 1897. Altitude about 725 feet. This seems to be about 100 miles farther south than any previously known station for this species.

TIPULARIA UNIFLORA (Muhl.) B.S.P. Prel. Cat. N. Y. 51. 1888

I have found the evergreen winter leaves and dead flowering stems of this rare and curious orchid in rich woods at four or five stations in Athens.

CASTANEA DENTATA (Marsh) Borkh. Handb. Forstb. **1**: 741. 1800

In rich woods, Athens, altitude 650 ft. Trees rather few and small, and fruiting sparingly. Is the southern limit of this species moving northward? Bartram (Travels, p. 36) mentions "*Fagus castanea*" as one of the trees observed in the vicinity of Wrightsborough, Ga. (now in McDuffie Co.), in 1773, and Chapman (Fl. S. States, ed. 1, 424. 1860) gives its range as "West Florida and northward" (perhaps an error), but it is now generally supposed to be confined to the mountains and northern states.

PYRULARIA PUBERA Mx. Fl. Bor. Am. **2**: 233. 1803

About 15 or 20 individuals in an area of a few square rods in rich shady woods, Athens. Altitude 650 ft. This is near the southern limit of this species. It flowers in April, but formed no fruit in the two seasons in which I observed it, and seems likely to become extinct in this locality. The flowers although apparently perfect all fall off a few days after expanding.

CHENOPODIUM BOSCIANUM Moq. Enum. Chenop. 21. 1840

In October, 1896, I collected this plant in dry open woods on the University campus in Athens. It does not seem to have been reported from Georgia before.

BOERHAAVIA ERECTA L. Sp. Pl. 3. 1753

In cultivated ground on the University campus, Athens, in flower October, 1896. This is one of its northernmost stations.

ALSINE PUBERA (Mx.) Britton, Mem. Torr. Club, **4**: 107. 1893

Rich shady woods, Athens. Altitude about 650 ft. Flowering from March to May. Southern limit?

CERASTIUM BRACHYPODUM (Engelm.) Robinson; Britton, Mem. Torr. Club, **5**: 150. 1894

Collected on dry rocks near Oconee River, Athens, March 15, 1897, with *Myosotis verna* and *Valerianella radiata*. New to the southeastern states.

CIMICIFUGA RACEMOSA (L.) Nutt. Gen. **2**: 15. 1818

Found in May, 1897, with flowers unopened, in rich woods on the southwest side of the Middle Oconee River at Tallasee Shoals and Princeton. Southern limit.

ARABIS CANADENSIS L. Sp. Pl. 665. 1753

In dry rocky woods near Oconee River, Athens, and Jack's Creek, Morgan Co. The latter station seems to be the southernmost known.

DIAMORPHA PUSILLA Nutt. Gen. **1**: 293. 1818

On flat exposed granite rock, Athens, with *Arenaria brevifolia*. This little plant seems to have a very brief period of activity. On April 20, 1897, the plants were in full bloom, covering the rock with a mass of red stems and leaves and pinkish flowers; but when the locality was visited on May 15th all the leaves and petals had fallen, and the now fruiting plants were dried up and scarcely visible.

HEUCHERA RUGELII Shuttl.; Kunze, Linnaea, **20**: 43. 1847

A few specimens of this plant grow in crevices on the north face of the granite cliff mentioned above as the habitat of *Polypodium vulgare*. I have found it in flower from September to November in 1896. This seems to be its southermost known station, and the first in Georgia.

PARNASSIA ASARIFOLIA Vent. Jard. Malm. *pl. 39.* 1803

In wet woods, at one locality in Athens. Altitude 625 ft. Previously known only from the higher mountains. In October, 1896, when I collected my specimens, the plant began to flower about the middle of the month, which is about six weeks later than it does in North Carolina, according to specimens from that state.

CRATAEGUS BOYNTONI Beadle, Bot. Gaz. **28**: 409. Jan. 10, 1900

In dry woods, Clarke Co., where it is one of the commonest species of the genus. My specimens, which were collected in Athens, April, 1897, have been determined by Dr. Britton.

WALDSTEINIA PARVIFLORA Small, Bull. Torr. Club, **25**: 137. 1898

In rich woods near Tanyard Branch and Bobbin Mill Creek, Clarke Co. Altitude about 600 ft. Flowering March–May. These stations are farther south and at a lower altitude than any cited by Dr. Small in his description.

ALCHEMILLA ARVENSIS (L.) Scop. Fl. Carn, ed. 2, **1**: 115. 1770

In April, 1897, I found a small patch of this diminutive weed in a pasture in Athens, which makes the first known station for it in Georgia, and the southermost in this country.

ROSA BRACTEATA Wendl. Bot. Beobacht. 50. 1798

Common along fences and roadsides in Athens, flowering from June to October.

MEDICAGO ARABICA (L.) All. Fl. Ped. **1**: 315. 1785

In fields and along roadsides, Clarke Co. This species does not seem to have been reported as naturalized in the southeastern states before.

ROBINIA PSEUDACACIA L. Sp. Pl. 722. 1753

Collected in rich woods near the Middle Oconee River in Jackson Co., May 6, 1897, in flower. Altitude 700 ft. My specimens, which I refer with some hesitation to this species, were slender shrubs about 2 m. tall, with odorless flowers.

STYLOSANTHES RIPARIA Kearney, Bull. Torr. Club, **24**: 565. Dec., 1897

In dry woods, Athens. My specimens were collected on the University campus, at an altitude of about 725 ft., May 27, 1897.

VICIA HUGERI Small, Bull. Torr. Club, **24**: 490. Nov., 1897

In dry, woods, Clarke Co. I first collected the plant in Athens in April, 1895. This is farther east than any station cited by Dr. Small.

OXALIS RECURVA Ell. Bot. S. C. & Ga. **1**: 526. 1821; Small, Bull. Torr. Club, **21**: 471–474. *pl. 422.* 1894

I can add another to the increasing list of stations for this long misunderstood species, viz: Athens, where I collected it in a dry field near the Oconee River, April 24, 1897. My specimens have been identified by Dr. Small.

CROTON CAPITATUS Mx. Fl. Bor. Am. **2**: 214. 1803

Collected in a railroad cut, Athens, Sept. 20 and Oct. 31, 1896. This seems to be one of the easternmost points reached by this woolly western plant in its travels.

ACER LEUCODERME Small, Bull. Torr. Club, **22**: 367. 1895

Common in rich shady woods, on the north side of hills, in Clarke Co., flowering in April. Identified by Dr. Small.

VIOLA CUCULLATA Ait. Hort. Kew. **3**: 288. 1789. Britton & Brown, Ill. Fl. **3**: 520. *f. 2487b.* 1898

The true *V. cucullata* as now understood, is represented from the southern states in the Columbia University Herbarium by a single specimen from Knoxville, Tenn., and I can find no record of its having been collected farther south. I collected it, however, in a small bog in Athens at an altitude of about 625 ft. in 1896 and 1897, and I also observed what appeared to be the same thing in a springy place near Tallasee Shoals on the Middle Oconee River, at an altitude of 650 ft., May 5, 1897. It begins to flower about the first of April.

VIOLA MULTICAULIS (T. & G.) Britton, Mem. Torr. Club, **5**: 227. 1894

In dry woods, on the north side of the valley of Sandy

Creek, Clarke Co. Altitude about 625 ft. This is one of the easternmost stations for this species, and seems to be also the northernmost known, with the exception of the type locality in Kentucky.

VIOLA HASTATA Mx. Fl. Bor. Am. **2**: 149. 1803

Until within a few years Athens was the only known station in Georgia for this rare species. I have found it in one locality in the city, in low rich woods, at an altitude of about 600 feet, which is probably the lowest altitude at which it has been collected. I secured two flowering specimens in March and April, 1897, at which time there were perhaps a dozen individuals in all.

VIOLA TRIPARTITA Ell. Bot. S. C. & Ga. **1**: 302. 1817; Small, Bull. Torr. Club, **24**: 497, Nov., 1897

V. hastata var. *tripartita* Gray, Bot. Gaz. **11**: 291. 1886.

Elliott (*l. c.*) describes this species, as also the preceding, "from specimens collected near Athens, Georgia, by Mr. Green." I have found it quite abundant in rich woods in several parts of the city. This species was long considered a variety or "aberrant form" of *V. hastata*, but it could never have been so considered by any one who was familiar with the two species in the field; and Dr. Small has recently pointed out some of the many differences between them. I had opportunity to compare the two species in the living state in the spring of 1897, and was impressed with their total dissimilarity. There is, however, a form which in the herbarium appears on superficial examination to be somewhat intermediate between the two, but its affinities are clearly with *tripartita*. This form is **Viola tripartita glaberrima** (*V. hastata* var. *glaberrima* Ging.; DC. Prodr. **1**: 300. 1824; Chapm. Fl. S. States, ed. 3, 34. 1897). It differs from typical *tripartita* in having leaves all undivided and glabrous, but is in other respects very similar. It seems to extend farther south than the type, and is the plant which was taken for *V. hastata* in Florida. I have collected it in rich woods near the Middle Oconee river, about two miles southeast of Athens, in 1896 and 1897. Like *V. tripartita*, with which it is perhaps connected by intermediate forms, its leaves are conspicuously plicate, a character which distinguishes it at once from *V. hastata* in the field, but is not evident in herbarium specimens.

ELAEAGNUS HORTENSIS Bieb. Fl. Taur. Cauc. **1**: 112. 1808

Common in dry woods in the southern part of Athens, appearing perfectly at home. Flowering in April. This plant has evidently been long established, and I have been unable to trace its origin. It does not seem to be cultivated in the vicinity at the present time.

HARTMANNIA SPECIOSA (Nutt.) Small, Bull. Torr. Club, **23**: 181. 1896

In May, 1896, I found a colony of this western species flourishing and blossoming by the roadside between Florence and Bostwick, Morgan Co., and in other similar localities a little later. It does not seem to have been reported from middle Georgia before.

PANAX QUINQUEFOLIUM L. Sp. Pl. 1050. 1753

A few plants in rich shady woods near Bobbin Mill Creek, Clarke Co. Altitude 610 feet. This seems to be the southernmost known station for this species in North America.

SCANDIX PECTEN-VENERIS L. Sp. Pl. 256. 1753

One specimen found on the University campus, Athens, with nearly mature fruit, April 25, 1896. The locality was obliterated the following winter, and I did not see the plant again.

DAUCUS PUSILLUS Mx. Fl. Bor. Am. **1**: 164. 1803

In dry fields, Athens, at altitudes from 600–700 feet. This is one of the northernmost stations known for this species.

LEUCOTHOË CATESBAEI (Walt.) Gray, Man. ed. 2, 252. 1856

On shaded banks of both rivers, Clarke Co. Altitudes 580–675 ft. This is probably near the southern limit of this Alleghanian species.

GALAX APHYLLA L. Sp. Pl. 200. 1753

In rocky woods on both banks of the Middle Oconee River, Clarke Co., rare. Altitudes 600–675 ft. In flower May 28, 1897. This is its southern limit, so far as known.

LYSIMACHIA NUMMULARIA L. Sp. Pl. 148. 1753

This species does not seem to have been reported from the Southern States. It is very abundant in open meadows along

Tanyard Branch in Athens, but rarely flowers. I found only two flowering specimens in 1896 and three in 1897. Though it is not a native, I have never seen it in cultivation in Georgia, and cannot satisfactorily account for its occurrence in Athens.

MOHRODENDRON CAROLINUM (L.) Britton, Gard. & For. **6**: 463. 1893

I have noticed one peculiarity of this species which does not seem to have ever been recorded. Its corollas are open wide some weeks before anthesis, while still green and not half grown. I suspect that the same may be true of the other species of the genus and of the related genus *Styrax*, but I have never had opportunity to observe the aestivation of the latter.

CUSCUTA COMPACTA Juss.; Choisy, Mem. Soc. Gen. **9**: 281. *pl. 4. f. 2.* 1841

On shrubs near Oconee River, Athens. This is one of the easternmost stations for this species, and seems to be the first reported in Georgia.

GILIA RUBRA (L.) Heller, Contr. Herb. F. & M. Coll. **1**: 81. 1895

In dry rocky field near Oconee River, Athens, altitude 600 ft. I can find no record of a more northern station for this species.

Scutellaria multiglandulosa (Kearney) Small

S. integrifolia multiglandulosa Kearney, Bull. Torr. Club, **21**: 482. 1894.

This seems to be the same plant which is described by Dr. Chapman in the first edition of his Southern Flora (1860) as *S. integrifolia* L. and in the third edition (1897) referred to *S. brevifolia* Gray, with a mark of doubt. A comparison of one of my specimens with type material of *S. brevifolia* from Texas (Hall's no. 458) shows the two to be clearly distinct, however. Collected in a dry field in Athens, near the river, in 1895, 1896 and 1897. Altitude 600 ft. Previously known only from south Georgia and Florida. This plant, which Dr. Small now separates as a distinct species, bears little resemblance to *S. integrifolia*, of which it was published as a variety. In all the specimens I have collected the corollas are invariably white, a character which has not been noted before. It flowers in Athens in May and June.

BLEPHILIA CILIATA (L.) Raf.; Benth. Lab. 319. 1833

In dry woods, Athens, flowering in May and June. This is near its southern limit.

THALESIA UNIFLORA (L.) Britton, Mem. Torr. Club, **5**: 298. 1894

In rich woods, Athens; rare. This species does not seem to have been recently reported from the Southern States, and I have seen no southeastern specimens besides my own.

PAULOWNIA TOMENTOSA (Thunb.) Baill. Hist. Pl. **9**: 434. 1888

This tree is becoming naturalized in Georgia. In Athens it has escaped to the woods in several places, and seems very much at home.

GALIUM UNIFLORUM Mx. Fl. Bor. Am. **1**: 179. 1803

Collected in dry woods on west bank of Middle Oconee River, opposite Princeton, May 28, 1897. Altitude 600 ft. This is its northernmost station, as far as I know.

VIBURNUM ACERIFOLIUM L. Sp. Pl. 268. 1753

In rich woods, Clarke and Morgan Cos. This species is not definitely known from farther south.

VIBURNUM RUFOTOMENTOSUM Small, Bull. Torr. Club, **23**: 410. 1896

In dry woods, Clarke Co.; not rare.

LONICERA JAPONICA Thunb. Fl. Jap. 89. 1784

Dr. Small has noted the naturalization of this species in the Southern States. It is quite common about Athens, growing along roadsides or often in moist woods and along streams, and thriving as well as any native plant. It flowers from May to November, and fruits freely.

CAMPANULA DIVARICATA Mx. Fl. Bor. Am. **1**: 109. 1803

On rocks near Bobbin Mill Creek, Clarke Co., flowering in September. Altitude 620 ft. This is another Alleghanian plant which extends well down into the foothills.

EUPATORIUM COMPOSITIFOLIUM Walt. Fl. Car. 199. 1788

E. coronopifolium Willd. Sp. Pl.

In dry fields, Athens, flowering late in October. This is one of its highest and northernmost stations known.

SOLIDAGO BRACHYPHYLLA Chapm.; T. & G. Fl. N. A. **2**: 218. 1841

In dry oak woods, Athens, altitude 675 ft. Probably its northern limit.

PLUCHEA PETIOLATA Cass. Dict. Sci. Nat. **42**: 2. 1826; Kearney, Bull. Torr. Club, **21**: 265. 1894

Mr. Kearney (l. c.) has pointed out the difference between this species and *P. camphorata* of the coast. It does not seem to have been reported from Georgia however. I found it in September, 1896, in wet woods in the southern part of Athens.

FILAGO NIVEA Small, Bull. Torr. Club, **24**: 333. July, 1897

Evax multicaulis DC. Prodr. **5**: 459. 1836.

Dr. Small has noted the occurrence of this western plant in the vicinity of Stone Mountain. In May, 1896, I found it in a field near Bostwick, in Morgan Co., and a year later in Athens, which is about 50 miles farther east than Stone Mountain.

COREOPSIS GRANDIFLORA Hogg; Sweet, Brit. Fl. Gard. **2**: *pl. 175.* 1825–7

In dry fields, Athens. This is its eastern limit, as far as known.

SENECIO SMALLII Britton, Mem. Torr. Club, **4**: 132. 1893

Common in dry fields, Clarke, Oconee and Walton Cos.

ACANTHOSPERMUM AUSTRALE (L.) Kuntze, Rev. Gen. Pl. 303. 1891

According to Dr. Chapman, who examined one of my specimens, this tropical weed was first introduced in wool at the Augusta factories. If so it has not spread northward as much as southward. In the fall of 1896 I collected it along one of the railroads in Athens, which seems to be the northernmost point it has reached.

COLUMBIA UNIVERSITY.

New Plants from Idaho and from other Localities of the Northwest

By L. F. Henderson

Lepidium montanum **papilliferum**

Nearly the whole plant, especially the stamens, covered with papillae, which seen in optical section are club-shaped, oblanceolate or obovate, and bright white : radical leaves more divided than in the type, ordinarily bipinnate, and on young plants thickly rosulate : stem inclined to branch more from the base : pod more nearly round.

This plant I should call *L. papilliferum*, deeming it a good species, were it not that I find the pod quite variable in typical *L. montanum*, the leaves running in some cases from pinnate to bipinnate, and a very few papillae occasionally present on some parts of the plant, even on Nuttall's type, with occasionally a very few *hairs* in place of papillae on the filaments but never papillae, as far as I have examined the material in the Gray Herbarium. No. 4121. Growing amongst species of *Artemisia* and *Bigelovia* on the plains about Nampa, southern Idaho, July 30, 1897. The same plant was collected by Miss Mulford at the same place, July 1, 1892. As the plants were nearly as much advanced as were mine, the difference in season is to be accounted for by my plants having been collected near an irrigating ditch, where they flowered late into the summer.

Types in the Gray Herbarium ; cotypes in the National Herbarium, in the Idaho Herbarium and in my private collection.

Sisymbrium perplexum

Annual, or possibly biennial, 15–35 cm. high, branching from the base or near it with many wiry ascending branches, pubescent more or less strongly with a stellate pubescence : radical leaves 1–3 cm. long including the petiole, spatulate to oblanceolate, repandly dentate to pinnatifid or nearly entire ; cauline leaves oblong-oblanceolate, slightly pinnatifid to entire, sessile or petioled : flowers small, white or slightly tinged with purple : pods on pedicels 5–8 mm. long, more or less torulose, curved or straight, 10 mm. long or more : seeds granular, with incumbent cotyledons : stigma nearly entire, projecting slightly over the placentae : septum with a broad central nerve, conspicuously celled, the cells in and near the nerve longitudinally elongated, those of the wings very irregularly oblique or transverse.

A singular species, simulating *Braya humilis* remarkably, but differing in the slightly more-lobed leaves, petals with slightly broader claws, a less stellate inflorescence, longer pedicels, and the very peculiar septum. Were it not for this latter peculiarity, the plant might well be considered a variety of *Braya humilis*, but the broad nerve and different cell structure of the septum separate it from this genus, if they do not even invalidate the generic standing of *Braya*. No. 3037. On a dry slope under *Pinus ponderosa*, Salmon River Canyon, beyond Florence, Idaho, July 1, 1895. Altitude about 4800 ft.

Type in the National Herbarium; cotypes in the Gray Herbarium, in that of the University of Idaho, and in my private collection.

Arenaria Salmonensis

Caudex ligneous, much branched below the surface of the ground: stems delicate, 6–8 cm. high, glabrous below, glandular above: fascicled leaves few, glabrous, serrate-margined, about 1 cm. long, acerose, acute; cauline similar but slightly shorter, arcuate or erect: cyme loose, 2–4 times divided, the bracts very scarious, ovate, 1-nerved, 1–2 cm. long: pedicels 2–6 mm. long, these as well as the sepals minutely glandular: sepals 2–3 mm. long, ovate, very obtuse when the scarious edge is well developed or acutish when the edge is less developed: petals a half longer than the sepals, narrowly oblanceolate, obtuse or somewhat erose at apex: stamens commonly 10: pod slightly exceeding the sepals, with 2-cleft valves.

Very near to *Arenaria subcongesta*, but differs in smaller stature, smaller flowers, and fewer radical tufts of leaves.

No. 3505. Dry, gravelly plains, near the source of Salmon River, Blaine County, Idaho, July 20, 1895, near 6500 ft. alt.

Lupinus erectus

25–35 cm. high, erect, many-stemmed, herbaceous, closely appressed canescent to silky, few-leaved, branching slightly above with apparently sterile branches, with peduncle about 5 cm. long: radical leaves very numerous, the petioles twice to thrice exceeding the leaflets, these linear-oblong to narrowly oblanceolate, acute to acuminate, 5 to more commonly 8 in number, 1.5–4 cm. long, appressed silky-canescent on both sides; cauline leaves 2 or 3, with shorter or very short petioles: stipules adnate, subulate: raceme dense, cylindric, 8–9 cm. long by 2 cm. wide: bracts persistent, exserted and recurved before anthesis, in anthesis equaling the calyx, lanceolate to narrowly subulate: flowers 7–8 mm. long, on pedicels less then 2 mm. long, sub-verticillate: calyx silky, with subequal lips and very small bractlets; the lower lip entire, the upper cleft for two-thirds its length: standard obovate to orbicular, silky, reflexed: keel short-pointed, ciliate: ovary 3–4 seeded, silky: pod unknown.

Differs from *L. canescens* Howell, in much smaller stature, fewer flowers, leaflets not densely appressed, and shorter racemes. From *L. lepidus* it differs in not being densely silky, bracts persistent, banner silky, shorter pedicels, entire lower calyx-lip, flowers smaller, and ovules fewer. From *L. confertus* it differs in less branching character, shorter pubescence, shorter peduncle, entire lower calyx-lip, smaller petals, not narrowly ovate but obovate orbicular silky banner.

No. 3088. Rather dry ground, Long Valley, Boise County, Idaho, July 4, 1895, altitude over 4000 ft.

Type in the National Herbarium; co-type in my private collection.

Lupinus retrorsus

Perennial, 6–9 dm. high, erect, simple or branching, softly hispid-villous with spreading or strongly retrorse white hairs, leafy, rather long-peduncled: leaves with retrorsely hispid petioles; leaflets from as long to half as long as the petioles, greenish villous above, whitish villous below, 4–7 cm. long, narrowly oblanceolate, acuminate or merely acute; stipules long setaceous, silky within, hispid without: raceme from 6 cm. in length when in flower to 30 cm. in fruit, densely flowered but verticillate, apparently few pods maturing: bracts quite persistent, long subulate-aristate, hispid, longer than the buds and many of the flowers: pedicels 1–4 mm. long, with the calyx very villous: flowers 8–12 mm. long: calyx broad at base, slightly saccate, shortly bracteolate, with upper lip broad, shorter then the lower, and cleft into two short broad lobes; lower lip broad, subentire, or with 3 short lobes; banner hairy, broadly obovate, rather retuse from the slightly cohering sides: keel ciliate, rather shortly pointed: pod densely villous with white hairs, 2 cm. long, ripening 3–4 of the 5–6 ovules: seeds small, pinkish-brown and mottled with small brown spots.

Apparently nearest to the next, but very distinct from any *Lupinus* with which I am acquainted.

No. 4608. Low, grassy places, along dry or drying rills, hills of Cœur d'Alene Lake, opposite Harrison, Idaho, August 7, 1898. Flowers were mainly gone at this time. Type in the Gray Herbarium; co-types in my private collection and in the herbarium of the University of Idaho.

LUPINUS LIGULATUS **barbatus**

Differs from the type of *L. ligulatus* Greene, in having stipules not adnate, stem hairy, leaflets more than 6–8 (about 9), raceme long-peduncled, flowers scattered, only 8–10 mm. long, and in the ovary not very villous.

This was referred for me to "*Lupinus Burkii?*" but it differs from that species in its very different pubescence, not broad stipules, in long and open raceme, deciduous bracts, ovules 6–7, I should almost hesitate to refer this plant to *Lupinus ligulatus*, were it not that a specimen is in the Gray Herbarium, collected in Klamath County, Oregon, by Applegate, which more nearly approaches the type in its stipules adnate below, free above, and flowers only 8–10 mm. long. No. 1699. Wet, sunny, clay banks, Glendale, southern Oregon, May, 1897 and 1898.

Type in the Gray Herbarium; co-types in my private collection.

Aster Cordalenus

Growing in clumps, nearly erect, 20–30 cm. high, slender, much branched and leaved, especially above, glabrous below, pubescent above, the rather short branches corymbosely aggregated at top of stem: leaves linear to narrowly oblong-oblanceolate, uppermost lanceolate, 5–8 cm. long, 5–10 mm. wide, entire or some with a few rather distant serratures near the middle, those of the inflorescence not much reduced, strongly ciliate, otherwise glabrous, clasping to strongly auriculate at base: heads very foliaceous, campanulate to hemispherical, 5–7 mm. high by 7–10 wide: outer series of involucral bracts entirely foliaceous, loose, widely linear, acute, exceeding the inner or even exceeding the rays; inner bracts narrower, more or less white with herbaceous tips: rays about 20, blue to violet, 8–10 mm. long: disk-flowers purple, with rather short tube and pappus: akenes from nearly glabrous to strongly pubescent.

This plant is certainly closely related to some of the forms of *Aster foliaceus*, but differs from any of the varieties of this species, (or from any of these *species* more probably), in the smaller heads with even proportionately larger involucral bracts, more crowded stems, corymbose inflorescence, and more abundant smaller leaves tending to become condensed at top of stem. From *A. Oreganus*, which it resembles in general habit and size of heads, the very different involucral bracts completely separate it. No. 2992. Moist gravelly bars, Fort Sherman, Lake Cœur d'Alene, Idaho, August 22, 1897. Types placed in the Gray and National Herbaria, as well as in the herbarium of the University of Idaho, and in my private collection.

Aplopappus insecticruris

Upright or nearly so from erect or ascending rootstocks, 30–40 cm. high, leafly, more or less villous with many-celled and jointed white hairs: radical leaves 8–10 cm. long on petioles of nearly equal length, the blades almost glabrous, petiole and ordinarily midrib villous, subcoriaceous, serrate with rather distant triangular-spinulose teeth, oblanceolate, acute to acuminate; cauline decreasing slightly in size towards the heads, lanceolate to oblong, below shortly petioled, above sessile and clasping, pectinately serrate: heads 1.5–2 cm. high by 2–3 cm. wide: bracts of the involucre loose, about equal in length or the outer foliaceously enlarged and exceeding the head, linear-lanceolate, in 2 or 3 series, subcoriaceous, acute to pungently acuminate, outer villous-pubescent below, glabrous above, inner chartaceous at base: rays conspicuous, light yellow, 1.5 cm. long, about 20 in number: disk-corollas exceeded by the tawny rigid strongly-toothed pappus: style-appendages very hairy, longer than the stigmatic portion: akene from narrowly oblong to shortly subturbinate in different heads of the same plant, thickly covered with coarse more or less appressed dull-white or tawny hairs.

Near to *A. hirtus*, but differing in the nearly glabrous and larger leaves, less wooly stem, larger heads with smoother involucral bracts, coarser pappus, and more pubescent style-branches. The akenes, though similar in the main to those of *A. hirtus* in shape and covering, are inclined to be larger. The peculiarly articulated hairs, resembling the legs of many species of insects, though by no means peculiar to this species or even genus, suggested the name.

No. 3013. Dry, stony ground, western end of Big Camas Prairie, Blaine County, Idaho, July 14, 1895. Type in the National Herbarium; co-types in the Gray and Idaho University Herbaria, as well as in my private collection.

Aplopappus laceratus

Less than a span high, whole plant glandular with short stipitate glands, more or less leafy to the top: leaves rather thin and soft, radical spatulate to narrowly oblanceolate, cauline linear-lanceolate to narrowly linear, green, with long-ciliated margins, 1–4 cm. long, obtuse or acute: involucre campanulate to hemispherical, 1 cm. high and wide, its bracts subequal in two or three rows, lanceolate, acute to acuminate, outer ones green or purplish, inner mainly thin-chartaceous, all with hyaline margins which for the lower half at least are ciliate to pectinately-lacerate: corolla ampliate upwards, deeply 5-toothed, with style-appendages subulate and slightly longer than the stigmatic portion: pappus soft, white, not abundant, equaling the corolla: akenes sub-cuneate, striate, densely sericeous.

Close to *A. Lyallii* as well as to *A. pygmaeus*, but differing decidedly from both. From the first it differs in the more lacerate involucral scales, long-ciliate narrower leaves, shorter and broader akenes, and in the compactly caespitose rootstock. From *A. pygmaeus* it differs in being glandular, in having no broad obtuse outer scales, and in the silky, not pubescent, shorter akenes.

No. 3014. In moist ground amongst rocks, Soldier Mountain near Big Camas Prairie, Blaine County, Idaho, at an elevation of over 10,000 ft., July 15, 1895.

ANTENNARIA DIMORPHA **integra**

Plant spreading, with no well-defined caudex: hairs upon the akene almost altogether entire.

I should hesitate to regard this as a mere variety, in spite of its resemblance to the type, were it not that from its usual habit of spreading by slender, much-divided rootstocks it occasionally departs in the formation of quite a decided caudex, which is, however, in all cases more slender than any form of *A. dimorpha* in the Gray Herbarium; secondly, though the hairs in most cases show no division at all, while the ordinary forms of the species show hardly any simple hairs, yet now and then a hair can be found with notched apex, or with even recurved lobes.

No. 3036. Sandy, dry ground, Long Valley, Boise County, Idaho, at an elevation of 4100 ft., July 5, 1895. Type in the National Herbarium; co-types in the herbarium of the Idaho University and in my private collection.

CIRCIUM UNDULATUM **ciliolatum**

Differs from the type in having the bracts noticeably ciliolate. I should hesitate to call this a variety rather than a species, were it not that I find hardly a single specimen of *C. undulatum* in the Gray Herbarium that has not a few slightly ciliated bracts, and that it has all the other characters of the species. In having ciliolated bracts it approaches *Circium Grahami*, but differs from that species in more cottony leaves and involucre, smaller stature, and in more prickly involucral bracts.

No number appears with the specimens. I collected this in dry fields near Ashland, southern Oregon, July 8, 1886. Type in the Gray Herbarium; co-type in my private collection.

LYGODESMIA SPINOSA **lanata**

Differs from the type only in being lanate all over, stem more striate, and rather longer peduncles. No. 3229. Gravelly banks and bars of Wood River, Hailey, Blaine County, Idaho, July 21, 1895. Type in the National Herbarium; co-types in the Idaho University herbarium and in my private collection.

Microseris nigrescens (§ *Nothocalais*)

Scapes 26 cm. high from a thick caudex, glabrous save for a little pubescence below the head: leaves 3–24 cm. high, linear, widest above the middle, 3–10 mm. wide, pale green, with plane and entire margins, glandular mucronate at apex: involucres 15–20 mm. high, campanulate, the bracts subequal, lanceolate, acuminate, very thin and scarious, mottled with small dark dots: akenes 6–7 mm. long, narrowly fusiform, with rather short neck, the seed reaching almost to the top of the nearly black akene: pappus exceeding the akene, white, from $\frac{1}{5}$–$\frac{1}{3}$ mm. wide, attenuate from near the base: rays purplish on the outside, exceeding the involucre by about 5 mm.

Certainly closely related to *M. troximoides*, but differing from this species in the smaller nearly black akene, in the very fine pappus, not half so wide as in that species, and in the rather wider, softer leaves with unwrinkled margins. A nearer approach still to *Troximon.*

No. 3033. Wet meadows, Hot Springs, near Warren's Mining Camp, Idaho County, Idaho, July 2, 1895. Type in my private herbarium; co-type in the National Herbarium.

Whatever claim *Stephanomeria myrioclada* may have to specific rank, a thing I very much doubt, it is certain that Dr. Gray confused two plants in his description of this species in the Synoptical Flora. Eaton's type has the pappus just as he described it in the Botany of the King Exploration—"plumose nearly or quite to the base." Dr. Gray, after his description, cites two plants, one the Eaton plant, collected by Watson, the other the Hawthorne, Nevada plant, collected by M. E. Jones. The label attached to the latter bears this inscription: "*S. lygodesmoides* M. E. Jones, n. sp." It is so entirely different from *S. myrioclada* that I do not hesitate to describe it, since Mr. Jones assures me he has never done so.

Stephanomeria lygodesmoides M. A. Jones

Erect from a woody or even "shrubby" base, glabrous, with numerous rather stout ascending branches throughout: lower cauline leaves not seen; upper narrowly linear, less than 2.5 cm. long, ascending or pendent, entire, acute, the smaller bract-like and squarrose: head 4 mm. high, the involucre of 4 principal bracts and the same number of bractlets: flowers 3–5: akenes smooth, angled, with sordid pappus which is very plumose half way down, the remaining part scabrous.

Probably the same thing, or near it, is in the Gray Herbarium from S. B. Parish, no. 3228, but the branches are thicker and more divaricate, the leaves slightly runcinate-pinnate, and the plant even woodier at base. Mr. Jones assures me that his plant was also very woody at base. The akenes of both plants exactly match. These two plants are certainly near Greene's *Ptiloria divaricata*, but he describes his species, which I have not seen, as herbaceous to the base, and with monocephalous branches, while this plant has often two heads to the branch, and the pappus is not "joined into bundles of three at base."

Nemophila inconspicua

Small, depressed, glaucous, with the leaves and calyx much more strigose than the stem; leaves 5-lobed to parted, with rounded or obtusely triangular lobes, blade round to ovate in outline and more or less decurrent on the petiole : corolla equaling calyx or slightly shorter : appendages of the calyx ovate, a quarter the length of the ovate-lanceolate lobes : corolla white, 2.5 mm. long, the widely oblong lobes equaling the tube : stamens about equaling the tube, with small cordate anthers, the filaments attached from near the base to one third the way up the tube : internal appendages of the corolla small, narrow, attached to their bases, either acuminate or delicately fimbriate at apex in the same flower : style rather conspicuous and cleft to near the middle : seeds 4, the strong caruncle disappearing with age, deeply pitted, and with innumerable small punctures between the pits.

It simulates small forms of *N. parviflora*, and also of *N. breviflora*, but differs from both very materially. From *N. parviflora* it differs in the short corolla, shape and attachment of internal appendages, shape and size of anthers : from *N. breviflora* in the number of seeds, smaller appendages to the calyx, equality of corolla tube and lobes, shape of internal appendages, and noticeably 2-cleft style ; from *N. spathulata* Coville in manifest style, presence of internal appendages, and round capsule.

No. 3289. Loose, moist soil, Soldier Mountain, Blaine County, July 16, 1895. Type in the National Herbarium ; co-type in my private collection.

Nemophila Kirtleyi

From 5–20 cm. in height, diffuse and weak ; stems leafy to the top, purplish, shortly hispid below, longer hispid above, the hairs strongly divergent to retrorse ; all the lower leaves opposite, the upper alternate, ovate in outline, irregularly 5-parted with oblong to ovate lobes, these latter rarely 3-lobed or strongly dentate, slightly retrorse ; petioles destitute of auricles, but narrowly winged, hispid-ciliate, as are the sepals and to a less degree the petals : appendages of the calyx ovate, less than 1/3 the length of the lobes ; these lanceolate, enlarging in fruit, nearly as long as the lobes of the corolla : corolla one-half to three-quarters of an inch wide, with violet border and whitish center, conspicuously green-spotted near the junction with the stamens : internal appendages conspicuous, half fan-shaped, attached along the greater part of one side, cut into many lobes, these delicately fimbriate : stamens slightly over half the length of the corolla, with anthers oblong-sagittate, retuse, 2.5 mm. long : style half as long as the sepals, cleft one third the way down : peduncles slightly longer than the leaves and proceeding from their axils : pod 4-ovuled, 2–4-seeded : seeds oval, large, deeply pitted.

In aspect the plant resembles small forms of *N. phacelioides* Nutt., but easily separable from that species in opposite leaves, smaller stature, vari-colored corolla, and deeply pitted seeds, to say nothing of its far different range. From *N. aurita* it differs in absence of winged petioles and clasping base of leaves, less divisions to the leaves, and color of flowers. From *N. racemosa* it differs in not having a racemose inflorescence and in larger flowers.

No. 3082. Growing in warm, loose soil under *Pinus ponderosa*, Salmon River hill, beyond Florence, Idaho County, July 1, 1895.

I take pleasure in dedicating this species to my young friend and companion of my 1895 trip, Charles Kirtley, of Salmon, Idaho.

Type in the National Herbarium at Washington, co-types in the herbaria of Idaho and Harvard.

Phacelia minutissima

Annual, 2–6 cm. in height, hirsutely pubescent, glandular above, branching from the base, erect: leaves narrowly oblanceolate to spatulate, the base narrowed into a slender petiole, the blade entire or rarely slightly denticulate: flowers not numerous, shortly pedicelled: sepals spathulate-linear, 2–4 mm. long, moderately or far surpassing the small, bluish-white, oblong-campanulate corolla: the appendages of the latter not long, somewhat v-shaped at the base of the filament: anthers not small for size of flower, on filaments rather stout and one half to two thirds the length of the corolla: capsule rather large, ovate, acute: seeds 1–1.5 mm. in length, somewhat angled by pressure, oval-oblong, marked with a delicate net-work of roundish figures.

Very near to *P. saxicola* Gray, but it differs from that species in seeds being 3 or 4 times larger, (those of *P. saxicola* being only 0.35 mm. in diameter), not round but widely oblong and with much smaller reticulations, in shorter corolla, larger anthers on shorter thicker filaments, in appendages not so "linear" but shorter and making a much more noticeable angle at their juncture with the stamen base.

No. 3386. Dry, gravelly or rocky ground, at 8000 feet elevation, Soldier Mountain, Blaine County, July 16, 1895.

Type in the Washington Herbarium, co-types in the Idaho and Gray herbaria.

Chionophila Tweedyi

This plant was published in the Botanical Gazette, **15**: 66 as *Pentstemon Tweedyi* by Canby & Rose. This the writer thinks an error, which is probably due to the lack of mature fruit when the species was named. The serious question is, not whether it is not a *Pentstemon*, but whether it should not be raised to generic rank. For some time the writer was impressed with the necessity of making a new genus to fit this plant, but the more carefully he weighed each point the more convinced he was that the plant could more naturally be placed in *Chionophila*. The reasons will now be given, while at the same time the really generic characters will not be overlooked.

The genus *Chionophila* was based by Bentham on specimens collected by Dr. James on Pike's Peak in Colorado, and the monotypic species was named for the discoverer. Many specimens of this plant are found in the Gray Herbarium, and they all show the characters as described by Bentham. The most important are a close spicate inflorescence which is noticeably secund; a small glabrous plant, rising from a thick rhizoma; radical leaves with very scarious bases; very large and long calyx; corolla with 4 perfect stamens and one sterile one of much less length, and a many-ovuled ovary. Mr. Bentham had not seen the capsule, but Dr. Gray in the Synoptical Flora describes the seeds as "rather large, oblong, with a very loose and arilliform cellular-reticulated outer coat." I have also noted in some of the corollas I have examined in the Gray Herbarium that they are not perfectly straight at base, but a little larger on one side than the other. The proposed *Chionophila Tweedyi* agrees with this plant generically in the following points. It is about the same height, has just such leaves, the radical with wide scarious bases, and I note in both the same scarious *bracts* surrounding the leaves besides the *leaf-bases* of former years; similar opposite and sheathing cauline leaves; very similar fertile and sterile stamens, the former with equally confluent cells; very similar seeds, the description given by Dr. Gray for *C. Jamesii* fitting *C. Tweedyi* exactly; furthermore the two plants both blacken readily in drying. On the other hand the points of dissimilarity are more apparent than real. The flowers of *C. Jamesii* are arranged in a one-sided spike, those of the other in an open fewer-flowered raceme; the corolla of *C. Jamesii* is nearly if not quite straight, that of the other is quite saccate at base dorsally, thus causing the corolla to be turned aside at quite a strong angle with the axis of inflorescence and nearly erect pedicels; the calyx of *C. Jamesii* is large and "funnelform," that of *C. Tweedyi* is short and more lobed; while the lower lip of *C. Jamesii* is coated with a thick mat of hairs, the lower one of *C. Tweedyi* is merely strongly papillate.

To sum up, then, the two plants resemble one another in the ovary and seeds, in the stamens fertile and sterile, in the upper parts of the corollas, in the leaves and their bases, and in their blackening when dried. They depart from one another in the inflorescence, in the corolla-base, in the hairiness of the lower corolla-lip, and in the shape of calyx. The seeds and corolla base would cut the plant off from *Pentstemon* more than from *Chionophila*. Neither could the plant be placed in *Collinsia*, though having the gibbous base of this genus, as the stamens are not enclosed in the keel-shaped sac of the lower lip, nor are the seeds "peltate and concave centrally," while the sterile filament is not a mere gland. For these many reasons it seems best to the writer to transfer the plant to *Chionophila* rather than to constitute a new genus for it.

No. 3883. It grows in Idaho, wherever I have found it, not in swampy ground, as Mr. Tweedy finds it, but in open, loose soil at the bases of mountains.

Idaho County in flower, July 2, 1895. Flowers nearly white with tinge of purple. Custer County in fruit, August 2, 1895. Altitude about 6000 ft.

Type in the National Herbarium, co-types in the Idaho and Gray herbaria.

Castilleia Covilleana

Stems numerous from a subvertical rootstock, about 15 cm. high, leafy from the base, throughout glandular as well as villous with long crisped hairs, especially above: leaves narrow, entire at base, 3-parted above into linear more or less circinate lobes, 2–3 cm. long: bracts broader, 3-parted and the central lobe 2–3-cleft, some noticeably circinate, about equaling the flowers: calyx equaling or slightly surpassed by the corolla, *much deeper cleft behind than before*, the divisions shortly cleft into lanceolate acute lobes, glandular and villous : corolla slightly villous, conspicuously glandular above, with tube twice the length of the lower lip ; lip somewhat saccate with three deeply infolded narrow plicae slightly longer than the three erect light-colored subconvolute acute or obtuse lobes : style shortly exserted, with conspicuous 2-lobed stigma : anterior stamens equaling the corolla.

This plant approaches *C. breviflora* Gray in the unequally cleft calyx and the triple pliae or folds of the lower lip of the corolla, but it differs from that species in the calyx being cleft more deeply posteriorly than anteriorly, in the narrower less lobed leaves, in the glandular stem and inflorescence, as well as in the longer crisped hairs, and in the lower lip of the corolla being concealed below the anterior cleft of the calyx. From the first and last of these differences, it seems to constitute a new section in *Castilleia*, provided these characters are found to be constant.

Among rocks, between 10,000 and 11,000 ft. elevation, Soldier Mountain, Blaine County, July 15, 1895. No. 3388. Type in the National Herbarium ; co-type in the Idaho Herbarium.

I take pleasure in dedicating this unique species to Mr. Coville, botanist of the Agricultural Department at Washington, through whose instrumentality I was enabled to take the trip in 1895, and to whom I am indebted for the loan of additional material for comparison.

✓ SALIX LONGIFOLIA tenerrima

Differs from the type in the following characters :

A smooth shrub, 2–4 meters high, with light bark up to the youngest branches : leaves shorter and narrower, 1–2 mm. wide on fructiferous branches, 2–4 mm. wide on the sterile, glabrous or very early glabrate : pedicels slightly longer, capsule glabrous : scales glabrous save for the slightly ciliate edges.

Shaded, rocky banks of mountain rills gone dry in July, Elmore County, where the type was collected, as well as sandy bottoms, Payette River, Canyon County, Idaho, July 12, 1895, and August 1, 1897.

This beautiful bush has often been referred to *Salix exigua* of Nuttall, but it cannot be that, as Nuttall describes his plant "foliis sericeis—capsulis sessilibus." Neither can it be his *S. fluviatilis*, as he describes that species with leaves twice as wide, stipules none, scales of the female catkin bearded below. Furthermore, he describes *S. fluvistilis* as abundant at the confluence of the "Oregon and Wallamet." I have never seen this variety west of the Cascade Mts.

Type in the National Herbarium; co-types in the Herbarium of the University of Idaho and in the Gray Herbarium.

Allium simillimum

Stems 2.5–3 cm. high from the bulb, slender, flattened and very narrowly winged; bulb ovate, 8–12 mm. long, loosely covcred with many membranous layers, the reticulation of which runs from long rectangular above, through square, to figures below wider than long and from pentagonal to heptagonal: leaves 2, about 1 mm. wide, 8–9 cm. long, falcate to recurved; bracts 2, broadly ovate, acute or acutish: flowers 6–9, 5–6 mm. long, on slender pedicels 2–3 mm. long; segments narrowly oblong, obtuse, delicately denticulate with spreading papillae half the way up, pinkish white, with strong greenish midvein; stamens half to two thirds the length of the segments, the filaments broadened at base and attached for ⅓ their length to the segments: anthers oblong-oval, cordate at base: ovary slightly crested.

Though occupying a place midway between *A. tribracteatum* and *A. parvum*, it differs from both these species in many ways. From the first it differs in narrower leaves, spathe valves 2, and these barely acute not acuminate, shorter and obtuser perianth segments considerably surpassing the stamens and beautifully papillate along the margins. From *A. parvum* it differs in reticulated bulb-coats, slender pedicels, shorter papillate perianth segments, smaller bulbs, and narrower leaves.

No. 3100. Open moist loose soil amongst rocks, at 8000 feet altitude, Sesesh Peak, Idaho County near Boise County, July 2, 1895.

Type in the National Herbarium at Washington; duplicate types in the herbaria of Idaho University and Harvard.

The type of *Calochortus nitidus* was collected by Douglas, "On the Chain of the Blue Mountains, and mountainous districts of the Columbia, from the confluence of the Spokan upwards." This is just the locality in which *Calochortus pavonaceus* Fernald was collected, and it is hardly to be doubted that the two species are identical. The figure in Dougl. Hort. Trans. **7**: p. 277 would seem to prove this. From Douglas' description we would also learn indirectly that the color of the flower is lilac, and from both description and figure that the plant is of a large stature. Points that Douglas did not bring out and which Mr. Fernald did, are the conspicuous spot on the inner segments, like the spot in a peacock's tail-feather, arching round the gland above, the suborbicular gland slightly wider than high, and, a thing no one seems to have noted, a decided scale below the gland, more or less covered and so disguised by the thick, yellow hairs of the gland.

Now the plant so common about the National Park, and radiating in all directions for many miles from this center, has so many points that differ from the type, that I propose it as a new variety, and as this was undoubtedly Watson's *C. eurycarpus*, a plant he afterwards reduced to *C. nitidus*, this may now stand as

CALOCHORTUS NITIDUS **eurycarpus**

Differs from the type of *C. nitidus* Douglas (*C. pavenaceus* Fernald), in smaller stature, flowers straw-colored to lilac-purple, in having a large round dark spot above the gland, not lunate as in type, in gland from oval to round, thus higher than wide, not wider than high as in *C. nitidus*, and in a narrower, almost invisible lacerately fringed scale.

Common from southern Idaho to the National Park, and collected in various localities during the summers of '95 and '99. Types in the National Herbarium at Washington, as well as in the herbaria of Idaho University and Harvard, nos. 3097, 3098 and 3099.

Anyone who should first examine a plant of the common *Smilacina racemosa* of the Eastern States, and then one of the *S. amplexicaulis* type from California, would unhesitatingly pronounce them separate species. The long narrow petiolate leaves and short style of the former are strikingly different from the ovate crowded sessile leaves and long style of the latter. And yet to one who has observed and studied these plants for years throughout Oregon, Washington and Idaho, these apparently well marked differences disappear, and intergrading forms of every description can be found. Around Portland, Oregon, can be found forms that differ not at all from the Eastern plant in leaves, flowers and fruit. In the same locality can be found other forms that differ only in slightly longer style. As you go south these forms gradually disappear and give place to the typical California plant about Ashland, Southern Oregon. Even with these marked intergrades, we might take still the California plant as a good species at one end of the string and *S. racemosa* of Portland as the other, were it not that in moving eastward, other perplexing forms arise. In the mountains about Moscow, Idaho, forms can be found on the south and exposed sides of the mountain with more or less of the *amplexicaulis* type, save the leaves are shortly petioled, and the style not so long as in the type. On the north and heavily wooded sides can be found plants of the *racemosa* type, but leaves not so long petioled, and style longer. (In the Gray Herbarium are many eastern forms of *S. racemosa*, that differ quite considerably in the length of petioles.) To make matters worse, in the Yakima country and in eastern Oregon are found types much like the Californian, but with styles as short or even shorter than the eastern *S. racemosa.* I therefore propose the following revision of this group:

1. SMILACINA RACEMOSA Desf., the eastern United States representative, extending west to the Pacific Ocean.

2. SMILACINA RACEMOSA AMPLEXICAULIS Watson, the common plant of California and southern Oregon with crowded ovate amplexicaul leaves and very long styles.

3. SMILACINA RACEMOSA **brachystyla.** Differing from the Californian plant only in the remarkably short style. The type of this variety I have transferred from my own herbarium to that of Harvard, where it will be more accessible. No. 4843.

After much study in the field and the examination of the immense number of specimens in the Gray Herbarium, I see no way to separate *S. sessilifolia* from *S. stellata* save in the length of the pedicels, a very trifling distinction. Forms can be found in the West that match the eastern forms in rootstock, size of fruit, more or less folded leaves which vary from acute to acuminate, and size of flowers. What therefore is left of specific value? I have even found some forms along the Snake River in Idaho that have pedicels no longer than in some extreme eastern forms, and would be considered typical *S. stellata* were the leaves not flat—a character I find by no means uniform in the eastern plants. The western plant is certainly not deserving of more than varietal rank, if even that, but on account of *generally* longer pedicels and longer and more acuminate leaves, I propose it as

SMILACINA STELLATA **sessilifolia**

Differs from the type in rather longer pedicels and in most cases in longer and more acuminate leaves.

ISOETES BOLANDERI **Sonnei**

Differs from the types as described by Engelmann in shorter, more rigid leaves, apparent absence of stomata, almost orbicular macro-sporangium spotted with small dark spots, and in the wide velum which covers from ⅓ to ⅔ of the sporangium.

Sent to me in 1887 by Mr. C. F. Sonne, who collected it in Donner Lake, California, in October of that year.

Were it not that the velum has been found by me to be a very variable and untrustworthy character in this genus, varying as it does in this plant from ⅓ to ⅔ the width of the sporangium, and in *I. nuda*, *I. Howellii*, and *I. Underwoodi* to such an extent as to make me credit the statement of Mr. A. A. Eaton, that they are all one species, I should be inclined to think this a species distinct from *I. Bolanderi.*

Type in my private collection; co-types distributed to unknown parties.

Isoetes occidentalis

Trunk bilobed: plant always submerged, without stomata: leaves few in small plants, 40–60 in large forms, spreading, rigid, tapering, quadrangular, acute or acuminate, not contracted above the sporangium, dark green, lacking bast-bundles, 10–20 cm. long in the same plant, or merely 5–6 cm. in the smaller: ligule narrowly triangular: velum covering about ⅓ the sporangium: macrospores 400–450 μ, finely crested with simple or confluent crests, or even mere prominences: microspores 30 μ long and very papillose to echinulate.

In a foot or two of water, but never emerging. Lake Cœur d'Alene, Idaho, August–Sept., 1897. No. 4786. Type in my private collection and in the herbaria of Columbia, Harvard and Idaho Universities.

This plant, or something extremely like it, exists in nearly all the lakes in the Northwest. It has been referred to *I. lacustris*, as well as to *I. echinospora Braunii.* To the latter it bears very little resemblance, since the leaves are rigid, not giving way in the slightest when taken from the water, and the macrospores have never the spinules of that species.

To *Isoetes lacustris* it is certainly very near, perhaps too near for specific delimitation, but it differs from either the European or American forms of that species in the more numerous and tapering leaves, apparently thicker than any forms of *I. lacustris*, in the macrospores smaller and less conspicuously crested, but especially in the smaller and very rough microspores. Perhaps including Engelmann's var. *paupercula* as a small form. In other forms of apparently the same species the leaves are thicker, not so tapering, and merely acute. Such a form I collected many years ago in Lost Lake, near Mt. Hood.

Index to recent Literature relating to American Botany

This Index is intended to include (1) Titles of all papers and books relating to American plants; (2) All papers on botanical subjects by American botanists; (3) Papers of special interest relating to physiological or morphological subjects wherever published. Botanists can aid greatly in this matter by the contribution of separates of their papers especially those published outside the usual botanical journals, such as the publications of learned societies, experiment station bulletins and reports, and journals only occasionally containing botanical matter.

The titles are reprinted monthly on standard library cards of two widths, and are sold to subscribers at the price of one cent per card.

The editors will welcome any notice of omitted titles or other suggestions relative to the greater efficiency of the Index. Address all matter relating to the Index to The Torrey Botanical Club, Columbia University, New York City.

Arthur, J. C. Cultures of Uredineae in 1899. Bot. Gaz. **29**: 268–276. 30 Ap. 1900.

Bailey, L. H. & Miller, W. Cyclopedia of American Horticulture. Vol. I. 8vo. Pp. 1–509. *f. 1–743.* New York, 1900.

Bernard, N. Sur quelques germinations difficiles. Rev. Gen. Bot. **12**: 108–120. 1900.

Blodgett, F. H. A Parasite upon Carnation Rust. Bull. N. Y. Agric. Exper. Sta. 175: 1–13. *pl. 1–3.* Ap. 1900.

Britton, N. L. Descriptions of new North American Thorns. Bull. N. Y. Bot. Garden, **1**: 447–449. 1900.

Crataegus Brownii, C. Eggertii, C. Porteri, C. occidentalis, C. tenuifolia, C. campestris, and *C. pyriformis*, new species.

Britton, N. L. The Buttonbush a tree. Jour. N. Y. Bot. Garden, **1**: 54. *f. 11.* 1900.

Cockerell, T. D. A. Some Plants of New Mexico. Bot. Gaz. **27**: 280, 281. 30 Ap. 1900.

Denniston, R. H. *Euphorbia Lathyris* L. and *Euphorbia Helioscopia* L. Pharm. Rev. **18**: 159–162. *pl. 1, 2.* Ap. 1900.

De Vries, H. Sur la fecondation hybride de l'endosperme chez le mais. Rev. Gen. Bot. **12**: 129–137. *pl. 15.* 1900.

Guignard, L. L'appareil sexuel et la double fecondation dans les tulipes. Ann. Soc. Nat. VII. **11**: 365–387. *pl. 9–11.* 1900.

Holm, T. Studies in the Cyperaceae; XII. Segregates of *Carex filifolia* Nutt. Am. Jour. Sci. IV. **9**: 355–363. *f. 1, 2, A–F.* My. 1900.

Carex elynoides and *Carex oreocharis*, new names.

Hooker, J. D. *Cotyledon* (*Echeveria*) *Purpusii.* Curt. Bot. Mag. III. **56**: *pl. 7713.* 1 My. 1900.

Native of California.

Jacky, E. Die Compositen-bewohnenden Puccinien vom Typus der *Puccinia hieracii* und deren Spezialisierung. Zeitsch. für Pflanzenkr. **9**: 263–295. *f. 1–19.* 20 N. 1899; 330–346. *f. 20–36.* 4 F. 1900.

Jenman, G. S. *Polypodium Harrisii.* Gard. Chron. III. **27**: 241. 21 Ap. 1900.

A new species from Jamaica.

Johannsen, W. Das Aetherverfahren beim Fruhtreiben. 1–28. *f. 4.* Jena, 1900.

Kennedy, P. B. Coöperative Experiments with Grasses and Forage Plants. Bull. U. S. Dept. Agric. (Div. Agrost.) **22**: 1–86. *pl. 1–13.* 1900.

Kuhla, T. Die Plasmaverbindungen bei *Viscum album*, mit Beruchsichtigung des Siebrohrensystems von *Cucurbita pepo.* Bot. Zeitung. **58**: 29–58. *pl. 3.* 1900.

Kuster, E. Beiträge zur Kenntniss der Gallenanatomie. Flora, **87**: 117–193. *f. 1–21.* 1900.

Lucet & Constantin. Rhizomucor parasiticus, especes pathogene de l'homme. Rev. Gen. Bot. **12**: 81–98. *f. 1–22.* 1900.

MacDougal, D. T. Tube Mounts for Exhibition. Jour. N. Y. Bot. Garden, **1**: 58–60. *f. 14.* 1900.

MacDougal, D. T., & Lloyd, F. E. Roots and Mycorhizas of some Monotropaceae. Bull. N. Y. Bot. Garden, **1**: 419–429. *pl. 10–12.* 1900.

Maige, M. A. Recherches biologiques sur les plantes rampantes. Ann. Sc. Nat. VII. **11**: 249–364. *f. 1–21.* 1900.

Matruchot, M. L. Sur une structure particuliere der protoplasma chez une Mucorinee, et sur une propriete generale des pigments bacteriens et fongiques. Rev. Gen. Bot. **12**: 33–60. *f. 1–25.* 1900.

Millspaugh, C. F. Plantae Utowanae. Part I. Field Col. Mus. **2**: 1–110. *pl. 25.* Mh. 1900.

New species in *Meliola, Asterella, Sorosporium, Vermicularia, Uredo, Zamia, Panicum, Cenchrus, Peperomia, Chamaecrista, Kraemeria, Caesalpinia, Tribulus, Jatropha, Omphalandria, Euphorbia, Abutilon, Malvaviscus, Cienfuegosea, Turnera, Hydrocotyle, Convolvulus, Salvia, Gerardia, Eupatorium,* and *Porophyllum.*

Nash, G. V. A new *Trisetum* from Michigan. Bull. N. Y. Bot. Garden, **1**: 437. 1900.

Trisetum Brittonii.

Nash, G. V. Some new Grasses from the Southern States. Bull. N. Y. Bot. Garden, **1**: 429–436. 1900.

New species in *Erianthus, Manisuris, Andropogon* (4), *Paspalum* (4) and *Aristida.*

Peirce, G. J. The Relation of Fungus and Alga in Lichens. Am. Nat. **34**: 245–253. Ap. 1900.

Perkins, J. R. Monographie der Gattung Mollinedia. Engler's Bot. Jahrb. **27**: 636–683. *pl. 9, 10.* 23 F. 1900.

71 species enumerated, 4 from Mexico, 1 from Guatemala, and the remainder from South America. 44 species and 7 varieties described as new.

Reinitzer, F. Ueber die Eingung der Huminsubstanzen zur Ernahrung von Pilzen. Bot. Zeitung. **58**: 59–73. 1900.

Rothert, W. Ueber Sclerotien in den Fruchten von *Melampyrum pratense.* Flora, **87**: 98–108. 1900.

Rydberg, P. A. An annotated Catalogue of the Flora of Montana, and the Yellowstone Park. Mem. N. Y. Bot. Garden, **1**: 1–501. *pl. 1.* 1900.

Includes descriptions of 163 new species and varieties.

Sauvageau, C. & Davis, B. M. Origin of the Thallus, Alternation of Generations, and the Phylogeny of *Cutleria.* Bot. Gaz. **29**: 277–280. 30 Ap. 1900.

Schaffner, J. H. The Nutation of *Helianthus.* Bot. Gaz. **29**: 196–200. 26 Mr. 1900. [Illust.]

Schneck, J. *Pteris cretica* in Illinois. Bot. Gaz. **29**: 204. 26 Mr. 1900.

Schumann, K. Die Cactaceae der Republik Paraguay. Monatsch. für Kakteenkunde, **9**: 132–134. 15 S. 1899; 149–154. 15 O. 1899; 164–168. 15 N. 1899; 185–188. 15 D. 1899.
New species in *Opuntia* and *Cereus*.

Small, J. K. The genus *Bumelia* in North America. Bull. N. Y. Bot. Garden, **1**: 437–447. 1900.
B. rufomentosa, *B. microcarpa*, *B. megacocca*, *B. cassinifolia*, and *B. lucida*, new species.

Smith, G. The Haustoria of the Erysipheae. Bot. Gaz. **29**: 153–184. *pl. 11, 12.* 26 Mr. 1900.

Smith, R. W. The Structure and Development of the Sporophylls and Sporangia of *Isoetes*. Bot. Gaz. **29**: 225–258. *pl. 13–20.* 30 Ap. 1900.

Sturgis, W. C. Notes on some Type-specimens of Myxomycetes in the New York State Museum. Trans. Conn. Acad. **10**: 463–490. *pl. 60, 61.* Mr. 1900.

Sydow, H. & P. Fungi aliquot novi a F. Stuckert in Argentina lecti. Mem. Herb. Boissier, **4**: 1, 2. 31 Ja. 1900.
7 new species in *Lenzites*, *Diplodia*, *Septoria*, and *Cercospora*.

Tammes, T. Ueber die Verbreitung des Carotins im Pflanzenreiche. Flora, **87**: 205–247. *pl.* 1900.

Terry, E. H. Another Locality for *Schizaea*. Fern Bull. **8**: 36. Ap. 1900.

Thaxter, R. Note on Structure and Reproduction of *Compsoopogon*. Bot. Gaz. **29**: 259–267. *pl. 21.* 30 Ap. 1900.

Thaxter, R. Preliminary Diagnoses of new species of Laboulbeniaceae—II. Proc. Am. Acad. **35**: 409–450. Ap. 1900.
69 new species; *Monoicomyces*, *Polyascomyces*, *Limnaiomyces*, *Eucorethromyces*, *Clematomyces*, *Misgomyces* and *Euzodiomyces*, gen. nov.

Ule, E. *Cardamine Africana* L. in Brasilien. Engler's Bot. Jahrb. **28**: 216, 217. 9 Mr. 1900.

Underwood, L. M. The Ellis Collection. Jour. N. Y. Bot. Garden, **1**: 38–40. 1900.

Ward, L. F. Report on the Petrified Forests of Arizona. 8vo., pp. 23. Washington, 1900.

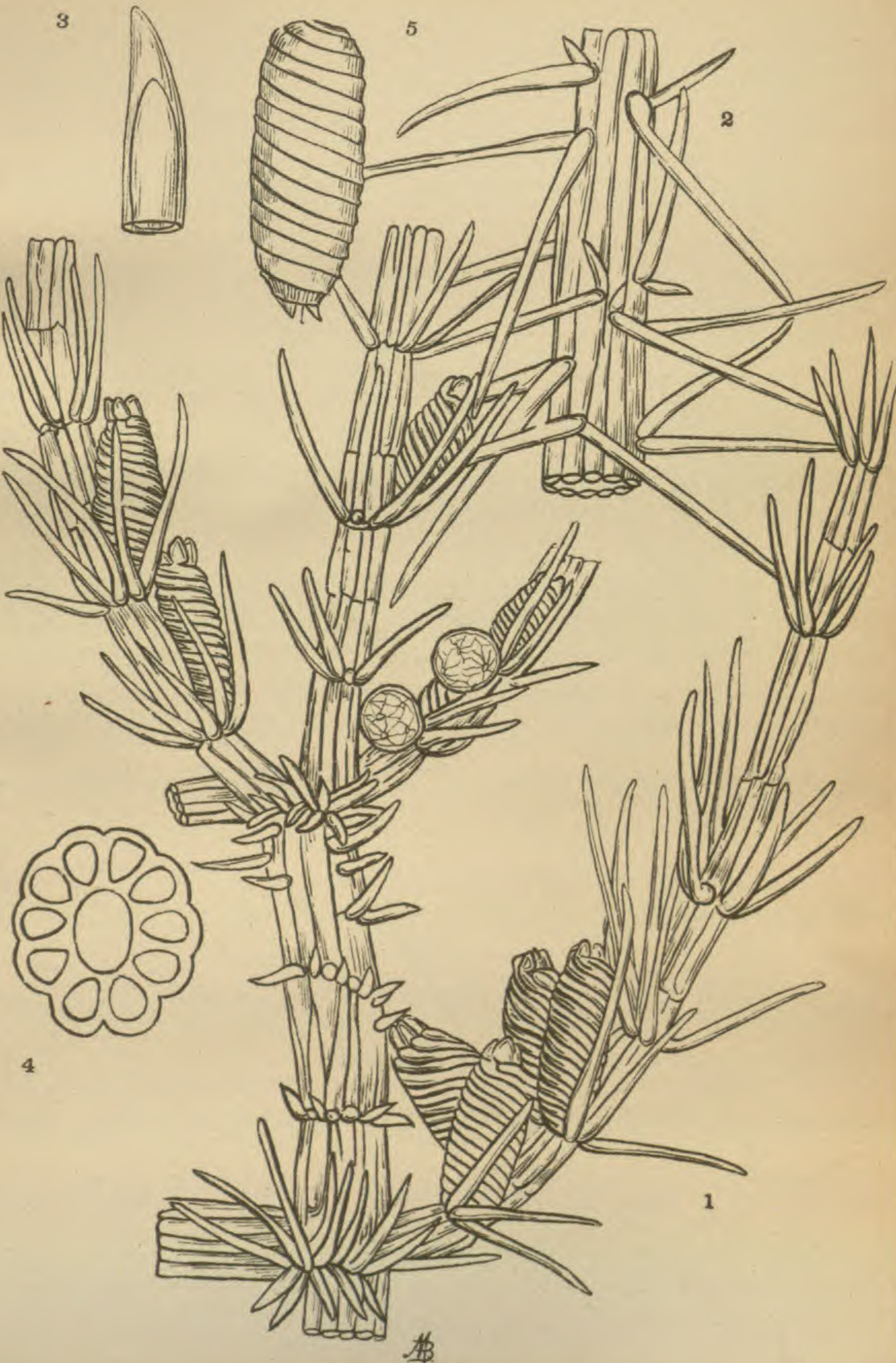
White, D. Relative Ages of the Kanawah and Allegheny Series as indicated by the Fossil Plants. Bull. Geol. Soc. Am. **11**: 145–178. Mr. 1900.

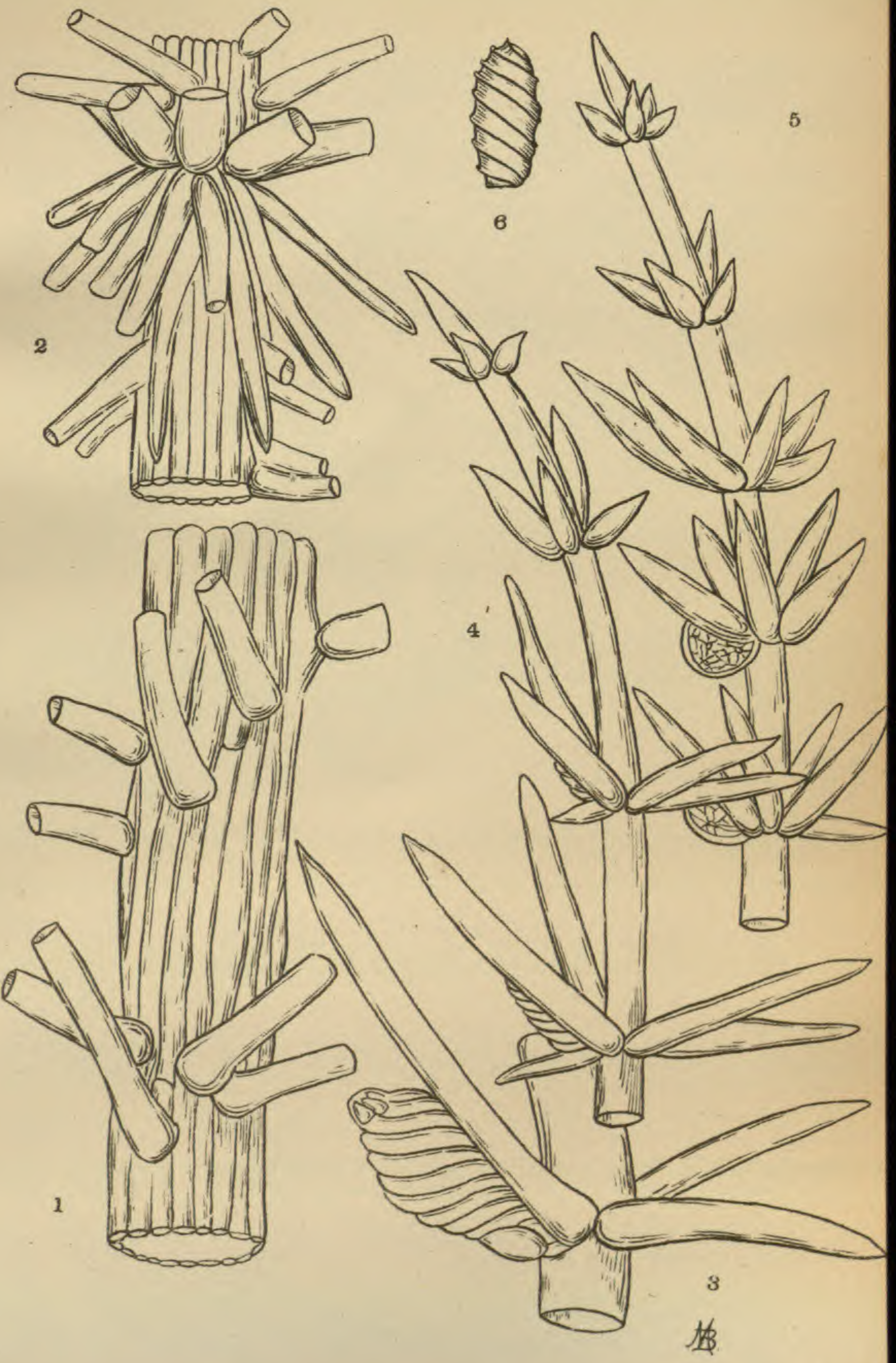
White, D. Report on Fossil Plants from the McAlester Coal Field, Indian Territory, collected by Messrs. Taff and Richardson in 1897. Ann. Rept. U. S. Geol. Surv. 1897–98, **19**[3]: 457–538. *pl. 67, 68.* 1899.

New species in *Mariopteris* (3), *Sphenopteris*, *Pecopteris*, *Neuropteris* (2), *Spheno phyllum*, and *Lepidodendron*.

Williams, R. S. Forest Conditions in the Klondike. Jour. N. Y. Bot. Garden, **1**: 44–46. 1900.

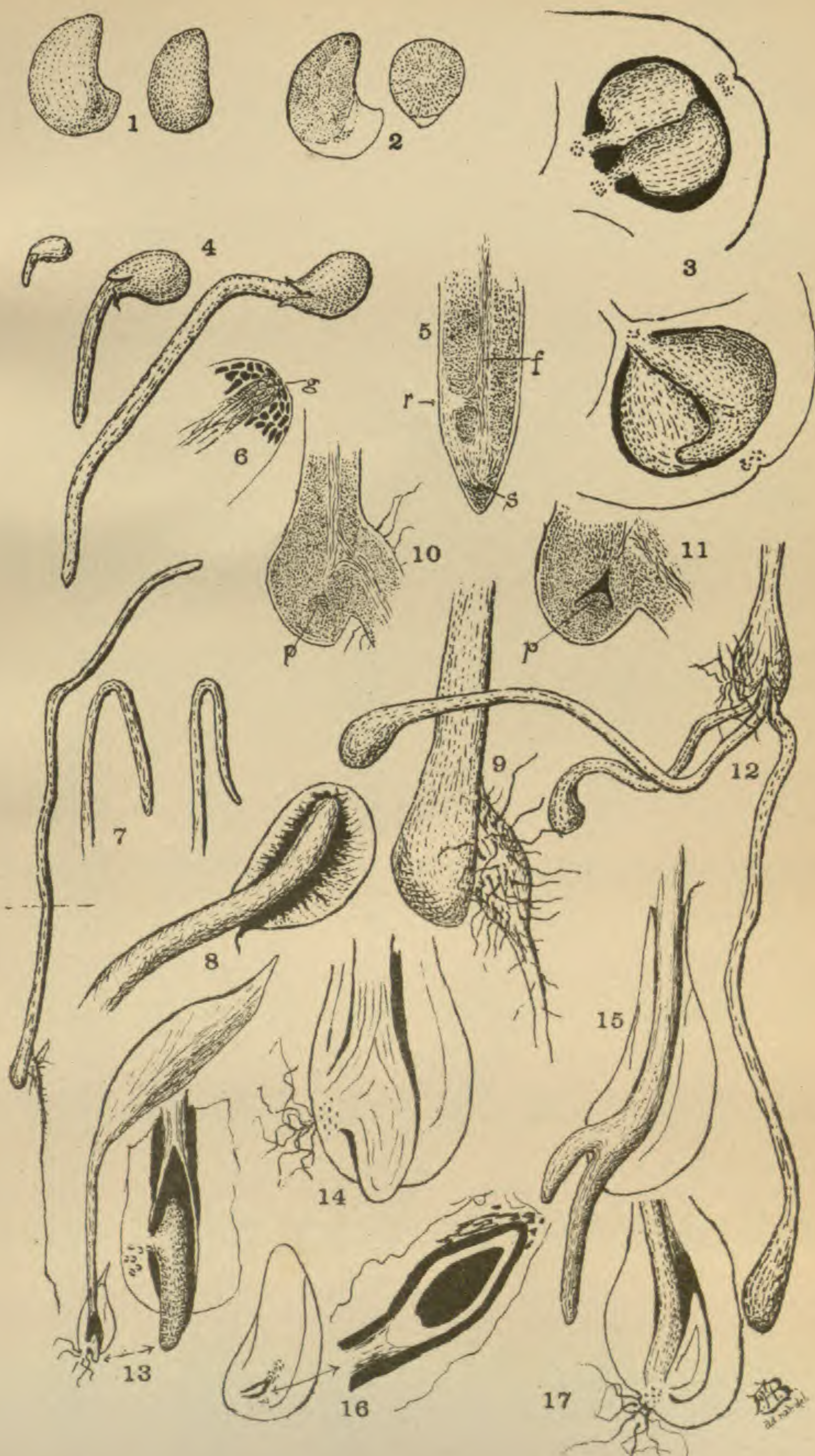
THE HELIOTYPE PRINTING CO., BOSTON.


3
5
2
4
1


2
6
5
4
1
3

THE HELIOTYPE PRINTING CO., BOSTON

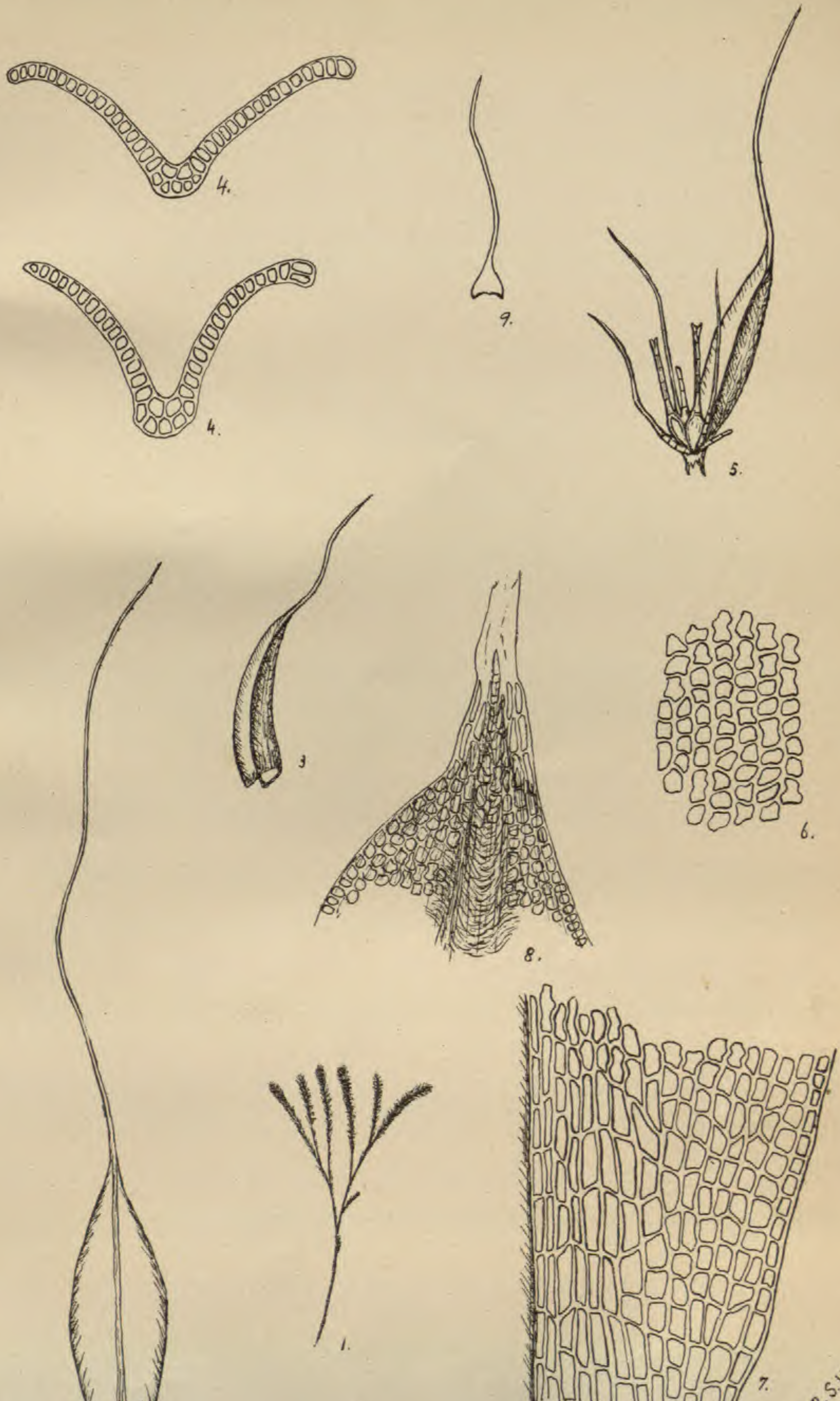
THE HELIOTYPE PRINTING CO., BOSTON.



ERYTHRONIUM AMERICANUM.

ERYTHRONIUM AMERICANUM.

ERYTHRONIUM AMERICANUM.



GRIMMIA BRITTONIAE.

GRIMMIA TENUICAULIS.

POHLIA POROSA

SCIRPUS GEORGIANUS

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT :

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895 ; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT :

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth) ; $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896 ; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages ; Vol. 2 642 pages ; Vol. 3, 588 pages ; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes ; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895 ; Tutor in Botany, 1895–.

Octavo, 360 pages ; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Subscriptions and remittances should be sent to 41 North Queen street, Lancaster, Pa., or Bronx Park, New York City.

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of 163 new species. ix + 492 pp. Roy. 8vo, with detailed map. Price to members of the Gaiden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg.

No. 3. The dichotomous *Panicums:* some new Species, by Geo. V. Nash.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg.

No. 5. Studies on the Rocky Mountain Flora I, by Dr. Per Axel Rydberg.

No. 6. Notes and Descriptions of North American Plants I and II, by Dr. J. K. Small.

All subscriptions and remittances should be sent to

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

PUBLICATIONS OF THE TORREY BOTANICAL CLUB.

(*1*) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates. Price $2 00 per annum. For Europe 10 shillings. Dulau & Co., 37 Soho Square, London, are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898), are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(*2*) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume 1, No. 1.—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume 2, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. 3. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. 4. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents.

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No. 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. 5. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S Price, $3.00.

Vol. 6. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*) With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. 7.—The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol. 8. No 1, Part 1.—The Comparative Embryology of the Rubiaceae. With four plates. By Francis Ernest Lloyd. Price, 50 cents.

(*3*) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

Address: **L. M. UNDERWOOD,**
COLUMBIA UNIVERSITY, NEW YORK CITY.

VOL. 27 JULY, 1900. NO. 7

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. — HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City

Associate Editors,
ANNA MURRAY VAIL,
BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D.,
CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. — WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D.,
MARIE L. SANIAL,
HELEN M. INGERSOLL,
ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH,
EUGENE SMITH,
MARIE L. SANIAL,
W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY,
DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 7

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JULY 1900

On the Development of Saururus cernuus L.

BY DUNCAN S. JOHNSON

(WITH PLATE 23)

The naked flower and the form of the carpel of *Saururus* have always led botanists to place it among the simpler Dicotyledoneae, usually in the Piperaceae. Engler has recently aroused new interest in all of these forms by separating from the Piperaceae the genera *Saururus*, *Anemiopsis*, and *Houttuynia* and constituting of them the family Saururaceae, which he regards as the simplest of the Dicotyledoneae after *Casuarina*. It was the desire to discover whether the evidence obtained from a study of the details of development would bear out this view of Engler that led me to undertake work on the Piperaceae collected by Professor Humphrey in Jamaica in 1897, and on material of *Saururus cernuus*, collected in Baltimore and North Carolina in 1899. The work on the Piperaceae will appear elsewhere and I give here a preliminary account of some features of the development of *Saururus*.

The one to three spikes of flowers are terminal in origin, but are soon pushed aside by the more vigorous growth of the last lateral bud. The flower consists of six stamens, and usually four carpels somewhat fused at the base, borne on the upper surface of a spoon-shaped bract. According to De Candolle the whole flower may sometimes be stalked from the axil of the bract.

The stamens arise on the upper and outer surface of the bract when the latter is but a slight swelling from the side of the axis. Soon after this the carpels appear as horseshoe-shaped elevations in the area within the circle of stamens, the lower flowers of the spike being always much further developed than the upper ones.

The stamen has four pollen-sacs, each with a many-celled archesporium, the wall and tapetum being formed in the usual way. The pollen grains are shed soon after the definitive macrospore of the same flower is formed. They are then binucleate and have a large thick area in the wall on one side. Nothing has been seen as yet of the sprouting of the pollen grain or the mature pollen tube. Further careful work will probably discover this, though it is certain that the pollen tube is much less prominent in the tissue of the style than in the related genus *Peperomia.*

Soon after the edges of the carpel meet and before they have fused far above the base, a single ovule appears on the inner face of each half of the carpel near the suture (*ov*, Fig. 2). These ovules are clearly lateral in origin and not, in any case seen, basal as described by De Candolle. Neither was any case found of a third or fourth ovule as described by Bentham and Hooker, though the latter character may perhaps be variable like the insertion of the flower noted above.

The ovules are sessile, orthotropous and at first transverse. They originate at about the same level, but very soon one pushes above the other with the micropylar end upward, and elongates parallel to the axis of the carpel until finally it fills practically the whole cavity of the latter. The lower ovule may develop far enough to form a ripe embryo-sac, but no case of fertilization of this was seen, and in the later stages it is transverse and flattened against the bottom of the cavity of the carpel by the erect upper ovule (*nc*, Fig. 4). The latter develops to form the single seed of the ripe fruit (Fig. 6).

The archesporial cell is single and axial, though at first there are often two or three cells equally near the axial position in the nucellus. The primary archesporial cell divides to form a tapetal cell and a definitive archesporium. The former gives rise to but few cells (*tp*, Fig. 5), which do not thicken their walls as do the tapetal cells of *Peperomia.*

The definitive archesporial cell or macrospore mother cell divides by mitosis into an upper and a lower cell, of which the upper divides once more while the lower immediately develops into the functional macrospore or embryo-sac mother cell, which pushes downward into the nucellus and upward to destroy the two degenerating macrospores above (*es*, *des*, Fig. 3).

At about the time that the primary archesporial cell becomes distinguishable the development of the inner integument begins. This is soon followed by the outer integument, arising in the same way from the surface cells at the base of the nucellus; both integuments closing in to form the micropyle at about the time the macrospore begins to encroach on its sister cells. The first division of the macrospore is transverse, and the following divisions apparently occur in the normal manner, as we find a little later an eight-nucleate and then a typical seven-nucleate embryo-sac (Fig. 1). The oösphere is rather clear or with large vacuoles, while the synergids which also have definite walls, have much denser contents (*eg*, Fig. 1). The polar nuclei fuse near the middle of the embryo-sac to form a nucleus twice the size of the egg nucleus (*epn*, Fig. 1). The antipodals are apparently quite normal at first, each with a darkly staining nucleus, but they soon become flattened against the base of the embryo-sac. Then their nuclei disorganize and the antipodals are no longer distinguishable, probably playing no further part (*ant*, Fig. 1).

After the seven-celled embryo-sac is formed it grows rapidly, especially in length, breaking down the tissue of the enlarging nucellus till it reaches two-thirds of the way to the base of the latter (Fig. 4), a length of 250 micromillimeters. Finally it broadens at the base, remaining narrow at the top, assuming thus the shape of a long-necked flask, with the egg apparatus at the top and the endosperm nucleus at the base of the neck.

It is evidently at about this time that fertilization occurs, for soon after this the endosperm nucleus divides. One of the daughter nuclei remains in the neck while the other moves down into the body of the flask, and then a wall is immediately formed across the base of the neck giving rise thus to two endosperm cells (*epn*, Fig. 4). From this time on the upper nucleus divides frequently, a cell wall forming immediately each time, and the neck of the embryo-sac thus becomes filled with a number of endosperm cells before any change is perceived in the egg or synergids (*ep*, Fig. 5). The lower of the first two endosperm nuclei grows to a very large size (*epn*, Fig. 5), but never divides further. It lies in a thin layer of cytoplasm near the wall of this large, lower endosperm cell and seems to control the advance of the latter upon the tissue of the nucellus. The nucleus persists for a long time but finally begins to show signs of degeneration and when the seed is ripe there is no distinct nucleus to be seen. Darker granules, which may be remnants of the nucleus, are sometimes seen in the otherwise faintly staining contents of this lower endosperm cell, or haustorium as it may perhaps prove to be in function (Fig. 6).

The egg begins to develop when the neck contains a dozen or more endosperm cells. The first division and several of the succeeding ones seem to be transverse. A suspensor a few cells in length is thus formed (Fig. 6), and at the lower end the embryo is developed. The latter in the ripe seed shows a pointed micropylar or root end and two slightly projecting cotyledons below with no distinct stem apex between them (Fig. 6). An axial strand of procambium is just evident at this stage.

The endosperm of the neck has by this time expanded laterally, and uses up practically all of the nucellus above and at its sides. It thus forms a double cone of tissue occupying the apex of the seed, with its lower point pushing in the upper wall of the lower endosperm cell (Fig. 6). The cells of this cap of endosperm are thin-walled, have small nuclei and are filled with a granular darkly staining substance, evidently cytoplasm. Several layers of the endosperm cells nearest the embryo are devoid of stainable contents, though their walls are still distinct, and none but those immediately in contact with the embryo have their walls compressed together. These empty cells are shown unshaded in Fig. 6.

The fate of the synergids of the embryo-sac has not thus far been determined.

The stored food material is evidently contained chiefly in the very abundant nucellar tissue or perisperm (*psp*, Fig. 6), which is closely packed with starch. This tissue is developed by the rapid growth of the basal part of the nucellus (Figs. 1, 4, 6), which finally fills nine tenths or more of the ripe seed, the cells being arranged in rows radiating out from the lower endosperm cell (Fig. 6).

The carpel at this time forms a thick, warty coat of several or many layers of outwardly rather loosely packed cells, the whole evidently serving, by means of the enclosed air, to float the fruit in the water, into which they often fall, and by which they must frequently be transported (*cp*, Fig. 6).

The inner integument is of three layers of which the inner and outer are of transversely elongated cells, the walls of which become thickened to the occlusion of the cell cavity. The cells of the middle layer remain thin-walled and are crushed between the other two (*iin*, Fig. 6—the whole thickness of this integument indicated in solid black). The outer integument is of two layers, the outer usually of larger cells, both with thin walls (*oin*, Fig. 6). These two layers appear as a whitish filmy coat over the dark inner integument when the carpel is removed from the ripe seed. At the base of the ovule a mass of chalazal cells becomes greatly thickened in the ripe seed to complete the testa in this region (Fig. 6).

THE GERMINATION OF THE SEED

The exact time and rate of sprouting under natural conditions has not been observed as yet, since the plants under observation near Baltimore failed to develop good seeds last season. Fruits obtained on the grounds of the New York Botanical Garden were kept in moist *Sphagnum* at a low temperature, from January to May, without showing any inclination to germinate. This may possibly have been due to the absence of light, though other experiments indicate that other factors were concerned. Some of the fruits were placed in damp *Sphagnum*, others in water, and still others in soil. All were given plenty of light and kept at a temperature of twenty five degrees centigrade, but none of these gave any external indication of sprouting, and sections showed that no appreciable change in the form or relation of embryo, endosperm and perisperm occurred during two months' time.

About the first of April, however, all the seeds that had been kept warm and given light and air, began to sprout freely. Then it was found that at this time the seeds that had been cool and dark also sprouted readily when given light and heat. These observations seem to show that changes occur here, not morphological, but probably of a chemical nature, such as are known to occur in many other seeds, and that these changes can take place under quite different conditions of light and temperature.

A careful study of the processes of germination shows that the first noticeable change in the seed is a swelling of the endosperm, which finally burst through the seed coats at the top and projects through the rent in these and the carpel as a white papilla (*ep*, Figs. 7, 9). This swelling enlarges the cavity occupied by the embryo in the endosperm and soon the embryo shows signs of renewed development. The root end elongates and the cotyledons grow downward and bend together at the ends (*em*, Fig. 7). Still later the root of the embryo pushes through the tip of the endosperm papilla till finally everything but the cotyledons is free. The latter remain tightly grasped by the collar-like end of the endosperm papilla, and reach at first not nearly to the bottom of the cavity in the latter (*cot*, Fig. 8).

During this time the only change in the relation of the endosperm and perisperm is that the former pushes down slightly into the large lower endosperm cell or sac (*ep*, Figs. 7, 8). As development goes on the hypocotyl elongates, pushing the root down into the soil, and the cotyledons stretch to push the stem growing point well out of the seed in one direction (*cot*, Fig. 9), while their tips push inward and thicken to force the endosperm which covers their tips like a cap, down against the tissue of the perisperm (*cot*, *ep*, *psp*, Fig. 10). The latter is gradually broken down by the encroaching endosperm, till in the later stages of germination it forms a second cap over the cotyledons outside the endosperm (*psp*, Fig. 10). After the root penetrates the substratum the hypocotyl continues to elongate and thus the whole fruit is raised into the air supported by the cotyledons (Fig. 9). The latter become broadly ovate, with only the narrow thick tip enclosed by the endosperm, and separate at the base to allow the plumule, which is now formed, to push its way out.

In the latest stages just before the fruit drops from the cotyledons the endosperm consists of a thin layer of compressed cells, without noticeable nuclei or other contents. Though the tip of the endosperm which projects out of the seed is exposed to the light, there was no indication that functional chloroplasts are ever formed.

The perisperm is either similarly flattened against the integument, or, in other cases, the cells seem to be emptied of their starchy contents while the walls retain their former shape. Whether the endosperm plays any part in the secretion of an enzyme for the digestion of the perisperm is as yet uncertain, but soon after the embryo pushes out of the seed the endosperm cells begin to lose their contents and do not appear like actively secreting cells.

The epidermal cells of the tips of the cotyledons have very dense contents and retain this character as long as they remain in the seed. On the surface of the cotyledons, at the tip, while they are still imbedded in the endosperm far from the light, and before chloroplasts are visible in the cells of this region, structures like typical stomata are formed abundantly. These stomata or stoma-like structures seem more abundant and more widely open at the very tip than elsewhere on the cotyledons. This fact suggests their possible connection with the absorption of food material. This has, however, not yet been proven.

Of the older seedling, after the empty carpel drops off, I need say here only that the first leaf from the plumule expands during the fourth or fifth week, and the second soon follows. In seedlings of seven or eight weeks the cotyledons cease growth, at a length of about four millimeters ; the two stem leaves at this time assume nearly the typical cordate form of the mature leaf.

CONCLUSION

I have elsewhere stated that I failed to find in the development of the embryo-sac of *Peperomia* any essential primitive features, and the present study of the related genus *Saururus* has failed in a similar manner, it seems to me, to indicate this plant as especially primitive. The origin of the parts of the flower and the development and structure of the mature embryo-sac are essentially as found generally in the Angiosperms. The immediate formation of cell walls in the endosperm occurs, as Hofmeister has shown, in more than twenty different families of this group. The occurrence of further cell walls in but one of the first two endosperm cells he has also shown to be a not infrequent phenomenon. Thus *Asarum*, *Nymphaea*, *Plantago*, the Campanulaceae, Labiatae, etc., resemble *Saururus* in forming cellular endosperm in only the upper of the first two endosperm cells ; while in *Catalpa*, *Acanthus*, and other forms, it is formed in the lower cell of the pair.

Again the slightly developed embryo and the small amount of endosperm in the ripe seed, are found not only in the Piperaceae, but in such distantly related forms as *Nuphar*, *Brasenia* and other

Nymphaeaceae, as well as in many parasitic genera, of various families, and much of the nucellar tissue remains also as perisperm in certain of the Chenopodiaceae, Caryophyllaceae, and in the Cannaceae among the Monocotyledoneae. All of these facts seem to me to show that *Saururus* is not among the higher Dicotyledoneae, but for the support of the view that it is among the very lowest, we must rely entirely upon a single character, namely, the absence of the floral envelopes.

Finally the behavior of the endosperm at germination is unique so far as I have been able to learn from the literature. We may best regard it perhaps as the lower member of a series of which such seeds as those of *Phaseolus* and *Cucurbita* form the other extreme. In other words, in seeds of the latter type, the endosperm completes its function of absorbing the tissue of the nucellus, and passing this on to the embryo, during the ripening of the seed, while in *Saururus* the final result is the same, but is only reached during the germination of the seed.

Explanation of Plate 23

Abbreviations used. *ant*, antipodal; *cot*, cotyledon; *cp*, carpel; *des*, degenerating embryo-sac mother cell; *ea*, egg apparatus; *eg*, oösphere; *em*, embryo; *ep*, endosperm; *epn*, endosperm nucleus; *es*, embryo-sac mother cell; *in*, integument; *iin*, inner integument; *nc*, nucellus; *oin*, outer integument; *ov*, ovule; *psp*, perisperm; *sg*, synergid; *st*, stigma; *tp*, tapetal cell; *vb*, vascular bundle.

1. Longitudinal section of ovule with mature embryo-sac, × 250.

2. Transverse section of carpel near the base, showing two ovules. The dotted lines indicate the line of fusion of the edges of the carpel figured and of this with the adjacent carpels, × 50.

3. Tip of nucellus with tapetal cells, one functional and two degenerating embryo-sac mother cells, × 775.

4. Longitudinal section of carpel showing two ovules, one with flask-shaped embryo-sac, × 50.

5. Longitudinal section of embryo-sac slightly older than the last, × 150.

6. Longitudinal section of ripe fruit, showing degree of development of embryo, endosperm, perisperm, integuments and carpel, × 40.

7. Longitudinal section of sprouting seed, showing pushing out of endosperm and renewed development of embryo, × 30.

8. Part of longitudinal section of sprouting seed, showing embryo attached by cotyledons to endosperm, × 30.

9. A twenty-day old seedling, showing relation of cotyledons, endosperm, seed coats and carpel, × 7.

10. Longitudinal section of the seed and cotyledons of such a seedling showing the encroachment of the endosperm upon the perisperm, × 14.

Studies in Sisyrinchium—VIII: Sisyrinchium Californicum and Related Species of the Neglected Genus Hydastylus

By Eugene P. Bicknell

The well-known *Sisyrinchium Californicum* of Aiton's Hortus Kewensis has rested for so long undisturbed in the genus *Sisyrinchium* that some fault of iconoclasm would seem to attend its removal from its time-honored place. Nevertheless the generic misfit of the plant in *Sisyrinchium* was long ago apprehended and a separate genus was created for it by Salisbury on the suggestion of Dryander (Trans. Hort. Soc. **1**: 310. 1812). This genus, *Hydastylus*, adequately founded as I do not doubt, appears to have missed the sanction of any later systematist.

The species was first brought to notice by Archibald Menzies who imported it into England for cultivation in 1796. Ten years later it was described and figured by Ker-Gawl as *Marica Californica* (Bot. Mag. *t. 983*, 180?), a disposition of the plant manifestly having regard for family relationship rather than generic affinity.

In 1812 Aiton, or Dryander, it may be, with clearer view transferred it to *Sisyrinchium*. The same year Dryander and Salisbury reached a truer conception of the plant's separateness of structure from *Sisyrinchium*, and their genus *Hydastylus* must now be revived to accommodate not this plant alone but also a well-defined generic group of yellow-flowered species of which it is the type.

The genus *Hydastylus* may be thus characterized :

Annual or perennial herbs with the habit and appearance of *Sisyrinchium*, but usually only imperfectly caespitose, discoloring or turning black in drying, most or all of the species staining purple under appropriate conditions ; rootstocks usually obscure or poorly developed, the delicate roots pale and slender. Leaves narrowly linear, the conduplicate bases more or less membranously expanded : stems ancipital, simple and scapose, terminated by a spathe of two conduplicate bracts enclosing membranous scales ; pedicels slender, often long-exserted, straight or finally recurved : perianth yellow, the mostly narrowed segments black-lineate or with brown or orange veins, obtuse or acute but not aristulate nor emarginate; filaments more or less adherent below but commonly free nearly to the base or at least for more than half their length, somewhat spreading above; anthers narrowly linear, versatile; style-branches slender, divergent: capsule oblong to globose or pyriform, more or less trigonous, three-celled, many- or few-seeded: seeds rounded, distinctly pitted, widely umbilicate or acetabuliform.

Western North American from Vancouver to Lower California and at least to southern Mexico, extending east to Arizona and Coahuila.

The most evident points of difference between this genus and *Sisyrinchium* reside in the flowers and consist of partially free filaments, linear versatile anthers and slender spreading style-branches, together with yellow perianth, the lineate segments never aristulate nor emarginate and strictly glabrous ovary. In addition there is some indefinable foliar attribute which with more or less clearness announces the genus quite apart from the flowers. In fact two of the species here described are confidently referred to the genus although the flowers are unknown.

It will doubtless be found to be in accordance with the alignment of nature to limit the genus *Sisyrinchium* by the characters of tubular-united filaments, short erect anthers, undivided style and, with rare exceptions, blue, violet or white flowers, with the perianth segments aristulate or acutely pointed; furthermore the ovary is puberulent in the majority of species.

This understanding of the genus will exclude from it a number of South American species which it has hitherto been held to embrace and make necessary the formation of still other genera, but this, I fully believe, will prove to be the only logical treatment of the group. There might have seemed little reason for this view under the long-established belief that the genus in North America was at best a most insignificant one but now that its numerical importance has disclosed itself the beautiful homogeneity of the species of the blue-flowered section becomes in itself very suggestive and bears strongly against the congeneric equivalent with their group of the heterogeneous assemblage of species that have been included within it.

On this view *Sisyrinchium* proper is primarily a North American genus which though well-represented in South America has there a much less extensive representation than has been accorded it.

Of the genus *Hydastylus* it should be said that it may require to be more broadly interpreted in order to accommodate certain branched and yellow-flowered South American species which have yet to be made a subject of critical study.

Key to the Species of Hydastylus

Flowers large; perianth 12–18 mm. long; leaves 2–7 mm. wide, mostly turning very dark when dry.
  Flowers large; pedicels mostly longer than the bracts, 20–40 mm. long; seeds 1.25–1.5 mm. in diameter. 1. *H. Californicus.*
  Flowers smaller; pedicels mostly shorter than the bracts, 10–20 mm. long; seeds .75–1 mm. in diameter. 3. *H. brachypus.*
Flowers small to medium sized, 6–12 mm. long; leaves mostly 1–3 mm. wide, not usually turning very dark; pedicels not recurved.
  Anthers small, 2–2.5 mm. long.
    Pedicels little longer than the bracts, erect; perianth 8–10 mm. long. 2. *H. borealis.*
    Pedicels slenderly exserted, somewhat spreading; perianth 6–8 mm. long. 5. *H. rivularis.*
  Anthers larger, 3–5 mm. long.
    Pedicels more or less exserted, erect; perianth 8–12 mm. long. 4. *H. Elmeri.*
    Pedicels long-exserted, closely erect; plant slender, 15–30 cm. high; perianth 8–12 mm. long. 6. *H. longipes.*
    Pedicels long-exserted, somewhat spreading; plant low or depressed; leaves 1.5–2 mm. wide. 7. *H. parvus.*
    Pedicels exserted; plant low or depressed; leaves .05–1.5 mm. wide. 8. *H. Schaffneri.*
Flowers very small, 3–5 mm. long; pedicels recurved-spreading; capsules 3–6 mm. long.
  Outer bract much prolonged; anthers 1 mm. long. 9. *H. cernuus.*
  Bracts subequal; anthers 3–5 mm. long. 10. *H. subcernuus.*
Flowers unknown; leaves very thin; capsules 6–10 mm. long.
  Capsules large, 8–10 mm. long, pyriform; leaves and stem 2–5 mm. wide, serrulate; pedicels flexuous. 11. *H. serrulatus.*
  Capsules 6–7 mm. long, obovoid-oblong; leaves and stem narrower, not serrulate; pedicels spreading or recurved. 12. *H. translucens.*

HYDASTYLUS CALIFORNICUS (Ker.) Salisb. Trans. Hort. Soc. 1: 310. 1812.

Marica Californica Ker-Gawl. Bot. Mag. *t. 983.* 1806.

Sisyrinchium Californicum Hort. Kew. ed. 2, IV.: 135. 1812.

Sisyrinchium lineatum Torrey, Pac. R. R. Rep. IV., 143. 1857.

Sisyrinchium flavidum Kellogg, Proc. Cal. Acad. II.: 50. *t. 3.* 1863.

Mostly 20–30 cm. high (15–60 cm.), dull green and glaucescent, turning dark or often quite black on the herbarium sheet and readily staining a deep purple, roots spreading from a weak descending rootstock. Leaves thin and rather openly weak-nerved, mostly about half the height of the stem but sometimes equaling it, obtusely pointed, commonly 2–4 mm. wide (1.5–7 mm.): stem usually 2–3 mm. wide, sometimes broadly wing-flattened and becoming 6 mm. wide, the edges like those of the leaves smooth or obscurely serrulate-roughened: spathes erect, 3–8 mm. wide in pressed specimens; outer bract 20–52 cm. long, narrowed to an obtuse point, occasionally subequal with the inner one but usually slightly surpassing it and sometimes as much as 20 mm. longer, the margins below narrowly hyaline, often purplish, united-clasping for 5–10 mm.; inner bract 20–35 mm. long, white-scarious and obtuse or obtusely pointed at the apex; interior scales brownish hyaline, often slightly exserted: flowers 3–7, on erect pedicels 20–40 mm. long, usually a little surpassing the bracts, at least the inner ones, and sometimes exserted as much as 10 mm.; perianth bright yellow, 12–18 mm. long, the oblong obtuse or acutish segments with 5–7 black or dark brown nerves which often become tortuous or crinkled when dry: stamens about 7 mm. high, subequal with or surpassing the style branches, the narrow versatile anthers orange-yellow, 3.5–5 mm. long: capsules on erect pedicels, at maturity 7.5–12 mm. long, 6–8 mm. wide, trigonous-obovoid or ellipsoid, becoming very dark: seeds numerous, 1.25–1.5 mm. in diameter, black, strongly pitted, excavated-umbilicate.

Coast region of California, in marshes, perhaps exclusively within maritime influence, from San Diego to Mendocino County, flowering from April to June.

SAN DIEGO, Pac. R. R. Rept. l. c.

MONTEREY CO., C. C. Parry, M.D., April, 1850, in full flower, type of *S. lineatum* Torrey; Mrs. Rich, on sheet with type; Herb. Columbia.

Near the 35th parallel, Dr. J. M. Bigelow, Whipple's expedition, 1853–4.

CONTRA COSTA CO., Antioch, Dr. A. Kellogg, April 21, 1870, just in flower.

SAN FRANCISCO, Mrs. Brandegee; Kellogg and G. W. Harford, 1868; Kellogg, 1866; Presidio, 1887, Edward L. Greene.

SAN MATEO CO., Crystal Springs, April, 1896, Miss Alice Eastwood.

SONOMA CO., Michener and Bioletti, 1892; Bodega Point, Eastwood.

MENDOCINO Co., Bolander, 1866; Eastwood, 1894; H. E. Brown, 1898.

Specimens from "California" have also been examined, collected by Dr. Gibbons (1853), Dr. Coulter and E. Hall.

IRELAND, near Wexford, Rev. E. S. Marshall, June, 1896, fide A. B. Rendle, Journ. Bot. XXXIV., 494.

Numerous specimens covering the extended range of this plant of at least seven hundred miles along the California coast show a great amount of variation and give indications apparently little less than conclusive of two closely allied species within the region.

The type locality of *H. Californicus* is stated to be "Port Bodega" (A. B. Rendle, l. c.), from whence specimens were taken to England over a century ago. Recent collections by Miss Alice Eastwood, made at Bodega Point, Sonoma County, presumably the type locality, are of the form which has been most frequently collected and which shows certain rather suggestive differences from the type specimens of Torrey's *S. lineatum.* As a rule this more northern plant is taller and less discolored from drying with longer and thinner often broader leaves and longer spathes having the outer bract often considerably prolonged, flowers larger, apparently more delicately veined and with the segments less broadened toward the apex, and longer anthers. Present material is not conclusive as to the exact relationship of these two forms, but it would seem that Torrey's specimens may represent a closely allied species of more southern range extending from San Diego to San Francisco, the true *H. Californicus* perhaps not ranging far south of San Francisco. It may be now impossible to determine from Kellogg's description of his *S. flavidum* to which of these plants his name implies. It may be noted, however, that in the Herbarium of the California Academy of Science are two sheets of the more northern plant labelled in pencil "*S. aureum* Kellogg" and another sheet bearing specimens of both plants with penciled memoranda noting their differences. It would appear that these were part of Kellogg's material and since they bear date some years later than the publication of his *S. flavidum* the inference is that he regarded his *S. aureum* as distinct from the latter which would thus be shown to be identical with Torrey's *S. lineatum.*

A somewhat distinct appearing form of the plant which would seem to belong with true *H. Californicus* if two species are ever to be distinguished is indicated by the specimens collected by Dr. Bigelow on Lieutenant Whipple's expedition of 1853–4. These are remarkable for their low stature as compared with their broad leaves and stems, which are 3–6 mm. wide, and their stout spathes; the broad thin wings are notably broadened towards the top of the stem but abruptly contracted at the spathe as in *H. brachypus*, decribed beyond, but unlike the latter the flowers are of the largest size, becoming 18 mm. long, on slightly exserted pedicels, and the spathes are much larger with the outer bract more united-clasping and the inner one less obtuse.

Quite an opposite extreme of development is shown by specimens from Sonoma Co. collected by Michener and Bioletti. These are remarkably tall and slender with short spathes and decidedly exserted pedicels.

Hydastylus borealis sp. nov.

Very close to *H. Californicus* but ordinarily much smaller and more slender, with spathes and flowers about one half the size, much smaller stamineal-column and anthers, smaller capsules and decidedly smaller seeds.

Commonly 15 cm. high (6–30 cm.) not usually turning very dark in drying and when young showing little discoloration; roots usually more slender and delicate than in *H. Californicus*, often much elongated. Leaves commonly only 1–3 mm. wide, rarely 4 mm., often with abruptly linear tip, sometimes even almost subcaudate; stem usually narrower than the leaves: spathe stiffy erect, the inner bract 12–18 mm. long, slightly surpassed by the outer one which is less united-clasping than in *H. Californicus*— usually only 3–4 mm.: flowers on closely erect slightly exserted pedicels 15–22 mm. long; perianth yellow, 8–10 mm. long, the segments apparently mostly five-nerved: stamens 5–6 mm. high, the anthers small, 2–2.5 mm. long: styles 2.5–3 mm. long: capsules ellipsoid, 6–8 mm. long or sometimes narrower obovoid-oblong, and a little longer, 3.5–6 mm. wide: seeds .75–1 mm. in diameter, globose, excavated on one side, finely pitted, often of a semi-transparent reddish color.

Vancouver Island to Whatcom County, Washington, growing on shores of fresh water lakes and flowering from early in July until after the middle of August. Professor Macoun writes "It grows always in soft mud on the margins of fresh water lakes away from the coast."

WASHINGTON: Whatcom Co., W. N. Suksdorf, flowers July 7; fruit August.

VANCOUVER ISLAND: Lake shores, July 1, 1887, first flowers, and Shawnigan Lake, July 12, 1887, John Macoun; Shawnigan Lake, Aug. 18, 1897, fruit and last flowers, Wm. N. Canby; Sooke, Aug. 3, 1893, John Macoun, fruit and last flowers.

The very close affinity of this plant to *H. Californicus* is much more apparent than its diversity; nevertheless, its much smaller average size throughout and especially its smaller flowers, short anthers and small seeds, taken in connection with its inland distribution and lacustrine habits, is certainly sufficient evidence that it cannot be regarded as the same. The question of varietal relationship in cases such as this must always of course, remain merely a matter of conjecture in the absence of conclusive proof.

The present case is almost fatally complicated by the existence in the coast region of Washington and Oregon of yet another form even more closely related to *H. Californicus.* In a way this plant is intermediate between the two but I cannot conscientiously escape the difficulty it presents by referring it to either, nor do I know how to treat it as a variety; neither can it be ignored. The only consistent course therefore is to give it recognition as a closely allied species, even though its entire validity remains to be established. It may therefore be called to notice as *Hydastylus brachypus.*

Hydastylus brachypus sp. nov.

Mostly low and stout, 8–15 cm. high, but becoming twice as tall, leaves and stem broad, 2–5 mm. wide, sometimes narrower, commonly becoming very dark in drying, the leaves abrupt at the apex or short acuminate, mostly obtusely pointed, the stem often very broadly thin-winged, and abruptly contracted below the spathe; roots very slender and delicate: spathes short, the inner bract 15–20 mm. long, mostly broad above and obtusely rounded and scarious at the apex; outer bract abruptly narrowed to an obtuse point, subequal with or but slightly surpassing the inner one, the broad base rather loosely short-clasping for 2–5 mm., the lower margins conspicuously white or purplish-hyaline; interior scales ample, usually slightly exserted: flowers apparently medium sized, the anthers 3–4 mm. long: capsules oblong to broadly ellipsoid, 7–10 mm. long, at maturity crowded together on short pedicels mostly 10–15 mm. long, on large plants becoming 20 mm. long, mostly much shorter than the bracts: seeds black, distinctly pitted and umbilicate, small, .75–1 mm. in diameter.

Coast region of Oregon and Washington. Flowering in June and July.

OREGON: Elihu Hall, 1871; Newport, A. Isabel Mulford, June 1, 1892.

WASHINGTON: Near Gray's Harbor, Wilke's Expedition, 1838–42; Chehalis Co., July 6, 1897, F. H. Lamb; Estuary of the Columbia, Nuttall; low hills of the Columbia, Dr. Scouler.

Very near indeed to *H. Californicus* and often equally stout, but mostly lower, with shorter spathes, broader and less unequal bracts, the inner one more obtuse, smaller flowers, very much shorter pedicels and smaller capsules and seeds.

The plant is mostly much stouter than *H. borealis* with broader and more obtuse leaves and bracts and dries darker; the flowers and capsules are rather larger, although the seeds appear to be equally small; in the specimens examined the seeds are darker, less finely pitted and less widely umbilicate, except in size agreeing more nearly with those of *H. Californicus.* Although a larger plant than *H. borealis*, the pedicels, which are relatively much shorter, are in most specimens absolutely so, say 10–15 mm. as against 15–20 mm.

The exact status of the plant can probably be determined only by critical comparative study in the field.

Hydastylus Elmeri (Greene).

Sisyrinchium Elmeri Greene, Pittonia, **2**: 106. 1890.

Nearly allied to *H. Californicus* but smaller and especially more slender, 15–30 cm. high, not turning dark unless carelessly dried. Leaves half the height of the stem or less, 1–3.5 mm. wide: stems very slender, .75–1.5 mm., rarely 2 mm. wide, very narrowly winged or merely margined, like the leaves sometimes minutely serrulate; bracts of the spathe subequal or the outer one slightly the longer, 16–25 mm. long and united-clasping for mostly 5–6 mm., narrowed or short-attenuate to an obtuse point, the rather narrow inner bract scarious obtuse: flowers yellow, rather closely 5–7-nerved; perianth 10–12 mm. long: stamens 5–7 mm. high: anthers as long as in *H. Californicus* or nearly so, usually 4–5 mm. long; pedicels very slender, 18–23 mm. long, erectly exserted for 1–6 mm.: fruit unknown.

A plant of the Sierra Nevada from northern to middle California, representing there the much larger and stouter *H. Californicus* of the coast.

Though clearly an excellent species as recognized by Professor Greene it can be but poorly understood from existing material. As compared with *H. borealis* it is decidedly more slender with relatively shorter leaves, narrower bracts, longer anthers and more exserted pedicels.

CALIFORNIA: Sierra Nevada, June 28, 1889, Elmer Drew; Type in Herb. Prof. E. L. Greene; Plumas Co., 1876, Mrs. R. M. Austin; Mrs. Ames; Indian Valley, J. G. Lemmon; American Valley, May, 1879, Miss M. A. Plumer.

Hydastylus rivularis sp. nov.

Very small, 3–10 cm. or even 15 cm. high, becoming dull but not turning black in drying, the roots very slender and delicate. Leaves ascending and erect in a short basal tuft, the longer ones 2–6 mm. long, .05–1.5 mm. rarely 3 mm. wide, faintly few-nerved, rather abruptly obtuse, the translucent extreme edges like those of the stem crenulately uneven under a lens; stem straight or outcurved, .05–1 mm. or even 1.5 mm. wide, distinctly thin-winged: spathes straight or deflected, very small, the inner bract 12–17 mm. long, usually surpassing the outer one, the scarious-margined tip obtuse or acutish; outer bract narrowed to an obtuse tip, united-clasping below for 3–6 mm.; interior scales subequal with the bracts, dark-lineate: flowers few, 1–3, on capillary loosely erect or flexuously spreading, much exserted pedicels 15–23 mm. long, surpassing the bracts 5–10 mm., sometimes even twice their length: perianth orange-yellow, 6–8 mm. long, the segments oblong, obtusely pointed, rather openly 5-nerved: stamens 3–5 mm. high, the anthers very small, 2–2.5 mm. long, about the length of the style-branches: seeds apparently few and relatively large.

CALIFORNIA: Fresno Co., Ford of Bubb's Creek, July 5, 1899, in full flower, Miss Alice Eastwood; Mariposa Co., June 3, 1883, J. W. Congdon, first flowers; Eldorado Co., July 13, 1897, first flowers, Ezra Brainerd, wet rocks near Slippery Ford, altitude, 6000 feet.

A diminutive and very delicate plant growing in the wet and sandy or stony margins of fords of mountain streams, and apparently confined to the Sierra Nevadas of middle California.

Its affinity is with *H. Elmeri* and reduced examples of the latter approach it closely, but a wide difference appears between fully developed specimens of the two plants. The very much smaller size and shorter narrower leaves of more delicate texture, the small spathes with elongated inner bract, the small flowers with less close-veined segments, small anthers and mostly flexuously long-exserted pedicels afford a combination of characters which I cannot reconcile with what appear to be the normal characters of *H. Elmeri*.

The species is not unlike the smallest examples of *H. borealis* which, however, is normally altogether larger and stouter, with longer and much broader and more acute leaves, larger spathes and flowers, the outer bract the longer, and but little exserted pedicels.

Hydastylus longipes sp. nov.

Pale dull green and glaucescent, not turning dark when dry, from 15 to 30 cm. high, often in narrow tufts. Leaves numerous, mostly about half the height of the stem, closely erect, rather thin, 1–3 mm. wide, narrowed to an obtuse or acutish usually slightly bent point, the almost hyaline edges smooth: stems from less than 1 mm. to 2.5 mm. wide, the narrow wings smooth-edged: spathes sometimes slightly purplish, rather narrow, 1.5–3 mm. wide, erect or a little bent: bracts thin, often only obscurely nerved, outer one 1.7–2.5 cm. long, connate below for 4–6 mm., narrowly hyaline above to the narrowed and obtusely-pointed tip which surpasses the inner bract 2–6 mm.: inner bract much enclosed, the tip white-scarious and obtuse: longer interior scales equaling the inner bract or nearly so: flowers 3–6 on slender, erect, much exserted pedicels 2–3.8 cm. long, sometimes twice the length of the spathes: perianth 8–12 mm. long, apparently orange-yellow, the segments with fine orange or brownish veins, narrowly oblong, rounded or obtusely pointed at apex: stamens 6–7 mm. high, anthers about 4 mm. long: capsules broadly oblong or obovoid-oblong, slightly retuse, 5–7 mm. high, 4–5 mm. wide, thin-walled, turning dark, erect and contiguous: nearly mature seeds irregularly obovoid or subglobose, 1 mm. in diameter, umbilicate, rugulose pitted.

High mountains of Arizona and northern Mexico, flowering from early July until after the middle of August.

ARIZONA: San Francisco mountain, Aug. 18, 1889, fruit and last flowers, F. H. Knowlton; Aug. 4, 1898, 9000–10,000 ft. in meadows, Dr. D. T. MacDougal; Rincon Mts., 7500 ft., 1891, G. C. Neally; Harts Little Spring, July 14, 1892, full flower, E. O. Wooton; J. W. Toumey.

MEXICO: Chihuahua, Sierre Madre, 7500 ft., July 18, 1899, full flower; communicated by Prof. E. O. Wooton.

The aspect of this plant is nearest that of *H. Elmeri* but it is more tufted and leafy with rather broader stem but narrower leaves, rather more prolonged and narrower outer bract, much more exserted pedicels apparently also with less closely and distinctly lineate perianth segments and somewhat shorter anthers.

Hydastylus Schaffneri (Watson)

Sisyrinchium Schaffneri Watson, Proc. Am. Acad. **18**: 160. 1883.

Low, in erect or somewhat depressed leafy tufts, 4–10 cm. high, from short rootstocks bearing pale and apparently soft and somewhat thickened simple roots, dull green, discoloring when dry. Leaves equaling the stems or shorter, very narrow, 0.5–1.5 mm. wide, rather abruptly membranously expanded to a relatively long conduplicate base, narrowed to a very obtuse sub-cartilaginous tip, apparently thickish, the rather obscure fine nerves becoming somewhat prominent in drying, the intervals minutely cross-rugulose or even subscabrellous, the edges smooth or nearly so: stems erect or spreading, narrowly wing-margined, .05–1 mm. wide, rugulose like the leaves and smooth edged or nearly so: spathes mostly deflected, small, 10–15 mm. long, 1.5–2 mm. wide, the bracts subequal or usually the outer one slightly the longer, rugulose, the outer one attenuate to an obtuse tip or sometimes more abruptly narrowed, united-clasping for 3–5 mm., the margins below narrowly hyaline: inner bract less narrowed, scarious obtuse at apex: interior scales subequal with the bracts: flowers few, 3–5, on slenderly exserted, erect or sub-spreading pedicels 15–23 mm. long, exserted 5–8 mm.: perianth yellow, distinctly lineate, about 6–8 mm. long: anthers 2.5–3 mm. long.

Central Mexico, San Luis Potosi, 6000–8000 ft. altitude, no. 881, C. C. Parry and Ed. Palmer, 1878, no. 527, Shaffner.

I have examined three sheets of this type material, two of no. 881. It does not appear that the plant has since been collected.

Hydastylus parvus sp. nov.

Similar to *H. Schaffneri* (Watson) of Mexico, but with broader leaves and stem and larger spathes, the flowers on more exserted pedicels and larger with longer anthers.

Leaves shorter than the stems, mostly 1.5–2 mm. or even 2.5 mm. wide, apparently thinner and rather more distantly nerved than in *H. Schaffneri* and only obscurely if at all rugulose: stem 1.5–2 mm. wide, wing-flattened: spathes 13–18 mm. long, distinctly broader than in *H. Schaffneri*, 2.5–3 mm. wide, the bracts subequal, but often the inner one slightly the longer, the outer one rather more loosely united-clasping than in *H. Schaffneri* and less attenuate, the inner one broader above and more scarious-obtuse; pedicels 23–28 mm. long, usually becoming nearly twice the length of the bracts, erect or diverging: perianth 7–10 mm. long; anthers 3.5–5 mm. long.

MEXICO: "low valley near Saltillo, March 22, 1847, no. 340, Dr. Gregg" just in flower. Type in Herb. Miss. Bot. Gard. and Herb. Columbia.

Hydastylus cernuus sp. nov.

Caespitose in small open tufts 7–18 cm. high from a cluster of pale and delicate fibrillate roots, dull green and glaucescent, turning brown or blackish when dry. Leaves membranously equitant at base, sometimes equaling the stems but mostly shorter, very thin with delicate rather distant nerves often with a fainter alternating series, 1.5–4.5 mm. wide, acuminate to an obtusish point, sometimes obscurely roughened on the sides above, the almost hyaline edges smooth or minutely serrulate: stems erect or ascending, slender, .75–1 mm. wide, delicately wing-margined, the edges smooth to serrulate: spathes erect; outer bract much prolonged, mostly twice the length of the inner one or even longer and surpassing it 5–25 mm., 15–40 mm. long, attenuate to an obtuse point or foliaceously broadened and acuminate, united-clasping for about 5 mm. at base; inner bract 10–15 mm. long, narrow, acutish to obtuse, usually much concealed; interior scales narrow, shorter than the inner bract: flowers very small, 3–5 mm. long, pale yellow, the segments somewhat obtuse, dark-lineate: anthers linear, .05–1 mm. long, the stamens 1.5–2 mm. high: pedicels capillary, becoming 12–18 mm. long, finally slenderly exserted and recurved, the capsules mostly cernuous: capsules pale brown with very thin almost membranous walls taking the impression of the contained seeds, subglobose and 3–5 mm. high to somewhat pyriform and rather longer; seeds mostly 2–4 in each row, sometimes more, large, 1.25–1.5 mm. in diameter, subglobose to broadly oblong, semi-transparent brown, deeply close-pitted and excavated-umbilicate.

MEXICO: Chihuahua; Sept. 7, 1887, fruit mature and last flowers; "High plains between Cusihuiriachic and Guerrero, C. G. Pringle; wet places, Sierra Madre, Oct. 11, 1888, fruit mature and last flowers,". C. G. Pringle.

Printed labels refer the older collections of this plant to *H. Schaffneri* from which, however, it may be readily distinguished by much broader leaves, elongated primary bracts and much smaller flowers with very short anthers and recurved pedicels.

Hydastylus subcernuus sp. nov.

Caespitose in small tufts, 6–15 cm. high, the leaves mostly erect, the stems erect or ascending, turning dark brown in drying; roots pale, very delicate and fibrillate. Leaves about half the height of the longer stems, mostly 1.5 mm. wide (1–2 mm.), thin and delicately open-nerved, tapering to an obtuse point, the edges smooth to distantly denticulate: stem 2–15 cm. high, .05–1.5 mm. wide, delicately wing-margined, the thin edges minutely denticulate or usually so: spathes small, the narrow bracts subequal or usually the outer one a little surpassing the inner, sometimes as much as 6 mm. longer, 13–22 mm. long, united-clasping for 5–6 mm., attenuate to an obtuse point; inner bract narrowly obtuse-pointed; interior scales nearly equaling the inner bract: flowers 3–5, small, perianth about 5 mm. long, yellow, delicately dark lineate: stamens about 3–50 mm. long; pedicels capillary, 15–20 mm. long, finally exserted and recurved spreading: capsules less membranous than in *H. cernuus* but similarly moulded over the contained seeds, mostly obovoid-pyriform and 5–6 mm. high: seeds few in a row, larger and rather darker and more coarsely pitted than in *H. cernuus*, 1.5–1.75 mm. in diameter, widely excavated on one side or more or less acetabuliform.

LOWER CALIFORNIA: Sierra de la Laguna, January 22, T. S. Brandegee, type in Herb. Cal. Acad. Sci.

Nearly related to *H. cernuus*, but with narrower leaves, much shorter outer bract, larger flowers with much larger anthers, pedicels less exserted and recurved, capsules rather larger, seeds larger and more coarsely pitted and acetabuliform.

Hydastylus serrulatus sp. nov.

Growing in nearly simple tufts, 14–32 cm. tall, from very delicate and fibrillate nearly simple roots, rather bright transparent green, discoloring but little when carefully dried. Leaves acuminate to an acutish point, 2–5 mm. wide, thin and somewhat translucent, very delicately nerved, the main nerves rather distant with 1–3 fainter nerves in the intervals, rather distantly reticulated with minute cross-veinlets, the edges sharply fine-serrulate: stems 2–5 mm. wide, the stem proper very narrow, the wings very broad and thin, nerved and semi-transparent like the leaves and with serrulate edges: spathes mostly narrower than the stem: outer bract lanceolate-attenuate, 25–37 mm. long, surpassing the inner one 3–12 mm., united clasping 6–8 mm. at the flattened and sharply two-edged base: inner bract attenuate and acutish, 20–25 mm. long: interior scales more than three-quarters the length of the inner bract: capsules 3–6, large, pyriform, narrowed to an almost substipitate base, 8–10 mm. long, on slender, somewhat flexuously spreading pedicels about 25 mm. long: seeds black, subglobose, about 1.5 mm. in diameter, strongly pitted, excavated-umbilicate.

A species very distinct from any of the others here described, characterized especially by the very thin and reticulated semi-transparent leaves, broadly-winged stem and large pyriform capsules.

MEXICO: Orizaba, "in the mountains," Botteri, no. 1856. Type in Herb. Dr. Charles Mohr; Michoacan, 1857, Dr. Carlos Sartorius, Herb. Dr. Charles Mohr.

Hydastylus translucens sp. nov.

Very similar to *H. serrulatus*: glaucescent, the spathes often purplish tinged, 15–25 cm. high, showing more or less discoloration from drying, leaves equaling the stems or nearly so, 2–3.5 mm. wide: as compared with those of *H. serrulatus* longer and narrower, much more slenderly attenuate and even thinner and more translucent, with fewer cross-veinlets, the edges not distinctly serrulate, but wholly smooth except near the apex, or with some very minute or obscure denticulations: stem 1–1.25 mm. wide, the very thin translucent wings much narrower than in *H. serrulatus* and smooth-edged or nearly so: spathes not narrower than the stems, usually somewhat broader, the outer bract usually foliaceously prolonged, 30–47 mm. long, surpassing the inner one 10–25 mm., united-clasping 8–10 mm. above the sharply two-edged base: inner bract 17–22 mm. long, narrow, obtuse or emarginate: interior scales longer than in *H. serrulatus*, equaling the inner bract or nearly so: pedicels very slender and long-exserted, more or less spreading and finally recurved for about half their length, 25–37 mm. long: capsules 3–5, obovoid-oblong or somewhat pyriform, smaller and thinner-walled than in *H. serrulatus*, about 6–7 mm. long: seeds larger than in any other species of the genus at present known, 2–2.5 mm. in longer diameter, flattened acetabuliform, strongly reticulate-pitted.

LOWER CALIFORNIA, Sierra de la Lagura, January 24, some fruit mature. T. S. Brandegee, Herb. Cal. Acad. Sci.

Closely related to *H. serrulatus*, *H. cernuus* and *H. subcernuus* but unmistakably a distinct species, as clearly shown by its much larger seeds, longer outer bract and longer pedicels without regard to other characters. These four plants form a group of closely related species constituting a section of the genus rather obviously distinct from the more northern group represented by *H. Californicus*. The group characters especially to be noted are very thin membranous leaves showing cross-reticulations between the nerves, although these are few or obsolete in *H. cernuus* and *H. subcernuus*, more or less spreading or recurved pedicels and very thin-walled, mostly pyriform capsules.

Some Notes on Saxifraga and Primula

By K. M. Wiegand

Saxifraga bronchialis L.

Densely caespitose, glabrous : stems divaricately ascending, rather stout (4–9 cm. high, 1 mm. diameter), rarely purplish : leaves thick and firm, densely clustered at the base, 7–12 mm. × 1.75–2.5 mm., oblong-linear, not narrowed below, abruptly acute and white cuspidate, spinulosely ciliate to the apex or nearly so, cauline similar but much smaller (5–6 mm. × 1–1.5 mm.) : flowers few (1–7), in a flat-topped sparingly glandular cyme, on short (8 mm. or less) rather stout peduncles and sometimes in the larger plants appearing secundly racemose : calyx-lobes short-oblong or oblong-ovate (2–2.25 mm. long), obtuse or acutish : petals pale greenish-yellow, orange spotted below the middle (6.5 mm. × 2.75–3 mm.), broadly elliptical or oval, rounded at the apex, broadly unguiculate at the base : stamens equaling or slightly exceeding the corolla : ovary large and prominent, oblong-ovate : styles ⅔ the length of the ovary.

Across northern Siberia to Alaska.

Specimens examined : Emma Harbor (Capt. Scammon, West. U. Teleg. Exp. Exped. 1865–66) ; Plover Bay, lat. 64° (E. E. Smith, same Exped.) ; Disenchantment Bay (Funston, no. 91).

The specimens of *S. bronchialis* which have come to the herbarium from the far Northwest are so distinctly different in appearance from those commonly obtained upon the mountains of Idaho, Colorado and New Mexico that investigations were instigated to determine the significance of these differences. The numerous and marked differential characters given below leave no doubt that the two forms are specifically distinct.

The locality given by Linnaeus for this species was Siberia. No specimens from that country were available for this study, but the description given by Ledebour and others show that the Alaskan specimens are identical with the Asiatic.

The var. *chelerioides* Engler is found on the northwest coast, and differs from the type in being more delicate, with shorter more obtuse densely imbricated leaves, and smaller flowers, with smaller more nearly sessile petals.

Saxifraga austromontana sp. nov.

Densely caespitose, glabrous, the rootstocks densely scaly-bracted: stems divaricately ascending (7–18 cm. high, .75 mm. thick), slender, usually purplish: leaves thick and firm, crowded on the caudex (7–10 mm. × 1.5 mm.), linear oblong, slightly narrowed below, gradually acute or almost acuminate at the apex, terminated by a stout white bristle, shining, spinulose-ciliate from the base to within 1.5 mm. of the tip: cauline leaves much smaller, 4–6 mm. long, linear-subulate: flowers numerous, 4–12 or even more, on slender slightly glandular peduncles (4–10 mm. long), in a convex or often oblong open cyme, the lower sometimes quite distant: calyx-lobes 2 mm. long, ovate, obtuse, rarely apiculate, sparingly glandular: petals white, spotted with orange dots below the middle, and with deep-purple dots above, elliptic-oblong (5.5 mm. × 2 mm.), broadest just below the middle, obtuse at the apex, rounded and somewhat truncate at the base, not at all unguiculate: stamens $\frac{1}{5}$–$\frac{1}{4}$ shorter than the petals: ovary deltoid: styles very short, not over $\frac{1}{2}$ the length of the ovary.

Cascade Mountains of Washington to Alberta, and southward along the Rocky Mountains to New Mexico.

Specimens examined: Cascade Mts. (Lyall); Tunnel Mt., Alberta (W. C. McCalla, no. 2287 (1899)); Colorado (Parry, no. 168; Hall and Harbour, no. 197; Wolf, no. 802); New Mexico (Heller, no. 3775).

This species differs from *S. bronchialis* in its more subulate, darker green leaves, with fewer ciliae near the apex; more slender, often purple stems; many-flowered convex or oblong cymes, more slender pedicels; smaller, white petals with purple dots above, and not unguiculate at the base; stamens shorter than the corolla; and smaller capsules with much shorter styles. It probably includes all of the so-called *S. bronchialis* from the Rocky Mountains south of Alaska.

Primula Maccalliana sp. nov.

P. Mistassinica Hook. Bot. Mag. *t. 2973*. Not of Michx.

Low but not very slender (4–12 dm. high): leaves from broadly spatulate to obovate-cuneate, mostly quite broad, the larger usually sessile by a wedge-shaped base, the smaller rarely contracted into a short margined petiole, thick and rather fleshy, mostly glabrous and pale green above, more or less mealy beneath, obtuse or rounded, and crenate at the apex, entire below, 2–2.5 (rarely 3) cm. long: umbels 2–several-flowered, sparingly farinose: involucral bracts subulate, acute, 5 mm. long, somewhat dilated at the base and slightly auriculate; pedicels short and stout, about 4 (rarely 7) mm. long: calyx glabrous or nearly so, narrowly obconic, 4.75–5 mm. long, the lobes narrowly oblong-ovate or lanceolate, acutish, about one-half the length of the tube: corolla rather large, deep rich blue, rarely paler, not flesh-colored nor pink, orange eye large and conspicuous, tube yellow, scarcely exceeding the calyx, the lobes 5–6 mm. long, broadly obcordate, the base gradually, or more rarely abruptly contracted: fruit not seen.

Eastern slope of the Rocky Mountains in British America.

Specimens examined: "Along warm streams below the Sulphur springs," Banff, Alberta, altitude 4500 feet (W. C. McCalla, no. 2423 (1899)).

In the Botanical Magazine, *t. 2973*, Hooker figured a plant which he considered to be the true *P. Mistassinica* of Michaux. This plate was probably drawn from plants grown from seeds collected by Drummond and Richardson as these travelers were cited as having brought back seeds of this species on their return from the Canadian Northwest. The figure and the description leave little doubt that Mr. McCalla's plant is the one described by Hooker, and not the eastern plant of Michaux.

In general appearance *P. Maccalliana* resembles *P. farinosa* in the rather dense umbel, stouter habit and densely rosulate, pale, farinose, cuneate leaves; and seems to be somewhat intermediate between it and *P. borealis*. It differs from the former in its smaller size, nearly sessile short leaves, and much smaller calyx with proportionally longer more acute lobes. *P. borealis* is smaller and more slender with smaller narrowly spatulate long-petioled leaves, long-peduncled flowers, and subulate acutish calyx-lobes which are dark-purple spotted. *P. Sibirica* is much larger with slender-petioled leaves and longer calyx with short obtuse lobes, also dark-blotched.

From the eastern *P. Mistassinica* it differs quite markedly in its stouter habit, broader and more farinose leaves, short-pedicelled flowers, larger acute-lobed calyx, and large bluish, not pink or flesh-colored, corolla with tube scarcely longer than the calyx, and with a very prominent yellow eye.

P. Maccalliana is said by the present collector to be common in Alberta where it goes under the name *P. Mistassinica.* Doubtless it has a wide range in western British America. The mature capsule was not seen, but in Hooker's plate above referred to it is figured as being one third longer than the calyx.

CORNELL UNIVERSITY.

New and Noteworthy Northwestern Plants.—IV

By C. V. Piper

Amelanchier cuneata sp. nov.

Shrub about 2 meters high with dull grayish bark even on the branchlets; youngest twigs with a somewhat appressed white pubescence: leaves elliptic to obovate, few-toothed toward the obtuse apex, mostly attenuate to the more or less cuneate base, sparsely pubescent on each side when young, pale green, rather thin, 2–3 cm. long; petioles slender, a little shorter than the blades; stipules setaceous: racemes 10–20-flowered, the pedicels about 1 cm. long: calyx somewhat pubescent, the acute triangular-lanceolate lobes as long as the tube: petals oblanceolate, obtuse, 12 mm. long: stamens 20: fruit not seen.

In sage-brush land, Ellensburg, Wash., *C. V. Piper*, no. 2173, collected May 20, 1897.

Nearest *A. alnifolia* Nuttall, but easily distinguished by the pale twigs and cuneate leaves.

Potentilla gracilipes sp. nov.

Perennial, tufted: caudex stout, vertical, simple or branched above, 8–10 cm. long, 1 cm. in diameter, more or less covered with old petioles or pitted-scarred where they have fallen off: leaves densely imbricated at base, oblong in outline, pinnate of 9–11 leaflets or divisions, equally silvery sericeous on both sides, 4–6 cm. long; leaflets sessile, broadly cuneate, the lowermost entire, the other 3-cleft at apex, the lobes more or less unequal; petioles flattened, mostly concealed: peduncles few, 1-flowered, slender, pubescent, erect, 6–8 cm. high, bearing two bracts above, these ovate, sessile, acutish, simple or 3-lobed: flower 2–2.5 cm. in diameter: hypanthium rotate, appressed, pubescent, the calyx-lobes broadly ovate, acutish, 6–7 mm. long, the bractlets elliptic, much smaller: petals orbicular, short-clawed, bright yellow, 1 cm. long, well exceeding the calyx-lobes: stamens 50–60, the filaments glabrous, but with some villous pubescence at and near their bases: carpels numerous, densely silvery villous: styles terminal, as long as the carpel, more or less divergent: mature akenes not seen.

Face of north cliffs, Blue Mts., Oregon, at the head of Anthony's Creek, altitude about 8000 ft., in July, 1899, *W. C. Cusick*, no. 2246. Nearest *P. Breweri* Watson, but easily distinguished by its 1-flowered peduncles and villous carpels. Apparently it is the only North American species with pinnate leaves and strictly one-flowered peduncles.

Saxifraga Columbiana sp. nov.

Scapes rather stout, terete, erect, glandular, usually solitary from the caudex: leaves all radical, ovate to elliptic-oblong, obtuse, entire, the blades 2–6 cm. long, gradually narrowed into a somewhat shorter petiole: inflorescence a branched narrowly pyramidal cyme, the cymules rather dense: bracts lanceolate or linear: flowers 5–6 mm. in diameter on stout pedicels: calyx-lobes triangular ovate, obtuse, at length reflexed: petals whitish, elliptic or oblong, 1-nerved, slightly narrowed at base, shorter than the calyx lobes: filaments subulate, about equaling the petals: anthers pale yellow: carpels separate, divergent at apex.

Nearest *Saxifraga plantaginea* Small, which is a larger plant in every way. Both these species differ from others of the *integrifolia* group in that the petals are shorter than the calyx lobes. In the species here described the petals are very different in shape and size from those of *S. plantaginea.*

The following specimens have been examined:

WASHINGTON: Near Fort Colville, *Lyall* in 1861; "upper Oregon," *Geyer*, no. 625; Pullman, *Piper*, no 1508 (type).

IDAHO: Near Lewiston, *Sandberg*, *MacDougal* and *Heller*, no. 73, April 30, 1892; Clearwater River, *Spalding*.

OREGON: Union Co., *Cusick* in 1879.

Saxifraga apetala sp. nov.

Scapes stout, terete, erect, solitary, glandular pubescent, 1–2 dm. tall: leaves all radical, oval, oblong or ovate, obtuse, entire or obscurely denticulate, glabrous except the ciliate margin, the blade 1–3 cm. long, narrowed into a broadish petiole a trifle shorter: inflorescence dense, 1–2 cm. long: flowers very short-petioled, green: calyx-lobes broadly ovate or suborbicular, obtuse, erect, 2 mm. in length, the tube twice as long: petals wanting: stamens ten, the anthers pale yellow on subulate filaments nearly as long as the calyx-lobes: carpels disciform when young, the margin crenulate: mature fruit not seen.

The type is *G. R. Vasey's* no. 358, collected somewhere in Washington in 1889; the same plant has been found by *Whited* in the Kittitas Mts., twenty miles north of Ellensburg. The species is one of the *S. integrifolia* group and is easily distinguished by its apetalous flowers and long calyx-tube.

Saxifraga Idahoensis sp. nov.

Stems slender, erect, terete, glandular, 2–3 dm. high, usually several from a stout caudex: leaves all radical, the blades ovate, obtuse, coarsely dentate, 2–6 cm. long, abruptly contracted into a broad flat petiole as long as the blade, glabrous or with a few rufescent hairs on the margin and lower side: inflorescence a much-branched cyme, the branches assurgent: flowers numerous, 3 mm. in diameter, on slender strongly divaricate pedicels: bracts lanceolate or subulate: calyx-lobes ovate, obtuse, free nearly to the base, sharply reflexed even in early anthesis: petals white, orbicular, scarcely clawed, mostly 3-nerved toward the apex, not exceeding the calyx-lobes: filaments subulate, persistent, at length exceeding the petals: anthers pinkish: carpels free from each other, divergent above: the style short and stout.

All the specimens seen are from western Idaho.

"Clearwater," *Rev. Spalding.*

Island in the Clearwater above Lewiston, *Sandberg, McDougal* and *Heller*, no. 93, May 2, 1892.

Kendrick, *Henderson*, no. 2672, April 21, 1894, and no. 4588, April 26, 1897 [type].

Related to *S. occidentalis* Watson and *S. reflexa* Hook. Its nearly glabrous leaves, much branched inflorescence and small flowers easily distinguish it. Abnormalities in the structure of the flowers are of frequent occurrence.

Townsendia alpigena sp. nov.

Perennial, caespitose from a usually multicipital caudex, 2–4 cm. high: root stout, vertical: leaves numerous, clustered, spatulate, acutish, thickened at the margin, appressed strigulose when young, more or less glabrate at maturity, 1–2 cm. long: peduncles one or two bracted, 1 cm. high, hirtellous: heads solitary on the peduncles, 1–1.5 cm. in diameter, the involucre campanulate, of about three ranks of well-imbricated scales, these oblong, acute, scarious-margined, more or less pilose on the back, sometimes pink-tinged: rays 12–18, dark blue, linear, acute, 1 cm. long: pappus of the disk-flowers bright white, scabrous, multisetose, as long as the akene, that of the ray-flowers similar, but a trifle shorter: akenes flattened, those of the disk usually glabrous, except at the very base, those of the rays more hairy; hairs soft, as long as the width of the akene, many of them bidentate at apex, the teeth spreading or recurved.

Wallowa Mts., northeastern Oregon, 7000–8000 feet altitude, *W. C. Cusick*, no. 2294, collected July 31, 1899. The species is apparently nearest to *T. Arizonica* Gray.

ERIGERON CHRYSOPSIDIS Gray, Syn. Fl. **1**: 210. 1884

Erigeron ochroleucus hirtellus Gray, Proc. Am. Acad. **16**: 90. 1880.

The type sheet of this species contains the four following specimens from which the description in the Synoptical Flora was drawn up, namely:

"Mts. Oregon, Cusick, 1877." "Interior of Oregon, Nevins, 1877." "In stiff clay on mountain slopes, Rev. R. D. Nevins, 1877." "Stony hills, John Day's Valley, E. Oregon, May, 1880, Howell Bros." No. 200; also a fifth collection by Suksdorf, no. 349, "Plains, southwest of Morgan's Ferry, Yakima Co., Wash., June 7, 1884." This last specimen is the basis for the note in Syn. Fl. Supp. I., 447, 1886. It is clearly a different plant from the others, but agrees exactly with several later collections. A careful study of DeCandolle's description of *Chrysopsis hirtella*, Prodr. **5**: 327, leaves scarcely a doubt that the Douglas plant from the Columbia River there described is the same as the Suksdorf plant. This is discussed below. Of true *Erigeron Chrysopsidis*, Gray, excellent specimens have recently been distributed by *Mr. W. C. Cusick* under no. 2187, from the Blue Mts., Oregon. These specimens have leaves sometimes 8–10 cm. long, but always truly spatulate. The heads of this species are 2–3 cm. high, the rays 2 cm. long.

Erigeron Chrysopsidis brevifolius var. nov.

Densely caespitose, bearing scapes 4–6 cm. high: leaves 1–1.5 cm. long: heads 2 cm. high, the rays 1.5 cm. long, golden yellow.

Subalpine ridges of the Wallowa Mts., northeastern Oregon, 7000 ft. altitude, *W. C. Cusick*, no. 2270, July 27, 1899. Differs from the type in being smaller in every way and having relatively much shorter leaves.

✓ **Erigeron curvifolius** n. n.

Chrysopsis hirtella DC. Prodr. 5: 327. 1836.

Perennial with several or numerous branches from a woody caudex, 5–10 cm. high: root straight, simple: leaves not densely crowded, linear, entire, acute, sessile, more or less curved, 1.5–3 cm. long, 1–2 mm. wide, hirtellous with white hairs, the midrib broadened and whitish toward the base: flowering stems numerous, slender, appressed hirsute, scarcely exceeding the leaves, monocephalous, or rarely with a second smaller head: heads about 1 cm. high: involucre of 25–30 linear acuminate hispidulous bracts, all at length reflexed: rays 30–40, pale yellow, linear, 1 cm. long: achenes appressed hirsutulous; outer pappus of very short setae; inner nearly equaling the floret, which with the akene is 4 mm. long: receptacle with the alveoli wanting or very obscure, minute setae appearing in their places especially near the margin.

Readily distinguished from *E. Chrysopsidis* Gray by the much smaller heads and florets, very different leaves and by the receptacle not being alveolate.

It is a plant of the dry sandy plains of the Columbia and its habitat taken in connection with the linear leaves and peculiar receptacle renders it nearly certain that this plant, and not the subalpine *Erigeron Chrysopsidis* Gray, is the *Chrysopsis hirtella* of De Candolle.

The following specimens, all from Washington, have been seen viz.: Morgan's Ferry, Yakima Co., *Suksdorf*, June 7, 1884; Washtucna, *Elmer*, no. 1036, June, 1898; Pasco, *Hindshaw*, May 25, 1896; Pasco, *Piper*, no. 2993, May 25, 1899; Connell, *A. B. Leckenby*, June 18, 1897.

✓ **Pentstemon Gairdneri hians** var. nov.

Shrubby and decumbent below, the flowering shoots erect or nearly so, 2–3 dm. high, cinereous puberulent, or above glandular: leaves rather numerous, alternate, linear or linear-spatulate, sessile, acutish, revolute, more or less curved, ascending, 2–3 cm. long, 2 mm. wide: flowers 10–20, racemose or somewhat paniculate, rather strict; bracts lanceolate, acuminate, about 1 cm. long: calyx 1 cm. long, the lobes ovate, acuminate, subequal, free quite to the base, not equaling the corolla tube: corolla red, minutely glandular, 2.5 cm. long, tubular-funnelform, broadly dilated in the naked throat, bilabiate, the prominent lobes broadly rounded, subequal, widely spreading: stamens included in the tube of the corolla, the sterile filament pilose for the upper third; anther cells dehiscent the whole length and explanate: style about equal to the stamens, slightly exceeding the calyx lobes.

EASTERN WASHINGTON: *G. R. Vasey*, no. 432 in 1889 (type). Ellensburg, *Piper*, no. 2702. Wenatchee, *Whited*, no. 36. Tampico, *Flett*, nos. 1184 and 1187.

The original specimens of *Pentstemon Gairdneri* were collected in the Blue Mts., Oregon, by Douglas, and the species is well represented by *Cusick's* no. 1637, from that region. The variety is the commoner form in central Washington and is readily distinguished by its larger corolla with spreading limb and larger calyx lobes. Intergrading forms are not rare.

Pentstemon confertus globosus var. nov.

Erect, 2–3 dm. high, perfectly glabrous throughout, pale green: radical leaves oblong, acute, entire, 6–10 cm. long, attenuate into a petiole 1–2 cm. long; cauline leaves 3 or 4 pairs, the lower pair usually short-petioled, the others sessile, all similar to the radical but becoming broader upwards, the uppermost commonly ovate: inflorescence a dense head-like panicle of many short-pedicelled flowers, rarely with a second verticillate cluster below: calyx lobes nearly distinct, ovate-acuminate, narrowly scarious-margined, entire or obscurely dentate, nearly one half as long as the corolla: corolla intense blue, nearly 2 cm. long, tubular, bilabiate, the lower lip sparsely villous within, the lobes rounded, entire, subequal, one fourth as long as the tube: stamens included, the sterile bearded above the middle: anthers splitting their entire length but not explanate, the cleft ciliate margined.

Wallowa Mts., northeastern Oregon, altitude 6000–7000 ft., *W. C. Cusick*, no. 2328, Sept. 1, 1899.

Strikingly different from *P. confertus* Dougl. or any of the numerous forms of var. *coeruleo-purpureus* Gray, but lacking any distinct morphological characters. Except for the perfectly glabrous inflorescence, it would be referred rather to *P. attenuatus* Dougl., its flowers being fully as large as in that plant.

Pentstemon Newberryi rupicola var. nov.

A much-branched densely caespitose decumbent shrub, 5–8 cm. high, pilose-puberulent below, the inflorescence glandular-viscid: leaves numerous, opposite, ovate or orbicular, more or less dentate, obtuse, glaucous, with a persistent bloom, thick, not turning black in drying, .5–1 cm. long, attenuate at base into a short petiole: flowers 3–6 in a rather close corymb: bracts of the peduncles ovate or orbicular, entire, obtuse, retuse or acute, about 4 pairs: calyx lobes distinct, equal, ovate, acute, ciliate, glandular, about 7 mm. long: corolla 3 cm. long, bright rose crimson, naked in the throat, decidedly ventricose, somewhat bilabiate, the lobes oblong, obtuse, rather short: fertile anthers barely extruded, white-woolly: sterile filament short, glabrous.

Dry rocky cliffs, Mt. Rainier, 7500 ft. alt., *Piper*, no. 2086 (type); Goat Mts., Wash., 3000–6000 ft. alt., *Allen*, no. 130.

This plant is very different from *P. Newberryi* Gray in its depressed habit, thicker leaves and larger ventricose corolla. I should not hesitate to call it a species were it not for the fact that on Mt. Adams occurs a very similar plant, but with the tubular corolla of *P. Newberryi*, and thus forming a transition to it.

Castilleia rustica sp. nov.

Stems erect, apparently from a decumbent woody base, simple, or more commonly with erect branches, minutely white pubescent throughout and somewhat glandular above: leaves narrowly lanceolate, rather few, sessile, mostly entire: bracts 3–5-cleft, only the lower exceeding the flowers, greenish: spike dense, 2–8 cm. long: calyx 10 mm. long, short-villous, equally cleft before and behind, the segments somewhat shorter than the tube, each divided half way into similar triangular acuminate teeth: corolla greenish-yellow, 15 mm. long, glandular-puberulent above, the blunt galea more than half as long as the tube; lower lip very small, one-fourth as long as the galea, saccately 3-lobed, the free portions acute, one third as long as the saccate enlargements: stigma capitate, protruding: stamens included.

Rocks of the Wallowa River, northeastern Oregon, 6000 ft. alt., *W. C. Cusick*, collected August 7, 1899. A homely species with some affinity to *C. Lemmoni* Gray.

Castilleia rubida sp. nov.

Decumbent, 2–10 cm. high, the numerous simple stems from a stout woody caudex which is continued into a long tap-root: stems and leaves pubescent with short white crisp hairs and also minutely and densely glandular, especially in the inflorescence: leaves sessile, linear or lanceolate, entire or more frequently 3-cleft or 3-parted, 1–2 cm. long; bracts similar to the upper leaves, 3–7-cleft, mostly tinged with dull purple: flowers in a short dense spike: calyx tubular, more or less villous, 1 cm. long, equally cleft before and behind, the segments one half as long as the tube, each again deeply cleft so that the four triangular acuminate calyx-lobes are subequal: corolla greenish except the margins of the galea and the lower lip which are dull purplish, tubular, minutely glandular, 12 mm. long, the blunt galea only one third the length of the tube, slightly exceeding the saccately 3-lobed lip, the free portions of which are oblong, obtuse, and slightly longer than the ventricosities, each of which bears two smaller swellings on its summit: anthers orange-yellow, slightly extruded: stigma capitate, 2-lobed, extending beyond the galea.

Wallowa Mts., northeastern Oregon, 9000 ft. alt., *W. C. Cusick*, no. 2094, collected August 23, 1898, and again July 28, 1899. The 1898 plant was distributed as "*Castilleia Lemmoni* Gray?" to which the new species has some relation. The calyx and corolla are, however, very different.

Castilleia angustifolia Whitedii var. nov.

Stems clustered on a woody caudex, erect, 2–3 cm. high: leaves all entire, lanceolate, 2–3 cm. long; bracts broader than the leaves, the uppermost 3-lobed; otherwise as in the type.

Wenatchea, Wash., Kirk Whited, no. 1141, collected June 11, 1899. Particularly interesting as being markedly different from all its immediate allies in having entire leaves.

Salix bella sp. nov.

Shrub 2–4 meters high with slender erect stems, the bark gray and smooth: branches erect or little spreading; branchlets shining, yellow, very brittle, glabrous or sometimes puberulent, slightly glaucescent: leaves lanceolate or oblong, or oblong-obovate, mostly acute, 3–6 cm. long, or on vigorous young shoots even 12 cm. long, about one fourth as wide, above green and sparsely appressed puberulent, beneath velvety with a persistent silvery tomentum, entire or obscurely repand-crenulate; midrib yellow, conspicuous, bearing about 15 pairs of primary veins, stipules commonly present, free, lunate, acute, .5 cm. long or less: aments sessile, appearing before the leaves, or the pistillate sometimes on a very short peduncle that bears 2 or 3 small leaves: pistillate aments stout, oblong, 2–3 cm. long, or in fruit 4–6 cm., densely flowered; scales black, persistent, oblong, obtuse, 1.5 mm. long, villous with white hairs twice as long; capsules narrowly and somewhat angularly pyriform, attenuate, acute, grayish-sericeous, 6–7 mm. long, including the style: style 1.5 mm. long: stigmas thick, glandular, broad, entire or two-lobed or cleft; pedicel 1–2 mm. long: nectary small, one half as long as the pedicel: staminate aments 1–2 cm. long, densely flowered; scales black, ovate, usually acute, persistent, 2 mm. long, densely villous with long tawny hairs: stamens 2, usually unequal, twice as long as the scale: filaments free: anthers yellow: nectary small, about one fourth as long as the scale.

First detected near Garrison, Whitman Co., Wash., by Prof. L. F. Henderson. In this place only a dozen or more plants occur, but the species is abundant along the north fork of the Palouse between Colfax and Palouse, Wash., and along the Potlatch River near Collins, Idaho; also at Jansville, Idaho.

This species is one of the obscure *Salix pellita* group and apparently the only one of which complete material has been collected. Its relationship is with *S. candida*.

From *S. pellita* and at least so far as the Lyall type specimen is concerned, *S. bella* differs in these important particulars: the pistillate aments are sessile or nearly so; the capsule is smaller and more sericeous; the scale is black, obtuse, long villous instead of brown, acute, and sparsely pilose; and the stipules are well developed. The leaves too are quite different.

Salix subcoerulea sp. nov.

Shrub about 2 meters high: branchlets dark, glabrous, bluish with a bloom that easily rubs off: leaves oblong-lanceolate, occasionally oblanceolate, acuminate, acute at base, entire or obscurely crenulate, above green and minutely pubescent, beneath silvery appressed pubescent but scarcely tomentose, 2–5 cm. long, 1 cm. wide; pedicels short, about .5 cm. long: stipules obsolete: pistillate aments appearing with the leaves, pedunculate, usually with one or more small leaves at base, 2.5–4 cm. long, less than 1 cm. thick, erect, straight or cernuous: capsules short-pedicelled, pyriform, silvery sericeous, 2–3 mm. long, tipped with a slender yellow style 1 mm. long: stigmas thick, usually 2-lobed: scales black, ovate, obtuse, about 1 mm. long, sparsely pilose, with white hairs of the same length: pedicel about 1 mm. long, twice as long as the nectary: staminate aments unknown.

OREGON: Powder River Mts., in wet meadows near the head of Eagle Creek, *Cusick*, no. 1302, *Piper*, no. 2533: also near the head of Anthony Creek, *Cusick*.

CALIFORNIA: Donner Pass, *Torrey*, no. 489, in 1865. Near Mineral Spring, Sierra Nevada, *Coville* and *Funston*, no. 1427.

These California specimens are imperfect and are somewhat doubtfully referred to the species here described.

Evidently related to the above, but with nearly the foliage of *Salix macrocarpa* Nutt.: it differs from *S. bella* further in having pedunculate pistillate aments, smaller capsules, with the scales short-villous, and no stipules: from *S. pellita* the capsules and scales, as well as the foliage clearly separate it.

A new Species of Globulina

BY H. HASSELBRING

Among the parasitic fungi collected at Ithaca during the summer of 1898, an interesting plant bearing a remarkable resemblance to the members of the genus *Erysiphe* was found on leaves of *Antennaria plantaginifolia*. The resemblance, however, is restricted to the habit and superficial appearance of the plant. Microscopic examination at once shows it to belong to a widely different group.

The perithecia are brown and membranaceous, and possess a distinct ostiolum. This at once excludes the plant from the *Perisporiales*. The color of the perithecia might at first lead us to place the plant in the *Sphaeriales*, but other, less artificial characters point to the *Hypocreales* as the proper systematic place for the plant in question. As has been said the perithecia are thin and membranaceous, not carbonaceous as in the *Sphaeriales*. The spores are very slender and filiform, and easily break into shorter portions at the septa. This condition is rare among the *Sphaeriales*, but preëminently characteristic of certain groups of the *Hypocreales*. On account of these characters together with the superficial *Erysiphe*-like habitat of the plant its proper position seems to be in the genus *Globulina* Speg., although it differs in certain characters which will be mentioned below.

Up to the present time two species of *Globulina* are known. The first, *G. erysiphoides*, Speg. was described on leaves of Compositae from Brazil. Spegazzini indicates the peculiar habit of the plant by the specific name which he gave it. *G. Ingae* Pat. occurs on leaves of *Inga pachycarpa*, a leguminous plant from Ecuador. The genus *Globulina*, based upon the first species, is described as lacking the ostiolum, but Lindau questions this fact. The perithecia are colored, and paraphyses are said not to be present.

In view of these facts the present species is peculiarly interesting. It is the first northern species of the genus, and like the Brazilian plant occurs on the leaves of a composite. It has the habit of an *Erysiphe*, the perithecia being superficially seated among the leaf-hairs, with threads of mycelium interwoven among the hairs. The plant differs however, in having brown not brightly colored perithecia with a distinct ostiolum at the apex, and in hav-

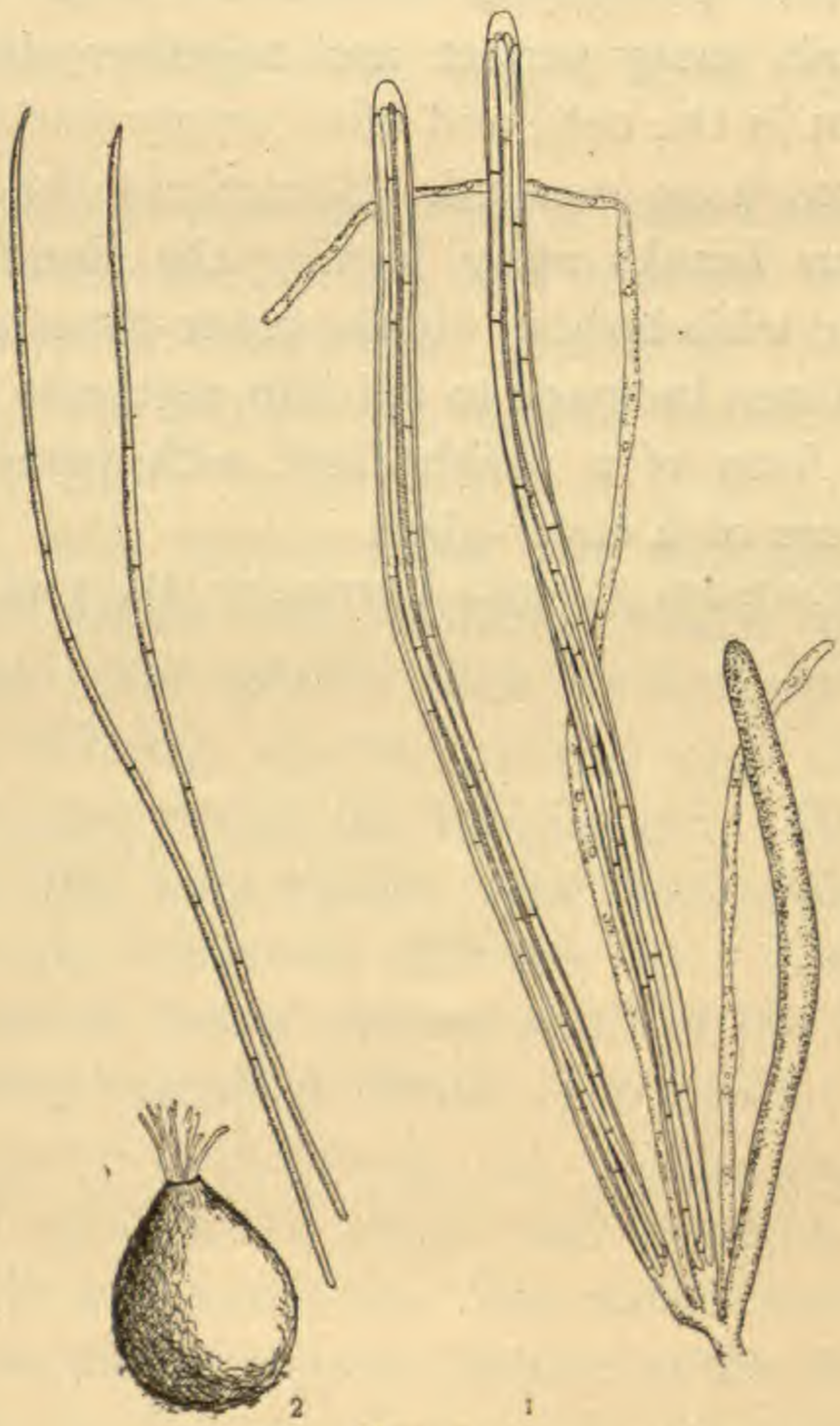


FIG. 1.

ing paraphyses. With these exceptions, some of which are doubtful on account of the imperfect knowledge of the genus, the plant agrees with the characters of *Globulina* of which it must be considered an undescribed species.

Globulina antennariae sp. nov.

Perithecia superficial, scattered, ovate or pyriform, brown membraneous, having a distinct ostiolum: asci cylindrical, slightly narrowed at the ends, mostly somewhat curved, $90–120 \times 4–5\ \mu$; paraphyses flaccid, usually longer than the asci: spores very slender and filiform, septate, hyaline, $90–105\ \mu$ long, easily breaking into shorter segments.

A plant having the habit of *Erysiphe*. On leaves of *Antennaria plantaginifolia* Hook. Ithaca, N. Y.

The accompanying cut shows the general appearance of the asci and spores. The asci are born in tufts on the ends of branched fertile hyphae with paraphyses intermixed with them. These tufts often contain many perfect asci together with some immature ones (shown in the cut), and often empty broken shells from which the spores have escaped. Sometimes the upper half or more of an ascus breaks away, leaving the slender spores protruding like long whip lashes. If the cover-glass is tapped gently they may sometimes be made to fall into segments. Fig. 2 of the cut shows the form of a perithecium, with paraphyses exuding under the pressure of a cover-glass.

BOTANICAL DEPARTMENT, CORNELL UNIVERSITY, March 16, 1900.

Proceedings of the Club

WEDNESDAY EVENING, MARCH 28, 1900

Vice-President Allen in the chair; about 270 persons were present.

Two resignations were accepted, of Miss Oline M. Ewing and of Mrs. D. P. Kingsford. One new member was elected, Mrs. Isaac Harris, 125 St. Marks Place, Brooklyn, N. Y.

The evening was devoted to a popular lecture on the "Autumn Wild Flowers" native to the vicinity of New York City, by Mr. C. Van Brunt, with lantern-slides, and included not only wild flowers, but also marsh views, autumnal foliage, and tracts of reddened samphire. The speaker took his audience to the Hackensack marshes, showing cat-tail, pickerel-weed, *Sagittaria*, *Coreopsis*, *Miloania*, sneezeweed, the lobelias, etc. Then the marshes about Jamaica Bay were visited, with beach-goldenrod, dodder, *Sabbatia*, *Gerardia*, *Lacinaria*, *Hibiscus*, etc. The weeds surviving about a deserted house yielded some of the most interesting pictures, showing magnified details of burdock, catnip, motherwort, matrimony-vine, knotweeds, etc. Other flowers shown included several goldenrods, asters and gentians, with fruits of milkweeds, holly and *Smilacina*. The series closed with rich displays of color in the herbaceous borders at the Botanical Garden at Bronx Park.

TUESDAY EVENING, APRIL 10, 1900

President Brown in the chair; twenty persons were present.

Four resignations were reported and accepted, those of Mr. Morris E. Leeds, Dr. Jerome B. Thomas, Jr., Mr. F. Wayland Fellowes, Miss Harriet M. Denison. Two new members were elected, Miss Martha Bunting, 36 E. 12th St., Miss Amy Schüssler, 474 W. 150th St.

On motion of Dr. Underwood, the Club nominated Dr. M. A. Howe as its candidate for the Newberry award for this year.

Dr. Britton called special attention to the Torrey Club excursion next Saturday to the Botanical Garden and the opening of the Saturday afternoon lecture course on that day. The progress of vegetation there now seems about two weeks late.

Dr. Underwood reported the acceptance by the Editorial Board of a paper on certain Powdery Mildews, being a monograph of the genus *Erysiphe*, by Mr. E. S. Salmon, of the Kew Gardens, London. This will form one of the forthcoming Memoirs of the Torrey Club and its expense has been guaranteed without charge to the Club. A large part of the Memoir is based on American material.

The paper of the evening was by Professor F. E. Lloyd, "Studies in the genus *Lycopodium*." Professor Lloyd discussed the distinguishing characters of the North American species, with reference to structure and habit. Two new species were recognized in this review of the genus. One group of species is remarkable for greater variation here than in Europe, producing five species here and one there; including here *L. inundatum* and its var. *Bigelovii*, *L. adpressum*, *L. alopecuroides* and *L. pinnatum*. The type-specimen of *L. pinnatum* of this group was exhibited. These species develop toward the close of the season a strong, starchy thickening of the growing end of the stem. This serves as a basis of growth the next spring. Professor Lloyd also restored the long-forgotten species *L. Sitchense*, which has 5 rows of leaves, but has been confused with the 4-rowed species, *L. sabinaefolium*.

Dr. Underwood followed, remarking on the general distribution of *Lycopodium*, about 94 species or perhaps properly about 120; of which 12 are North American; perhaps 21 are peculiar to the Andes, and with them grow many others which extend into Mexico or Guiana; about 8 are peculiar to Madagascar, 4 to India, etc.; mostly in mountain regions. *L. cernuum* probably encircles the world in the tropics. The local distribution along Atlantic America is peculiar, *L. alopecuroides*, reported from New England, cannot be traced by accessible specimens north of Long Island. The sprawling and arching habit of this species with spongy interior and caterpillar-like or foxtail-like exterior gives it a very peculiar effect. Dr. Underwood also described his discoveries of *L. porophilum* in Kentucky, Wisconsin, Alabama, etc.

The Secretary raised the question of the distribution of *L. annotinum*, which is present in the Adirondacks, Catskills and

Palisades, and forms compact areas in the Pocono; but has been searched for westward in New York without success.

Dr. Britton spoke of the interest attaching to *L. porophilum* as growing on sandstone rocks. Plants on sandstone rocks which have been attributed to *L. Selago* should be reëxamined with this in mind. Still another form on the sandstones of the Shawangunk also deserves further investigation. Miss Sanial reported collecting five species in or close to New York City.

Dr. Britton referred to a Japanese Witchhazel flowering April 1st at the Botanical Garden, *Hamamelis arborea*, with thorny, pinkish yellow flowers with dark central eye formed by the claret-colored calyx. It has been cultivated at Kew since 1875.

Adjournment followed.

EDWARD S. BURGESS,
Secretary.

WEDNESDAY EVENING, APRIL 25, 1900

Vice-President Allen in the chair; seventeen present.

Two new members were elected: Mrs. William Walter Clark, 27 W. 26th St., New York City; Mr. William L. Fisher, St. Paul's School, Garden City, N. Y.

Dr. Britton suggested that the meeting of the club be held at the home of Dr. Allen, at Litchfield, Conn., during the evening of May 30th; on motion it was determined to do so.

Dr. Britton also proposed that the meeting of May 8th be held in the lecture hall of the Museum Building at the New York Botanical Garden at 4:30 o'clock in the afternoon. On motion the proposition was carried.

The paper of the evening was by Mr. David Griffiths, "Some Saprophytic Fungi." Mr. Griffiths described the mechanical devices employed by the genera of the Pyrenomycetes for the distribution of their spores. The genera discussed were *Podospora*, *Sordaria*, *Deletschia* and *Sporosmia*.

Miscellaneous notes followed. Dr. Underwood exhibited specimens of *Helonias bullata* and *Epigaea repens*, both collected near Metuchen, N. J.

Dr. Britton remarked on the Japanese species of *Pachysandra* then blooming at the New York Botanical Garden, and called attention to the striking similarity between the fragrance of its flowers and those of *Epigaea repens.*

J. K. SMALL, *Secretary, pro tem.*

TUESDAY AFTERNOON, May 5, 1900

The meeting was held in the lecture hall of the Museum Building at the New York Botanical Garden. Dr. Britton presided; twenty-seven persons were present.

The lecture of the afternoon was by Dr. M. A. Howe. The subject was "The Hepaticae." The term Hepaticae was used in a restricted sense, excluding the Anthocerotes. After a few introductory remarks in regard to the position occupied by the Hepaticae in the vegetable kingdom, the speaker reviewed the life-history of a few of the typical forms, the principal details of structure being exhibited by aid of lantern slides. The slides also showed the habit characters of various local species and of some from the Pacific coast.

J. K. SMALL, *Secretary pro tem.*

WEDNESDAY EVENING, MAY 30, 1900

The meeting was held at Hazelwood, the residence of Vice-President Dr. T. F. Allen, near Litchfield, Conn., subsequent to a field excursion arranged by Dr. Allen, in the vicinity of Litchfield, the Club being his guests from May 29th to May 31st.

Dr. Allen in the chair and sixteen members present.

In the absence of the Secretary, Dr. N. L. Britton was elected Secretary *pro tem.*

The minutes of the meeting of May 8, 1900, were read and approved.

Messrs. F. L. Montgomery and E. A. Colby, duly recommended by the Committee on Admissions were elected active members of the Club.

The resignations of Mrs. Charles M. Kirby, Dr. Leon Labonde and Miss Mathilde E. Sutro were presented and accepted.

It was resolved that the regular meetings of the second Tuesdays in October and November be held at the Museum Building of the New York Botanical Garden at four o'clock P. M.

Professor Lloyd called attention to the occurrence of nectaries * on the leaves of *Pteridium aquilinum*. The glands are found on the rachis, one below the insertion of each pinna, and may be recognized as modified oval areas covered by a dark red epidermis. The color is due to the presence of matter dissolved in the sap, and is found also in lines running up and sometimes down the rachis from the glands. These are very active during the rapid growth of the frond, their activity ceasing on the attainment of maturity. The secretion, which is very abundant, is formed independently of bleeding pressure, and the fluid is thick and syrupy. So rapidly does it accumulate that one may notice the increase in the size of the drops with a hand lens. The secretion escapes through modified stomata similar in form to the water-stomata of *Tropaeolum*. The glandular tissue beneath extends deeply into the cortical mass of the petiole ; its cells are small and contain chlorophyll.

Small ants, and one honey-gathering dipterous insect were noticed visiting the glands ; none were seen to be gnawed by the insects. As Francis Darwin observed, the plant has few natural enemies or none, and the interpretation must be sought in the internal economy of the plant, probably in connection with nutrition. The abundant excretion of sugar may be a carrier of or an accompaniment to the excretion of some harmful substance. It is noteworthy that up to the present time no other pteridophyte has been reported to be possessed of nectar-secreting organs. The plants on which the observations were made grew near Bantam Lake, Litchfield, Conn.

Dr. Britton remarked on a young tree of the Swamp Spruce, *Picea brevifolia* Peck, found during the day in a sphagnum bog near Litchfield, and stated that this was probably the most southern known station for this species in New England. The short glaucous leaves and nearly glabrous twigs readily distinguish this tree from the Black Spruce, *P. Mariana*.

Mrs. Britton exhibited specimens of the red-flowered Columbine of the Litchfield region, and remarked on its growth in open fields and the pubescent character of the plant, differing in these features from the plant of the vicinity of New York, which inhabits

* Described briefly by Francis Darwin ('77), and later by Figdor ('91).

rocky ledges and is nearly or quite glabrous. She noted that the pubescent plant is also abundant in fields on the Pocono plateau of Pennsylvania.

A vote of thanks was tendered to Dr. Allen for his most generous and agreeable hospitality.

N. L. BRITTON,
Secretary pro tem.

Hollick, A. A Report on a collection of Fossil Plants from north-western Louisiana. Geol. Surv. La. Rept. **1899**: 276–288. *pl. 32–48.*

New species in *Quercus*, *Artocarpus*, *Ficus*, *Toxylon*, *Cryptocarya*, *Celastrus*, *Andromeda* and *Apocynophyllum*.

Hume, H. H. A new species of *Puccinia*. Bot. Gaz. **29**: 352–353. 25 M. 1900.

Jenman, [G. S.]. *Asplenium Fawcettii* n. sp. Gard. Chron. III., **26**: 121. 12 Au. 1899.

From Jamaica.

Knowlton, F. H. Fossil Plants Associated with the Lavas of the Cascade Range. Ann. Rept. U. S. Geol. Surv., 1898–99, 20^3, 37–64. *pl. 1–6.* 1900.

New species in *Acrostichum*, *Pinus*, *Juglans*, *Quercus* (4), *Ulmus*, *Ficus* (2), *Benzoin*, *Cinnamomum*, *Laurus* and *Phyllites* (2).

Kurtz, F. Sobre la existencia de una Dakota-Flora en la Patagonia Austro-Occidental. Revista del Museo de la Plata, **10**: 1–18. 1899.

New species in *Araucarites*, *Abietites* and *Perseophyllum*.

Nelson, A. Correction in *Aragallus*. Erythea, **7**: 189, 190. 20 Je. 1900.

Robinson, B. L. *Sebastiana* (?) *bilocularis* Wats. Erythea, **7**: 189. 20 Je. 1900.

Rowlee, W. A., & Nichols, S. P. The Taxonomic value of the staminate Flowers of some of the Oaks. Bot. Gaz. **29**: 353–356. 25 M. 1900. [Illust.]

Smith, R. W. The Structure and Development of the Sporophylls and Sporangi of *Isoetes*. Bot. Gaz. **29**: 312. *pl. 1.* 25 M. 1900.

White, D. Fossil Flora of the Lower Coal Measures of Missouri. Monogr. U. S. Geol. Surv. **37**: I–XI; 1–467. *pl. 1–73.* 1899.

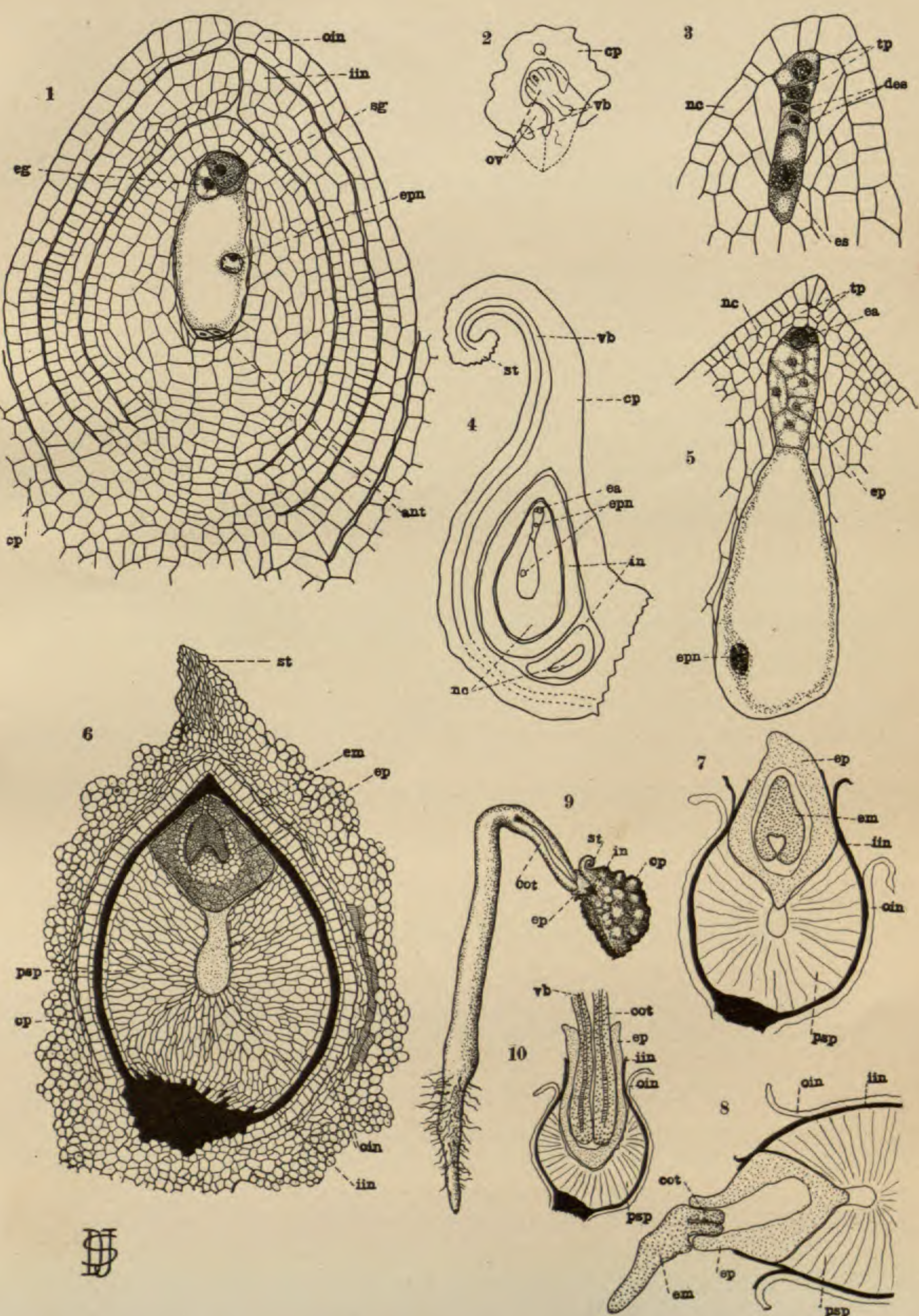
New genus *Brittsia*, and new species in *Eremopteris*, *Mariopteris*, *Sphenopteris* (8), *Oligocarpia*, *Alethopteris* (2), *Pecopteris* (2), *Aphlebia*, *Linopteris*, *Cyclocladia*, *Sphenophyllum*, *Lepidodendron*, *Lepidophloios*, *Lepidophyllum* (2) and *Taeniophyllum*.

Ward, F. Description of a new genus and twenty new species of fossil cycadean trunks from the Jurassic of Wyoming. Proc. Wash. Acad. Sci. **1**: 253–300. *pl. 14–21.* F. 1900.

New genus *Cycadella* and 20 new species.

Ward, F. With the collaboration of Walter P. Jenney, Wm. M. Fontaine and F. H. Knowlton. The cretaceous Formation of the Black Hills as indicated by the fossil plants. Ann. Rept. U. S. Geol. Surv. 1897–98, 19^2: 521–946. *pl. 57–172.* 1899.

Webster, H. [Note on] *Peziza rapulum* Bull. Rhodora, **2**: 106. My. 1900.



JOHNSON ON SAURURUS.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—and Hon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Subscriptions and remittances should be sent to 41 North Queen street, Lancaster, Pa., or Bronx Park, New York City.

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–5, 449 pp, 3 maps, and 12 plates, 1896–1900. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. 1. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of 163 new species. ix + 492 pp. Roy. 8vo, with detailed map. Price to members of the Garden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg.

No. 3. The dichotomous *Panicums*: some new Species by Geo. V. Nash.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg.

No. 5. Studies on the Rocky Mountain Flora I, by Dr. Per Axel Rydberg.

No. 6. Notes and Descriptions of North American Plants I and II, by Dr. J. K. Small.

No. 7. Vegetative Reproduction and Multiplication in *Erythronium*, by Frederick H. Blodgett.

All subscriptions and remittances should be sent to

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

PUBLICATIONS OF THE TORREY BOTANICAL CLUB.

(1) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates. Price $2.00 per annum. For Europe 10 shillings. Dulau & Co, 37 Soho Square, London, are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898), are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(2) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume 1, No. 1.—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume 2, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. 3. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. 4. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents.

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No. 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. 5. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S. Price, $3.00.

Vol. 6. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*) With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. 7.—The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol. 8. No. 1, Part 1.—The Comparative Embryology of the Rubiaceae. With four plates. By Francis Ernest Lloyd. Price, 50 cents.

---

(3) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

Address: **L. M. UNDERWOOD,**
COLUMBIA UNIVERSITY, NEW YORK CITY.

VOL. 27 AUGUST, 1900. No. 8

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street, New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

Vol. 27 No. 8

BULLETIN

OF THE

TORREY BOTANICAL CLUB

AUGUST 1900

Notes on the Flora of South Georgia

Roland M. Harper

During the summers of 1895, 1896 and 1897 I devoted most of my time to botanizing in and around Americus, the county seat of Sumter County, Georgia, which was my home at that time. As this region is almost unknown to botanists, I had excellent opportunity to observe many little-known or otherwise interesting plants, some of them far out of their accredited ranges.

Sumter County is situated in the western part of that section known as South Georgia, which includes about 64 counties, with an area of 35,000 square miles, or over half the area of the State. South Georgia is sharply defined both geologically and topographically from the older sections of the State, especially from Middle Georgia, which adjoins it on the northwest. It varies in elevation from sea-level to about 600 feet, and contains three distinct geological formations. Of these, the Cretaceous is represented by a narrow wedge-shaped area in the northwestern portion, and the Quaternary by a narrow strip along the coast and larger rivers, while the remainder belongs to the Tertiary formation.

Sumter County, as far as known, lies entirely in the Tertiary, though its northwestern corner approaches within a short distance of the Cretaceous. The predominating soil in Sumter County, as throughout South Georgia, is sand, generally mixed with more or less clay, organic matter, or marl ; the latter being principally confined to the vicinity of the Flint River, on the eastern border of the county.

[Sept. 6, 1900.]

The average annual temperature of Americus is 68° F., with the following averages for the four seasons: spring, 68°; summer, 81°; autumn, 69°; winter, 54°. The average rainfall is for spring, 13 inches; summer, 16; autumn, 8; winter, 10; total for the year, 47. It will be noticed that over one third of the total annual precipitation occurs in the summer, a fact which, no doubt, has its effect on the character of the flora.

Of the numerous floral and agricultural regions into which South Georgia is divided, I have noticed but two principal ones in Sumter County: the red-clay hill region and the pine-barren region. The former seems to correspond with the Lower Eocene formation and the latter with the Middle Eocene. The red-clay hills form a belt extending across the northwestern part of the county, and consist of low, rounded ridges, with broad valleys between them. The pine-barrens are in the southeastern part, and are almost perfectly level throughout. Both regions, like the whole of South Georgia, are characterized by the scarcity of surface rocks, the few that do occur being in the form of small boulders or pebbles.

The city of Americus lies near the dividing line between these two regions, so that I had equal facilities for studying both. With the exception of two trips into Dooly County, on the east, and one each into Schley and Macon Counties on the north, my botanical operations during these three summers were confined to Sumter County. This vicinity is remarkable for the large number of coast plants which here reach their inland limits, 125 miles from the Gulf coast and about 200 from the Atlantic. The region I explored is nearly all north of lat. 32° N. and west of long. 84° W., and at a higher altitude and, of course, farther inland than any point in Florida.

In a preceding number of the BULLETIN I have mentioned the great difference between the floras of Middle and South Georgia. Probably less than one half of the species of spermatophytes in Clarke County are common to Sumter County. On comparing the two floras we find the same kind of differences between them as are said to exist between temperate and tropical regions. In South Georgia the species seem to be more numerous and the individual plants fewer and farther apart (this is especially noticeable in the case of the grasses); there are more evergreen trees and shrubs and fewer evergreen herbs; and there are more species of climbing plants and epiphytic spermatophytes. Comparing the representation of various families in the two regions, we find in South Georgia more species of Cyperaceae, Orchidaceae, Nymphaeaceae, Magnoliaceae, Leguminosae, Euphorbiaceae, Aquifoliaceae, Rhamnaceae, Malvaceae, Hypericaceae, Melastomaceae, Onagraceae, Halorrhagidaceae, Loganiaceae, Gentianaceae, Asclepiadaceae and Rubiaceae; and fewer species of Cupuliferae, Caryophyllaceae, Ranunculaceae, Cruciferae, Crassulaceae, Saxifragaceae, Rosaceae, Violaceae, Cornaceae and Labiatae. To illustrate the deficiencies in some of the latter families, I will mention that I have found the Caryophyllaceae (exclusive of Illecebraceae) and Cruciferae represented only by a few weeds, the Ranunculaceae only by two or three species of *Clematis*, and the Saxifragaceae only by the shrubby genus *Itea*, with a single species.

The flora of South Georgia, at least of that part of it which I have explored, seems to be more highly differentiated into plant-communities than that of Middle Georgia. I have recognized twelve or fifteen distinct floral areas in Sumter County alone, and this number could no doubt be considerably increased by careful study. The plants of this region seem to be more exacting in their requirements for perfect development than those of colder climates, hence there is very little intergradation between the various plant-communities.

I will mention first the strictly aquatic plants, which inhabit ponds and streams, either floating free or rooting in the mud. These are found mostly in artificial mill-ponds, for natural ponds in this region are very small and few and far between. The following aquatics have been observed in Sumter County:

Potamogeton diversifolius Raf.
lonchites Tuckerm.
Eleocharis interstincta (Vahl) R. & S.
Lemna minor L.
Brasenia purpurea (Mx.) Caspary.
Castalia odorata (Dryand.) Woodv. & Wood.
Myriophyllum heterophyllum Mx.
Limnanthemum lacunosum (Vent.) Griseb.
aquaticum (Walt.) Britton.
Utricularia inflata Walt.

Most of the above I have found in only one or two localities each. It may be of interest to note that *Limnanthemum aquaticum* may be either a rooting or a floating plant. It seems to make no difference to the plant whether its petioles are attached to the rootstock or not, for I have found the plants in great abundance crowded together along the shore of a pond and floating free, with their petioles broken off below the inflorescence, but with flowers open as usual.

In wet ditches and open muddy places I have found the following species:

Sparganium androcladum (Engelm.) Morong.
Sagittaria latifolia Willd.
Paspalum distichum L.
Dulichium arundinaceum (L.) Britton.
Eleocharis obtusa (Willd.) Schult.
Carex lupulina Muhl.
Orontium aquaticum L.
Polygonum hydropiperoides Mx.
Hypericum mutilum L.
Jussiaea decurrens (Walt.) DC.
Jussiaea leptocarpa Nutt.
Ludwigia alternifolia L.
glandulosa Walt.
Isnardia palustris L.
Proserpinaca palustris L.
Hydrocotyle umbellata L.
Cynoctonum Mitreola (L.) Britton.
Micranthemum orbiculatum Mx.
Utricularia macrorhyncha Barnhart.

The following are found in alluvial woods and swamps and on muddy banks of creeks and rivers subject to overflow:

Botrychium obliquum Muhl.
Polypodium polypodioides (L.) A. S. Hitchcock.
Taxodium distichum (L.) L. C. Rich.
Juniperus Virginiana L.
Sabal glabra (Mill.) Sarg.
Arundinaria macrosperma Michx.
Scirpus divaricatus Ell.
Rhynchospora corniculata (Lam.) Gray.
Carex folliculata australis Bailey.
Peltandra Virginica (L.) Kunth.
Tillandsia usneoides L.
Commelina hirtella Vahl.
Iris versicolor L.
Habenaria flava (L.) Gray.
Saururus cernuus L.
Populus deltoides Marsh.
Carpinus Caroliniana Walt.
Quercus lyrata Walt.
Michauxii Nutt.
Boehmeria cylindrica (L.) Willd
Liriodendron Tulipifera L.
Clematis crispa L..
Penthorum sedoides L.
Ilex opaca Ait.
Berchemia scandens (Hill) Trel.
Triadenum petiolatum (Walt.) Britton.
Hydrocotyle verticillata Thunb.
Cornus Amomum Mill.

Nyssa uniflora Wang.
Leucothoë racemosa (L.) Gray.
Fraxinus Americana L.
Caroliniana Mill.
Chionanthus Virginica L.
Hydrolea quadrivalvis Walt.
Tecoma radicans (L.) DC.
Dianthera Americana L.
Lobelia cardinalis L.
Conoclinium coelestinum (L.) DC.
Pluchea petiolata Cass.

Polypodium and *Tillandsia* are usually epiphytes, but I have included them here because in this region they are mostly confined to river-swamps.

In non-alluvial swamps and wet woods, where the soil consists largely of humus, the flora is quite different from that just mentioned, as may be seen from the following list:

Asplenium Filix-foemina (L.) Bernh.
Osmunda regalis L.
cinnamomea L.
Arisaema triphyllum (L.) Torr.
Lilium superbum L.
Smilax laurifolia L.
Walteri Pursh.
Myrica cerifera L.
Alnus rugosa (DuRoi) Koch.
Ulmus alata Mx.
Magnolia glauca L.
Liriodendron Tulipifera L.
Itea Virginica L.
Rosa Carolina L.
Cercis Canadensis L.
Kraunhia frutescens (L.) Greene.
Apios tuberosa Moench.
Liquidambar Styraciflua L.
Rhus Vernix L.
Cyrilla racemiflora Walt.
Ilex glabra (L.) Gray.
Acer rubrum L.
Decodon verticillatus (L.) Ell.
Ludwigia pilosa Walt.
Parthenocissus quinquefolia (L.) Planch.
Aralia spinosa L.
Clethra alnifolia L.
Azalea viscosa L.
Cephalanthus occidentalis L.
Pinckneya pubens Mx.
Sambucus Canadensis L.
Viburnum nudum L.
dentatum L.
Mikania scandens (L.) Willd.

A number of species grow on the banks of creeks and rivers above the usual high-water mark which are not found in the alluvial swamps lower down. Among these are the following:

Uniola latifolia Mx.
Smilax Bona-nox L.
Salix nigra Marsh.
Betula nigra L.
Fagus Americana Sweet.
Magnolia grandiflora L.
Amelanchier Canadensis (L.) Medic.
Sebastiana ligustrina (Mx.) Müll. Arg.
Passiflora lutea L.
Kalmia latifolia L.
Styrax Americana Lam.
Catalpa bignonioides Walt.
Diodia Virginiana L.

The wet meadows of Sumter County have quite an interesting flora. The following species have been collected mostly in the meadows along Muckalee Creek in Americus :

Woodwardia areolata (L.) Moore.
Virginica (L.) J. E. Smith.
Osmunda regalis L.
cinnamomea L.
Homalocenchrus oryzoides (L.) Poll.
Cyperus strigosus L.
Kyllinga pumila Mx.
Scirpus Eriophorum Mx.
Rhynchospora glomerata paniculata (Gray) Chapm.
inexpansa (Mx.) Vahl.
Carex vulpinoidea Mx.
verrucosa Muhl.
Melanthium Virginicum L.
Lilium Catesbaei Walt.
Habenaria ciliaria (L.) R. Br.
cristata (Mx.) R. Br.
Gyrostachys praecox (Walt.) Kuntze.
Glottidium Floridanum DC.
Linum striatum Walt.
Hibiscus aculeatus Walt.
Rhexia Virginica L.
Mariana L.
Ludwigia sphaerocarpa Ell.
Oxypolis rigidus (L.) Britton.
Asclepias lanceolata Walt.
Mentha viridis L.
Mesosphaerum rugosum (L.) Pollard.
Gerardia purpurea L.
Vernonia Noveboracensis (L.) Willd.
Eupatorium purpureum L.

In sandy or sphagnous bogs are found the following species :

Lycopodium Carolinianum L.
adpressum (Chapm.) Lloyd & Underw.
Campulosus aromaticus (Walt.) Scribn.
Cyperus Haspan L.
Fuirena squarrosa hispida (Ell.) Chapm.
Carex verrucosa Muhl.
Mayaca Aubleti Mx.
Eriocaulon decangulare L.
Tofieldia racemosa (Walt.) B.S.P.
Zygadenus glaberrimus Mx.
Aletris aurea Walt.
Habenaria blephariglottis (Willd.) Torr.
Pogonia ophioglossoides (L.) Ker.
Limodorum tuberosum L.
Sarracenia rubra Walt.
Drummondii Croom.
Drosera capillaris Poir.
Pyrus arbutifolia (L.) L. f.
Polygala lutea L.
cruciata ramosior Nash.
Ascyrum stans Mx.
Hypericum fasciulatum Lam.
pilosum Walt.
Triadenum Virginicum (L.) Raf.
Rotala ramosior (L.) Koehne.
Rhexia ciliosa Mx.
Pieris nitida (Bartr.) Benth & Hook.
Cynoctonum sessilifolium (Walt.) Gmel.
Sabbatia macrophylla Hook.
Bartonia Virginica (L.) B.S.P.
Gratiola pilosa Mx.
quadridentata Mx.
Oldenlandia uniflora L.
Eupatorium perfoliatum L.
Solidago stricta Ait.
Coreopsis gladiata Walt.
Baldwinia uniflora Nutt.

In sandy soil which is too dry for a bog, but not dry enough to be loose, a number of interesting species are found. This kind of soil is frequent in the ditches along railroad tracks, and is characterized by the following species:

Pteris aquilina L.
Paspalum laeve Mx.
  purpurascens Ell.
Panicum elongatum Pursh.
Cyperus pseudovegetus Steud.
Eleocharis tuberculosa R. Br.
Fimbristylis autumnalis (L.) R. & S.
Scirpus Americanus Pers.
Lipocarpha maculata (Mx.) Torr.
Xyris Caroliniana Walt.
Juncus marginatus Rostk.
  scirpoides Lam.
Lilium Carolinianum Mx.
Eryngium aquaticum L.
Ptilimnium capillaceum (Mx.) Hollick.
Steironema lanceolatum (Walt.) Gray.
Sabbatia angularis (L.) Pursh.
Collinsonia anisata Sims.
Mesosphaerum rugosum (L.) Pollard.
Monniera acuminata (Walt.) Kuntze.
Ilysanthes refracta (Ell.) Benth.
Gerardia purpurea L.
Helianthus angustifolius L.
Helenium autumnale L.
Erechthites hieracifolia (L.) Raf.

Richest in number of species, particularly in Leguminosae and Compositae, are the comparatively large areas of dry loose sand. The following is a partial list of species inhabiting such areas:

Pteris aquilina L.
Pinus palustris Mill.
Andropogon furcatus Muhl.
Cenchrus echinatus L.
Cyperus retrofractus (L.) Torr.
Scleria triglomerata Mx.
  pauciflora Muhl.
Commelina Virginica L.
Chrosperma muscaetoxicum (Walt.) Kuntze.
Yucca filamentosa L.
Agave Virginica L.
Castanea pumila (L.) Mill.
Quercus cinerea Mx.
Eriogonum tomentosum Mx.
Rumex hastatulus Baldw.
Froelichia Floridana (Nutt.) Moq.
Paronychia riparia Chapm.
Clematis reticulata Walt.
Sassafras officinale Nees & Eberm.
Rubus trivialis Mx.
Morongia angustata (T. & G.) Britton.
Cassia Chamaecrista L.
  nictitans L.
Baptisia alba (L.) R. Br.
  lanceolata (Walt.) Ell.
  megacarpa Chapm.
Crotalaria rotundifolia (Walt.) Poir.
Psoralea canescens Mx.
Kuhnistera pinnata (Walt.) Kuntze.
Indigofera Caroliniana Walt.
Zornia bracteata (Walt.) Gmel.
Meibomia stricta (Pursh) Kuntze.
Lespedeza Stuvei Nutt.

Bradburya Virginiana (L.) Kuntze.
Clitora Mariana L.
Strophostyles umbellata (L.) Britton.
Dolicholus tomentosus (L.) Vail.
simplicifolius (Walt.) Vail.
erectus (Walt.) Vail.
Polygala incarnata L.
polygama Walt.
Boykinii Nutt.
grandiflora Walt.
Tragia urticaefolia Mx.
urens L.
Jatropha stimulosa Mx.
Stillingia sylvatica L.
Euphorbia cordifolia Ell.
Rhus copallina L.
Ceanothus Americanus L.
Vitis aestivalis Mx.
Ascyrum multicaule Mx.
Cfscyrum pumilum Mx.
Hypericum maculatum Walt.
Sarothra gentianoides L.
Lechea villosa Ell.
Opuntia vulgaris Mill.
Gaura Michauxii Spach.
Angelica villosa (Walt.) B.S.P.
Vaccinium arboreum Marsh.
Polypremum procumbens L.
Amsonia angustifolia (Ait.) Michx.
Apocynum cannabinum L.
Asclepias verticillata L.
amplexicaulis Smith.
tuberosa L.
Acerates viridiflora (Raf.) Eaton.
Ipomoea pandurata L.
Breweria humistrata (Walt.) Gray.
Cuscuta arvensis Beyr.
Onosmodium Virginianum (L.) A. DC.
Verbena Caroliniana Mx.
Callicarpa Americana L.
Salvia azurea Lam.
Dicerandra linearifolia (Ell.) Benth.
Monarda punctata L.
Trichostema dichotomum L.
Physalis Virginica Mill.
Afzelia pectinata (Pursh) Kuntze.
Dasystoma flava (L.) Wood.
Virginica (L.) Britton.
Calophanes oblongifolia (Mx.) Don.
Galium hispidulum Mx.
Vernonia angustifolia Mx.
Eupatorium hyssopifolium L.
album L.
rotundifolium L.
Lacinaria elegans (Walt.) Kuntze.
scariosa (L.) Hill.
tenuifolia (Nutt.) Kuntze.
Chrysopsis Mariana (L.) Nutt.
graminifolia (Mx.) Nutt.
Isopappus divaricatus (Nutt.) T. & G.
Sericocarpus bifoliatus (Walt.) Porter.
Silphium Asteriscus L.
compositum Mx.
Berlandiera tomentosa Nutt.
Rudbeckia hirta L.
Tetragonotheca helianthoides L.
Helianthus divaricatus L.
Coreopsis major Walt.
tripteris L.
Gaillardia lanceolata Mx.
Lygodesmia aphylla (Nutt.) DC.

In South Georgia the flora of roadsides, waste places, and cultivated fields is very similar to that of the dry sand areas, and it is impossible to draw a sharp line between them. Almost any of the sand-loving plants may be found along roadsides or in other artificial localities, but the following seem to be mostly confined to such places:

Andropogon scoparius Mx.
Syntherisma sanguinalis (L.) Krok.
Chaetochloa viridis (L.) Scribn.
Sporobolus Indicus (L.) R. Br.
Capriola Dactylon (L.) Kuntze.
Eleusine Indica (L.) Gaertn.
Dactyloctenium AEgyptiacum (L.) Willd.
Cyperus rotundus L.
Stenophyllus capillaris (L.) Britton.
Polygonum Pennsylvanicum L.
Chenopodium ambrosioides L.
Amarantus spinosus L.
retroflexus L.
Phytolacca decandra L.
Boerhaavia erecta L.
Mollugo verticillata L.
Portulaca oleracea L.
Alsine media L.
Lepidium Virginicum L.
Coronopus didymus (L.) J. E. Smith.
Cardamine hirsuta L.
Rubus nigrobaccus Bailey.
trivialis Mx.
Albizzia Julibrissin Durazz.
Cassia occidentalis L.
Tora L.
Lespedeza striata (Thunb.) H. & A.
Oxalis stricta L.
Croton glandulosus L.
Acalypha ostryaefolia Riddell.
Euphorbia Preslii Guss.
maculata L.
Modiola Caroliniana (L.) Don.
Sida spinosa L.
Passiflora incarnata L.
Onagra biennis (L.) Scop.
Hartmannia speciosa (Nutt.) Small.
Daucus pusillus Mx.
Ipomoea coccinea L.
purpurea (L.) Roth.
hederacea Jacq.
Jacquemontia tamnifolia (L.) Griseb.
Cuscuta arvensis Beyr.
Heliotropium Indicum L.
Verbena bracteosa Mx.
Lamium amplexicaule L.
Leonotis nepetaefolia R. Br.
Physalis angulata L.
Solanum nigrum L.
Carolinense L.
Datura Tatula L.
Plantago major L.
aristata Mx.
Diodia teres Walt.
Richardsonia scabra St. Hill.
Lonicera Japonica Thunb.
Erigeron Canadensis L.
Ambrosia artemisiaefolia L.
Xanthium strumarium L.
Bidens bipinnata L.
Helenium tenuifolium Nutt.
Anthemis Cotula L.
Acanthospermum australe (L.) Kuntze.
Sitilias Caroliniana (Walt.) Raf.
Lactuca Canadensis L.

It will be noticed that very few of these are European weeds. Some have been introduced from the West, some from the tropics, and a few from Asia, but the majority are natives of Georgia. It may be worthy of note that there are very few species of troublesome weeds in this section.

The dry or rich woods which are so characteristic of Middle Georgia are of small extent in South Georgia, and comparatively few species inhabit them. In the following list of plants growing in woods I have combined both rich and dry woods, as in South Georgia the two kinds are scarcely distinguishable.

Polystichum acrostichoides (Mx.) Schott.
Uniola longifolia Scribn.
Carex triceps Mx.
Hymenocallis lacera Salisb.
Hypoxis erecta L.
Dioscorea villosa L.
Gyrostachys gracilis (Bigel.) Kuntze.
Tipularia unifolia (Muhl.) B.S.P.
Hexalectris aphyllus (Nutt.) Raf.
Quercus digitata (Marsh.) Sudw.
Phoradendron flavescens (Pursh) Nutt.
Asimina parviflora (Mx.) Dunal.
Persea Borbonia (L.) Spreng.
Hamamelis Virginiana L.
Liquidambar Styraciflua L.
Agrimonia mollis (T. & G.) Briton.
Psoralea pedunculata (Mill.) Vail.
Stylosanthes biflora (L.) B.S.P.
Meibomia nudiflora (L.) Kuntze.
Falcata comosa (L.) Kuntze.
Phaseolus polystachyus (L.) B.S.P.
AEsculus octandra Marsh.
Vitis rotundifolia Mx.
Ampelopsis arborea (L.) Rusby.
Parthenocissus quinquefolia (L.) Planch.
Sida rhombifolia L.
Aralia spinosa L.
Nyssa sylvatica Marsh.
Oxydendrum arboreum (L.) DC.
Diospyros Virginiana L.
Koellia incana (L.) Kuntze.
Dasystoma pectinata (Nutt.) Benth.
Pedicularis Canadensis L.
Epiphegus Virginiana (L.) Bart.
Ruellia strepens L.
Mitchella repens L.
Galium uniflorum Mx.
Viburnum rufotomentosum Small.
Elephantopus tomentosus L.
Solidago brachyphylla Chapm.
Hieracium Gronovii L.

All the plants mentioned so far are found outside of the pine-barren region. In the pine-barrens the flora is very different, and, to me at least, the most interesting of all.

At this point it might be well to state that the term pine-barren is a very inappropriate one, for the soil of the pine-barrens seems to be just as fertile as any other soil in the region, if not more so. This term is not used by the natives, but has been used so universally in botanical works that it has come to have a very definite meaning.

There are several kinds of pine-barrens, botanically considered. In Sumter County I have distinguished three, differing principally in the amount of water in the soil.

First are the wet pine-barrens, in which the ground is usually covered with water a few inches to a foot or so in depth. I know only one or two such places, but in them I have found the following species:

Pinus palustris Mill.
Rhynchospora corniculata (Lam.) Gray.
Tracyi Britton.
Pontederia cordata L.
Stillingia aquatica Chapm.
Ilex myrtifolia Walt.
glabra (L.) Gray.
Hypericum fasciculatum Lam.
Proserpinaca pectinata Lam.
Sabbatia decandra (see p. 432).
gentianoides Ell.
Gratiola quadridentata Mx.
Monniera Caroliniana (Walt.) Kuntze.
Utricularia purpurea Walt.
juncea Vahl.
Lobelia Nuttallii R. & S.
Sclerolepis uniflora (Walt.) B.S.P.

In the moist pine-barrens, where there is no standing water on the surface, the species are more numerous, the following being a partial list of them:

Lycopodium alopecuroides L.
Pinus palustris Mill.
Taxodium distichum imbricarium (Nutt.) Sarg.
Rottboellia rugosa Nutt.
Campulosus aromaticus (Walt.) Scribn.
Dichromena latifolia Baldw.
Rhynchospora axillaris (Lam.) Britton.
microcarpa Baldw.
Tofieldia racemosa (Walt.) B.S.P.
Aletris aurea Walt.
Gyrotheca capitata (Walt.) Morong.
Habenaria nivea (Nutt.) Spreng.
Gyrostachys praecox (Walt.) Kuntze.
Limodorum tuberosum L.
Sarracenia lacunosa Bartr.
Polygala cymosa Walt.
Ilex myrtifolia Walt.
Hypericum myrtifolium Lam.
virgatum Lam.
Rhexia glabella Mx.
Hydrocotyle repanda Pers.
Sabbatia paniculata (Mx.) Pursh.
campanulata (L.) Torr.
Acerates Floridana (Lam.) A. S. Hitchcock.
Breweria aquatica (Walt.) Gray.
Gerardia linifolia Nutt.
Trilisa odoratissima (Walt.) Cass.
Chondrophora nudata virgata (Nutt.) Britton.
Aster adnatus Nutt.
Pluchea foetida (L.) B.S.P.
Rudbeckia Mohrii Gray.
Helianthus Radula (Pursh) T. & G.
Coreopsis nudata Nutt.

Most of the herbaceous plants of moist pine-barrens have conspicuous white, yellow, or pink-purple flowers. Among those with white flowers are *Dichromena* (in this case it is the involucre that is colored), *Habenaria nivea*, and *Sabbatia paniculata;* with yellow, *Aletris, Gyrotheca, Polygala cymosa, Hypericum myrtifolium, H. virgatum, Chondrophora* and *Rudbeckia Mohrii*; and with pink-purple, *Limodorum, Rhexia, Sabbatia campanulata, Breweria, Gerardia, Trilisa*, and *Coreopsis*. As most of these colored flowers, and several others not mentioned, can generally be found in the same locality and at the same time, it follows that these pine-barrens in summer present a very beautiful appearance; and, all things considered, they are most delightlful places for the botanist.

Lastly may be mentioned the plants of dry pine-barrens, where the surface soil consists of dry sand. These are not of great extent in Sumter County, and their flora is similar to that of the dry sandy fields already mentioned. The following is a list of some of the principal plants of dry pine-barrens:

Pteris aquilina L.
Pinus palustris Mill.
Gymnopogon ambiguus (Mx.) B.S.P.
Crotalaria Purshii DC.
Cracca Virginiana L.
Meibomia arenicola Vail.
Galactia erecta (Walt.) Vail.
Ceanothus microphyllus Mx.
Vaccinium staminenm L.
Asclepias tomentosa Ell.
Lacinaria elegans (Walt.) Kuntze.
  tenuifolia (Nutt.) Kuntze.
Coreopsis lanceolata L.
  delphinifolia Lam.

The four or five hundred species mentioned in the above lists probably represent less than half the number of pteridophytes and spermatophytes in Sumter County.

Below I give an annotated list of species which are little known, or are of interest on account of their distribution.

As there are very few points in this part of the State whose altitudes are known, I do not attempt to give the altitudinal distribution of each species. I will mention, however, that in the city of Americus the altitude ranges from about 300 feet along Muckalee Creek to 400 or more in the central portions of the city. The altitude of the pine-barren region, about 10 miles southeast of Americus is probably about 250 feet, and that of the Flint

River at the southeastern corner of the county, 22 miles from Americus, about 200 feet.

ADIANTUM CAPILLUS-VENERIS L. Sp. Pl. 1096. 1753

Collected at the mouth of a small limestone cave in Dooly County, near the Flint River, August 5, 1896, and July 26, 1897. This seems to be the only known station in Georgia for this rare fern.

LYCOPODIUM ALOPECUROIDES L. Sp. Pl. 1102. 1753

This species is quite common in the moist pine-barrens of Sumter County, where it seems to be the only representative of the genus.

LYCOPODIUM ADPRESSUM (Chapm.) Lloyd & Underwood, Bull. Torr. Club, **27**: 153. *pl. 3. f. 14–18.* Apr. 1900

This species resembles the preceding very much, but never grows with it, as far as I have observed. I have always found it in sandy bogs outside of the pine-barrens. *L. Carolinianum* inhabits similar localities.

TAXODIUM DISTICHUM IMBRICARIUM (Nutt.) Sargent, Sylva N. A., **10**: 152. 1896

On July 26, 1897, I found some small specimens of a *Taxodium* which is evidently referable to this variety, in pine-barrens near Cobb, about three miles west of the Flint River. Although the trees were only about 4 m. tall, they bore considerable fruit. It seems to me that this plant differs sufficiently from *T. distichum* in size, form of leaves, and especially in habitat, to be recognized as a good variety.

JUNIPERUS VIRGINIANA L. Sp. Pl. 1038. 1753

The only place in Georgia where I have seen this tree undoubtedly native is in the Flint River swamps, in Dooly County, where it attains a considerable size. In Middle Georgia it generally has the appearance of being escaped from cultivation.

ROTTBOELLIA RUGOSA Nutt. Gen. **1**: 84. 1818

Collected in moist pine-barrens in the eastern part of Sumter County, August 30, 1897, in flower. I do not find that this species has been reported from so far inland before.

PANICUM ELONGATUM Pursh, Fl. Am. Sept. 69. 1814

Not rare in rather moist sandy soil, Sumter County. Flowers in late summer. This grass does not seem to have been hitherto reported south of North Carolina. Mr. G. V. Nash has kindly identified one of my specimens, collected in Americus, Aug. 22, 1897.

ELEOCHARIS MUTATA (L.) R. & S. Syst. **2**: 155. 1817

Found growing in three or four inches of water in a wet meadow near Ellaville, Schley County, July 24, 1895. I know of no other station in Georgia for this species, and it is certainly not common.

ELEOCHARIS TUBERCULOSA (Mx.) R. & S. Syst. **2**: 152. 1817

In moist sand, Americus, June, 1897. This seems to be its inland and upper altitudinal limit, as far as known, and also the first station in Georgia.

SCIRPUS ATROVIRENS Muhl. Gram. 43. 1817

On June 21, 1897, I collected a fine specimen of this species in a meadow near Muckalee Creek in Americus, thus extending its known range over 200 miles.

SCIRPUS DIVARICATUS Ell. Bot. S. C. & Ga. **1**: 88. *pl. 2. f. 4.* 1816

In alluvial soil along Muckalee Creek, Americus and northward. Not previously reported from Georgia.

RHYNCHOSPORA TRACYI Britton, Trans. N. Y. Acad. **11**: 84. 1892

Ceratoschoenus capitatus Chapm. Fl. S. States, ed. 1, 529. 1860.

Collected in wet pine-barrens in the southern part of Sumter County, July 21, 1897. This station is farther east and about 100 miles farther north and at a higher altitude than any previously known for this species, and is also the first in Georgia.

CAREX FOLLICULATA AUSTRALIS Bailey, Proc. Am. Acad. **22**: 62. 1886

Collected in muddy woods near Muckalee Creek about two miles north of Americus, with *Scirpus divaricatus*, July 3, 1897. Not previously reported from Georgia.

PONTEDERIA CORDATA L. Sp. Pl. 288. 1753.

This species seems to be very rare in Georgia. I have collected it only once, in a pine-barren pond in Sumter County, July 21, 1897. This is probably the only station now known in the State.

LILIUM SUPERBUM L. Sp. Pl. ed. 2, 434. 1762

Grows in rich deep damp woods just south of Americus. This seems to be about 150 miles south of any previously known station.

HYMENOCALLIS LACERA Salisb. Trans. Hort. Soc. **1**: 338. 1812

Collected in rich woods near DeSoto, Sumter County, July 26, 1897, in flower.

TIPULARIA UNIFOLIA (Muhl.) B.S.P. Prel. Cat. N. Y. 51. 1888

In rich woods, under the shade of *Fagus Americana* and *Magnolia grandiflora*, near Muckalee Creek, Americus. Flowers in August.

HEXALECTRIS APHYLLUS (Nutt.) Raf.; Wats. & Coult. in Gray's Man. ed. 6, 501. 1890

In rich woods, Schley and Sumter Counties, flowering in July, very rare. I have only found two or three specimens.

ERIOGONUM TOMENTOSUM Mx. Fl. Bor. Am. **1**: 246. *pl. 24.* 1803

In dry sand, along or near the Flint River, Sumter and Macon Counties, flowering in August. This species has not been reported from farther inland or at a higher altitude.

RUMEX HASTATULUS Baldw.; Ell. Bot. S. C. & Ga. **1**: 416. 1817

In dry sandy soil, Americus. Not previously reported from so far inland in the Atlantic States.

FROELICHIA FLORIDANA (Nutt.) Moq. in DC. Prodr. $\mathbf{13}^2$: 420. 1849

Grows in dry sand near the Flint River, Sumter County.

PARONYCHIA RIPARIA Chapm. Fl. S. States, ed. 2, 607. 1883

On July 26, 1897, I collected in dry sand along the Flint River a *Paronychia* which I afterward determined to belong to this species, which is known only from the banks of this river. I can find no record of the exact location of the original station, but it is no doubt farther south than mine.

CLEMATIS RETICULATA Walt. Fl. Car. 156. 1788

Common in dry sandy fields and woods about Americus, flowering from June to August.

SARRACENIA DRUMMONDII Croom, Ann. Lyc. N. Y. **4**: 100. *pl. 1.* 1848.

In sandy bogs, ranging from two miles southeast to three miles northwest of Americus; the largest and commonest species of the genus in Sumter County. I have measured specimens whose leaves and scapes were fully a meter tall. Sumter County seems to be the northern limit of this species.

SARRACENIA RUBRA Walt. Fl. Car. 152. 1788

In bogs with *S. Drummondii*, but less common, and only attaining about one fourth of the maximum dimensions of the former. This species on account of its small size and dull coloring is much more easily overlooked, and does not seem to have been collected many times.

SARRACENIA LACUNOSA Bartr. Travels, 415. 1791

S. variolaris Mx. Fl. Bor. Am. **1**: 310. 1803.

Found only in the pine-barrens, where the other two species do not occur. Bartram's description of *S. lacunosa* is sufficiently complete to leave no doubt as to what species he had in mind, and his name antedates that of Michaux by a dozen years. *S. minor* Walt. is still older, but its identity with *S. lacunosa* does not seem to have been established.

DROSERA CAPILLARIS Poir. Encyc. **6**: 299. 1804

In sandy bogs, often with the two *Sarracenias* first mentioned, flowering June to August. This is near its inland limit.

AGRIMONIA MOLLIS (T. & G.) Britton, Bull. Torr. Club, **19**: 221. 1892

In dry woods, Americus, flowering in August. This is one of its southernmost known stations.

BAPTISIA MEGACARPA Chapm.; T. & G. Fl. N. A. **1**: 376. 1838

On July 3, 1897, I found specimens of this species in fruit in dry sandy soil near Muckalee Creek, north of Americus, thus extending its known range northward about 40 miles.

PSORALEA CANESCENS Mx. Fl. Bor. Am. **2**: 57. 1803

In dry sand and dry pine-barrens in the eastern part of Sumter Co., rare. Fruits in July. This seems to be its inland and upper altitudinal limit.

AMORPHA VIRGATA Small, Bull. Torr. Club, **21**: 17. *pl. 171.* 1894

Collected, in fruit, on the bank of Gum Creek, Dooly County, July 26, 1897.

KUHNISTERA PINNATA (Walt.) Kuntze, Rev. Gen. Pl. 192. 1891

Petalostemon corymbosus Mx. Fl. Bor. Am. **2**: 50. 1803.

On Sept. 5, 1897, I collected this curious plant in dry sandy soil on the site of Andersonville Prison, Macon County. At that time its flowers had not begun to open. This seems to be the only definitely known station for it outside of Florida.

GLOTTIDIUM FLORIDANUM DC. Prodr. **2**: 266. 1825

Sebania vesicaria Ell. Bot. S. C. & Ga. **2**: 222. 1824.

Abundant in low grounds near Muckalee Creek, Americus, flowering in August and September. This is probably the highest known station for it. This plant is one of the largest annuals we have, the stem becoming about 3 meters tall and 4 cm. in diameter at the base. In the fall it becomes hard and woody, and I have cut stems in winter which could not be readily distinguished from a woody branch of the same size.

POLYGALA BOYKINII Nutt. Jour. Acad. Phila. **7**: 86. 1834

Collected in dry sandy soil near DeSoto, July 26, 1897.

STILLINGIA AQUATICA Chapm. Fl. S. States, 405. 1860

Found in a wet meadow near Ellaville, July 24, 1895, and in pine-barren ponds, Sumter County, June 26, 1897. The altitude of the former station is about 570 feet, and it is probably the northernmost known for this species.

SEBASTIANA LIGUSTRINA (Mx.) Muell. Arg. in DC. Prodr. **15**^{2}: 1165. 1862

Banks of Muckalee Creek and Flint River, Sumter County. Flowers in June.

EUPHORBIA CORDIFOLIA Ell. Bot. S. C. & Ga. **2**: 656. 1824

Collected in dry sandy fields near Andersonville, September 5, 1897. This is one of its highest and northermost stations.

CEANOTHUS MICROPHYLLUS Mx. Fl. Bor. Am. **1**: 154. 1803

Collected in dry pine-barrens near Huntington, June 26, 1897, at which time its fruit had mostly fallen. This station is on or near its northern limit.

SIDA RHOMBIFOLIA L. Sp. Pl. 684. 1753

Grows in sandy soil, in dry oak groves, Ellaville and Americus, also near Huntington. Flowers in July and August.

HIBISCUS ACULEATUS Walt. Fl. Car. 177. 1788

In wet places near Leslie, Sumter County, flowering in July and August. Northern limit?

HYPERICUM FASCICULATUM Lam. Encyc. **4**: 160. 1797

In pine-barren ponds, growing 1–1.5 meters tall. Without flowers this species strikingly resembles a small coniferous tree, with its shreddy bark, resinous sap, and linear evergreen leaves. Flowers June to August.

HYPERICUM MYRTIFOLIUM Lam. Encyc. **4**: 180. 1797

In moist pine-barrens near Huntington, flowering from June to August. Northwestern limit?

HYPERICUM PILOSUM Walt. Fl. Car. 190. 1788

Sandy bogs near Americus, flowering in August. Inland limit?

ASCYRUM PUMILUM Mx. Fl. Bor. Am. **2**: 177. 1803

Collected in sandy soil near DeSoto, July 26, 1897. This seems to be its northern limit, as far as known.

LUDWIGIA PILOSA Walt. Fl. Car. 89. 1788

Collected in wet places near Leslie, August 31, 1897. This species does not seem to have been collected so far inland before.

JUSSIAEA LEPTOCARPA Nutt. Gen. **1**: 279. 1818

In wet ditches, Americus. This seems to be its northeasternmost known station.

HARTMANNIA SPECIOSA (Nutt.) Small, Bull. Torr. Club, **23**: 181. 1896

Sparingly introduced along roads and railroads, Americus and eastward.

NYSSA UNIFLORA Wang. Beitr. Forstw. Nordam. Holz. 83. *pl. 27. f. 57.* 1787

Grows in the swamps of Muckalee Creek a mile or two below Americus. It probably does not extend much farther from the coast, in Georgia at least.

KALMIA LATIFOLIA L. Sp. Pl. 391. 1753

Forms small thickets on the banks of Muckalee Creek in Americus and a short distance south of the city, with *Magnolia grandiflora*. I know of no more southern station for this species.

FRAXINUS CAROLINIANA Mill. Gard. Dict. ed. 8, no. 6. 1788

In Muckalee Creek swamps below Americus. Inland limit?

CHIONANTHUS VIRGINICA L. Sp. Pl. 8. 1753

On muddy banks of Muckalee Creek below Americus, with *Sabal glabra*, *Quercus lyrata*, *Nyssa uniflora*, *Fraxinus Caroliniana*, etc. Here it becomes a tree 6–8 meters tall and about 3 dm. in diameter at the base, appearing very different from the shrub which represents the species in Middle Georgia. Not noticing that its leaves were opposite, I mistook this *Chionanthus* tree for a *Nyssa* for two or three years, and it appears that the same mistake has been make by collectors in other states.

CYNOCTONUM SESSILIFOLIUM (Walt.) Gmel. Syst. **2**: 443. 1791

Occurs in sandy bogs near Americus, flowering in July and August. Inland limit.

SABBATIA MACROPHYLLA Hook. Comp. Bot. Mag. **1**: 171. 1835

Grows in a sphagnous bog north of Americus, at an altitude of about 350 feet. It is accompanied by *Sarracenia rubra*, *S. Drummondii*, *Pogonia ophioglossoides*, *Polygala cruciata ramosior*, *P. lutea*, etc., and flowers in July. This is probably the highest known station for this species. It has been previously reported only from near the Gulf coast.

Sabbatia decandra (Walt.)

Chironia decandra Walt. Fl. Car. 95. 1788.

Sabbatia chloroides var. *erecta* Ell. Bot. S. C. & Ga. **1**: 286. 1817.

Sabbatia chloroides var. *stricta* Griseb. Gen. et Sp. Gent. 125. 1839; also in DC. Prodr. **9**: 50. 1845. Gray, Syn. Fl. N. A. 115. 1886.

Sabbatia dodecandra stricta Mohr, Bull. Torr. Club, **24**: 26. 1897.

Although Walter's description of this species ("flor. decemfidis colore dodecandrae, foliis linearibus, caule rigido erecto") is rather brief, still there is no other known plant in the southeastern states which answers it exactly, and as his name for the species is cited as a synonym by both Elliott and Grisebach, no hesitation is felt in taking it up here.

That it is a species distinct from *S. dodecandra* (L.) B.S.P. (*S. chloroides* Pursh) there can be no doubt after comparing specimens of the two. One important and apparently constant distinguishing character, which seems to have been hitherto overlooked, is found in the calyx-segments. These in *S. decandra* are semicircular in cross-section, and awl-shaped, while in *S. dodecandra* they are flat, and of about the same width from the base to near the apex. *S. decandra* is one of the most beautiful and conspicuous plants of the wet pine-barrens of Sumter County, where it flowers in July and August. Besides my own specimens, collected July 21, 1897, the following in the herbaria of Columbia University and the New York Botanical Garden, all from Florida, are referred here:

DUVAL CO.: *A. H. Curtiss*, July (no. 2231); near Jacksonville, *H. D. Keeler*, 1870–76, *A. H. Curtiss*, July 10, 1893 (no.

4374), July 16, 1894 (no. 5050); Baldwin, *G. V. Nash*, July 20, 1895 (no. 2250); Pablo, *L. H. Lighthipe*, July 11, 1896 (no. 372).

Between Quincy and Aspalaga, and near St. Marks, *Rugel*, July, 1843. Without definite locality or date: *Allison* (no. 329); *Chapman*.

SABBATIA GENTIANOIDES Ell. Bot. S. C. & Ga. **1**: 286. 1817

With the preceding, flowering at the same time, and with very similar flowers. Both probably reach their inland and upper altitudinal limits here.

ASCLEPIAS AMPLEXICAULIS Smith, Georgia Insects **1**: 13. *pl. 7*. 1797

A. obtusifolia Mx. Fl. Bor. Am. **1**: 115. 1803.

Grows in dry sandy soil north of Americus; not common.

ASCLEPIAS TOMENTOSA Ell. Bot. S. C. & Ga. **1**: 321. 1817

In dry pine-barrens between Huntington and Leslie, flowering in July and August. I find no record of any station farther north than this.

JACQUEMONTIA TAMNIFOLIA (L.) Griseb. Fl. Brit. W. I., 474

In sandy soil, especially in cultivated fields, Americus and eastward. This is near its northern limit.

BREWERIA AQUATICA (Walt.) Gray, Syn. Fl. N. A. **2**[1]: 217. 1878

In moist pine-barrens near Huntington, June 26, 1897. I do not find that this species has been previously reported from Georgia.

CUSCUTA COMPACTA Juss.; Choisy, Mem. Soc. Gen. **9**: 281. *pl. 4. f. 2*. 1841.

On various shrubs, especially about the edges of swamps, common. Flowers in September.

DICERANDRA LINEARIFOLIA (Ell.) Benth. in DC. Prodr. **12**: 243. 1848

Ceranthera linearifolia Ell. Bot. S. C. & Ga. **2**: 94. 1821.

Collected in dry sandy soil near Andersonville, Sept. 5, 1897. The place where I found this plant answers very well Elliott's description of the type locality, which is "high pine-barren ridges between the Flint and Chatahouchie rivers." The original station was probably farther south than mine however.

MESOSPHAERUM RUGOSUM (L.) Pollard, Bull. Torr. Club, **24**: 156. 1897

Hyptis radiata Willd. Sp. Pl. 3: 84. 1081.

Grows in moist sandy places in the eastern part of Sumter County. Flowers. Northern limit?

LEONOTIS NEPETAEFOLIA R. Br. Hort. Kew. ed. 2, 3: 409. 1811

I have found this showy weed along sandy roadsides at two or three localities north and east of Americus.

GRATIOLA QUADRIDENTATA Mx. Fl. Bor. Am. **1**: 6. 1803

In wet pine-barrens and sandy bogs, Sumter County.

GERARDIA LINIFOLIA Nutt. Gen. **2**: 47. 1818

Collected in moist pine-barrens near Huntington, Aug. 30–31, 1897, in flower. Not previously reported from Georgia.

UTRICULARIA MACRORHYNCHA Barnhart, Bull. Torr. Club, **25**: 515. 1898

Grows in wet muddy or sandy places; the commonest *Utricularia* in Sumter County. This species has been previously reported only from Florida.

EPIPHEGUS VIRGINIANA (L.) Bart. Comp. Fl. Phila. **2**: 50. 1818

Found only in "Magnolia Dell" near Muckalee Creek, Americus, under *Fagus Americana*.

CATALPA BIGNONIOIDES Walt. Fl. Car. 64. 1788

Grows on high banks of the Flint River, on the Sumter County side. There has been some uncertainty as to the native habitat of this species, but the evidence is strongly in favor of its being native in Georgia. The locality above mentioned is in a region remote from human habitations, where there are no introduced plants within many miles, so that it is extremely improbable that the *Catalpa* could have been introduced.

RICHARDSONIA SCABRA St. Hil. Pl. Us. Bres. **7** : *pl. 8*

Not rare in sandy waste places and cultivated fields, Americus.

PINCKNEYA PUBENS Mx. Fl. Bor. Am. **1** : 105. *pl. 13.* 1803

This unique and interesting shrub is quite common in non-alluvial swamps in Sumter County, and flowers in June and July. It has not previously been reported so far from the coast or at so high an altitude.

VIBURNUM DENTATUM L. Sp. Pl. 268. 1753

Grows in a swampy place near Barlow's Mill, Sumter County, where it flowers in September. This seems to be its southern limit.

LACINARIA ELEGANS (Walt.) Kuntze, Rev. Gen. Pl. 349. 1891

In dry sandy soil east and west of Americus, flowering in August and September. According to my observations the corollas in this species are invariably pure white, a fact which does not seem to have been noted before.

ASTER ADNATUS Nutt. Jour. Acad. Phila. **7**: 82. 1834

Not rare in moist pine-barrens east of Huntington. Previously known only from Florida and Alabama. The flowers of this species must be very late, for no trace of them is visible at the end of August.

RUDBECKIA MOHRII Gray, Proc. Am. Acad. **17** : 217. 1882

R. bupleuroides Shuttl.; Chapm. Fl. S. States, ed. 2, 629, 1883.

One of the characteristic plants of moist pine-barrens in the southeastern part of Sumter County, flowering from June to the end of August. This makes the third known station for this species. the other two being in West Florida, about 125 miles farther south and 200 feet lower.

HELIANTHUS RADULA (Pursh) T. & G. Fl. N. A. **2** : 321. 1842

In moist pine-barrens, flowering in September. Sumter County seems to be its northern limit, as far as known.

COREOPSIS NUDATA Nutt. Gen. **2**: 180. 1818

Collected in moist pine-barrens near Huntington, June 26, 1897, in flower. Previously known only from Florida and the adjacent coast of Georgia. The type-locality of this species is given by Nuttall as "St. Mary's, West Florida," but St. Mary's is in southeastern Georgia.

LYGODESMIA APHYLLA (Nutt.) DC. Prodr. **7**: 198. 1838

Collected in dry sand near the Flint River, in Dooly County, July 26, 1897. The type-locality and previously known range of this species are the same as in the case of *Coreopsis nudata*.

COLUMBIA UNIVERSITY.

The Erysiphaceae of Japan

By Ernest S. Salmon

(With Plate 26)

During the past eighteen months I have received from Prof. Kingo Miyabe, of the Sapporo Agricultural College, Japan, a large and well-preserved collection of Japanese Erysiphaceae, numbering 200 specimens. Most of this material is mentioned in my "Monograph of the Erysiphaceae" (3), but some of Professor Miyabe's specimens arrived too late to be included. I have also received subsequently 15 specimens from Prof. Shotaro Hori, of the Nishigahara Exper. Station, Tokio. Further, two articles have lately appeared dealing with Japanese mildews: one by H. & P. Sydow (1), in which a supposed new species of *Uncinula, U. Kusanoi*, is described; the other by P. Hennings (2), in which "*Phyllactinia suffulta* var. *moricola*" and "*Microsphaera Japonica*" appear. Dr. Hennings has very kindly sent me specimens of the two latter plants, and included also with them specimens of three more species from Japan under the Mss. names of *Uncinula verniciferae, U. Shiraiana* and *Microspharea sambucicola*. Dr. Hennings informed me that the description of these species was already in the printer's hands, and kindly gave me permission to mention them in this paper.

To Prof. K. Miyabe and Prof. S. Hori I beg to express my thanks for the valuable material (now in Kew Herbarium) sent by them; also to Mr. P. Sydow for a specimen of *Uncinula Kusanoi.*

Before giving a full list of the species (with their host-plants and localities), known to me from Japan, a few remarks are necessary on these lately published species.

U. Kusanoi H. & P. Syd. (on *Celtis Sinensis* Pers.). Meguro pr. Tokio (leg. Kusano), has perithecia from 80–110 μ in diameter, cells of the outer wall 15–20 μ wide, appendages 10–20, usually slightly exceeding the diameter of the perithecium, but varying from 1–1 ½ times its diameter, often unequal in length on the same perithecium, simply uncinate at the thin-walled hyaline apex, becoming thick-walled, refractive, and often rough in the lower half, 5–6 μ wide below, 17–20 μ wide across the apex; asci 3–4, rarely 5, broadly ovate to subglobose, $45–52 \times 35–40$ μ, very shortly stalked, spores crowded, 4–6, or rarely 7, usually 6, $21–24 \times 10–12$. (See Figs. 1–12.) The authors remark (1) of the plant, "Mit keiner der bisher auf *Celtis* bekannten *Uncinula*-arten zu identifiziren"; and it is quite true that the present fungus is distinct from *U. polychaeta*, *U. parvula* and *U. confusa*. But after careful comparison I am unable to separate "*U. Kusanoi*" from *U. Clintonii* Peck. At first sight *U. Clintonii* (in perhaps its commonest form) appears distinct in the larger perithecia with more numerous longer appendages, large and more numerous asci, and especially in the much enlarged clavate apex of the appendages, often measuring 30 μ across (see Figs. 18–23). But, as I have previously pointed out (3) the enlarged apex of the appendages cannot be considered as a constant character of *U. Clintonii*. In two interesting examples of the species—one from Crawfordsville, Indiana (E. M. Fisher, Oct., 1890. Ex. Herb. U. S. Dept. Agric., no. 1055), the other from Washington, D. C. (P. Magnus, Oct., 1897) (see Figs. 13–17), we find the perithecia exhibiting all the characters of the Japanese plant.

The perithecia of these American specimens are equally small (in one case the diameter was only 70 μ) the appendages are as few, with the apex measuring 20 μ across; and the number and size of the asci and spores are the same. Until lately *U. Clintonii* had been supposed to be confined to the United States (where it is not uncommon, on the single host-plant *Tilia Americana*, in the Eastern States), but, as I have already recorded (3), two Japanese examples of a fungus on *Zelkova acuminata* and *Aphananthe aspera* sent to me by Professor Miyabe, although differing slightly from the American forms of *U. Clintonii*, approached so closely to this species as to be unable to be separated. The discovery in Japan of a form of *U. Clintonii* on *Celtis Sinensis* agreeing exactly with certain American examples on *Tilia Americana* is therefore very interesting. I have received the present species (on *Celtis Sinensis*) from Prof. S. Hori (Tokio, Akabane, Oct. 15, 1899; coll. Nishida & Nambu).

Phyllactinia suffulta var. *moricola* P. Henn. Following the description the author remarks: "Diese Varietät ist von der Typischen Art schon äusserlich durch das dickfilzige, weisse bis gelbliche Mycel gut verschieden." In the specimen sent (on *Morus alba*, Tokio, leg. Miyoshi), the mycelium is persistent in a thin effused coat, but, as I have already shown (3), it isimpossible to regard the persistence or evanescence of the mycelium in the Erysiphaceae as a systematic character of the first importance. In certain examples of *P. corylea* (*P. suffulta*) on *Corylus* from Europe, and on *Quercus* from North America, the mycelium is frequently persistent just as in the Japanese plant, but no characters are shown of sufficient weight to separate the plants in any way from the type. It is interesting to find that in a specimen of *P. corylea*, sent to me by Professor Miyabe, on the same host (*Morus alba*) fromSapporo (E. Tokubuchi) the mycelium is perfectly evanescent. *Microsphaera sambucicola* P. Henn. ("on *Sambucus*, Japan") is *M. grossulariae*. This is the form of the species which was described by Gerard, from American specimens on *Sambucus Canadensis*, as *M. Van Bruntiana*, but which has been correctly referred to *M. grossulariae* by Burrill (Ell. & Everh. N. Amer. Pyren., p. 24).

Microsphaera Japonica P. Henn. (on *Cornus macrophylla*, Tokio). The author remarks (2) " Die Art ist von *M. pulchra* C. et Peck durch 8-sporige, eiförmige Asken durch die spitzen Enden der Anhängsel u. s. w. verschieden, derselben aber nahe stehend." I have already (3) referred this Japanese plant to *M. alni*, and also shown that "*M. pulchra*"—which is a more extreme form than the present plant cannot possibly be maintained as distinct. From the description given in the diagnosis (2) it would appear that the appendages were observed in an immature condition. The apex of a mature appendage is shown at Fig. 24. Comparison of this figure with those I have given (3) of the appendages of *M. alni* will show the identity of the Japanese plant.

Uncinula Shiraiana P. Henn. (on *Celtis Sinensis*, Tokio) is *U. polychaeta*. I had already seen examples of this fungus on the same host from Tokio, Sugamo (S. Hori). In these latter specimens the asci are 2-, or more often 3-spored, in Dr. Hennings' plant the asci are usually 3-spored, sometimes 2- or 4-, or very rarely 5-spored. In examples of the species from America the spores are almost constantly 2 in number, and the peculiarity of the

Chinese and Japanese specimens in having usually more spores has already been remarked (3). Tracy and Galloway, however, have recorded (Bot. Gaz. **13**: 29–32. 1888) the occurrence of 3 and 4 spores in the ascus in some American specimens.

U. verniciferae P. Henn. (on *Rhus vernicifera*, Tokio). The specimen sent is too immature to enable me to give a full description of the plant. It appears, however, a distinct species, showing affinity with *U. Sengokui*, but differing in the thicker-walled appendages, slightly narrowed upwards to the closely coiled frequently helicoid apex.

Dr. Hennings has also sent me an interesting form of *Erysiphe polygoni* on *Actinostemma racemosum*. This is remarkable in having the perithecia more or less imbedded in the persistent mycelium. Similar forms occur in Japan on *Diervilla Japonica* and *Paeonia obovata*.

The example of *M. alni* sent by Professor Hori on *Styrax Japonicum* from Tokio, Akabane (coll. Nambu and Nishida) is instructive in showing the variation that occurs in this species in the mode of branching of the apex of the appendages. In this specimen appendages may be found on the same perithecium with long or short primary branches (Figs. 25 and 26).

The occurrence of *Uncinula salicis* var. *Miyabei* on *Tilia Migueliana* is extremely interesting. The specimen was sent by Professor Miyabe, from Hokkaido, Prov. Ishikari, Shintotsugawa (coll. T. Kawakami) and agrees well with the original examples on *Alnus incana* and *A. maritima*. Professor Hori has sent specimens on the last named host from Tokio, Todamura under the MSS. name of *Uncinula aggregata*. It is possible that the present plant will prove to be specifically disinct from *U. salicis*.

I give below the distribution of the species of the Erysiphaceae occurring in Japan.

Erysiphe cichoracearum.—Europe (throughout); Africa (Algeria, Egypt); Asia (Persia, Turkestan, Siberia (Minussinsk)); New Zealand; North America (United States (throughout) and Canada (Ontario, New Brunswick, Newfoundland)).

E. galeopsidis.—Europe (throughout); Asia (Turkestan, Siberia (Minussinsk)); North America (United States (throughout) and Canada (Ontario, Newfoundland)).

E. graminis.—Europe (throughout); Africa (Algeria); Asia (Cyprus, Transcaucasia, Persia, Turkestan, Siberia (Minussinsk)); Australia (South, Victoria and New South Wales); North America (United States (throughout) and Canada (Ontario, Newfoundland)).

E. polygoni.—Europe (throughout); Africa (Canaries, Algeria); Asia (Transcaucasia, Turkey, Persia, Turkestan, India, Siberia (Minussinsk)); Australia (Victoria); New Zealand; North America (United States (throughout) and Canada (Manitoba, Ontario, New Brunswick)).

Microsphaera alni.—Europe (throughout); Asia (Transcaucasia); North America (United States (throughout) and Canada (Manitoba, Ontario, New Brunswick)).

M. berberidis.—Europe (throughout); Asia (Cyprus, Transcaucasia, Turkestan).

M. grossulariae.—Europe (throughout); North America (United States (throughout)).

Phyllactinia corylea.—Europe (throughout); Africa (Algeria); Asia (Transcaucasia, Turkey, Siberia (Minussinsk), China (Yunnan)); North America (United States (throughout) and Canada (Ontario, Newfoundland); Central America (Guatemala); South America (Paraguay, Patagonia).

Podosphaera leucotricha.—Europe (probably widely spread; recorded from Germany, Austria–Hungary and Russia); North America (United States (Vermont, Wisconsin, Iowa, Missouri, Kansas, Mississippi)).

P. oxyacanthae.—Europe (throughout); Africa (Algeria); Asia (Siberia (Minussinsk)); North America (United States (throughout), and Canada (Ontario, New Brunswick), Greenland.

P. oxyacanthae var. *tridactyla.*—Europe (throughout); North America (Washington (State)).

Sphaerotheca humuli.—Europe (throughout); Africa (Algeria); Asia (Transcaucasia, Turkestan, Siberia (Minussinsk)); North America (United States (throughout), and Canada (Ontario, New Brunswick, Newfoundland).

S. humuli var. *fuliginea.*—Europe (throughout). Asia (Turkestan, Siberia (Minussinsk)); North America (United States (throughout), and Canada (Ontario, New Brunswick)).

Uncinula aceris.—Europe (throughout); Asia (Transcaucasia).

U. australiana.—Australia (New South Wales).

U. clandestina.—Europe (not recorded farther east than Austria-Hungary and Poland); Africa (Algeria).

U. Clintonii.—North America (United States, widely spread in the Eastern States, but not recorded further west than Minnesota).

U. necator.—Europe (widely spread in the conidial state (*Oidium Tuckeri*), perithecia recorded from France only) ; North America (United States (throughout) and Canada (Ontario), with perithecia).

U. polychaeta.—Asia (China, (Yunnan)) ; North America (United States (South Carolina, Alabama, Mississippi)) ; South America (Argentine (Buenos Ayres)).

U. salicis.—Europe (throughout) ; Asia (Transcaucasia, India, Siberia (Minussinsk), China (Yunnan)) ; North America (United States (throughout)) and Canada (Ontario, Quebec).

According to their distribution the Japanese species may be arranged in the following six classes :

1. Cosmopolitan species : *Erysiphe cichoracearum*, *E. galeopsidis*, *E. graminis*, *E. polygoni*, *Microsphaera alni*, *Phyllactinia corylea*, *Podosphaera oxyacanthae*, *Sphaerotheca humuli* and var. *fuliginea*, *Uncinula salicis*.

2. European and North American species, recorded in Asia from Japan only : *Microsphaera grossulariae*, *Podosphaera leucotricha*, *P. oxyacanthae* var. *tridactyla*, *Uncinula necator*.

3. Old World species (*a*) European and Asiatic : *Microsphaera berberidis*, *Uncinula aceris* ; (*b*) European and African : *Uncinula clandestina*.

4. American species : *Uncinula Clintonii* (United States (Eastern States)) ; *U. polychaeta* (found in China also) (United States (Eastern States) and South America).

5. Australian species : *Uncinula australiana*.

6. Species known only from Japan : *Uncinula fraxini*, *U. Sengokui*, *U. salicis* var. *Miyabei* (see also *U. verniciferae*, p. 440).

The following is an alphabetical list of the Japanese species, with their host-plants and localities. Appended to this is a host index.

ERYSIPHE CICHORACEARUM DC.

On *Laportea bulbifera*, Yoichi, Prov. Shiribeshi (G. Yamada); on *Plantago Kamtschatica* Zenibako, Prov. Shiribeshi, and Shiriuchi, Prov. Oshima (K. Miyabe); on *P. major* var. *Asiatica*, Sapporo (K. Miyabe), Zenibako, Prov. Shiribeshi, and Saruru, Prov. Hidaka (E. Tokubuchi), Otaru, Prov. Shiribeshi (T. Nishida), Satsukari, Prov. Oshima, and Wakkanai, Prov. Kitami (K. Miyabe); on *Artemisia vulgaris*, Sapporo (K. Miyabe & E. Tokubuchi), Otaru, Prov. Shiribeshi (T. Nishida), Kamoikotan, Prov. Ishikari (K. Miyabe); on *A. Japonica*, Sapporo (E. Tokubuchi & T. Nishida).

E. GALEOPSIDIS DC.

On *Lamium album*, Inantoge, Prov. Shiribeshi (G. Yamada), Morioka, Prov. Rikuchu (Y. Takahashi), Sapporo (Y. Tokubucho & K. Miyabe), Satsukari and Taniyoshi, Prov. Oshima (K. Miyabe); on *Chelonopsis moschata*, Shikabe, Prov. Oshima (K. Miyabe), Ozawamura, Prov. Shiribeshi (G. Yamada); on *Stachys aspera* var. *Japonica*, Sapporo (E. Tokubuchi), Sunagawa, Prov. Ishikari (K. Miyabe).

E. GRAMINIS DC.

On *Hordeum vulgare*, Kyoto (N. Hiratsuka), Sapporo (G. Yamada & N. Hiratsuka), Mombetsu, Prov. Iburi and Iwanai, Prov. Shiribeshi, Hokkaido (G. Yamada); Tokio, Nishigahara (S. Hori), Hondō, Prov. Owari, Chita (Tokubuchi).

E. POLYGONI DC.

On *Elsholtzia cristata*, Sapporo (K. Miyabe, G. Yamada & E. Tokubuchi); on *Scutellaria scordiifolia*, Sapporo (K. Miyabe); on *Aconitum Fischeri* (*A. Kamtschaticum*), Toshimoi, Etrup Isl., Kuriles (T. Kawakami), Saruru, Prov. Hidaka, Hokkaido (E. Tokubuchi), Zenibako, Prov. Shiribeshi, Hokkaido (K. Miyabe); on *Polygonum aviculare*, Zenibako, Prov. Shiribeshi (K. Miyabe), Sapporo (G. Yamada); on *Fagopyrum esculentum*, Sapporo (G. Yamada), on *Pilea stipulosa* (*P. petiolaris*), Sapporo (K. Miyabe); on *Saxifraga cortusaefolia*, Sapporo (E. Tokubuchi); on *Diervilla Japonica*, Sapporo (N. Hiratsuka & K. Miyabe); on *Paeonia obovata*, Sapporo (E. Tokubuchi & K. Miyabe); on *Thalictrum minus* var. *elatum*, Abashiri, Prov. Kitami, Hokkaido (K. Miyabe); on *T. aquilegifo-*

lium, Okushiri Island, Hokkaido (K. Miyabe); on *Clematis fusca* var. *Yezoensis*, Sorachibuto, Prov. Ishikari, Hokkaido (K. Miyabe); on *Amphicarpaea Edgeworthii*, var. *Japonica*, Nagasaki (G. Kurosawa), Otaru, Prov. Shiribeshi and Sapporo (K. Miyabe), Tokio, Akabane (S. Hori); on *Astragalus reflexistipulus*, Sapporo, Hokkaido (K. Miyabe); on *Vicia Cracca*, Sapporo (K. Miyabe), Obashiri, Prov. Kitami, Hokkaido (K. Miyabe), Abuta, Prov. Iburi, Hokkaido (K. Miyabe), Ishizaki, Prov. Oshima, Hokkaido (K. Miyabe); on *Peucedanum terebinthaceum*, Sapporo (E. Tokubuchi); on *Caucalis Japonica*, Mombetsu, Prov. Iburi, Hokkaido (K. Miyabe), Sapporo (E. Tokubuchi); on *Vicia unijuga*, Sapporo (E. Tokubuchi & G. Yamada); on *Caltha palustris*, Kutchau, Prov. Iburi, Hokkaido (G. Yamada); on *Quercus glauca*, Kyoto (T. Nishida); on *Sedum Telephium* var. *purpureum*, Sapporo (cult.) (G. Yamada).

MICROSPHAERA ALNI (Wallr.) Salm.

On *Corylus rostrata* var. *Mandshurica*, Otaru, Prov. Shiribeshi, Hokkaido (K. Miyabe & E. Tokubuchi); on *Quercus dentata*, Sapporo (K. Miyabe & G. Yamada); on *Q. crispula*, Sapporo (K. Miyabe), Noboribetsu, Prov. Iburi (T. Kawakami); on *Alnus incana*, near Morioka, Prov. Rikuchu (Y. Takahashi); on *Cornus macrophylla*, Makomonoi, near Sapporo (K. Miyabe), Utashinai, Prov. Ishikari (E. Tokubuchi); on *Picrasma quassioides* (*P. ailanthoides*), Sapporo (N. Hiratsuka, Y. Takahashi & G. Yamada); on *Castanea vulgaris* var. *Japonica*, Temya and Otaru, Prov. Shiribeshi, Hokkaido (K. Miyabe), Sapporo (E. Tokubuchi), Morioka, Prov. Rikuchu (Y. Takahashi); on *Ligustrum medium*, Sapporo (E. Tokubuchi); on *Syringa Amurensis* var. *Japonica*, Chubetsu, Prov. Ishikari (K. Miyabe); on *Schizandra Chinensis*, Sapporo (K. Miyabe & E. Tokubuchi); on *Styrax Japonicum*, Tokio, Akabane (Nambu & Nishida).

M. BERBERIDIS (DC.) Lév.

On *Berberis vulgaris*, Esashi, Prov. Oshima (K. Miyabe), Okushiri Isl., Hokkaido (K. Miyabe), Samani, Prov. Hidaka, Hokkaido (E. Tokubuchi).

M. GROSSULARIAE (Wallr.) Lév.

On *Sambucus racemosa*, Tokio, Akabane (Nishida & Nambu); on *S. racemosa* var. *pubescens*, Abuta, Prov. Iburi (K. Miyabe), Sapporo (G. Yamada).

PHYLLACTINIA CORYLEA (Pers.) Karst.

On *Amelanchier Asiatica*, Ujina, by the Inland Sea (H. Kawakami); on *Magnolia Kobus*, Sapporo (G. Yamada & E. Tokubuchi), Tokio (S. Hori); on *Actinidia arguta*, Sapporo (E. Tokubuchi & G. Yamada); on *Broussonetia papyrifera*, Komaba, Tokio (K. Sengoku); on *Hamamelis Japonica*, near Morioka, Prov. Rikuchu (Y. Takahashi); on *Betula alba*, Sapporo (N. Hiratsuka); on *Alnus incana*, Sapporo (G. Yamada); on *A. incana* var. *glauca*, Tokio, Komaba (S. Hori); on *A. maritima* (*A. Japonica*), Sapporo (K. Miyabe), Saitama-Ken, Omiya (S. Hori); on *Paulownia imperialis*, Hirosaki, Prov. Rikuoku (N. Hiratsuka), Matsuyama, Prov. Iyo, Isl. Shakoku (K. Okudaira), Saitama-Ken, Urawa (S. Hori); on *Morus alba*, Sapporo (E. Tokubuchi) (K. Miyabe), Shinotsu, Prov. Ishikari (G. Yamada), Tokio (S. Hori); on *Fraxinus Mandshurica*, Sapporo (N. Hiratsuka).

PODOSPHAERA LEUCOTRICHA (Ell. & Everh.) Salm.

On *Pyrus Sieboldi* (*P. Toringo*), Sapporo (K. Miyabe).

P. OXYACANTHAE (DC.) de Bary

On *Spiraea betulifolia*, Sapporo (Bot. Gardens) (K. Miyabe).

P. OXYACANTHAE var. TRIDACTYLA (Wallr.) Salm.

On *Prunus communis*, Sapporo (G. Yamada & E. Tokubuchi) Otaru, Prov. Shiribeshi, Hokkaido (K. Miyabe).

SPHAEROTHECA HUMULI (DC.) Burr.

On *Epilobium* sp., Etrup Isl., Kuriles (T. Kawakami); on *E. cephalostigma*, Ozawamura, Prov. Shiribeshi (G. Yamada); on *Potentilla fragarioides*, Samani, Prov. Hidaka, Hokkaido (E. Tokubuchi), Kumaishi, Prov. Oshima, Yozo (K. Miyabe), Sapporo (K. Miyabe), on *Spiraea Kamtschatica*, Sapporo (K. Miyabe), Garugawa, Prov. Ishikari (K. Miyabe), Shiriuchi, Prov. Oshima, Hokkaido (K. Miyabe); on *S. Aruncus*, Sapporo (K. Miyabe);

on *Poterium tenuifolium*, and var. *album*, Sapporo (K. Miyabe); on *P. officinale* var. *carneum*, Saruru, Prov. Hidaka, Hokkaido (E. Tokubuchi), Sapporo (K. Miyabe); on *P. Canadense* var. *medium*, Zuwosan, Prov. Iwaki (K. Miyabe); on *Geranium Nepalense*, Kami-iso, Prov. Oshima, Hokkaido (K. Miyabe) ; on *Agrimonia Eupatoria*, Mombetsu, Prov. Iburi, Hokkaido (K. Miyabe), Sapporo (G. Yamada); on *Spiraea Thunbergii*, Morioka, northern part of Main Island, Hondo (Y. Takahashi).

S. HUMULI var. FULIGINEA (Schlecht.) Salm.

On *Ajuga ciliata*, Sapporo (E. Tokubuchi); on *Calamintha Chinensis*, Sapporo (K. Miyabe); on *Siegesbeckia orientalis*, Sapporo (Takahashi & Hiratsuka); on *Cnicus Weyrichii* var. *Grayanum*, Sapporo (G. Yamada); on *Carpesium abrotanoides*, Sapporo (G. Yamada); on *Arctium majus*, Sapporo (K. Miyabe & E. Tokubuchi); on *Lactuca Raddiana*, Sapporo (K. Miyabe); on *Impatiens Noli-tangere*, Sapporo (E. Tokubuchi & K. Miyabe); on *I. Textori*, Sapporo (K. Miyabe & G. Yamada): on *Adenocaulon bicolor* (*A. adhaerescens*), Saruru, Prov. Hidaka, Hokkaido (E. Tokubuchi), Abuta, Prov. Iburi, Hokkaido (K. Miyabe); Sapporo (G. Yamada); on *Lactuca brevirostris* (*L. squarrosa*), Morioka, Prov. Rikuchu (Y. Takahashi); on *Fatoua pilosa* var. *subcordata*, Nagasaki (G. Kurosawa).

UNCINULA ACERIS (DC.) Sacc.

On *Acer pictum*, Sapporo (G. Yamada & K. Miyabe), Sugamo, Tokio (S. Hori) ; on *A. spicatum* var. *Ukurunduense* (G. Yamada).

U. AUSTRALIANA McAlp.

On *Lagerstroemia Indica*, Tokio (S. Hori) ; Sendai (K. Miyabe & K. Sengoku), Nishigahara, Tokio (S. Hori).

U. CLANDESTINA (Biv. Bern.) Schroet.

On *Ulmus campestris*, Sapporo (Takahashi & Hiratsuka) ; on *U. parviflora*, Hondo, Prov. Mino, Gifu (E. Tokubuchi).

U. CLINTONII Peck

On *Aphananthe aspera*, Tokio (K. Sengoku & K. Miyabe) ; on *Zelkova acuminata* (*Z. Keaki*), Kobe (K. Miyabe) ; on *Celtis Sinensis*, Tokio, Akabane (Nishida & Nambu).

U. FRAXINI Miyabe MSS. Salm.

On *Fraxinus longicuspis*, Sapporo (K. Miyabe).

U. NECATOR (Schwein.) Burr.

On *Actinidia polygama*, Okushiri Isl., Prov. Shiribeshi, Hokkaido (K. Miyabe), Samani Sando, Prov. Hidaka, Hokkaido (E. Tokubuchi) ; on *A. arguta*, Sapporo (K. Miyabe) ; on *A. Kolomikta*, Yubari, Prov. Ishikari, Hokkaido (E. Tokubuchi).

U. POLYCHAETA (Berk. & Curt.) Ell.

On *Aphananthe aspera*, Tokio (K. Sengoku), Hondo, Gifu (E. Tokubuchi) ; on *Celtis Sinensis*, Tokio, Sugamo (S. Hori).

U. SALICIS (DC.) Karst.

On *Salix viminalis*, Sapporo (E. Tokubuchi); on *S. daphnoides* (*S. acutifolia*), Sapporo (E. Tokubuchi) ; on *S. stipularis*, Sapporo (E. Tokubuchi) ; on *S. Caprea*, Sapporo (G. Yamada) ; on *S. Urbaniana*, Sapporo (N. Hiratsuka) ; on *S. gracilistyla* (*S. Thunbergiana*), Shibuya, Tokio (S. Hori); on *Populus balsamifera*, Sapporo (K. Miyabe) ; on *P. suaveolens*, Sapporo (K. Miyabe) ; on *P. tremula*, Abashiri, Prov. Kitami, Hokkaido (J. Tanaka).

U. SALICIS var. MIYABEI Salm.

On *Alnus incana*, Sapporo (G. Yamada) ; on *A. maritima* (*A. Japonica*), Sapporo (K. Miyabe), Tokio, Todamura (S. Hori) ; on *Tilia Migueliana*, Hokkaido, Prov. Ishikari, Shintotsugawa (T. Kawakami).

U. SENGOKUI Salm.

On *Celastrus articulatus*, Komaba, Tokio (K. Sengoku).

HOST INDEX

Acer pictum, spicatum var. Ukuruduense..........................U. aceris.
Aconitum Fischeri (Kamtschaticum)..........................E. polygoni.
Actinidia arguta..........................P. corylea and U. necator.
A. Kolomikta, polygama..........................U. necator.
Actinostemma racemosum..........................E. polygoni.
Adenocaulon bicolor (adhaerescens)..........................S. humuli var. fuliginea.
Agrimonia Eupatoria..........................S. humuli.
Ajuga ciliata..........................S. humuli var. fuliginea.
Alnus incana..........................U. salicis var. Miyabei, M. alni and P. corylea.

A. incana var. glauca	P. corylea.
A. maritima (Japonica)	P. corylea and U. salicis var. Miyabei.
Amelanchier Asiatica	P. corylea.
Amphicarpaea Edgeworthii var. Japonica	E. polygoni.
Aphananthe aspera	U. polychaeta and U. Clintonii.
Arctium majus	S. humuli var. fuliginea.
Artemisia Japonica, vulgaris	E. cichoracearum.
Astragalus reflexistipulus	E. polygoni.
Berberis vulgaris	M. berberidis.
Betula alba	P. corylea.
Broussonetia papyrifera	P. corylea.
Calamintha Chinensis	S. humuli var. fuliginea.
Caltha palustris	E. polygoni.
Carpesium abrotanoides	S. humuli var. fuliginea.
Castanea vulgaris var. Japonica	M. alni.
Caucalis Japonica	E. polygoni.
Celastrus articulatus	U. Sengokui.
Celtis Sinensis	U. Clintonii and U. polychaeta.
Chelonopsis moschata	E. galeopsidis.
Clematis fusca var. Yezoensis	E. polygoni.
Cnicus Weyrichii var. Grayanum	S. humuli var. fuliginea.
Cornus macrophylla	M. alni.
Corylus rostrata var. Mandshurica	M. alni.
Diervilla Japonica	E. polygoni.
Elsholtzia cristata	E. polygoni.
Epilobium cephalostigma	S. humuli.
Fagopyrum esculentum	E. polygoni.
Fatoua pilosa var. subcordata	S. humuli var. fuliginea.
Fraxinus longicuspis	U. fraxini.
F. Mandshurica	P. corylea.
Geranium Nepalense	S. humuli.
Hamamelis Japonica	P. corylea.
Hordeum vulgare	E. graminis.
Humulus Lupulus	S. humuli.
Impatiens Balsamina, Noli-tangere, Textori	S. humuli var. fuliginea.
Lactuca brevirostris (squarrosa), Raddiana	S. humuli var. fuliginea.
Lagerstroemia Indica	U. australis.
Lamium album	E. galeopsidis.
Lapartea bulbifera	E. cichoracearum.
Ligustrum medium	M. alni.
Magnolia Kobus	P. corylea.
Morus alba	P. corylea.
Paeonia obovata	E. polygoni.
Paulownia imperialis	P. corylea.
Peucedanum terebinthaceum	E. polygoni.
Picrasma quassioides	M. alni.

Pilea stipulosa (petiolaris) ....E. polygoni.
Plantago Kamtschatica, major var. Asiatica..........................E. cichoracearum.
Polygonum aviculare...E. polygoni.
Populus balsamifera, suaveolens, tremula..............................U. salicis.
Potentilla fragarioides...S. humuli.
Poterium Canadense var. medium, officinale var. carneum, tenuifolium and var. album..S. humuli.
Prunus communis..P. oxyacanthae var. tridactyla.
Pyrus Sieboldi (Toringo)...P. leucotricha.
Quercus crispula, dentata...M. alni.
Q. glauca...E. polygoni.
Rhus vernicifera...U. verniciferae (see p. 440).
Salix Caprea, daphnoides, gracilistyla, purpurea, stipularis, Urbaniana, viminalis..U. salicis.
Sambucus racemosa and var. pubescens..................................M. grossulariae.
Saxifraga cortusaefolia...E. polygoni.
Schizandra Chinensis..M. alni.
Scutellaria scordiifolia..E. polygoni.
Sedum Telephium var. purpureum...E. polygoni.
Siegesbeckia orientalis..S. humuli var. fuliginea.
Spiraea Aruncus..S. humuli.
S. betulifolia...P. oxyacanthae.
S. Kamtschatica, Thunbergii...S. humuli.
Stachys aspera var. Japonica...E. galeopsidis.
Styrax Japonicum...M. alni.
Syringa Amurensis var. Japonica.. "
Thalictrum aquilegifolium, minus var. elatum..........................E. polygoni.
Tilia Migueliana...U. salicis var. Miyabei.
Ulmus campestris, parvifolia...U. clandestina.
Vicia Cracca, unijuga..E. polygoni.
Zelkova acuminata (Keaki)..U. Clintonii.

BIBLIOGRAPHY

1. **Sydow, H. & P.** Fungi novi japonici. Mém. de l'Herb. Boiss., No. 4, p. 4. 1900.

2. **Hennings, P.** Fungi japonici. Engler's Bot. Jahrbüch. 28: 271, 272. 1900.

3. **Salmon, E. S.** A Monograph of the Erysiphaceae. Mem. Torr. Club, 9. 1900.

Explanation of Plate 26

(Unless otherwise stated, all figures are magnified 400 times.)

FIGS. 1–12. *Uncinula Kusanoi* H. & P. Syd., from an authentic specimen; 1, 2, perithecia, × 150; 3, cells of outer wall of perithecium; 4–7, appendages; 8–10 asci; 11, 12, spores.

FIGS. 13, 14. *U. Clintonii* Peck, from specimens collected at Crawfordsville, Ind., U. S. A. (E. M. Fisher) (Ex Herb. U. S. Dept. Agric., no. 1055); 13, perithecium, × 150; 14, appendage.

FIGS. 15–17. *U. Clintonii* Peck, from specimens collected at Washington, D. C. (P. Magnus); 15, perithecium, × 150; 16, appendage; 17, ascus.

FIGS. 18–23. *U. Clintonii* Peck, from specimens collected at Winona, Minn. (J. M. Holzinger) (Ex Herb. U. S. Dept. Agric.); 18, perithecium, × 150; 19–22, appendages; 23, ascus and spores.

FIG. 24. *Microsphaera Japonica* P. Henn.; apex of mature appendage.

FIGS. 25, 26. *M. alni* (Wallr.) Salm., from specimens collected at Akabane, Tokio (Nambu & Nishida) on *Styrax Japonicum;* apex of two appendages from the same perithecium.

The Development of the Karyokinetic Spindle in Vegetative Cells of Higher Plants

By Amanda McComb

(With Plates 24 and 25)

Until recent years very little was known in regard to the development of the nuclear spindle in higher plants. The commonly accepted view, that the karyokinetic spindle arose through the instrumentality of centrosomes or centrospheres was shown to be incorrect by the researches of Mottier ('97) and Osterhaut ('97) upon spore-mother cells of certain higher plants. This discovery gave an impetus to the study of karyokinesis in vegetative cells, and during the last few years a number of observers have devoted their entire attention to this subject.

Nemec ('98) who has recently published an account of the origin of the spindle in vegetative cells states, that when the chromatin thread divides into chromosomes a hyaline court appears about the nucleus. In *Allium cepa* it is never of uniform width around the nucleus, but it is broader on the sides turned towards the poles of the future spindle.

This court is sharply differentiated from the surrounding cytoplasm by a definite membrane. When the chromosomes are assuming an equatorial position this membrane begins to disappear. In this hyaline space or court central spindle fibers originate, while the peripheral fibers owe their origin to the membrane.

"Zu der selben Zeit," to use his exact words, "wo der Kernfaden in die Chromosomen zerfällt, erscheint um den Kern herum ein hyaliner Hof, der jedoch zunächst an den Polen der Theilungsachse sicher zu constatiren ist (l. c., Fig. 34, Taf. III.). Der Hof ist gegen die ihn umgebende Plasmaansammlung scharf abgegrenzt. * * * Dasselbe scheint auch seine eigene Membran zu besitzen (l. c., 34, Taf. III.), die jedoch im Stadium wo sich die Chromosomen zur Aequatorialstellung umzulagern beginnen, verschwindet."

"Die Spindelanlage tritt ueberall als ein hyalines, den kern umgebendes Gebilde auf, das an den Polenkappenförmig geformt ist."

The mantle fibers, which, according to the same observer, are first noted with the appearance of the hyaline court, arise in the cytoplasm immediately surrounding the court. These fibers grow gradually from the poles and on reaching the cell walls fasten themselves there.

Soon after the appearance of Nemec's paper, Hof ('98) published an account of his researches in an article entitled "Histologische Studien an Vegetationspunkten."

He found nothing that indicated the origin of the nuclear spindle until at the time of the segmentation of the chromatin thread. When first noted the spindle anlage, according to Hof, has the appearance of caps of kinoplasmic fibers at two diametrically opposite points on the outer surface of the nucleus. These kinoplasmic fibers, which he calls the pole caps, from their reaction toward reagents, show themselves to be the beginning of the nuclear spindle.

These caps take the form of a sharply pointed cone in the inner part of which are delicate threads that are fastened to the nuclear wall and converge to one point, whereby a bipolar spindle is formed.

Not until the chromatin thread is segmented into the chromosomes does he observe any indication of the karyokinetic spindle. "Auf die Längspaltung der chromatischen Elemente des Fadens folgt auch seine Segmentirung in Chromosomen. Diese treten auseinander und platten sich noch mehr ab, wobei aber die Chromatin spaltung wie der unkenntlich wird und der Faden sich gleichmässig tingirt. Die Kernwandung ist noch immer unverändert vorhanden. Im Gegensatz hierzu fand Mottier, das bei der vegetativen Theilung der *Liliaceen* der Chromatin faden zur Zeit, wo die Kernnandung als solche verschwindet, und die Spindelfasern in die Kernhöhle eintreten noch nicht in seine Segmente getheilt sei. In sammtlichen von mir untersuchten Objecten verhielt sich das, wie, eben angeführt wurde, anders.

Bis in das geschilderte Stadium hinein, war an meinen Objecten, weder ausserhalb noch innerhalb die Andeutung einer Spindelanlage zu finden.

Hierauf erst werden gleichzeitig an zwei diametral-entgegenstehenden Punkten der Kernoberfläche, ihr kappenförmig aufsitzend, kinoplasmatische Ansammlungen kenntlich, * * * Dis Fasern convergiren gewöhnlich alle nach einem Punkt, dem Pol der Kappe; die Spindel-Anlage ist als dann worklich bipolar."

According to Shaffner ('98) in his paper on karyokinesis in root tips of *Allium cepa*, "The division begins with the separation of the centrospheres, and when these have moved apart nearly 180° the incept (anlage) of the achromatic spindle appears, forming two dome-shaped projections on opposite sides of the nucleus, at the summits of which centrospheres are situated, forming the poles around which are cytoplasmic radiations."

"These centrospheres gradually extend outwards, drawing the spindle into a sharp pointed bipolar structure." "The incept of the spindle is very sharply differentiated from the surrounding cytoplasm and the space between it and the nuclear membrane appears very clear and transparent, like the achromatin of the nucleus."

The mantle fibers he regards as streams of cytoplasm which have nothing to do directly with the formation of the spindle.

In a study of nuclear division in the root-tip of *Allium cepa*, *Vicia faba* and *Erythronium Americanum* my observations have shown that in many cases, at least, certain very early stages in the development of the spindle have been overlooked by the three observers just cited.

The material for this study was prepared according to the method used by Mottier ('97) in his studies of *Lilium*.

In the earliest stages observed by me the fibers which take part in the formation of the spindle are comparatively few, and difficult to differentiate from the remaining cytoplasm.

In some cases at least the spindle anlage takes its origin in a delicate kinoplasmic weft surrounding the nucleus, rather than within a clear space or court formed about the nucleus. Figs. 1 and 2 represent two very early stages. In Fig. 1 the kinoplasmic fibers present form a delicate weft about the nucleus. In Fig. 2 the weft is more pronounced and it is seen to retreat from the nucleus at two opposite points forming the cap-like spaces or courts described by Nemec. In Fig. 2 it is not assumed that the fibers which converge toward the cell wall indicate the poles of the future spindle, but they lie in the equatorial region. It is clear that the spindle shown in Fig. 8 arose from such an anlage as Fig. 2. In these first two figures mentioned, the chromatin thread had not segmented into chromosomes, so that it may be asserted with all certainty that the anlage of the spindle may appear in *Allium* before the segmentation into chromosomes.

The fibers of this weft, as they assume more and more a longitudinal direction, form cone-shaped masses of spindle fibers on opposite side of the nucleus. These cone-shaped caps may at first enclose a space nearly free from kinoplasmic fibers; but later fibers penetrate the cone- or cylindrical-shaped spaces and become attached to the nucleus membrane.

Very frequently the fibers forming the periphery of the conical cap are arranged so closely together as to give in optical section, the appearance of a membrane defining a hyaline space on opposite sides of the nucleus, similar to that described by Nemec.

In some cases, however, it seems evident that the spindle anlage does not consist of two distinct halves, but certain fibers extend from one polar region to the other, a condition which must necessarily follow in case the fibers form a weft in the beginning (Figs. 2, 3 and 6).

It may be reasonably questioned whether such stages as represented in Figs. 3, 4 and 5 ever passed through that of Figs. 2 or 1. There was nothing in the appearance of the nucleus which could justify the unqualified assertion that Fig. 3 or Fig. 4 was a later stage than Fig. 2, yet much may depend upon whether the division follows a period of longer rest or whether it was one of a more rapid succession of divisions. We shall return to this phase of the subject later on.

It is evident from Figs. 3, 4 and 5 that we have to do with mono-axial spindle anlages which are not necessarily strictly bipolar, although this is sometimes true. Frequently fibers of the anlage may converge into one point at one end and into more than one at the other (Figs. 3 and 4), but the developing spindle is not so pronouncedly multipolar as in reproductive cells (Mottier, '97).

It is a matter of frequent observation that the fibers on one side of the nucleus are much longer than those at the other

(Fig. 4). Whether this fact has any special significance can not be stated at present.

During the stage just mentioned, the chromatin thread is in the form of the hollow spirem. The longitudinal splitting has taken place earlier as described by Mottier. In all the stages following those represented in Fig. 1 until the separation of the chromosomes at the equatorial plate this longitudinal splitting exists, but it is not shown in all the figures, for the process of staining necessary to bring out the spindle fibers clearly, leaves the chromosomes too densely stained to enable one to distinguish the daughter segments.

The next important step in the process is the gradual disappearance of the nuclear membrane. This appears first on the sides next to the poles (Fig. 6). The kinoplasmic fibers enter the nuclear cavity. Many attach themselves to the chromosomes while others are seen to extend from pole to pole (Figs. 7, 8). In Figs. 6, 7, 8, the poles of the spindle are broadly truncate, although generally at this stage they are sharp pointed. The chromosomes are somewhat crowded in the equatorial region but they have not as yet become oriented into the equatorial plate of the mature spindle. This behavior of the chromosomes during the disappearance of the nuclear membrane and the penetration of the spindle fibers into the nuclear cavity, is similar to that which has been observed in pollen-mother cells (Mottier, '97).

Fig. 11 is instructive in that several distinct poles are still present in each polar region. The arrangement of the chromosomes in this figure shows clearly that it is of the same stage in development as Figs. 7 and 8. In the mature spindle here as in reproductive cells, three sets of spindle fibers may be distinguished, namely: those which extend from the poles to the chromosomes to which they are fastened, those running from pole to pole, and the so-called mantle fibers which diverge from the poles toward the periphery of the cell in the equatorial region (Figs. 8 and 11).

In the mature spindle the chromosomes are often quite regularly arranged in the equatorial plate forming the well-known monaster (Fig. 12). Frequently they do not appear to be oriented with such regularity. At this stage the spindle is as a rule strictly bipolar, but sometimes (Fig. 12) two or more poles still persist.

Another interesting phenomenon is presented in Figs. 5, 9, and 10. Here the chromatin spirem remains unsegmented at a much later period. In Fig. 5 the spindle anlage is a monoaxial bipolar structure, while the chromatin thread remains in the form of a continuous spirem. The same seems to be true also in Fig. 10, but here the nuclear membrane has disappeared and the spindle has reached a later stage in development. (The free ends shown in the drawing represents part of the spirem cut by the knife in sectioning.) The nucleolus is still present. In Fig. 9 the spirem is partly segmented. The chromosomes when in the equatorial plate are either straight rods or bent somewhat u or j-shaped. They are attached to the spindle fibers either at the ends or at the point of bending. Their evolution during metakinesis and the anaphase are so well known that a repetition here would be without value.

Although the spindle fibers may not in some cases be united into a common point or pole when the spindle is mature (Fig. 12), yet the several points or poles into which portions of the spindle fibers converge almost invariably unite into a single pole sometime during the anaphase.

Fig. 13 is a typical karyokinetic figure during the anaphase. The three sets of spindle fibers mentioned above are seen with great clearness. When the spindle fibers are relatively abundant it is readily seen that their arrangement is the same as in reproductive cells.

A marked contrast between the karyokinetic spindle in vegetative and reproductive cells in the higher plants and especially in the Liliaceae is the small quantity of spindle fibers in the former. This is one of the principal reasons why the process here is more difficult to follow. The spindle fibers are often comparatively few and difficult to stain sufficiently to enable the observer to trace them in detail, and at the same time to prevent over straining of the remaining cytoplasm which would invariably conceal the delicate fibers.

Fig. 14 shows the origin of the cell plate which is laid down here as in pollen-mother cells. The daughter chromosomes which are very regular in this particular case seem to be forming at once a daughter spirem by the union of their free ends.

From the foregoing it will be seen that the early development of the spindle does not quite agree with the observations of Hof ('98) on *Ephedra* in which it is claimed that no trace of the spindle appears until after the segmentation of the chromosomes. The segmentation of the chromatin spirem into the individual chromosomes represents a definite phase in the development of the karyokinetic process, yet the time when it occurs as measured by a certain stage in the formation of the spindle may not seem to be of much importance since it has been shown that the time of segmentation varies much under different conditions in embryo-sac and in pollen-mother-cells and we find this to be true also in vegetative cells.

In the first nuclear division in embryo-sac and pollen-mother-cells (Mottier, '97), the chromatin thread is segmented sometime before the nuclear membrane disappears and before a definite spindle is present; but in the two succeeding divisions in the embryo-sac and the second one in the pollen-mother-cell, which take place in a rather rapid succession, the nuclear membrane disappears and a definite spindle may be developed before the segmentation into chromosomes.

The first nuclear division in the pollen- and embryo-sac-mother-cells is preceded by a long period of growth in which the nucleus is in a resting stage characterized by the fine nuclear reticulum, whereas the second and succeeding divisions in the embryo-sac of *Lilium* follow a much shorter period of rest. In the pollen-mother-cell, as is well known, the nucleus does not enter the complete state of rest at all before the second division.

Hof has observed that in vegetative cells one nuclear division may follow another in rapid succession without the intervention of the period of complete rest, and we are convinced that the same often happens in *Allium*. In the light of this fact, therefore, it is possible that such conditions as revealed in Figs. 5, 9 and 10 represent nuclei which are dividing without having passed through the stage of complete rest. Here as in the embryo-sac the spindle has probably advanced farther before the segmentation of chromosomes. The possibility is also not excluded that in Fig. 14 we have the chromosomes uniting to form a hollow spirem to be a corresponding stage in a rapidly succeeding division.

In regard to the presence of centrosomes or centrospheres as claimed by Guignard and Schaffner ('98), I must assert with all emphasis that no such organs exist in the root-tip of *Allium*. In view of the development of the spindle through a multipolar structure as discovered by Belajeff ('94) and confirmed by other observers, and in the presence of well-fixed and well-stained preparations which show every step in the process it seems well-nigh incredible that any one should be able at the present day to read centrosomes or centrospheres into the process.

In view of the foregoing observations it is quite clear that the process of spindle formation in vegetative cells of the higher plants is not essentially different from that observed in reproductive cells of those plants. In both cases the spindle fibers, or at least the vast majority of them, are of cytoplasmic origin. They may either appear at first in the form of a weft about the nucleus or radiate from it. It matters little or nothing whether they radiate uniformly from the entire surface of the nucleus or are confined to two opposite sides. In the vegetative cells in question the spindle anlage may be monoaxial and strictly bipolar from the first, but it is often multipolar.

Whether the anlage be multipolar and polyaxial or multipolar and monoaxial seems to be of little importance. The spindle in all phases of its development is a product of the kinoplasmic fibers without the intervention or instrumentality of individualized kinetic centers such as centrospheres or centrosomes.

This work was carried out in the botanical laboratories of Indiana University under the direction of Prof. D. M. Mottier who so kindly gave me the benefit of his larger experience in similar investigations both in the making of preparations and in the interpretation of results.

Explanation of Figures 24 and 25

All figures drawn from microtome sections by the aid of a camera lucida and Bausch and Lomb $\frac{1}{12}$ oil immersion and oculars one inch and two inch.

All figures refer to *Allium cepa*.

Fig. 1. A cell in which a very delicate weft of kinoplasmic fibers appear about the nucleus. Chromatin thread is not segmented into chromosomes; the free ends indicate where the spirem was cut by the knife.

Fig. 2. The weft of kinoplasmic fibers is removed some distance from the nuclear membrane on two opposite sides, thus forming a colorless space between it and the nucleus. The fibers of the weft diverge on the right and left toward the cell wall.

FIG. 3. The spindle anlage consists of two cone-shaped caps on opposite sides of the nucleus. The fibers converge into one pole at the lower end, but form two or more at the upper end.

FIG. 4. Similar spindle anlage, but both poles broadly truncate.

FIG. 5. Spindle anlage similar to Fig. 4. The chromatin spirem which winds regularly in the nucleus is drawn as seen from the surface.

FIG. 6. The spindle anlage consists of a cylindrical complex of fibers in which the nucleus lies. The nuclear membrane has begun to disappear.

FIG. 7. The nuclear membrane has disappeared. The chromosomes are being oriented in the nuclear plate; the spindle poles are very truncate.

FIG. 8. Similar to Fig. 7. The mantle fibers are more pronounced.

FIG. 9. Chromatin more crowded in the center of the spindle-fiber complex. Segmentation of spirem has probably taken place.

FIG. 10. Chromatin spirem in all probability unsegmented; it is much contracted; a large nucleolus is still present. The chromatin in Figs. 9 and 10 seem to indicate that these divisions were not preceded by a period of complete rest.

FIG. 11. Spindle monoaxial but multipolar; chromosomes not quite arranged in the equatorial plate.

FIG. 12. Chromosomes arranged in the nuclear plate; the spindle is still multipolar in this case, but in this stage it is usually strictly bipolar. This is a mature spindle.

FIG. 13. Karyokinetic figure in an aphase.

FIG. 14. Chromosomes have arrived at the poles; the cell plate is being laid down in the connecting fibers.

LITERATURE

Guignard, L., '98. Les centres cintetiques chez les végétaux. Ann. des sci. Nat. Bot. III., **5**: 177. 1898.

Hof, A. C., 98. Histologische Studien an Vegetationspunkten. Botan. Centralb. **77**: —. 1898.

Mottier, D. M., '97. Beiträge zur Kenntniss der Kerntheilung in den Pollenmutterzellen einiger Dikotylen und Monokotylen. Jahrb. für wiss. Bot. **30**: 169–200. 1897.

——— **'97.** Ueber das Verhalten der Kerne bei der Entwickelung des Embryosacks und die Vorgänge bei der Befruchtung. Jahrb. für wiss. Bot. **30**: —. 1897.

Nemec, Bohumil, '99. Ueber die Karyokinetische Kerntheilung in den Wurzelspitze von *Allium cepa.* Jahrb. für wiss. Bot. **33**: 1899.

Osterhaut, W. J. V., '97. Ueber Entstehung der karyokinetisch Spindel bei Equisetum. Jahrb. für wiss. Bot. **30**: 160–167. 1897.

Shaffner, J. H. '98. Karyokinesis in the Root Tips of *Allium cepa.* Bot. Gaz. **26**: 225. 1898.

Botanical Club of the A. A. A. S.

PROGRAM OF THE NEW YORK MEETING OF 1900

The meetings were under the chairmanship of Prof. F. S. Earle, of Auburn, Ala.

The following papers were presented :

F. C. Stewart, "Notes on some Fruit Diseases."

L. C. Corbett, "Transpiration Apparatus."

O. F. Cook (presented by C. L. Pollard), "The Method of Types in Botanical Nomenclature."

C. O. Townsend, "The Effect of Hydrocyanic Gas upon Fungi and Fungus Spores."

W. A. Kellerman, "A Foliicolous Form of *Ustilago Reiliana*."

F. E. Lloyd, "Notes on Nectaries in Ferns."

C. L. Pollard, "The Washington Biologists' Field Club."

S. M. Tracy, "Notes on the Florida Flora."

The officers for the ensuing year were elected as follows :

President, Professor L. H. Pammell, Ames, Ia.

Secretary, Roscoe Pound, Lincoln, Nebraska.

FRANCIS LLOYD,
Secretary.

Index to recent Literature relating to American Botany

Andrews, F. M. Notes on a species of *Cyathus* common in Lawns at Middlebury, Vermont. Rhodora, **2**: 99–101. *pl. 17*. M. 1900.

Britten, J. Bibliographical Notes.—XXIII. An overlooked Paper by Rafinesque. Jour. Bot. **38**: 224–229. Je. 1900.

Campbell, D. H. Die Entwickelung des Embryosac von *Peperomia pellucida* Kunth. Ber. d. Deutsch. Bot. Gesell. **10**: 452–454. D. 1899.

Cardot, J. Note préliminaire sur les Mousses recueillies par l'Expédition antarctique belge. Rev. Bryol. **27**: 38–46. 1900.

Includes diagnostic notes on several new species, partly from the Straits of Magellan and Tierra del Fuego.

Conant, J. F. The Boston Mycological Club. Rhodora, **2**: 93–95. My. 1900.

Dixon, H. N. *Amblystegium compactum* in Britain. Jour. Bot. **38**: 175–182. My. 1900.

Eggleston, W. W. Flora of Mt. Moosilauke. Rhodora, **2**: 97–99. My. 1900.

H[ooker], J. D. *Acacia sphaerocephala*. Curt. Bot. Mag. III., **55**: *pl. 7663*. 1 Jl. 1899.

Native of Mexico.

H[ooker], J. D. *Begonia venosa*. Curt. Bot. Mag. III., **55**: *pl. 7657*. 1 Jn. 1899.

Native of Brazil, n. sp.

H[ooker], J. D. *Dahlia Maximiliana*. Curt. Bot. Mag. III., **55**: *pl. 7655*. 1 My. 1899.

Native of Mexico.

H[ooker], J. D. *Masdevallia muscosa*. Curt. Bot. Mag. III., **55**: *pl. 7664*. 1 Jl. 1899.

Native of Colombia and Ecuador.

H[ooker], J. D. *Nicotiana sylvestris*. Curt. Bot. Mag. III., **55**: *pl. 7652*. 1 My. 1899.

Native of Argentina.

H[ooker], J. D. *Yucca Whipplei*. Curt. Bot. Mag. III., **55**: *pl. 7662*. Jl. 1899.

Native of California

Huntington, J. W. Some Uncommon Mosses in Northern Essex County, Massachusetts. Rhodora, **2**: 95–97. My. 1900.

Loew, O. A new Enzyme of General Occurrence in Organisms. Science, II., **11**: 701, 702. 4 My. 1900.

Moore, G. F. *Chlorocystis Cohnii* on the Massachusetts Coast. Rhodora **2**: 104. My. 1900.

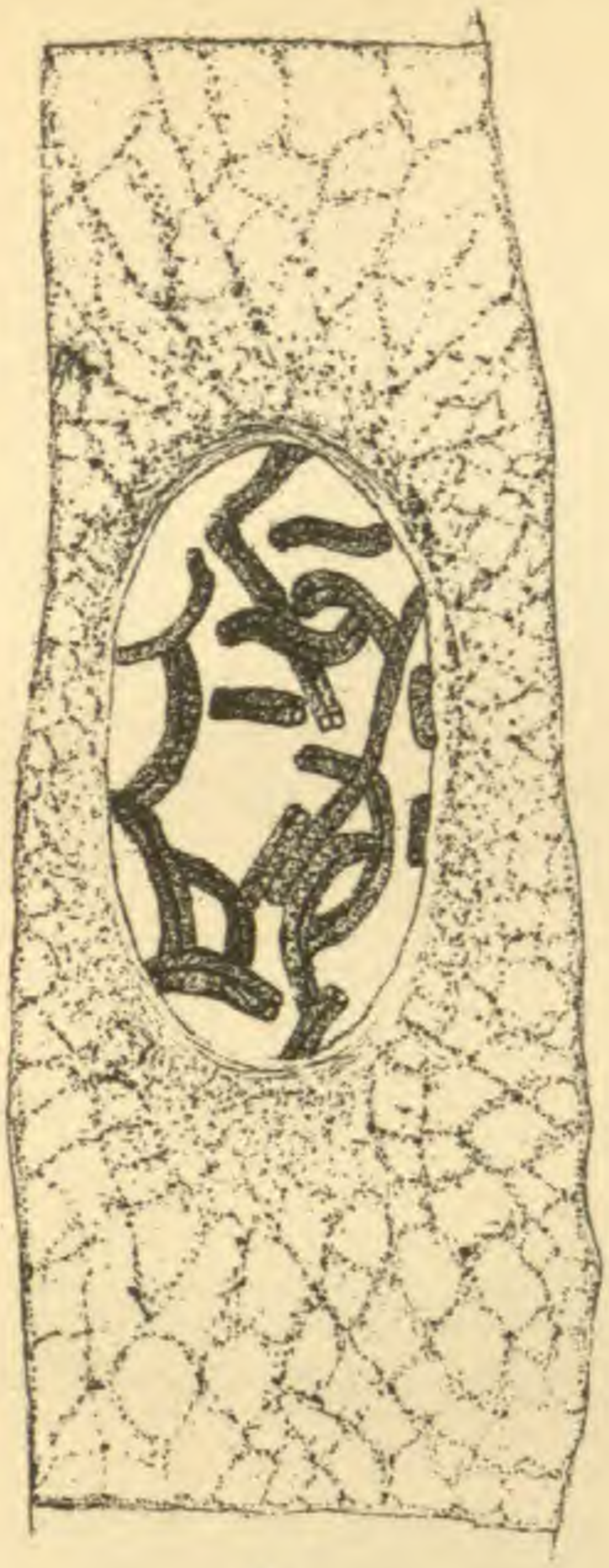
Moore, S. LeM. Alabastra Diversa.—Part VI. Jour. Bot. **38**: 153–160. My. 1900.
Includes diagnosis of two new species of *Gnaphalium* from New Grenada.

Robinson, B. L. Variations of *Ilex verticillata*. Rhodora, **2**: 104–106. My. 1900.
Three varieties recognized.

Suksdorf, W. N. Washingtonische Pflanzen. Deutsche Bot. Monatschr. **18**: 26, 27. F. 1900.
(To be continued.)

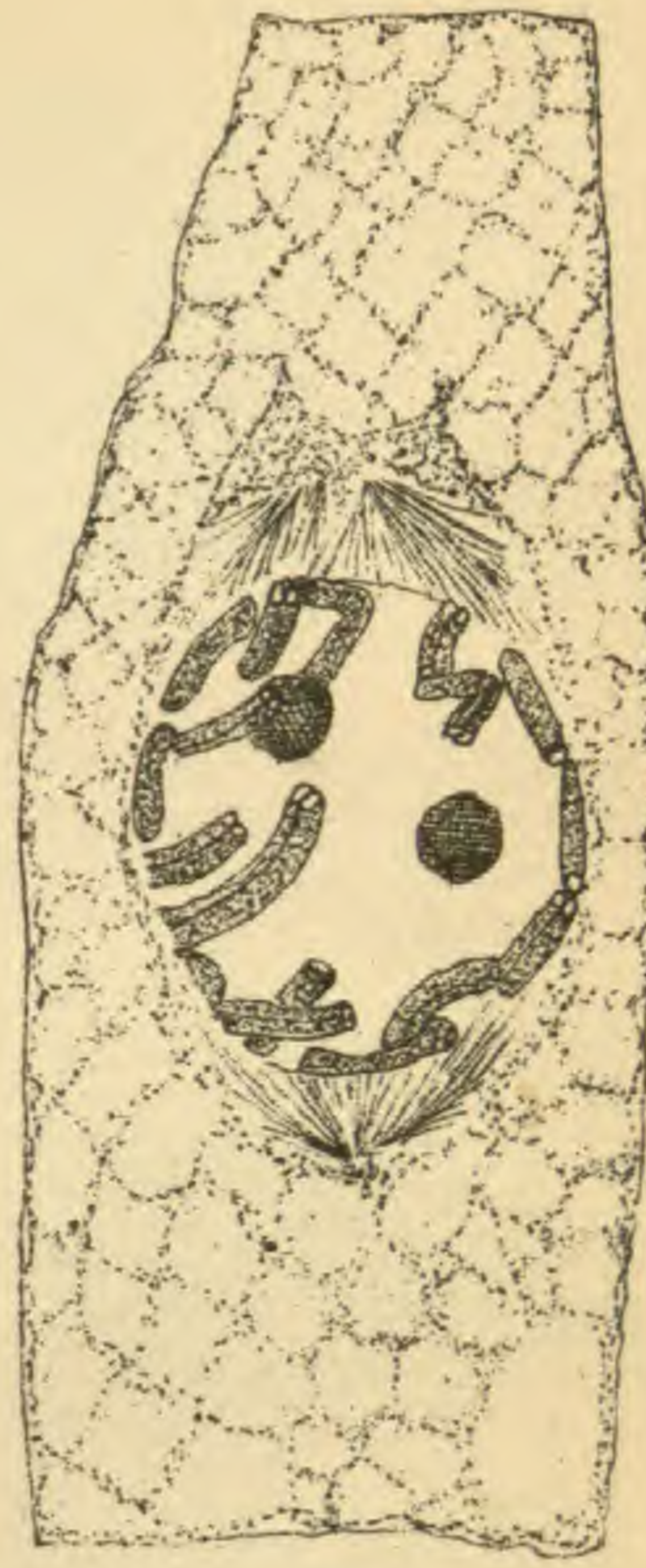
Ward, L. F. Description of a New Genus and Twenty New Species of Fossil Cycadean Trunks from the Jurassic of Wyoming. Proc. Wash. Acad. Sci. **1**: 253-300. *pl. 14–21*. F. 1900.
Cycadella, new genus.

Wiegand, K. M. Some Varieties of *Potamogeton* and *Spiraea*. Rhodora, **2**: 102–104. My. 1900.



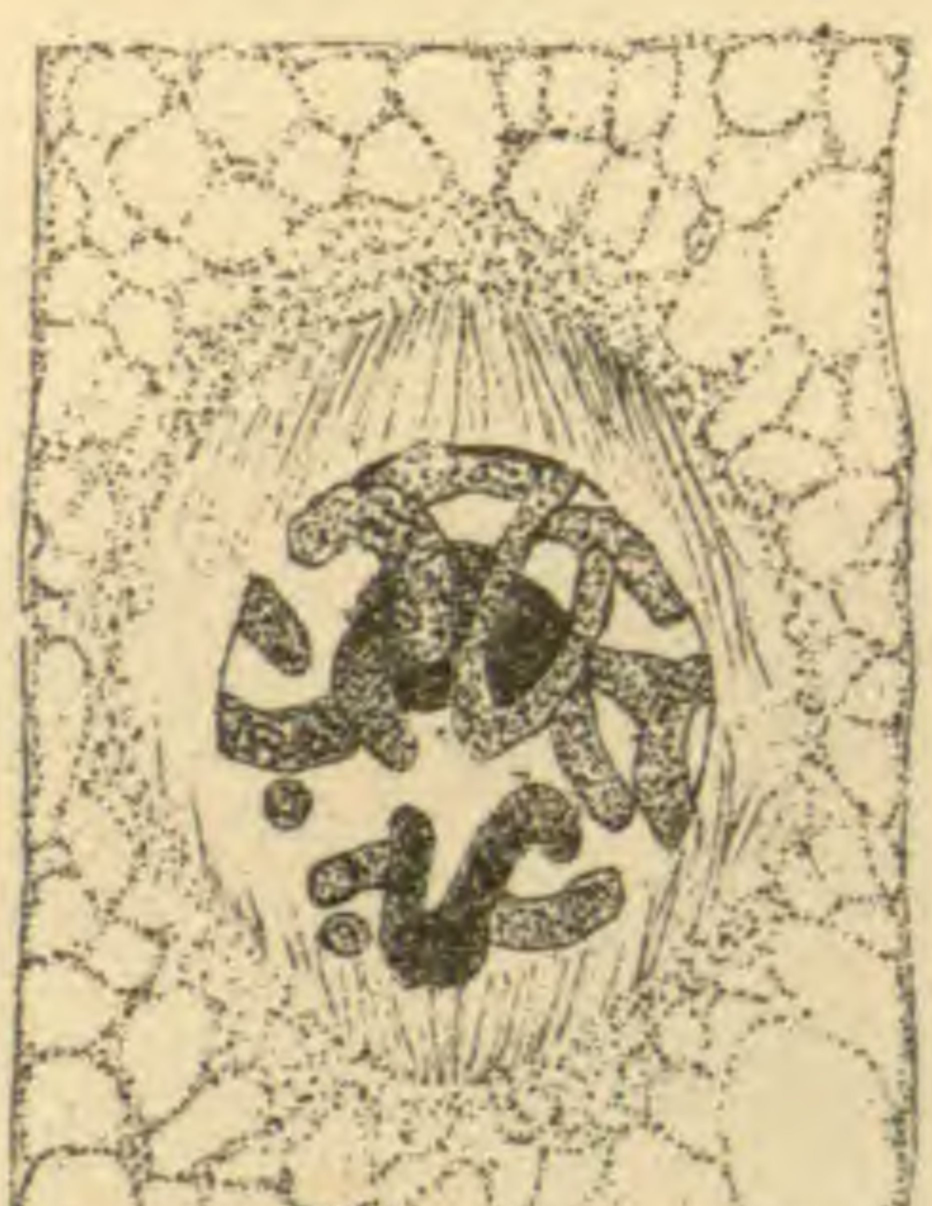
1

2

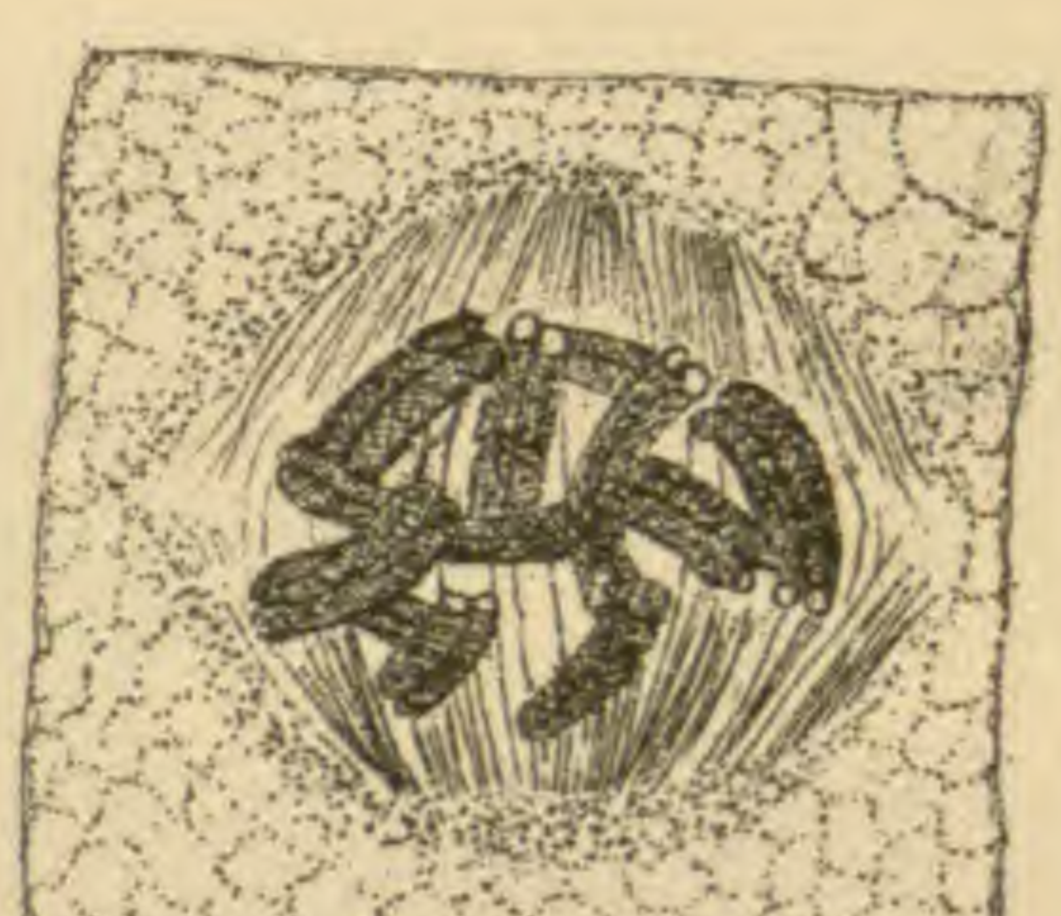


3

5

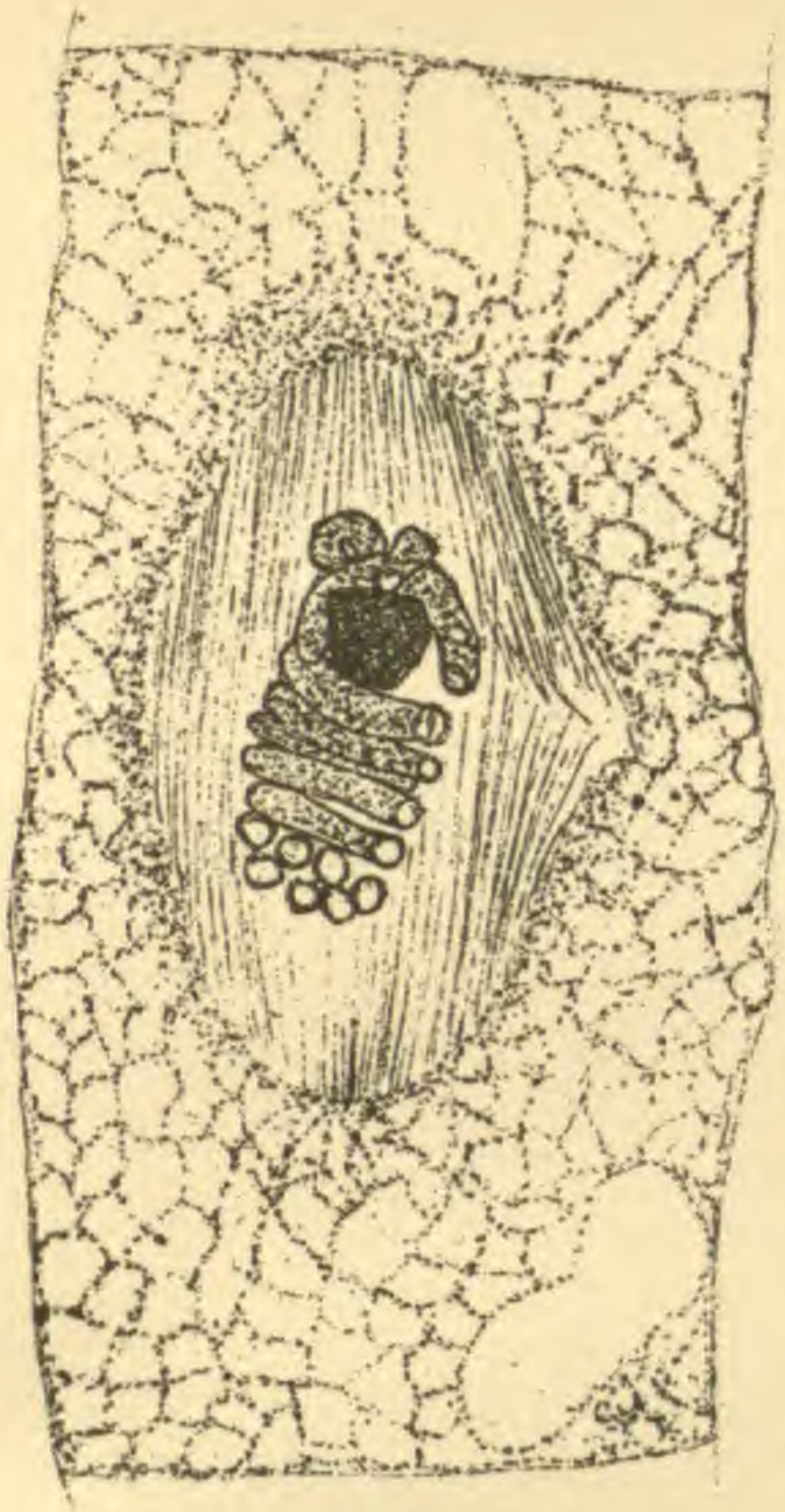


6



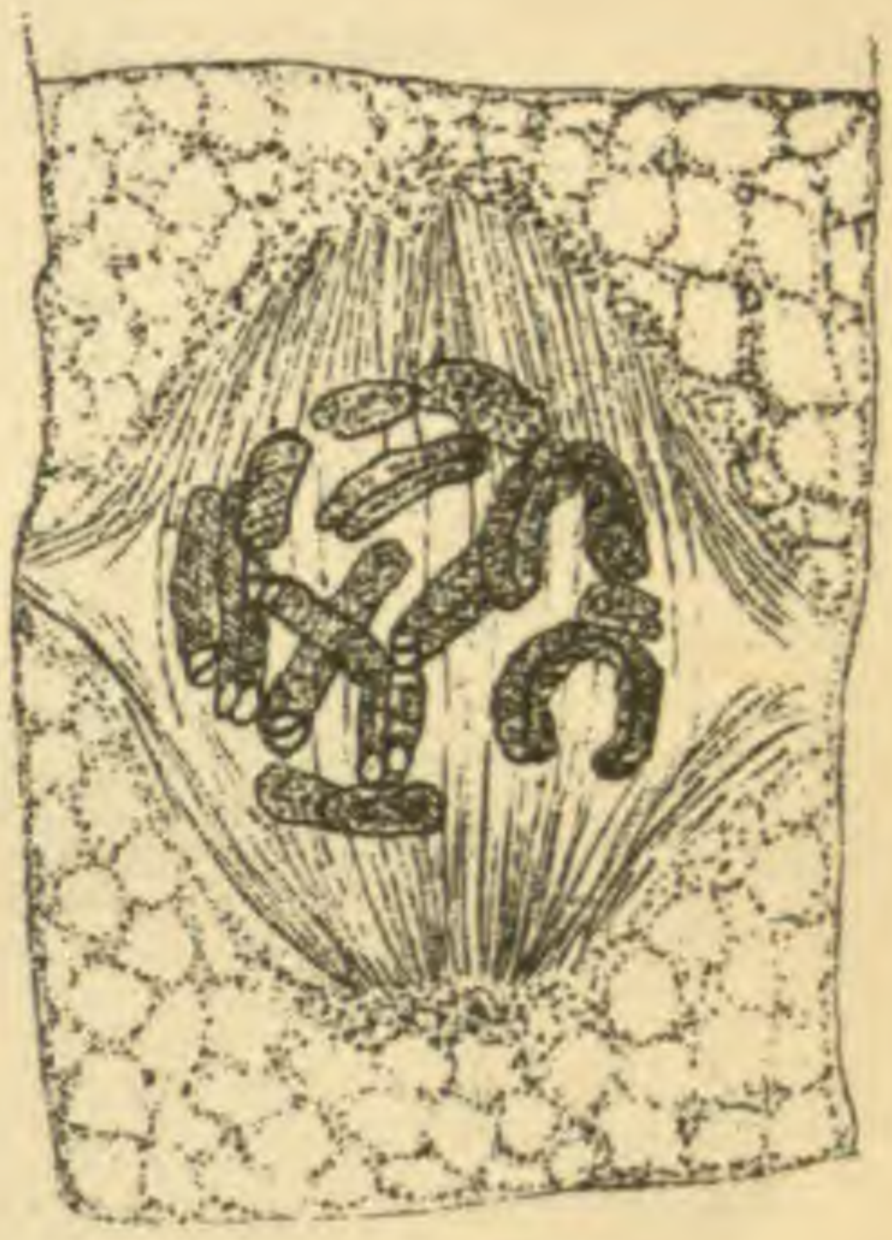
7

4

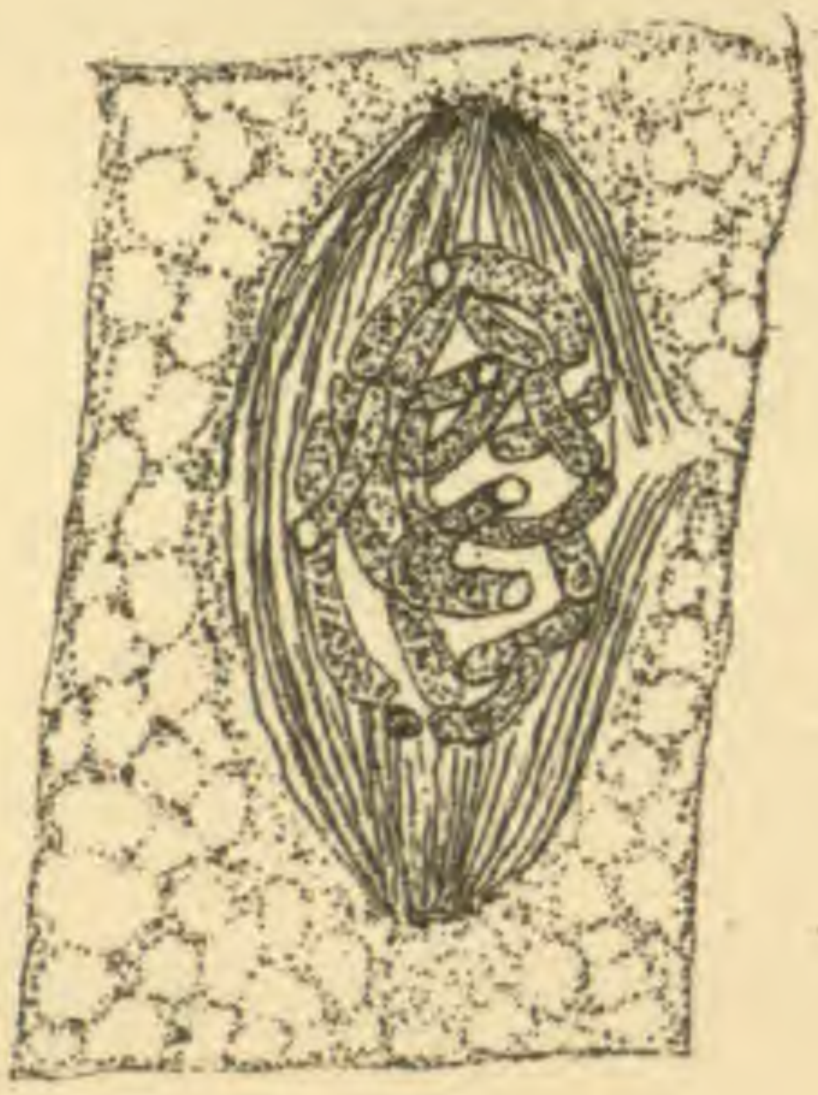


10

11

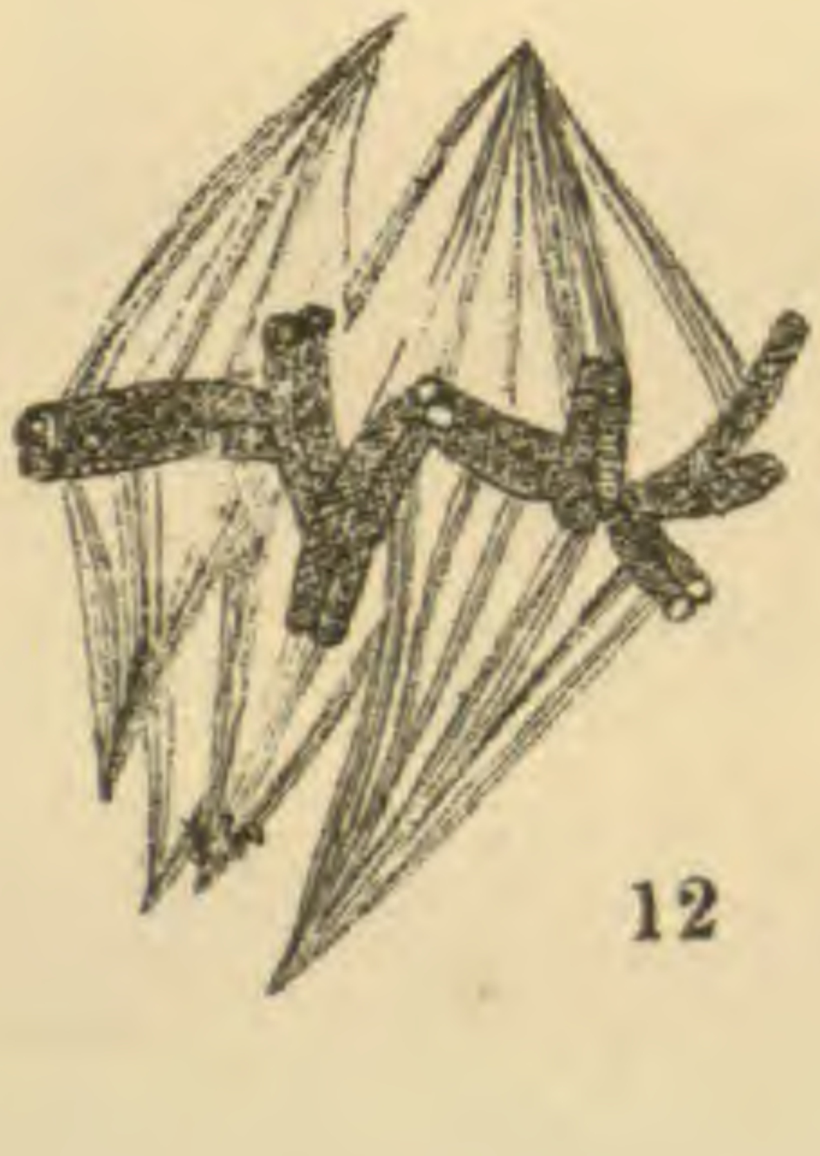


8

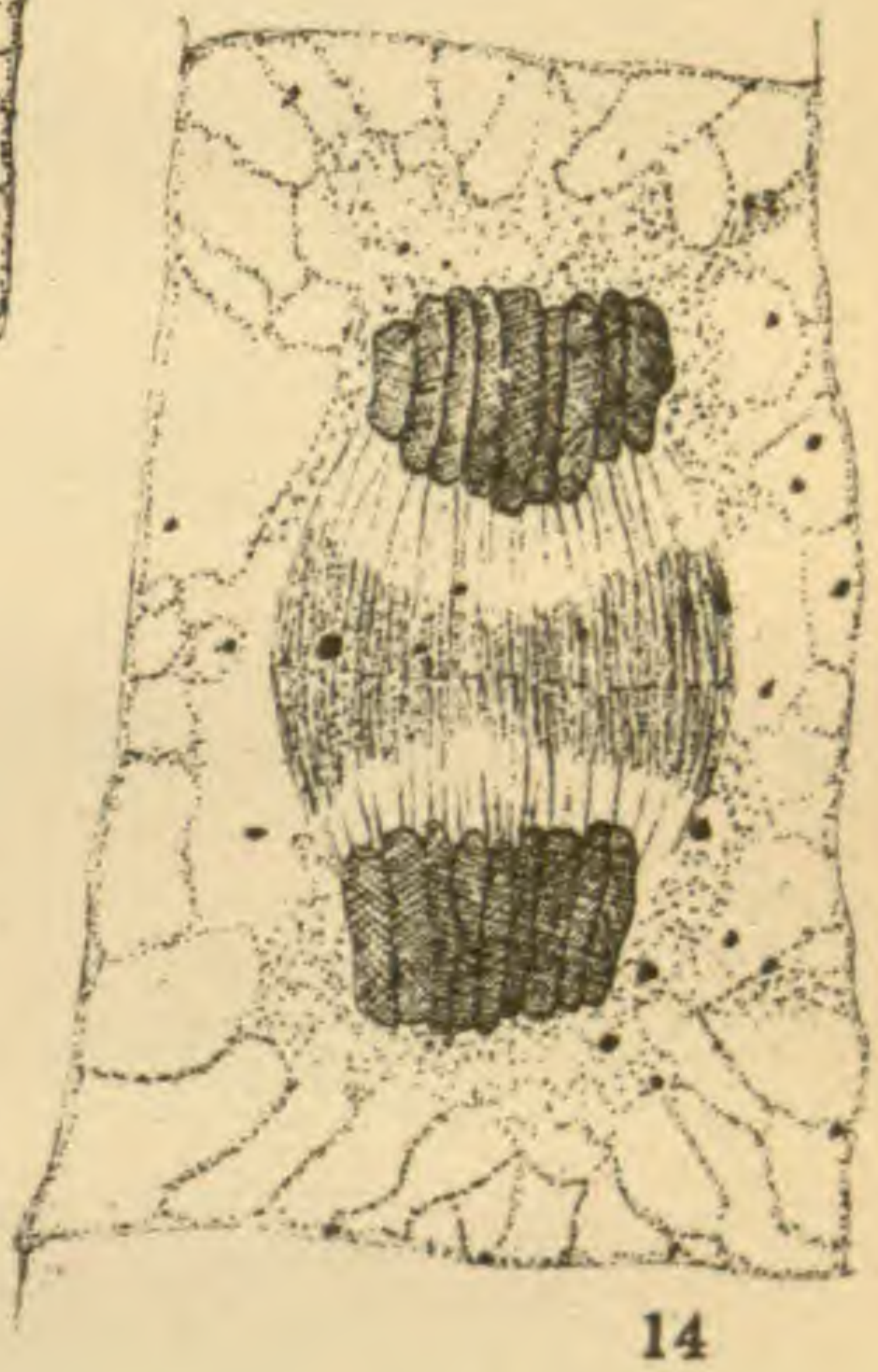


9

13



12



14

THE HELIOTYPE PRINTING CO., BOSTON.

THE HELIOTYPE PRINTING CO., BOSTON.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Subscriptions and remittances should be sent to 41 North Queen street, Lancaster, Pa., or Bronx Park, New York City.

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–5, 449 pp, 3 maps, and 12 plates, 1896–1900. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of 163 new species. ix + 492 pp. Roy. 8vo, with detailed map. Price to members of the Garden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg.

No. 3. The dichotomous *Panicums*: some new Species by Geo. V. Nash.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg.

No. 5. Studies on the Rocky Mountain Flora I, by Dr. Per Axel Rydberg.

No. 6. Notes and Descriptions of North American Plants I and II, by Dr. J. K. Small.

No. 7. Vegetative Reproduction and Multiplication in *Erythronium*, by Frederick H. Blodgett.

All subscriptions and remittances should be sent to

NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Catalogue of North American Plants

SECOND EDITION.

Good paper and printing, printing on one side of page only, larger type, genera arranged and numbered according to the Engler & Prantl sequence, and extensive use of synonyms, are features of this edition.

Price, $1.00 per copy, paper covers or $1.25 bound in cloth.

Sample pages may be had upon application.

A. A. HELLER,

547 WEST WALNUT STREET, LANCASTER, PA., U. S. A.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations Published by Longmans, Green & Co. New York. Price $3.00.

VOL. 27 SEPTEMBER, 1900. NO. 9

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL, BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D., CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D., PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D., MARIE L. SANIAL,
HELEN M. INGERSOLL, ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH, EUGENE SMITH,
MARIE L. SANIAL, W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 9

BULLETIN

OF THE

TORREY BOTANICAL CLUB

SEPTEMBER 1900

The Classification of the Fleshy Pezizineae with Reference to the Structural Characters illustrating the Bases of their Division into Families*

BY ELIAS J. DURAND

(WITH PLATES 27–32)

I. HISTORICAL

The classification of plants may be said to have passed through a course of development. In the early days, when the number of known species was small, they were included in comparatively few genera, although in many cases they were widely diversified in characters. As time went on and the number of described species increased, the limits of the genera were expanded until they included an exceedingly heterogeneous mass of forms. But as botanists turned their attention more and more to the arrangement of forms there became manifest the tendency to break up these heterogeneous groups into a number of smaller divisions. These large genera, as originally constituted are, in general, substantially equivalent to the ordinal and family groups of modern writers.

This mode of development is well illustrated in each of the great groups of the Ascomycetes. The genus *Sphaeria*, as understood by the earlier writers had practically the same limits as the order Pyrenomycetes of the modern systematists. In the course of time this genus was broken up into numerous genera which by later writers are included in several families.

* This paper was prepared under the direction of Professor George F. Atkinson whose kindness and assistance the writer wishes here to acknowledge.

The development of the classification of the Discomycetes has been along similar lines. In 1719 Dillenius * described a genus of fungi under the name *Peziza*. The catalogue proper and the apppendix are paged separately, and on page 76 of the latter occurs the description in the following terms: "TAB. 1, PEZIZA vel ut *Plinius* habet PEZICA pediculo etiam utplurimum, pileo vero semper caret, et ex substantia homogenea membranacea, concava et aquam continere apta, tenera plerumque, aliquando tamen, ut in seminiferis, subdura constat. Pertinent enim Fungi illi calyciformes seminiferi ad Pezizas, et corpuscula illa lentiformia minime vera semina sunt." No species are mentioned in this connection, but in the catalogue proper, which is arranged by months in which the plants appear, several Pezizas are enumerated on pp. 194–196—in all, thirteen forms.

The name *Peziza* is a modification of the Latin word *Pezica*, which is itself borrowed from the Greek *πέζικες* or *πέζεαι*. *Pezica* was mentioned by Pliny † in the following terms: "Belonging to the mushroom kind, also, there is a species known to the Greeks by the name 'Pezica,' which grows without root or stalk." Whether Pliny's Pezica refers to any of the plants at present included under the Discomycetes, it is of course, impossible to determine.

Linnaeus in the Species Plantarum of 1753 ‡ adopted the genus *Peziza* in very nearly the sense of Dillenius, and described eight species. In the Systema §, also, he retained the genus in the same sense and enumerated several species.

In the Observationes Mycologicae 1796 ‖ Persoon described the genus *Peziza* with sixteen species, and *Ascobolus* with three species.

Practically the first attempt at systematic classification of the Pezizaceous plants was made by Persoon in his Synopsis, in 1801¶. In this work the cup-shaped Discomycetes were described under three genera: *Peziza*, *Ascobolus* and *Helotium*. The group of the Ascoboli is quite distinct and well defined, so that, however much systematists may have differed as to its relative rank, the autonomy of the group has been preserved in nearly all systems of arrangement. The genus thus early defined had practically the same

* Dillenius, appendix, p. 76.
† Pliny, 19, 3, 14 § 38.
‡ Linnaeus (1), p. 1180.
§ Linnaeus (2).
‖ Persoon (1), p. 26.
¶ Persoon (2), p. 631.

limits as the family Ascobolaceae of later authors. The genus *Helotium* as limited by Persoon included four unquestioned species, which were also typical species of the same genus as defined by Saccardo.*

The two genera *Ascobolus* and *Helotium* together contained only eight well defined species. All the other cup-shaped Discomycetes, of which he enumerated 151 species, Persoon relegated to the genus *Peziza*. This genus was defined as follows: "Receptacle hemispherical, concave, tumid, bearing fruit in a smooth disc. (Thecae sack-like, invisible to the naked eye, when mature with eight sporidia which are expelled like smoke)." *Peziza*, as thus defined, was broken up by the author into seven lettered sections, which were based on the consistency of the cup, together with its external characters. Of these seven sections only the first four need concern us, as being included within the limits of this paper.

The section A, Tremelloideae, included those forms in which the consistency of the cup is more or less tremelloid. Its limits were in general very nearly those of the family Bulgarieae of Saccardo. Section B comprehended all of the large, fleshy Pezizineae which are externally smooth or subfarinaceous. Section C was made up of those which are externally strigose, pilose, or pubescent, whether they be fleshy or waxy, while Section D included those which are fleshy-waxy and smooth.

Persoon's arrangement was to a certain degree a natural one, although founded upon the gross characters of the plants. I have gone thus far into the details of the system because it formed the basis of the Friesian system of classification which remained in almost universal use for seventy years.

The next step in the systematic arrangement of the Discomycetes was taken by Fries † in 1822. In his Systema Mycologicum there was established an order Elvellaceae, made up of two suborders Mitrati and Cupulati. The suborder Mitrati was formed to include the genera with mitrate or clavate apothecia, while the cup-shaped ones made up the Cupulati. The latter group was divided into three families (1) Pezizeae, (2) Dermeae, and (3) Heteroclitae. The family Pezizeae (omitting the genus *Patellaria*)

* Saccardo (2), p. 210. † Fries (1), 2: 35.

corresponded pretty nearly to Schroeter's order Pezizineae. It was also equivalent to the genera *Peziza* (exclusive of divisions A, E, F, and G), *Ascobolus* and *Helotium* of Persoon.

The family Pezizeae comprised three genera, exclusive of *Patellaria*. These were *Peziza*, *Ascobolus* and *Bulgaria*. *Ascobolus* was transferred intact from Persoon's system. *Bulgaria* was the same as the section A, Tremelloideae, of that author, while the genus *Peziza* of Fries comprised Persoon's *Peziza* sections B, C and D.

Fries divided his genus *Peziza* into three series, which were in turn separated into twelve tribes. The three series *Aleuria*, *Lachnea* and *Phialea*, thus constituted, were equivalent to the divisions B, C and D, respectively, of Persoon.

From what has been said in the paragraphs preceding, it will be seen that the Friesian classification was founded directly upon that of Persoon. Prominent points of difference are found in the narrowed generic limits of *Peziza*, as well as the fact that three families were constructed from the genus as limited by Persoon. The important fact to be noticed, however, is that Fries established ordinal, subordinal, and family grouping which did not exist in the nomenclature of the earlier writer. Persoon's *Peziza* was the suborder Cupulati of Fries. On the other hand the minor divisions of the two authors corresponded almost precisely.

The Friesian arrangement, then, will be recognized as an important step in the development of the classification of the Discomycetes. It is apparent, however, that the basis for this is to be found almost entirely in the gross and external characters of the plants. No peculiarities of development or of microscopic structure had at this time any place in systematic classification.

This system of classification remained in use for twenty seven years. In 1849, the same author * produced a modification of his previous arrangement, which will be recognized as a marked improvement in the system. There was established a family Discomycetes under which were included six orders, (1) Helvellaceae, (2) Bulgariaceae, (3) Dermateae, (4) Patellariaceae, (5) Phacidiaceae and (6) Sticteae.

The order Helvellaceae included besides the cup-shaped forms, the mitrate and clavate ones as well.

* Fries (2).

This establishment of numerous orders based largely on the consistency of the plant was an important step. No less significant was the still further narrowing of the generic limits of *Peziza*, and the consequent formation of new genera. The *Peziza* of the former arrangement was here separated into eight genera, of which the largest and most important were *Peziza* and *Helotium*. The genus *Peziza* was as before divided into three series, which were still further broken up into eleven tribes. How much Fries relied upon gross characters may be gathered from his own statement that it is not possible to base natural genera on either the form, septation, or markings of the spores.

The second Friesian system of classification remained in use for thirty years. M. C. Cooke followed it in nearly every detail in his publications from 1871 to 1879, as did also Karsten in his earlier publications.

From what has been said it will be seen that the classification of the Pezizineous Discomycetes advanced in a definite direction from 1801 till 1879, and that this period was marked by three important steps in the progress.

It will be remembered that within the decade between 1860 and 1870 a great change came over the aspect of mycological study. This was heralded by the publication of de Bary's Morphology and Physiology of the Fungi, Lichens and Myxomycetes, in 1866. The most of the work done before this time had been upon the external or gross parts of the plant, the microscopic structure being almost entirely neglected. At this period, however, the attention of students was being turned more to the structural details and to the development of plants, a kind of investigation which has laid the foundation for sounder systems of classification.

This influence was early felt in the study of the Discomycetes. In 1864, De Notaris treated the Discomycetes in a general way under twenty six genera, of which nine would be included in the fleshy group. These were thrown together without any apparent principle of arrangement. Microscopic characters such as the form and color of the asci, paraphyses and spores were made use of, but the measurements were given in but few instances. Another character which was occasionally used, especially in generic descriptions, was drawn from the cell structure of the excipulum. Six genera were first described in this paper.

Nylander in 1868 followed the classification of Fries, enumerating 108 species of *Peziza* and 8 of *Ascobolus*. He was the first to describe accurately and fully the characters of the asci and spores and to give careful measurements. This author also laid much stress on the action of iodine in coloring the asci.

Karsten in 1869* divided the genus *Peziza* into 25 sections and described 239 species. This work is noteworthy in this connection principally as showing the tendency to break up the genus *Peziza* into subgenera.

Fuckel† in this same year defined a group Discomycetes, which he separated into six subgroups or families, as follows: Sticteae, Phacidiaceae, Patellariaceae, Bulgariaceae, Pezizeae, and Helvellaceae. These groups were based for the most part upon the Friesian arrangement. The most marked peculiarity of Fuckel's system is to be found in the closeness with which his generic limits were drawn. Under the Pezizeae were included thirty one genera, based upon the habit, consistency, color, external features, and the minute characters of the fruiting organs. The genera were grouped in the family on the basis of consistency.

Karsten‡ acknowledged his indebtedness to the labors of such men as Tulasne and de Bary, and adopted in his Mycologia Fennica of 1871 an arrangement in which their influence was manifested. In the work mentioned there was described an order, Discomycetes, including three families—the Helvellaceae, Pezizaceae, and Phacidiaceae. Under the Pezizaceae several subfamilies were described, of which some, notably the Pezizeae, Helotieae and Mollisieae, exhibited relationships which had not been indicated previously. A prominent character suggested in connection with these three families was taken from the structure of the cells of the sterile portion of the apothecium. In the arrangement of genera, Karsten discarded the Friesian system entirely. Many new genera were erected, but, in this respect, the present writer was much less radical than Fuckel.

During the few years following, no publication of importance appeared relating to the classification of the Discomycetes. To be

* Karsten (1). † Fuckel, p. 248. ‡ Karsten (2), p. 5.

sure, M. C. Cooke brought out the very excellent Mycographia or figures of the Discomycetes but the arrangement was that of Fries. In 1884, however, Saccardo,* in his Conspectus Discomycetum, applied to these plants the novel method of arrangement which he had already made use of in other groups of the Ascomycetes. He adopted an order Discomycetes, including eight families. Within the families the subdivisions were based on the color, form and degree of septation of the sporidia. Saccardo's generic limits occupied a middle ground between those of Fries, on the one hand, and of Fuckel and Karsten on the other. There were a few large genera with large numbers of subgenera.

Phillips, in 1887, adopted the major groups set forth by Saccardo, including, however, a ninth family, the Gymnoascaceae, with a single genus *Ascomyces* (*Exoascus*). The group Pezizeae was separated into two series, Nudae and Vestitae, based on the external features of the cup. Under these were arranged twelve genera, most of the species, however, being included under five of these, which in turn contained numerous subgenera, many of which had been given generic rank by Fuckel and Karsten.

In 1889, appeared the volume of Saccardo's Sylloge Fungorum † treating of the Discomycetes. The arrangement here used was based on the Conspectus of 1884. Generic limits were, however, much more closely drawn in the Sylloge than in the earlier work, the old Friesian arrangement was entirely abandoned, and most of the subgenera of the Conspectus were elevated to generic rank, while several new ones were added.

M. C. Cooke, ‡ in 1892, abandoned the Friesian system, adopting as the best yet produced the arrangement of Saccardo's Sylloge Fungorum. He, however, dispensed with the grouping based on the color of sporidia, making a subsequent slight rearrangement of the genera.

During the last dozen years there have appeared three important German works dealing with the Discomycetes. In 1887, Rehm began to elaborate the Discomycetes for Rabenhorst's Kryptogamen-Flora. The most striking innovation in this work was the inclusion of many of the Lichens among the Discomycetes. The order was separated into two divisions: (1)

* Saccardo (1). † Saccardo (2). ‡ Cooke (3), pp. xiii, 249 et seq.

Pezizaceae and (2) Helvellaceae. The Pezizaceae were broken up into five suborders: Phacidiaceae, Stictideae, Triblideae, Dermatiaceae and Pezizeae. The Lichens were distributed among the first three or four of these suborders, while the Bulgariaceae were included as a family under the Dermatiaceae. In subdividing the Pezizeae, Rehm elaborated the principle outlined by Karsten in giving prominence to the characters drawn from the sterile layers of the cup. The suborder was made to include four families: Mollisiaceae, Helotiaceae, Eupezizeae and Ascobolaceae. Rehm's generic limits were, in general, those of Fuckel and Saccardo.

Schröter, ‡ in 1893, followed Rehm for the most part, but differed from him in including the Taphrinineae and Hysteriineae under the Discomycetes. The families of the Pezizineae corresponded to those of the Pezizeae of Rehm, except that a fifth family was formed to include the genera *Ascodesmis* and *Ascocalathium*. Another arrangement of some novelty adopted by Schröter was the distribution in the Pezizineae of several genera formerly included with the Bulgariaceae.

In 1894, in writing the Discomycetes for Engler and Prantl, Schröter § departed somewhat from his arrangement of 1893 in that he included under the Pezizineae ten families of coördinate rank. Unfortunately, Schröter's work was cut short by death when it was but just begun. It was continued along similar lines by Lindau, by whom it was recently brought to completion.

II. MORPHOLOGICAL

Limits of the Paper.—The discussion in this paper is confined to Schröter's* subdivision Pezizineae, exclusive of the family Ascodesmidaceae. The group thus limited is equivalent to Rehm's† suborder Pezizeae, also to the families Pyronemaceae (in part), Pezizaceae, Ascobolaceae, Helotiaceae and Mollisiaceae treated by Schröter and Lindau in Engler and Prantl's Natürlichen Pflanzenfamilien. The examination is intended to cover all of the cup-shaped Discomycetes which are fleshy or waxy.

Technique.—The material on which the study and illustrations are based is mostly American. Much of it was taken from the

* Schröter (1), p. 1.
† Schröter (2), p. 173.
‡ Schröter (1), p. 31.
§ P. 501 et seq.

specimens in the Ellis and Everhart collection of North American Fungi. Some forms were obtained from Rabenhorst's Fungi Europaei, and from Roumeguère's Fungi Gallici. The remainder was found in the vicinity of Ithaca or was obtained from correspondents in various parts of the country. Most of the material was fresh or preserved in liquids. This was true of nearly all of the Pezizaceae. The tissues of the Helotiaceae and Mollisiaceae do not seem to be injured by drying. Such material, after being soaked in water, was dehydrated and imbedded in collodion. This method of imbedding is well adapted to work of this kind.

The sections, varying from 6 μ to 20 μ in thickness, were taken from near the base of the cup. The stipitate forms were cut longitudinally through the middle of the stem and cup.

Various stains were used, but alum eosin, acid fuchsin and Delafield's haematoxylin gave the best results.

Terms Employed.—The terms employed in this paper are those proposed and defined by de Bary.* The term apothecium is applied to the whole sporocarp. It consists of two principal portions. The fruiting layer or hymenium, and the sterile layers beneath or partially surrounding the fertile part. The stratum of hyphal tissue immediately beneath the hymenium is the hypothecium. Grading off from the hypothecium is an often more prominent and well-differentiated outer layer, the excipulum. Frequently two layers may be distinguished in the latter portion. The outer one, being usually more dense, forms a sort of membranous ectal layer of the apothecium, and encloses a medullary portion within.

The term pseudo-parenchyma is applied to the parenchyma-like tissue formed by the septation and coalescence of hyphae. All gradations between true hyphae and the pseudo-parenchyma may often be seen in a single plant. Prosenchyma is a tissue composed of long, slender, interwoven hyphae.

The several layers of the sterile portion of the apothecium are usually not strongly differentiated, but often grade almost imperceptibly into one another. It is upon the structure of the sterile layers of the apothecium that the division into families has been

* De Bary (2), p. 187.

largely based. In the following pages numerous examples will be studied in order to determine what characters may be safely used as bases for such family grouping.

Family PEZIZACEAE

DISCINA STEPHENSONIANA Ell.

This species grows on rotten wood. The plants are usually crowded and irregular with a short, fleshy stem. The cups are 3–8 cm. in diameter, with a flat or concave disk, and a recurved or laciniate margin. The flesh is light cinnamon brown, but whitish beneath.

This is a very interesting plant as far as the structure of its sterile layers is concerned. Beginning at the lower surface there appears first a layer of pseudo-parenchyma composed of very small thin-walled, polygonal cells. They average about 6–8 μ in diameter. Just above this layer is one of about equal thickness, composed of quite large, polygonal, isodiametric cells 30 μ in diameter. These cells show little or no trace of their hyphal origin. Joining this layer with an abrupt transition is a rather thin one of coarse hyphae, with frequent septa. Septation and coalescence have not advanced so far in these threads that the hyphal form is lost.

The transition from hyphae to pseudo-parenchyma is very nicely shown in the thick layer just above the hyphal one last described. The tissue is composed of stout hyphae loosely interwoven with large interhyphal spaces. These hyphae are much septated, and often coalesce, thus giving rise to many polygonal cells measuring from 15 to 90 μ in diameter. The thin layer immediately beneath the hymenium is composed of similar cells, among which the asci may be traced down for some distance.

DISCINA WARNEI Peck

The sterile layers in this species are composed throughout of very coarse hyphae which are much bent and septated so as to resemble a pseudo-parenchymatous tissue. In the looser portions individual threads may be traced for some distance. In these, certain portions are seen to be much swollen so as to be almost vesiculose. At other places the threads are thin and narrow and coalesced with other hyphae. In all cases the hyphal nature is evident. The whole tissue resembles closely that found in certain layers of the last species described.

ACETABULA VULGARIS Fuckel

The Acetabulas are cup-shaped, fleshy plants, provided with a short, thick stalk, the surface of which is marked by longitudinal ridges, which branch more or less, and continue on the lower surface of the cup.

The sterile portion of *A. vulgaris* is differentiated into three well marked regions. The hypothecium is about 75 μ thick and composed of a pseudo-parenchyma of small, rounded cells, 6–12 μ in diameter. A medullary portion occupying about two thirds of the remaining thickness is made up of coarse hyphae rather loosely interwoven. This grades off into the hypothecium above and the cortical layer below. The latter is pseudo-parenchymatous, being composed of cells 50–75 μ in diameter with thin walls, and more or less elongated toward the surface, where some are prolonged, giving to the exterior a scurfy appearance.

GEOPYXIS CUPULARIS L.

The genus *Geoypxis* resembles *Acetabula*, but differs from it in having the stem smooth. In the species under consideration the excipulum is quite thick, occupying about one half of the total thickness of the sterile part. It is composed throughout of rounded or irregularly polygonal cells with thin walls. Those at the surface are rather large, measuring 15–30 μ in diameter. Toward the inner side they become gradually smaller and grade off into the coarse, loosely interwoven hyphae of which the hypothecium is composed.

GALACTINIA SUCCOSA Berk.

The Galactinias are fleshy, cup-shaped, and sessile, but have the peculiarity of exuding a milky juice when wounded. In the present species the hypothecium is composed of rather large, loosely interwoven hyphae, which give rise on the upper side to the asci and paraphyses. The excipulum consists of two layers. The external one consists of large loosely interwoven hyphae forming a layer which is quite easily separated from the inner one. The latter is pseudo-parenchymatous throughout, being formed of large, irreglar thin-walled cells 20–50 μ in diameter.

HUMARIA PURPURASCENS Pers.

The Humarias are small, sessile, fleshy plants, without external pili. They grow usually on the ground. The sterile layers of *H. purpurascens* occupy about one half the total thickness of the cup. They are pseudo-parenchymatous throughout, and made up of small, irregular, thin-walled cells, 8–15 μ in diameter. Those of the hypothecium are smaller and obscure.

BARLAEA CONSTELLATIO (B. & Br.) Sacc. Pl. 27, Fig. 1

The genus *Barlaea* differs from *Humaria* chiefly in possessing spherical spores.

In the present species the hypothecium is made up of very small pseudo-parenchymatous cells, measuring about 5 μ in diameter. They are closely packed together, so that their character is not easily made out. Grading off quite sharply from this layer is the excipulum composed of rounded thin-walled cells, measuring 6–10 μ in diameter. The character of these cells is quite uniform throughout all parts of the layer.

The genus OTIDEA. Pl. 28, Fig. 5

The Otideas are fleshy, subsessile plants, usually with bright colors. They are peculiar in that the apothecium is much elongated on one side, or vertically cleft or incised. They grow on the ground or on rotten wood.

Mr. G. Massee,* having made an examination of the British species of this genus, sums up the results of his study of the sterile layers in the following manner: *Otidea neglecta, leporina, apophysata, phlebophora* and *pleurota* "have the excipulum composed of densely interwoven hyaline hyphae, which become abruptly converted close to the outside into a more or less colored cortex, consisting of somewhat parallel septate hyphae, which sometimes cohere laterally, and form an approach to a parenchymatous tissue

* Massee (1), p. 67.

* * * . A second type of structure is illustrated by *O. auricula*, and *O. micropus*, and consists of the excipulum being entirely parenchymatous, the cells very large and irregularly polygonal * * * . Finally, *O. onotica* exhibits a type of structure exactly intermediate between the two previously described. The hypothecium and the broad cortical layer are truly parenchymatous, whilst a central zone consists of densely interwoven hyaline hyphae."

The only *Otidea* which I have examined is *O. leporina* and my observations differ only slightly from those of Massee. In my specimens the hypothecium and bulk of the excipulum are composed of coarse, closely interwoven, hyaline hyphae. These become abruptly converted into a truly pseudo-parenchymatous cortical layer composed of polygonal cells 25–40 μ in diameter. These show little traces of their hyphal origin. Occasionally little groups of these cells project slightly from the surface, giving it a granular or furfuraceous appearance.

PEZIZA BADIA Pers.

The genus *Peziza* includes the large cup-shaped, fleshy Discomycetes which are smooth and sessile. The structure of the sterile layers presents considerable variations in different species and we have all gradations from the coarse interwoven hyphae exhibiting various degrees of septation and coalescence to the pseudo-parenchyma of large vesiculose cells in some species 0.1 mm. in diameter.

A typical structure is seen in *Peziza badia* Pers. The hypothecium in this plant is very thin, and composed of very small and dense pseudo-parenchyma. The excipulum exhibits three well-marked layers. The ental one is entirely pseudo-parenchymatous, and is composed of large, rounded, thin-walled cells 50–75 μ in diameter. Intermingled with these are numerous smaller ones. The middle layer joins the ental one with an abrupt transition. Its thickness is about equal to that of the ental and ectal layers combined, and it is composed entirely of stout hyphae much bent and closely interwoven. The ectal layer resembles the ental one in being made up of rounded thin-walled cells. These become somewhat elongated toward the surface giving the latter a mealy or pruinose appearance.

MACROPODIA PUBIDA B. & C. Pl. 28, Fig. 3

The Macropodias are stipitate plants with hemispherical brown cups which are clothed externally with velvety brown pili. In *M. pubida* the sterile layers make up about one half of the total thickness of the apothecium, at least at the sides of the cup. The excipulum and hypothecium are quite well differentiated, and are of about equal thickness. The excipulum is composed of rather large pseudo-parenchymatous cells with thick walls which are elongated somewhat toward the outside of the cup. They measure 30–40 μ in length. The ental cells of the excipulum are smaller and nearly isodiametric, 8–10 μ in diameter. They grade off into the thin-walled cells of the hypothecium. The hairs which make up the pubescence are simply produced excipular cells.

The hypothecium is thick and composed of small cells, 8–10 μ long, which are more or less elongated in a direction parallel to the surface of the cup. The cells of the medullary region of the stem are of the same character as those of the hypothecium.

SARCOSCYPHA

In this genus are included several interesting and pretty species growing usually on dead wood. The cups are stipitate and bright-colored within, usually of some shade of orange or scarlet. They are clothed externally with floccose hairs.

S. OCCIDENTALIS (Schw.) Sacc.

The structure of this plant is strictly Pezizaceous. The hypothecium and excipulum are not well differentiated, but grade into each other. The whole medullary portion of the cup is made up of a pseudo-parenchyma, composed of small, somewhat elongated flexuose cells, 6–8 μ in diameter, which are united into a close compact tissue. At the surface, the cells are larger, fully 15–25 μ in diameter, and are compacted into a layer which continues upward so as to form the margin of the cup.

S. FLOCCOSA (Schw.) Sacc.

In this plant the hypothecium is confined to a very thin layer of closely interwoven threads just beneath the hymenium. The medullary portion of the stem is made up of very closely compacted parallel threads running in a longitudinal direction. As the cup expands at the top of the stem these hyphae spread out in a radiating manner toward the margin. At the side of the hymenium they expand, forming a long and prominent margin to the cup. At this place they become thicker and looser, with frequent septa, thus forming a strongly pseudo-parenchymatous tissue, with cells 6–10 μ in diameter. The marginal pili are direct prolongations of these hyphal cells. At the surface of the cup these hyphae are replaced by a thin stratum of pseudo-parenchymatous cells, 5–6 μ in diameter.

S. COCCINEA (Scop.) Sacc. Pl. 28, Fig. 4

The hypothecium in this species cannot be well distinguished from the adjacent excipular tissues. The excipulum consists of two well-marked layers. The inner or medullary is very thick and is composed of long, rather slender, hyaline hyphae loosely interwoven. At the sides of the hymenium these become parallel and closely compacted, with frequent septa, thus forming a wide margin of cylindrical parenchymatous cells. This marginal tissue closely resembles that described for *S. floccosa* preceding.

The outer layer is composed of thin-walled pseudo-parenchymatous cells, 6 × 15–20 μ in diameter, which are elongated in a direction parallel to the surface of the cup. Aside from being different in form these ectal cells take a deeper stain than the medullary hyphae. This layer in some cases separates quite easily from the one within.

The structure of the medullary tissue of *Sarcoscypha coccinea* and *S. floccosa* suggests the prosenchyma found in the Helotiaceous plants. In 1893, Schröter * included the genus *Sarcoscypha* with part of *Macropodia* in the family Helotiaceae, remarking that it approaches closely to the genus *Peziza* (*Macropodia*), referring especially to *P. macropus*. But the gross characters of these plants, such as the size, form, and consistency of the cups associate them more closely with the Pezizas, and other writers, including Rehm †, have placed them among the Pezizaceous genera. It was difficult, therefore, before a study of the characters of the sterile layers was undertaken to believe that these forms should be consistently placed in different families.

† Rehm, p. 1070. * Schröter (1), p. 59.

In the structure of the excipulum, however, we find more conclusive evidence of the Pezizaceous relationship of the Sarcoscyphas and Macropodias. It will be noted from the descriptions of the sterile layers of *S. occidentalis*, *S. floccosa*, *S. coccinea* and *M. pubida* given above, that all have at least the outer layer of the excipulum pseudo-parenchymatous, while in the first and last species named the sterile parts are wholly so.

It should also be borne in mind in this connection, that tissue composed of stout interwoven hyphae, closely resembling that of *S. coccinea*, is not uncommon in undoubted Pezizaceous species. In several species of *Otidea*, for example, a large portion of the ental part of the excipulum consists of this tissue. *Otidea onotica* and *Discina Stephensoniana* each have a stratum of hyphal tissue lying between layers of large vesiculose cells. Even in *Peziza badia* a central zone of the excipulum is made up of stout, many-septate hyphae not very far removed in character from those found in *Sarcoscypha coccinea*.

It may be objected that the Sarcoscyphas are more or less leathery in their texture while the great majority of the Pezizaceae are fleshy and brittle. Certain of the species of *Otidea*, however, approach *S. coccinea* in texture. There seems to be little reason, therefore, for removing the species of *Sarcoscypha* from their long recognized position to associate them with forms with which they have no evident close relationship in either external form or internal structure.

LACHNEA. Pl. 27, Fig. 2

The Lachneas are sessile, usually bright-colored, fleshy Discomycetes, which are clothed externally with brown pili. The members of this genus may stand as typical of the family in nearly every way. The consistency is purely fleshy; the asci are large and cylindrical, opening by a lid at the apex; the paraphyses are well developed with clavate apices, and the sporidia are large.

In the structure of their sterile tissues, also, the species conform fully to the family type. The following species have been examined: *L. scutellata*, *L. hemispherica*, *L. setosa*, *L. umbrata* and *L. albo-spadicea*. These forms exhibit so little variation that one, *Lachnea scutellata*, will be described as typical of all. The hypothecium and excipulum are quite easily distinguishable, although shading gradually into each other. The hypothecium is composed of small pseudo-parenchymatous cells, 7–12 μ long, with thin walls. Those immediately beneath the asci are somewhat rounded, but the remainder show an elongation in a radial direction. The layer fades out toward the margin of the cup.

The excipulum consists of larger thin-walled cells, 40–50 μ in diameter. At the base of the cup they are somewhat vesiculose, and the walls have a brownish shade, with a tendency toward becoming thickened. The excipulum is produced at the sides so as to form a distinct margin to the cup. The marginal cells are smaller and narrower, and somewhat elongated. The external hairs are simply prolonged, thick-walled excipular cells. The pili may arise from any part of the excipulum, but their origin is usually deep seated, often being well in toward the hypothecium.

Phaeopezia fuscocarpa (E. & H.) Sacc. differs from *Lachnea* only in its dark spores, and agrees with it in the whole structure of its sterile tissues, which are pseudo-parenchymatous throughout.

SARCOSPHAERA SEPULTA (Fries) Schroet.

The plants of this genus are first spherically closed and buried in the ground. Later they split in a lobulated manner, becoming cup-shaped. The sterile layers of *S. sepulta* are pseudo-parenchymatous throughout. The cells increase gradually and uniformly in size from the hymenium to the outer surface, where the cells are brownish and give rise to the pili.

NEOTTIELLA NIVEA Romell.

The genus *Neottiella* differs from *Lachnea* in having the external hairs pure white instead of brown. In *N. nivea* the whole sterile tissues are pseudo-parenchymatous throughout, except at the surface where they give place to one of coarse hyphae closely interwoven. The latter give rise to the hairs which are long, linear, and septate, with thin, white walls. The cells of the pseudo-parenchyma are rounded or polygonal, 15–30 μ in diameter, and thin walled.

SPHAEROSPORA CONFUSA Cooke

Sphaerospora differs from *Lachnea* in having spherical spores. *S. confusa* has a thick, pseudo-parenchymatous excipulum, composed of large, polygonal, thin-walled cells. Those at the base are quite regular, 20–50 μ in diameter, the inner ones being slightly smaller. The hypothecium is also pseudo-parenchymatous, but the cells are quite small, being only about 10 μ in diameter.

Review of the Pezizaceae.—It will be noted from the foregoing descriptions that two types of tissue are found in the sterile layers of the Pezizaceae. In the first place there is the pseudo-parenchyma of rounded cells which show little trace of their hyphal origin. This tissue is the common one, occurring in a large proportion of the forms studied. Secondly, there is the tissue composed of coarse, loosely interwoven hyphae, usually much bent and septated. This is also a common form, and very frequently occurs associated with the first type. Very rarely is it the only form present. Between these two types we have all gradations even in the same plant.*

Family ASCOBOLACEAE

A thorough and comprehensive study of this group was published by Boudier in 1869. No other family of the Pezizineae, perhaps, has been treated in so thorough a manner. The writer found throughout the family a great uniformity in the structure of the sterile organs. He described a subhymenial layer composed of small cells closely compacted. Beneath is a stratum of pseudo-parenchyma formed generally of interlacing filaments and composed of oblong rounded cells. The surface is covered by a thin membrane.

LASIOBOLUS EQUINUS (Müll.) Karst. Pl. 29, Fig. 6

The plants of this species usually grow thickly crowded on cow dung in the spring. The cups are obconical, sessile, and orange-red, with the outer surface beset with long hyaline pili.

---

* *Pyronema omphalloides* Bull.—This genus was removed by Schröter [(2), p. 176] in 1894 from the Pezizaceae, and associated with three other small genera to form a new family, the Pyronemaceae.

I have not been able to obtain very satisfactory sections of this species from the material at hand. Enough, however, can be made out in them to make certain the pseudo-parenchymatous nature of the whole sterile portion. This may be seen also in the diagrammatic figure given by de Bary. The tissue is composed of small, polygonal, thin-walled cells, which become larger toward the base. Under the apothecium we find the layer of long, slender hyphae composing the subiculum.

The hypothecium is a thick layer composed of small rounded cells about 3 μ in diameter, very closely compacted and obscured by granules. Toward the base and sides of the cup this tissue passes into one composed of larger polygonal cells, 6–10 μ in diameter, making up the excipulum. The outer excipular cells give rise near the margin to the pili, which are much prolonged, thick-walled cells of this layer. In my sections the excipular cells continue fully to the surface without any limiting membrane. The cup is fixed at the base by hyphae continuous with the basal cells of the excipulum.

ASCOBOLUS FURFURACEUS Pers.

The structure of the sterile layers of this plant closely resembles that of the preceding. The cells are generally much larger, while one or two layers at the surface form a more or less distinct ectal membrane.

Family HELOTIACEAE

SCLEROTINIA PSEUDOTUBEROSA Rehm. Pl. 31, Fig. 11

This is a small plant with a long slender stem growing on acorns. The waxy cup is reddish-brown within, but greenish-brown without. The sterile part of the plant exhibits three well-defined areas. The subhymenial area, or hypothecium, is a thin layer of very slender, closely interwoven hyphae, perhaps 1–2 μ in diameter. In the center of the cup the layer is well defined, but toward the margin it is lost by becoming blended with the excipulum.

The excipulum is composed of two layers. The inner or medullary one fills the whole central part of the stem and cup. It is made of extremely slender interlacing hyphae, which are looser than those of the hypothecium. The tissue is lost as it approaches the margin of the cup. The outer layer of the excipulum closely resembles the hypothecium, and it is composed of intricately interwoven hyphae. It forms an ectal membrane of uniform thickness covering the whole outer part of the stem and cup, and makes up the margin of the latter.

CYATHICULA CORONATA (Bull.) De Not. Pl. 30, Fig. 7

This little plant is so characterized by the white setose teeth with which the margin of the cup is ornamented that it is not likely to be confused with any other.

The medullary portion of the stem is formed of a dense mass of hyphae, 2 μ in diameter, running longitudinally and closely compacted together. As the cup expands at the summit of the stem, these hyphae spread out toward the margin, filling the whole central portion of the cup. A thin subhymenial layer of this tissue, more closely compacted than the rest, is the hypothecium. The ectal hyphae, especially at the sides of the cup, are more closely interlaced, forming a denser stratum beneath the outer excipulum.

The ectal excipulum is a distinct uniform layer on the sides of the stem and cup. The loosely interwoven hyphae composing it extend obliquely outward from the medullary layer within. The surface hyphae are more closely interwoven. The margin, with the teeth characteristic of the genus, is formed by a direct upward prolongation of the ectal excipular threads.

CHLOROSPLENIUM AERUGINOSUM (Oed.) De Not. Pl. 30, Fig. 9

This plant may be known by the clear verdigris-green color of the stem and cup, and by the deep green color which the mycelium imparts to the wood on which it grows.

The hypothecial layer is thin and but little differentiated. The medullary portion is in all respects similar to that of the other Helotiaceous plants described, except that the outer hyphae are not the more compacted. In the ectal membranous excipulum the threads are a little less closely interwoven.

The green color so characteristic of this genus is due to green granules deposited in the excipulum. Scattered green granules occur throughout the layer, but at the surface they become so numerous as to obscure the hyphae. Irregular masses occur also on the surface, causing it to appear furfuraceous.

PHIALEA CYATHOIDEA (Bull.) Gill.

This little plant grows on decaying twigs and resembles a *Cyathicula* without teeth.

The sterile layers of this species resemble those of *Cyathicula coronata* so closely that a separate description is not necessary. Sections of the two plants could scarcely be distinguished but for the teeth. Various other species of *Phialea* examined have an essentially similar structure.

HELOTIUM CITRINUM (Hedw.) Fr. Pl. 30, Fig. 8

This is one of the commonest of the Discomycetes growing on rotton wood. The disc is a bright clear yellow.

This plant, too, resembles *Cyathicula* and *Phialea* in all essential particulars, as do *H. fagineum*, *H. fructigenum*, *H. virgultorum* and others.

HELOTIUM EPIPHYLLUM (Pers.) Fr. Pl. 31, Fig. 13

The hypothecium and medullary portion of this plant are essentially the same as those in plants previously described in this family. The ectal layer of the excipulum, however, differs very decidedly in being composed of small rounded cells 9–12 μ in diameter. These cells are thin-walled and hyaline, and form a definite pseudo-parenchymatous tissue. The layer fades out toward the margin, and in this respect, also, differs from all the plants previously described.

H. herbarum agrees in essential features with *H. epiphyllum.*

PITYA CUPRESSI (Batsch) Fuckel

Rehm* says of this plant: "Excipulum prosenchymatous." Massee† on the other hand gives: "Hypothecium and excipulum parenchymatous, cortical cells largest." My sections made from N. A. F. no. 2322 show the following structure: The hypothecium and medullary portion are prosenchymatous throughout. The innermost part is made up of closely interwoven slender hyphae occasionally septated. Toward the outside they become more parallel. The cortex or ectal layer of the excipulum is very different and is separated by an abrupt transition from the parts within. It is distinctly pseudo-parenchymatous, composed of rounded cells 9–15 μ in diameter. The walls are thin and hyaline.

* Rehm, p. 926.

† Massee (3), 4: 291.

LACHNELLA FLAMMEA (A. & S.) Fuckel

The plants of this species are small, sessile, nearly globose, and brick-red in color. The exterior is clothed with long, red-brown hairs.

The sterile layers of this plant are uniformly composed of slender, hyaline hyphae. At the surface many of the threads are produced into long, brown, septate pili.

LACHNUM VIRGINEUM (Batsch) Karst. Pl. 30, Fig. 10

This is a very common Discomycete growing on rotton wood. The whole plant is pure waxy white with a slender stem. The surface is clothed with white pili.

The hypothecium and medullary tissue are composed of very slender hyphae densely interwoven, thus conforming to the type described for *Cyathicula*. The ectal layer has the threads stouter and less closely interlaced. Toward the surface the hyphae become still looser and finally project as long slender hyaline pili, which are very prominent at the sides and margin of the cup.

LACHNUM SULFUREUM (Pers.) Rehm. Pl. 31, Fig. 12

The hypothecium and medullary part of the cup resemble the last species in being composed of slender, hyaline hyphae closely interwoven. The tissue extends to the margin where the threads project as slender pili. The ectal excipular layer is truly pseudoparenchymatous, being made up of rounded cells 9–12 μ in diameter with thin, hyaline walls. This tissue extends from just below the margin down the sides of the cup to the stem-like base where it fades out.

ARACHNOPEZIZA AURELIA (Pers.) Fuckel

This is a pretty little species growing on leaves or rotton wood. The cups are sessile on a thin white subiculum, are golden-red in color, and clothed externally with reddish pili.

There seems to be some confusion regarding the structure and position of this plant. In its external characters it is clearly related to *Tapesia*. Fuckel,* however, founded the genus *Arachnopeziza* to include those forms which are seated on a subiculum, but which possess filiform spores. Saccardo † placed this as a subgenus

* Fuckel, p. 303.

† Saccardo (2), p. 499.

under *Belonidium* on account of the form of the spores. Rehm * and Schröter † included the genus in the Helotiaceae, making it comprehend those species which, on account of their *prosenchymatous* excipulum, are separated from the Mollisiaceous genus *Trichobelonium*.

My sections made from Ellis and Everhart's N. A. F. no. 59, show the following structure: The excipulum consists of two layers. The inner one made up of slender hyaline hyphae grades off into the thin hypothecium above. At the sides of the cup the threads are looser, and many of them project from the sides and margin as golden-brown pili. The ectal excipular layer is present only at the base of the cup, being lost as the sides begin to be elevated. It is pseudo-parenchymatous, the cells being thin-walled and hyaline. They are somewhat elongated and measure $15 \times 5\ \mu$.

OMBROPHILA

The plants of this genus are small with a gelatinous consistency. They usually have a short stem and grow on decaying vegetable matter in damp places. Most authors have included this genus with the next under the Bulgariaceae. Rehm ‡ followed the usual disposition but observed that in their structural characters these plants approach the Helotiaceous division of the Pezizineae. Schröter § went a step further and united the most of Rehm's Bulgarieae to the family Helotiaceae under a gelatinous division.

O. aurea, *O. purpurascens*, and *O. violacea* have been examined, and in all the whole sterile tissues are composed of very slender, hyaline hyphae closely interwoven.

CORYNE URNALIS (Nyl.) Sacc.

This is a reddish-purple, gelatinous plant growing on rotten wood. It differs from the preceding genus in being larger, and in having septate spores.

The hypothecium and medullary portion are composed of very slender hyaline hyphae like those in *Ombrophila*. The ectal layer

---

* Rehm, p. 698.

† Schröter (1), p. 68, (2), p. 200.

‡ Rehm, p. 467.

§ Schröter (1), p. 98; (2), p. 208 et seq.

of the excipulum, however, is different, being composed of rounded, thin-walled, hyaline cells, 10–15 μ in diameter.

Review of the Helotiaceae.—It will be noted that in all the Helotiaceous plants described above the principal tissue is a prosenchyma composed of long-drawn-out, slender hyaline hyphae closely interwoven. In the greater number, especially of the stipitate forms, it is the only tissue present. In all, it fills the medullary part of the stem and cup. In a few forms there is a cortical layer of pseudo-parenchyma but in the family as a whole this tissue is comparatively rare. It seldom if ever forms the margin of the cup, but is confined to the surface of the sides and base. There is also a sharp line of demarcation between such tissue and the prosenchyma, and rarely can one detect the much septated and coalesced hyphae showing a transition to the cellular structure, such as is commonly seen in the Pezizaceae. The tissue, too, whether it be hyphal or cellular is always hyaline and thin-walled.

The hyphae in this family are very different in character from those found in the Pezizaceae. Here they are always very slender, long-drawn-out, but little branched, and infrequently septated. In the Pezizaceae they are stout, strongly curved, branched, and usually much septated. In the majority of cases in the Helotiaceae the ectal excipular layer forms a sort of cortical membrane covering the surface of the cup.

Family MOLLISIACEAE

MOLLISIA CINEREA (Batsch) Karst. Pl. 32, Fig. 14

This is a very common little Discomycete growing on rotten wood, especially in the spring. The cups are sessile and soft-waxy, with a cinereous disc.

The excipulum consists of two layers. The inner one with the hypothecium fills the medullary portion of the cup beneath the hymenium and extends upward to form the margin. It is composed of very delicate, hyaline hyphae. At the base and side of the cup, this gives place to a pseudo-parenchymatous outer excipular layer composed of rounded cells, 9–12 μ in diameter. The walls of the innermost cells are hyaline, but those near the surface are thickened and dark brown. *M. polygoni* and *M. atrata* agree with the species just described, except that the brown outer layer of the excipulum is thicker and forms the margin of the cup.

TAPESIA FUSCA (Pers.) Fuckel. Pl. 32, Fig. 15

In many respects this plant resembles *Mollisia cinerea*, but differs in being seated on a dark brown subiculum.

The hypothecium is poorly developed. The excipulum consists of two layers. The inner one is made up of small hyaline hyphae closely interwoven. The outer layer is composed of rounded or polygonal cells 9–12 μ in diameter. At the surface these cells have thick dark brown walls and are quite prominent, while the inner ones are hyaline and thin-walled.

The underlying subiculum consists of a layer of stout, loosely interwoven, brown hyphae, extending for some distance beyond the base of the cup on all sides. Many of these threads are continuous with the excipular cells at the base. *T. culcitella* (C. & E.) Sacc. differs in having the brown excipulum a little less extensive.

PSEUDOPEZIZA TRIFOLII (Bernh.) Fuckel

This plant is parasitic on the leaves of clover. The yellowish cups are at first buried beneath the epidermis, but finally break through, becoming sessile on the surface.

The excipulum is a single layer of rounded, brown-walled cells, 5–10 μ in diameter. At the base they are produced downward between the cells of the host. Occasionally those at the sides of the cup are prolonged from the surface in the form of very short pili. The hypothecium is thin.

PYRENOPEZIZA EBULI (Fr.) Sacc.

This is a small, sessile, black plant growing on herbaceous stems. It develops under the epidermis but finally breaks through, becoming cup-shaped.

The excipulum consists of two layers. The thick outer one is composed at the base of rounded or somewhat elongated cells, 5 μ in diameter, with brown walls. At the sides of the cup the cells are larger and more uniformly rounded, 9–12 μ in diameter. At the margin they become elongated and fibrous.

The inner excipular layer is made up of long, slender, hyaline threads which continue upward to form the inner part of the margin. The hypothecium is thin and obscure.

BELONIELLA DEHNII (Rab.) Sacc. Pl. 32, Fig. 17

This plant is parasitic on the stem and petioles of *Potentilla* As in other Mollisiaceous plants, the hypothecium is little prominent. The excipulum resembles that of *Pseudopeziza trifolii*. It is made up of polygonal cells, 10–12 μ in diameter. The innermost cells have thin, hyaline walls, but toward the surface they become thicker and dark brown in color. The excipular tissue is continuous at the base with the intercellular nutritive mycelium.

ORBILIA VINOSA (A. & S.) Karst. Pl. 32, Fig. 16

The plants of this species are small and gelatinous, becoming contorted when dry. The cups are sessile, smooth, with a clear wine-purple color. The species represents a group which was formerly placed in the Bulgariaceae. Rehm,* however, suggested that on the basis of excipular structure they approach mostly the division Mollisiaceae, and should, perhaps, be united wholly with it. Schröter † there foreunited the most of Rehm's Callorieae to the Mollisiaceae, in the same way that he did the Bulgarieae to the Helotiaceae.

In *Orbilia vinosa* the hypothecium is poorly developed. The excipulum has two layers. The inner one is composed of fine, closely interwoven hyphae. The outer layer consists of isodiametric cells, 9–12 μ in diameter with thin walls. It forms a stratum three to five cells thick over the whole exterior of the cup.

Review of the Mollisiaceae.—It will be seen that both prosenchyma and pseudo-parenchyma are found in this family. The former tissue when it occurs resembles that of the Helotiaceae. The latter is always present and forms the principal sterile tissue in the family. Except in the gelatinous group, the cells, at least the outer ones, have thick brown walls. This is a striking characteristic of all the Mollisiaceous plants. There seems to be no structural reason why *Orbilia* should not as well be united with the

* Rehm, p. 445.

† Schröter (1), p. 120; (2), p. 217.

Helotiaceae as with the Mollisiaceae. The general habit of the plants, however, seems to associate them rather with the latter group.

Conclusions.—1. It is possible to separate the fleshy Pezizineae into families of which the structure of the sterile layers of the cup offers important distinguishing characters.

2. Schröter's characterization of the Pezizaceae as having the hypothecium and excipulum composed of rounded cells is too general. Both cellular and hyphal tissues occur, but, as shown above, the structure of the latter is peculiar to this family.

3. Rehm's and Schröter's characterization of the Helotiaceae as having the excipulum prosenchymatous is also too general. This is the predominating tissue, but pseudo-parenchyma also occurs. Both kinds are, however, uniformly thin-walled and light colored.

4. The Mollisiaceae have the outer excipular layer pseudo-parenchymatous, the cells near the surface having thick dark brown walls.

5. On the basis of the preceding studies the families should be characterized as follows :

I. PEZIZACEAE

Plants usually of medium or large size. Apothecia free on the substratum, or rarely at first buried in the soil, fleshy, brittle, or rarely leathery, sessile, or with a thick, fleshy stem, externally smooth or pruinose, tomentose or pilose ; at first nearly or quite closed, later more or less cupulate, concave or plane. Hypothecium usually well developed, formed of rounded cells, or of stout, septate hyphae. Excipulum pseudo-parenchymatous, or formed of stout hyphae much bent and branched, septated and coalesced, showing a transition to pseudo-parenchyma. Asci cylindrical or clavate, not projecting above the hymenium, opening mostly by a lid at the apex. Spores spherical to fusoid, commonly large and one-celled. Paraphyses filiform, usually thickened at the apex.

II. ASCOBOLACEAE

Plants of small or minute size, usually growing on dung. Apothecia free on the substratum, fleshy or rarely somewhat waxy or gelatinous, sessile, externally smooth, granular, or pilose; at first closed, later concave, finally plane or discoid. Hypothecium and excipulum uniformly pseudo-parenchymatous, composed of rounded cells. Asci cylindrical or clavate, at maturity projecting far above the hymenium, causing it to appear papillose, usually opening by a lid. Spores spherical, elliptical, or fusiform, continuous, hyaline or colored, eight or more in an ascus.

III. HELOTIACEAE

Plants usually of small size. Apothecia free on the substratum, waxy, membranous, rarely leathery or gelatinous, sessile or stipitate, externally smooth or hairy; at first closed, later becoming cupulate, concave or plane. Hypothecium and excipulum usually prosenchymatous, composed of slender, long-drawn-out hyphae, but little septated, rarely pseudo-parenchymatous, formed of thin-walled, hyaline cells. Asci cylindircal or clavate, opening mostly by a pore at the apex. Spores usually small, spherical to filiform, continuous or septate, hyaline. Paraphyses filiform or acerose.

IV. MOLLISIACEAE

Plants of small size. Apothecia free on the substratum, or at first buried, finally erumpent; waxy, fleshy-waxy, membranous or gelatinous, sessile or nearly so, usually smooth, rarely hairy. Cups at first closed, later becoming cupulate, concave or plane. Hypothecium little developed. Excipulum wholly or in part pseudo-parenchymatous, composed of rounded cells, the ectal ones having thick, brown walls. Asci cylindrical or clavate, opening mostly by a pore at the apex. Spores small, spherical to filiform, continuous or septate, hyaline. Paraphyses filiform, often thickened at the apex.

SYNOPSIS OF FAMILIES AND GENERA

In the following synopsis of genera, only those will be included which may be expected to occur in North America. Although the Discomycetes have been pretty thoroughly studied in certain portions of the county, yet in America as a whole the group is very little known. It is to be hoped that these plants may be less neglected in the future, so that our knowledge of the large number of forms which probably occur may be somewhat more comprehensive.

A. Apothecia fleshy or rarely leathery. Tissue usually more or less pseudo-parenchymatous, or composed of coarse hyphae, much septated, and showing a transition to pseudo-parenchyma.
  B. Asci at maturity forming a uniform layer; plants usually of medium or large size. I. PEZIZACEAE.
  B. Asci at maturity projecting above the hymenium; plants of small size usually growing on dung. II. ASCOBOLACEAE.
A. Apothecia waxy, fleshy-waxy, gelatinous or membranous. Tissue usually at least partly prosenchymatous, formed of slender; long-drawn-out hyphae rarely septated, not showing a transition to pseudo-parenchyma.
  B. Excipulum usually prosenchymatous, rarely partly pseudo-parenchymatous, always hyaline. III. HELOTIACEAE.
  B. Excipulum wholly, or at least at the base, pseudo-parenchymatous, the outer cells with thick brown walls. IV. MOLLISIACEAE.

I. PEZIZACEAE.

A. Externally smooth or pruinose.
  B. Stipitate, distinctly cupulate.
    C. Externally venose-sulcate, stem stout. *Acetabula.*
    C. Externally even, stem slender or short. *Geopyxis.*
  B. Cups sessile or subsessile.
    C. Cups regular, not elongated or split on one side.
      D. Large, exceeding 1 cm.
        E. Distinctly cupulate, sessile.
          F. Exuding a colorless juice when wounded. *Peziza.*
          F. Exuding a milky juice. *Galactinia.*
        E. Plane or repand, sessile or subsessile.
          F. Spores elliptical. *Discina.*
          F. Spores spherical. *Detonia.*
      D. Small, rarely exceeding 1 cm.
        E. Subiculum none.
          F. Spores elliptical or fusiform. *Humaria.*
          F. Spores spherical. *Barlaea.*
        E. Seated on a subiculum. *Pyronema.*
    C. Cups elongated or split on one side.
      D. Spores elliptical. *Otidea.*
      D. Spores spherical. *Otidella.*
A. Externally hairy, strigose, setose or tomentose.
  B. Black strigose at the base, stipitate or sessile.
    C. Spores elliptical or fusiform. *Plectania.*
    C. Spores spherical. *Pseudoplectania.*
  B. Not black strigose at the base.
    C. Stipitate.
      D. Apothecia light-colored. *Sarcoscypha.*
      D. Apothecia brown. *Macropodia.*

C. Sessile.
D. Spores elliptical or fusiform.
E. Externally brown pilose or ciliate.
F. Sessile on the substratum, regular. *Lachnea.*
F. At first buried in the soil, finally splitting at the apex irregularly. *Sarcosphaera.*
E. Externally white pilose. *Neottiella.*
D. Spores spherical. *Sphaerospora.*

2. ASCOBOLACEAE.

A. Spores hyaline.
B. Spores spherical. *Cubonia.*
B. Spores elliptical or fusiform.
C. Spores more than eight in an ascus. *Ryparobius.*
C. Spores eight in each ascus.
D. Externally smooth. *Ascophanus.*
D. Externally pilose. *Lasiobolus.*
A. Spores colored.
B. Spores spherical. *Boudiera.*
B. Spores elliptical or fusiform.
C. Spores free in the ascus. *Ascobolus.*
C. Spores enclosed in a sack in the ascus. *Saccobolus.*

3. HELOTIACEAE.

A. Apothecia waxy, membranous or leathery.
B. Externally smooth. HELOTIEAE.
C. Sessile by a broad base. PEZIZELLEAE.
D. Spores 1-celled. *Pezizella.*
D. Spores elliptical or fusiform, 2–4-celled. *Belonium.*
D. Spores filiform, ∞-celled. *Gorgoniceps.*
C. Stipitate, or at least narrowed to a slender base.
D. Spores spherical. *Pitya.*
D. Spores elliptical or fusiform, 1-celled.
E. Apothecia green. *Chlorosplenium.*
E. Apothecia not green.
F. Margin toothed. *Cyathicula.*
F. Margin even.
G. Not arising from a sclerotium.
H. Cup small, membranous, thin, usually collapsing when dry; stem slender. *Phialea.*
H. Cup small, waxy, thick, not collapsing when dry; stem thick. *Helotium.*
H. Cup large, waxy-leathery; stem long and slender. *Ciboria.*
G. Arising from a sclerotium. *Sclerotinia.*
D. Spores elliptical or fusiform, 2–4-celled.
E. Cups large, waxy-leathery; stem long and slender. *Rutstroemia.*
E. Cups small, waxy, or membranous; stem short. *Belonioscypha.*
D. Spores filiform, ∞-septate. *Pocillum.*

B. Externally hairy.	TRICHOPEZIZEAE.
C. On a subiculum.	
D. Spores 1-celled.	*Eriopeziza.*
D. Spores elongated, ∞-celled.	*Arachnopeziza.*
C. Without a subiculum.	
D. Spores spherical.	*Lachnellula.*
D. Spores elongated.	
E. Hymenium beset with dark hairs.	*Desmazierella.*
E. Hymenium smooth.	
F. Paraphyses filiform, obtuse.	
G. Excipulum thin, spores 1-celled.	*Dasyscypha.*
G. Excipulum thick, spores 2-celled.	*Lachnella.*
F. Paraphyses acute at the apex.	
G. Spores 1-celled.	*Lachnum.*
G. Spores ∞-celled.	*Erinella.*
A. Apothecia gelatinous, horny when dry.	
B. Spores 1-celled.	
C. Cups minute, urceolate.	*Stamnaria.*
C. Cups larger, cupulate or concave.	*Ombrophila.*
B. Spores several-celled.	*Coryne.*

4. MOLLISIACEAE.

A. Apothecia waxy, fleshy-waxy or membranous.	MOLLISIEAE.
B. Apothecia from the first free on the substratum.	EUMOLLISIEAE.
C. Seated on a subiculum.	
D. Spores 1-celled.	*Tapesia.*
D. Spores ∞-celled.	*Trichobelonium.*
C. Without a subiculum.	
D. Spores 1-celled.	
E. Spores spherical.	*Mollisiella.*
E. Spores elliptical or fusiform.	*Mollisia.*
D. Spores finally 2-celled.	*Niptera.*
D. Spores fusiform, 4-∞-celled.	*Belonidium.*
D. Spores filiform, ∞-celled.	*Belonopsis.*
B. Apothecia erumpent.	PYRENOPEZIZEAE.
C. Apothecia bright colored, only slightly erumpent.	
D. Spores 1-celled.	*Pseudopeziza.*
D. Spores ∞-celled.	*Fabraea.*
C. Apothecia dark colored, much erumpent.	
D. Spores 1-celled.	
E. Cups hairy without.	*Pirottaea.*
E. Cups smooth without.	*Pyrenopeziza.*
D. Spores ∞-celled.	*Beloniella.*
A. Apothecia gelatinous, horny when dry.	CALLORIEAE.
B. Spores 1-celled.	*Orbilia.*
B. Spores 2–4-celled.	*Calloria.*

BIBLIOGRAPHY

de Bary, A. 1. Morphologie und Physiologie der Pilze und Flechten. 1866.

——— 2. Morphology and Biology of the Fungi, Mycetozoa and Bacteria. 1887.

Boudier, E. 1. Mémoire sur les Ascobolés. Ann. d. Sci. Nat. Bot. V. **10**: 191–268, *pl. 5–12*. 1869.

——— 2. On the importance that should be attached to the dehiscence of asci in the classification of the Discomycetes. Grevillea, **8**: 45–49. 1879.

Cooke, M. S. 1. Mycographia. Vol. I. 1875–79.

——— 2. Observations on *Peziza*. Grevillea, **8**: 129–141. 1879.

——— 3. Handbook of Australian Fungi. 1892.

De Notaris, G. Proposte di alcune rettificazioni al profilo dei Discomiceti, 357–388. 1864.

Dillenius, J. Catalogus plantarum sponte circa Gissam nascentium cum appendice, etc. 1719.

Fries, E. 1. Systema Mycologicum. 3 Vols. 1821–1830.

——— 2. Summa Vegetabilium Scandinaviae. 2 Vols. 1846.

Fuckel, L. Symbolae Mycologicae. 1869.

Karsten, P. A. 1. Monographia Pezizarum fennicarum, 101–206. 1869.

——— 2. Mycologia Fennica. 1871.

Linnaeus, C. 1. Species Plantarum. 1753.

——— 2. Systema Vegetabilium. 1774–1784.

Massee, G. 1. Elvella auricula. Grevillea, **22**: 65–67. 1894.

——— 2. Revised descriptions of Type-specimens in the Kew Herbarium. Grevillea, **22**: 99–107. 1894.

——— 2. British Fungus Flora. 4 Vols. 1895.

Nylander, W. Observationes circa Pezizas Fenniae, 1–97. 1868.

Persoon, C. H. 1. Observationes Mycologicae. 1796.

——— 2. Synopsis Methodica Fungorum. 1801.

Phillips, W. A Manual of British Discomycetes. 1887.

Pliny (C. Plinius Secundus). Historia Naturalis. 37 books, 77 et seq.

Rehm, H. Discomycetes. Rabenhorst's Kryptogamen-Flora v. Deutschland, Oesterreich u. d. Schweiz. 1887–1894.

Saccardo, P. A. 1. Conspectus generum Discomycetum hucusque cognitorum. Bot. Cent. **18**: 1–16. 1884.

——— 2. Sylloge Fungorum, **8**. 1889.

Schröter, J. 1. Discomycetes. Cohn's Kryptogamen-Flora v. Schlesien. 3. 1893.

——— 2. (Completed by Lindau). Engler & Prantl's Die Natürlichen Pflanzenfamilien, 1^1: 173–243. 1894.

Tulasne et Tulasne. Selecta Fungorum Carpologia. 3. 1865.

Explanation of Plates

The tissues here represented are all taken from median longitudial sections, and are drawn from the base or sides of the cup. The sketches were made with a camera lucida, but in the moie intricate ones the detail was filled in free hand. A portion of a stage micrometer is sketched by each figure to indicate the magnification.

FIG. 1. *Barlaea Constellatio.*

FIG. 2. *Lachnea scutellata.*

FIG. 3. *Macropodia pubida.*

FIG. 4. *Sarcoscypha coccinea,* part of cup at the surface showing the tomentum, the outer excipular layer, and a portion of the medullary part.

FIG. 5. *Otidea leporina,* showing the pseudo-parenchyma at the surface, and hyphal tissue within.

FIG. 6. *Lasiobolus equinus,* section of the entire plant. The specimen was not quite mature so that the asci do not project above the hymenium.

FIG. 7. *Cyathicula coronata.*

FIG. 8. *Helotium citrinum.*

FIG. 9. *Chlorosplenium aeruginosum.*

FIG. 10. *Lachnum virgineum.*

FIG. 11. *Sclerotinia pseudotuberosa.*

FIG. 12. *Lachnum sulphureum.*

FIG. 13. *Helotium epiphyllum.*

FIG. 14. *Mollisia cinerea.*

FIG. 15. *Tapesia fusca.*

FIG. 16. *Orbilia vinosa.*

FIG. 17. *Beloniella Dehnii.*

BOTANICAL LABORATORY, CORNELL UNIVERSITY.

Celtis pumila Pursh, with Notes on allied Species

BY E. J. HILL

(WITH PLATE 33)

Since 1889 I have had under observation the species of *Celtis* which grow in this vicinity—*C. occidentalis* L. and the one that generally goes under the varietal name of *pumila* A. Gray, regarded as the equivalent of *Celtis pumila* Pursh. Since finding the latter in 1893 the impression of their difference and the title of the latter to specific distinction have increased until at last I am convinced it should be restored to the rank assigned it by Pursh. This conclusion was communicated to Dr. N. L. Britton in a letter, July 19, 1899. *Celtis occidentalis* is a forest tree, here mostly found by the banks of streams or contiguous to them and is most common by the Desplaines River. It also occurs in the lower or more swampy sand region at the head of Lake Michigan, where it is seen sparingly on low sand ridges which border or divide from each other the shallow lakelets near the boundary of Indiana and Illinois. *Celtis pumila* is found in the dry dune region and is confined to a narrow belt extending east and west of the mouth of the Grand Calumet in Indiana, not yet seen beyond half a mile from Lake Michigan. A full description will be given of *C. pumila* alone; only points of comparison between *C. pumila* and other species of the genus need be added.

CELTIS PUMILA Pursh

A bushy straggling shrub, 0.75–4 m. high, often in clumps as broad as high, sometimes with ascending stems 4–5 m. long and 8–10 cm. in diameter. Branches divaricate or much divergent, usually making a wide angle with their support, often a right angle or even slightly directed downward. They are scraggy, abundantly furnished with short twigs 3–10 cm. long, which frequently end in a stiff, leafless, thorn-like point, due to winter killing, and giving them the appearance of a thorn-bush. The bark is thin, gray, smooth or a little roughened at the base. The new branchlets are puberulent, brown or reddish, often tinged with gray. The older branches are gray, with numerous small, oval or roundish, slightly elevated lenticels, lighter than the bark. Winter buds minute, 1–2 mm. long, triangular-ovate, flattened by pressure against the stem, furnished with two or three series of brown puberulent scales. Stipules linear-oblong, scarious, membranaceous, caducous, yellowish; margins hairy, often fimbriate. Leaves on petioles 1–1.5 cm. long, broad-ovate to oval or oval-oblong, acute to acuminate, mostly short-acuminate, sometimes a little falcate, 5–8 cm. long by 2.5–5 cm. wide; base commonly very oblique, sometimes rounded, rarely slightly heart-shaped; the margin entire to serrate in various degrees above the lower fourth. Sometimes they are prominently and quite evenly serrate on both margins, with callous-tipped, slightly incurved teeth, or on one side only, the teeth varying in position, number and prominence, often reduced to one or two. The leaves are puberulent when young, smooth or a little scabrous as they mature, usually thickened with age; light green or somewhat glossy above, frequently mottled with lighter colored spots, paler beneath; veins lighter and prominent on the lower surface, with many anastomosing veinlets. In autumn they turn to a pale or greenish yellow.

The flowers appear with the expanding leaves in May. The staminate are caducous, on slender recurved pedicels in groups of two or three, mostly three, on the basal part of the twigs in the axils of minute bracts or of the lower leaves, sometimes much crowded on short twigs and appearing racemose. The perfect flowers are usually solitary, on slender ascending pedicels from the axils of leaves above the staminate, or single and central in a staminate group. Sepals 4–6, mostly 4 or 5, thin, membranaceous, incurved-spreading, oblanceolate to oblong-linear or linear, boat-shaped, hairy, greenish to yellowish-green, frequently tinged with red, apex entire or sometimes laciniate; fringing hairs long. The stamens are 4–6, those of the sterile flowers rising from a torus covered with a dense white tomentum; filaments smooth, stout and tapering, bent inward before anthesis, bearing the oblong introrse anthers attached below the middle in an erect position. During anthesis they straighten, raising the recumbent anthers nearly to the top of the sepals, the filaments being shorter than the anthers and barely more than half the length of the sepals. In the perfect flower the anthers are erect, emarginate, nearly sessile and included, smaller than in the sterile. The vase-shaped ovary rises from a torus of dense white tomentum, and is glossy green. The stigmas are long, spreading or a little recurved, 8–10 mm. across when expanded, the tips generally strongly incurved or rolled inward, densely clothed above and around the ends with white, more or less papillose, hairs, the smooth green strip beneath being very narrow. The fruit is single, globular, 6–8 mm. in diameter, on ascending pedicels about the length of the petiole (9–12 mm.). It varies in color from bay or light brick to chestnut or even sooty when very ripe; it has a thick, tough skin and a thin, orange-colored, sweet flesh. The nutlet is globose, slightly higher than wide, sometimes a little flattened longitudinally, 5.5–6 mm. high by 5–5.5 mm. in diameter; the thick, white wall coarsely reticulated on the outer surface, pale orange and lustrous within. The pits are shallow, their bounding walls broad and rounded. The seed is covered by a thin, white, membranous coat marked at the chalaza by a dark circular spot. The fruit sometimes persists on the branches during the winter, but is apt to be eaten by birds.

Celtis pumila ranges from Delaware and Pennsylvania to Kansas, Colorado and Utah, and southward along the Atlantic border. It inhabits sand dunes, rocky places, rocky banks of streams, dry hills and mountains, being generally xerophytic in habit.

Specimens have been examined in the herbarium of the Field Columbian Museum from Delaware (W. M. Canby, *C. occidentalis* L. var. *pumila* Gray), from Pennsylvania (Traill Green, *C. occidentalis* L., Easton, Pa.); in the herbarium of J. M. Coulter, University of Chicago, from Kansas (No. 44, J. E. Bodin, *C. occidentalis* L. var., described as a large shrub or small tree about 15 feet high, "growing on rocky creek banks on limestone ground.") Besides material of *C. occidentalis* collected in various places in the vicinity of Chicago, specimens from different regions were available for comparison in the above herbaria, though unfortunately nearly always with immature fruit. Excellent fruit from Stark Co., Ill., was furnished by V. H. Chase. Specimens of *C. reticulata* Torr. were examined in the herbarium of J. M. Coulter from Bowie, Arizona, coll. Marcus E. Jones (with mature fruit) and from river bottoms, Oregon, coll. Drake and Dixon, Portland, Oregon. Also examples of *C. Mississippiensis* Bosc from various stations in the Mississippi valley were examined in the two herbaria.

The characters of *Celtis pumila* Pursh place it between *C. occidentalis* L. and *C. Mississippiensis* Bosc. Its fruit characters, especially as seen in the nutlet, bring it much closer to the latter and to *C. reticulata* Torr. (or *C. Mississippiensis* var. *reticulata* Sargent, if considered a variety). It very often has the entire leaves of *C. Mississippiensis.* The leaves of this species are narrower and relatively longer, but when short and broad approach those of *C. pumila.* Sometimes the leaves of *C. occidentalis* resemble those of *C. pumila* if the latter has them rather closely and evenly serrate on one or both margins, as in the specimen of W. M. Canby from Delaware. It is also seen in examples of the common hackberry from the Desplaines River in which the leaves are considerably thickened at fruiting time like those of *C. pumila.* The leaves of *Celtis occidentalis* are prevailingly much longer acuminate, thinner, though with a tendency to thicken in autumn, frequently scabrous, more apt to have a cordate base or one less oblique, and often become much larger. Being a tree, it has a trunk roughened by the peculiar bark of narrow, prominent, broken ridges so characteristic of the hackberry. The shrubby habit and peculiar mode of branching of *C. pumila* (that of *C. occidentalis* usually being ascending or making a sharper angle with the support) are features that at once strike the eye. The smaller winter buds, the flowering season from 10 to 15 days later than that of *C. occidentalis,* greener flowers with longer stigmas, commonly more hairy and more nearly entire sepals, shorter filaments, smaller, globular, lighter colored fruit, and especially the smaller globose nutlet with a white reticulated pitted surface, seed covered with a white membrane (that of *C. occidentalis* being light brown or dark brown near the black spot of the chalaza), are the most distinctive characters of *C. pumila* as compared with *C. occidentalis.*

A comparison of the nutlets of four species, enlarged 8 diameters, is given in connection with the text figures 1–4.

CELTIS OCCIDENTALIS. Fig. 1

Nutlet pale to dark fuscous, higher than wide, 6–8 × 5–6 mm., slightly obovate, apiculate, unsymmetrical. Surface more regularly reticulated, the pits deeper, the walls a little sharper than in *C. pumila*.

FIG. 1.

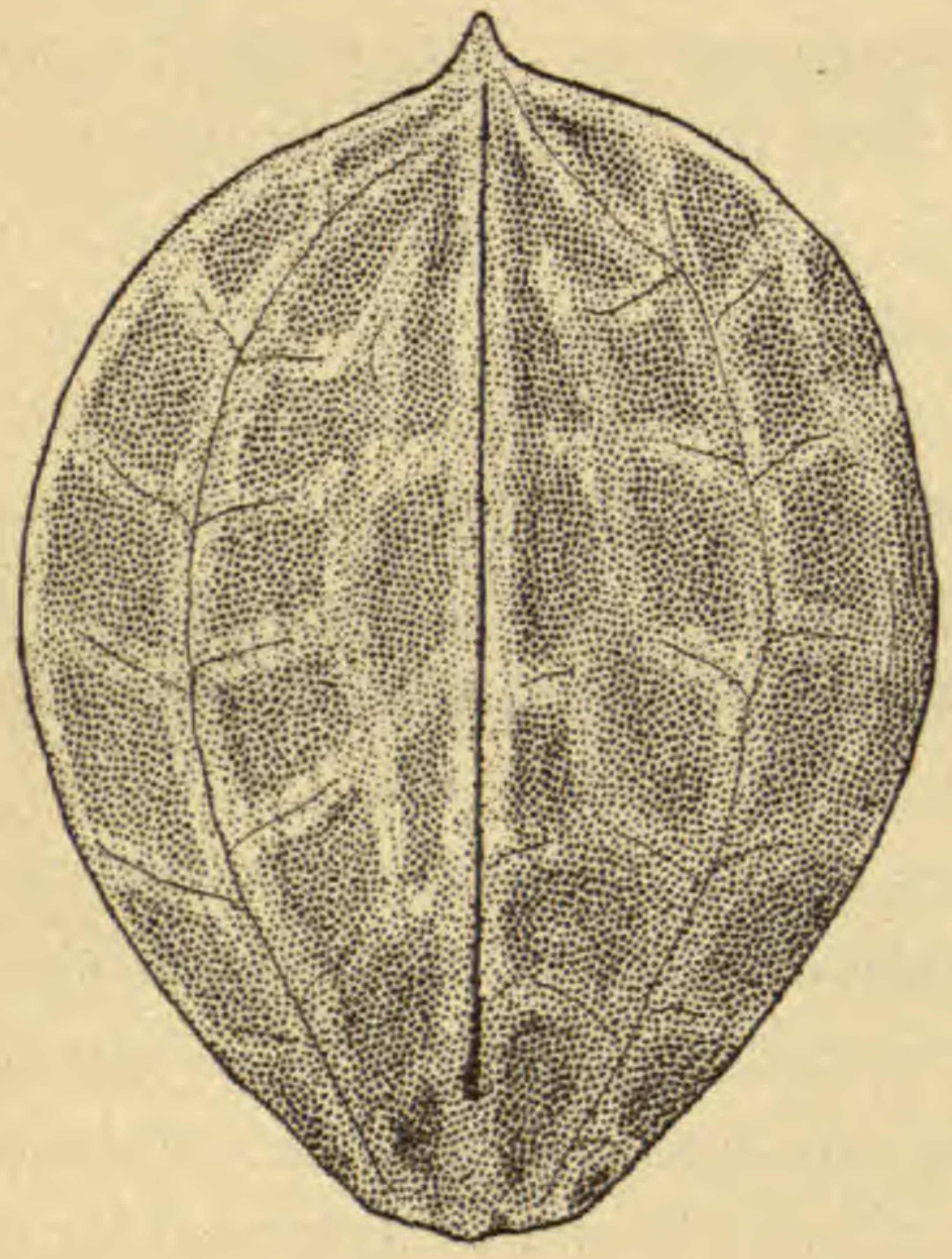
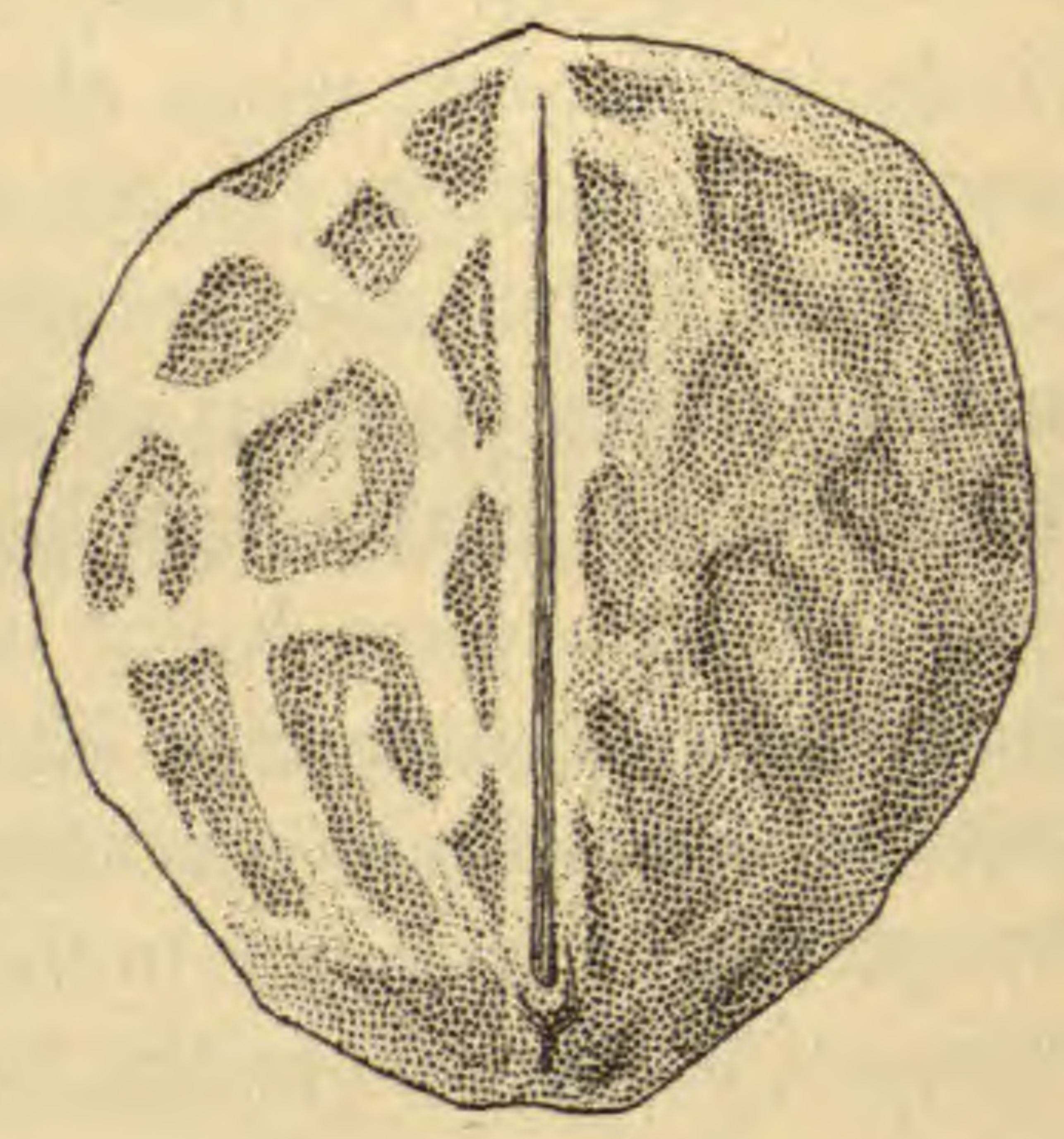


FIG. 2.



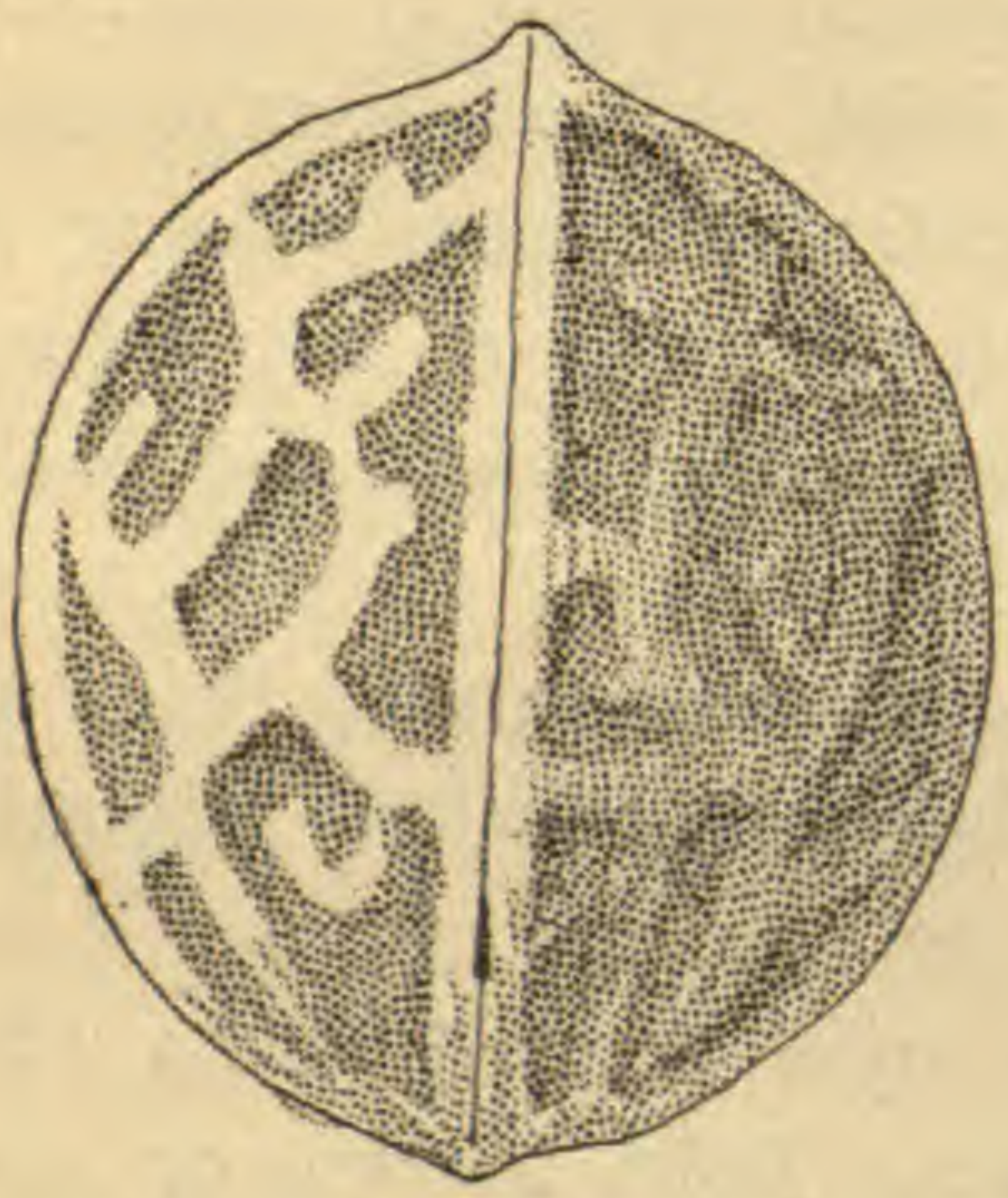


FIG. 3.

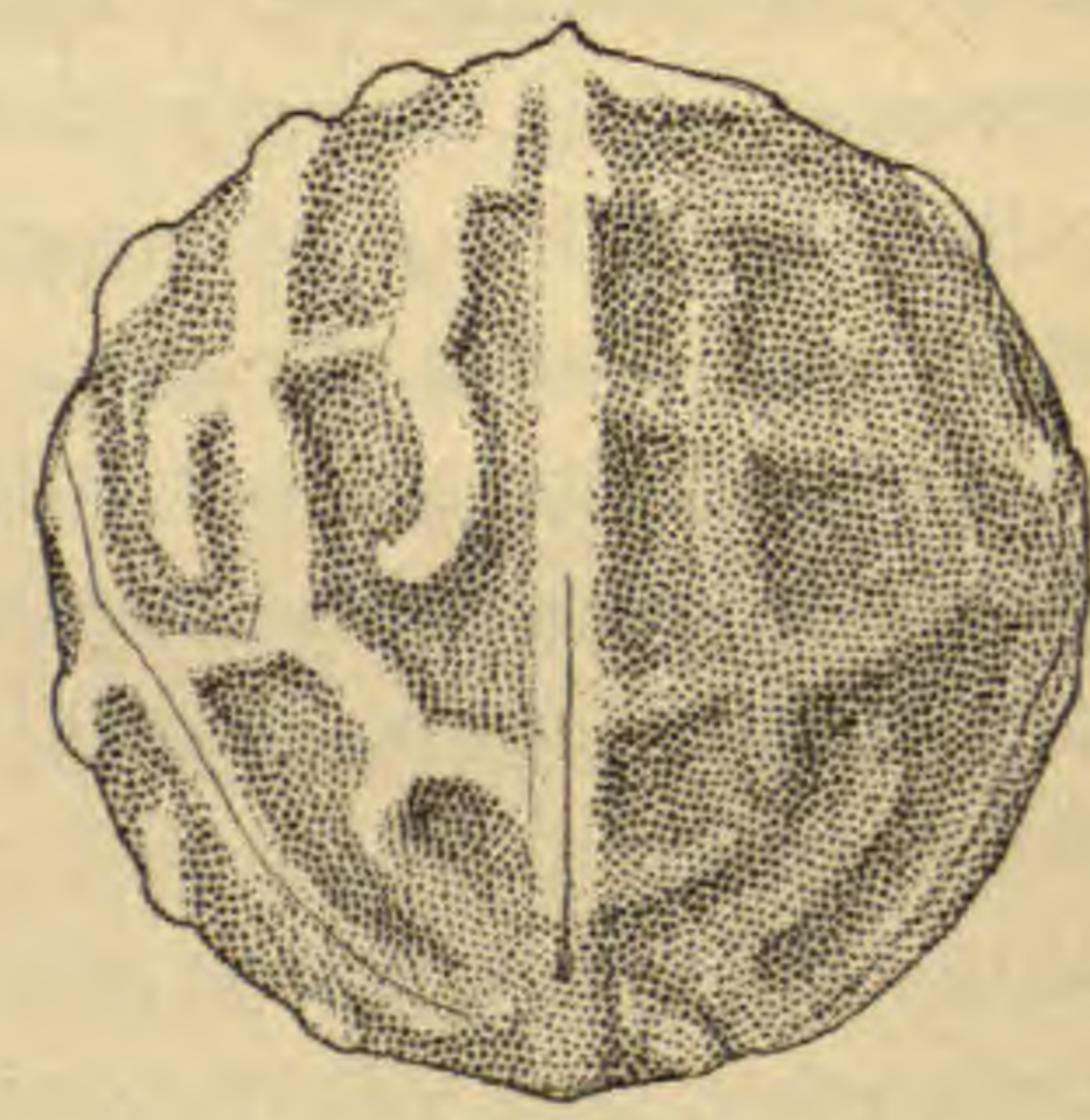


FIG. 4.

CELTIS RETICULATA. Fig. 2

Nutlet grayish-white, globose, 6 × 5.5 mm., unsymmetrical. Surface irregularly and coarsely reticulated, pits rather deep, larger ones raised in the center, bordering walls broad.

CELTIS PUMILA. Fig. 3

Nutlet white, 5.5–6 × 5–5.5 mm., globose or nearly spherical, being slightly higher than wide, bluntly apiculate. Surface coarsely reticulated, the pits shallow, the bordering walls broad and rounded.

CELTIS MISSISSIPPIENSIS. Fig. 4

Nutlet yellowish-white, 5 × 5 mm., globular, minutely apiculate. Surface reticulations irregular, the pits deeper and bordering walls sharper than in the others.

Another form, not figured, is worthy of notice. It is from a specimen in the herb. of the Field Columbian Museum, no. 63720, *C. occidentalis* L., coll. J. R. Lowrie, 1874, "barrens of Huntingdon Co., Pa." The nutlet is globose, a little higher than wide, 6.5 × 5 mm., in size and shape between that of *C. pumila* and *occidentalis*, light tan-colored. The reticulations, pits and their bordering walls are similar to those of *occidentalis.* The leaves are thinnish, larger than in *C. pumila*, slightly serrate, shaped much as in *C. occidentalis.* The specimen shows a branching rather spreading or divaricate, akin to that of shrubs in the dune region of Indiana. It has characters intermediate between *Celtis pumila* and *C. occidentalis*, but nearer the latter. It may be distinct but the material is too scanty to decide. Hybridity is also suggested.

My experience with the floral habits of the two species of our region in 1898 and 1899 well illustrates their difference and is worthy of record for its ecological bearings. It is a matter of long observation that the cold air of Lake Michigan retards the anthesis of plants growing near the shore. There may be a difference of a week within a distance of ten miles, as seen in the same species growing by the Desplaines River, about that distance away. *Celtis pumila* in the dune region is from one fourth to one half a mile from the shore. *C. occidentalis* at Wolf Lake and vicinity is from two to three miles from the shore. *C. occidentalis* along the Desplaines is about eleven miles from the lake. On April 28, 1899, this was collected at Wolf Lake in full bloom, the trees being yellow with the flowers. The day after those at Maywood on the Desplaines were examined. The staminate flowers had nearly all fallen off, showing that the anthesis would have been in the condition of those at Wolf Lake three or four days before, or about April 25th. On May 16th, *C. pumila* along the Grand Calumet near Miller was visited. It was a little late, the staminate flowers were nearly all gone and the perfect in about the same stage as those of *C. occidentalis* at Maywood on April 29th, showing that their anthesis occurred about the 12th of May. The previous year, May 25, 1898, *C. pumila* near Miller was examined. The shrubs were well covered by the greenish yellow flowers, the leaves small, from 2–3 cm. long by 1–2 cm. wide. Two days after, May 27th, I was at Maywood and was surprised to see *Celtis occidentalis* so much more advanced. It did not seem to be due to the mere difference of temperature between the lake shore and the river valley, and offered quite a strong plea for their specific distinction. The fruit on the Maywood trees was well advanced, as large as small peas, or about 5 mm. in diameter, the leaves quite large, 5–8 cm. long by 2–5 cm. wide. On May 18, 1899, *C. occidentalis* at Wolf Lake was essentially in this stage of development and may be compared with those of *C. pumila* at Miller two days before. The leaves of *C. pumila* were then 1–3.5 cm. long and 0.5–2 cm. wide. The largest on *C. occidentalis* at Wolf Lake were 9 by 5 cm. These stations, that by the Grand Calumet and Wolf Lake near Whiting, are best for direct comparison. Both are in the sand region of Lake Michigan, both subject to the same atmospheric factors of the lake air. The trees at Wolf Lake grow in sand and gravel washed up by waves or heaped by the winds, on rather low land raised 5 to 10 feet above the level of the lakelets or bordering marsh, but near enough to water to be moist for trees, being accompanied by elms, basswood, the white and blue ash. The shrubs by the Grand Calumet or on the lake dunes grow in loose dry sand, though their deeper roots get a fair degree of moisture, the surface being from 10 to 50 feet above the river or the level of Lake Michigan. The trees by the Desplaines are in the drift formation, the subsoil a stiff unctuous clay, the surface a clay loam very sticky when wet. The data give a difference of ten to fifteen days between the two species in the sand region and of four to six days in the same species in the two stations, Wolf Lake and Maywood, in 1899. It is of interest to note in this connection that one of my time-keepers for the anthesis of *C. pumila* is an orchid, *Cypripedium* *acaule*, growing in depressions of the sand hills in the vicinity of the shrub. Both can be obtained in bloom on the same occasion and have always proved true to time.

The vicissitudes of plant nomenclature are well illustrated by the changes of name to which *Celtis pumila* has been subjected. The first mention of it is by Muhlenberg (Catalogue, 95. 1813) where *C. occidentalis β pumila* is given. The description is brief, but items set down in connection with it apply—"dwarf, fruit a one celled globose drupe, fl. May; habitat Penns." Pursh (Fl. Am. Sep. **1**: 200. 1814) seems to have taken up the name of Muhlenberg, giving it specific rank but not mentioning that of Muhlenberg as a synonym. The description, though short, applies essentially to this form. "C. foliis ovatis acuminatis aequaliter serratis basi inaequalibus utrinque glabriusculis, junioribus tantum pubescentibus pedunculis subtrifloris, fructu solitario. On the banks of rivers, Maryland and Virginia, May, *v. v.* A small straggling bush; berries ovate, black." The "*v. v.*" indicates that Pursh had seen the plant in a living state. The early botanists mainly copied the description of Pursh as one sees in Beck (Bot. North. and Mid. States, 334. 1833) and in Eaton and Wright (N. Am. Bot. 186. 1840). The berries are described as brown and glaucous in both books. Beck gives Muhlenberg's var. *pumila* as a synonym. Nuttall (Gen. **1**: 202. 1818) gives as a third species, *C. occidentalis* and *C. crassifolia* having been mentioned, "*C. tenuifolia. C. pumila*, Pursh 1, p. 200? A low bush in the mountains of Virginia, flowering at the height of 2 feet. Leaves nearly as broad as long, now and then without serratures, often cordate-ovate, very little acuminated and almost perfectly smooth on both sides. Berries solitary, brown and glaucous." Torrey (Fl. N. U. S. 300. 1824) adds this account of Nuttall to the description by Pursh, not questioning its distinctness, though like Nuttall, he does that of *C. crassifolia* Lam. He adds the *C. occidentalis β pumila* of Muhlenberg's "Catalogue" as a synonym of *C. pumila* Pursh but with the mark of doubt. The treatment of *Celtis* by Rafinesque in his monograph of the genus (New Fl. N. A. **3**: 31. 1836) is characteristic. Fifteen species are made, six of them shrubby. The name *pumila* is appropriated as his own, being made the equivalent of "*C. occid.* var. *pumila* Mg. and some others but not Pursh and his copists." He adds: "This is marked in Collins' Herb. as the real *pumila* var. of Muhlenberg, but it appears that all of our 6 shrubby sp. must have been blended under this name; I shall now distinguish them properly although the synonyms are difficult to fix, owing to all copying Pursh rather than describe what they saw." It would appear from this that he had seen some of the forms at least. His *C. pumila* is a small low shrub only two feet high or long, being procumbent; the leaves were short, "hardly an inch long, hardly acuminate, rather acute, very thin and green with very large teeth." He concludes: "The large teeth and truncate base [of leaves] will distinguish this from all others besides the procumbent stem."

Another species is "*Celtis tenuifolia* Raf. (or parvifolia), C. pumila Pursh, T. B. & C. C. occid. var tenuif. Lam. Pers. Nuttall? etc.—shrubby erect branches divaricate, branchlets angular smooth leaves uniform ovate acuminate, serrulate in the middle, base acute obliqual unequal entire trinervate, both sides smooth, pedicels axillary uniflore longer than petioles, fruits round oboval brown—shrub 3 to 5 feet high, erect with spreading branches, found by myself in the hills of Maryland, blossoming in May, said to grow also in the Mts. of Virginia and in Louisiana, easily known by the few small teeth, leaves 1 or 2 inches long, rather thin." On the whole this description best accords with those I find in northern Indiana. Under *C. heterophylla* Raf., sent him from Alabama, he finds "a very singular species offering all kinds of leaves on the same small branches (1 or 2 inches long) yet unlike any of the other shrubby kinds." This variability of the leaves is often shown by the Indiana shrubs. As Darlington lived in the region where *Celtis pumila* was first observed, Chester County, bordering Lancaster County, the home of Muhlenberg, on the east, it is well to notice how he treats the form in his Flora Cestrica (180. 1837). He observes that *C. occidentalis*, as known to him in Chester County at least, is rather a large shrub than a tree, being eight to fifteen feet high. "It very much resembles, moreover, some small specimens which I collected on the *Potomac* above Georgetown,—which Mr. *Schweinitz* pronounced to be *C. pumila*; and hence have led me to suppose that Muhlenberg was correct in making *C. pumila* a variety of *C. occidentalis*."

As Schweinitz was a Pennsylvanian (born 1780) and became a correspondent of the elder Muhlenberg toward the close of his life, somewhere after 1813, when Muhlenberg first heard of him,* it seems that he would have known Muhlenberg's variety *pumila* at first hand and that it was the *pumila* of Pursh. Since one seen by Rafinesque was in the herbarium of Collins, who was a resident of Philadelphia, and a familiar friend of Muhlenberg, it is also evident that Collins knew the *C. occidentalis* var. *pumila* of Muhlenberg directly. This goes far to prove the identity of the two forms as well as the reasonable priority of Muhlenberg's name in this case, unless we entirely rule out the "Catalogue" as an authority for nomenclature. In my opinion the name should be written *Celtis pumila* (Muhl.) Pursh.

Plate 33 shows flowering and fruiting branches and winter buds, natural size, the perfect and sterile flowers and nutlet enlarged 5 diameters.

CHICAGO, Aug. 1, 1900.

---

*In a letter dated Lancaster, Dec. 13, 1813, Dr. Muhlenberg writes: "It is only today that I hear of an excellent *Mycologist* in North Carolina, who is a teacher among the Moravians at Salem, and has written upon the *Fungi* in Germany. His address is Rev. L. David de Schweinitz at Salem, North Carolina." (Darlington's Reliquiae Baldwinianae, 119, 1843.) They subsequently corresponded.

New Plants from Colorado

By George E. Osterhout

Allium rubrum

Bulbs single or few in a cluster 2.5–3 cm. × 1–1.5 cm., fibrous-coated: scape 2–3 dm. high, round, smooth, and glaucous, exceeding the leaves: leaves about four, 7 mm. wide or narrower, concave: the spathe spherical, not acuminate, breaking into three valves as the bulblets enlarge, followed by three or four flowers, the bulblets subspherical, red, seldom leaf-bearing: ovary not crested: the perianth segments 6–7 mm. × 4 mm., narrowly ovate, obtuse, the outer marked by a dark median line, the pedicels 1 cm. long, the filaments equaling the perianth and equaled by the style.

I have sent out a few specimens of this as *Allium Canadense*, to which I think it has not a close resemblance. Collected in North Park along the line between Colorado and Wyoming, July 9, 1896 (no. 1321).

Allium arenicola

Bulbs single or few in a cluster, 1.5 × 1 cm., the outer coats, fibrous: scape 1–1.5 dm. high, round, smooth and tapering upwards, shorter than the leaves: the leaves slender, 5 mm. wide or narrower, concave: the spathe oblong, acuminate, the acumination often recurved: umbel of several whitish ovate bulblets and flowers, the bulblets usually breaking through the base of the spathe, which is divided into two valves by the opening flowers: pedicels rather stout, 7–9 mm. long: perianth segments ovate-acuminate, 9 mm. × 5 mm., the tip recurved: filaments equaling the perianth and equaled by the style: ovary not crested.

Collected in sandy soil on the bank of Chama River at Chama, New Mexico, June 9, 1899 (no. 2008).

Artemisia Coloradensis

An herbaceous perennial from creeping rootstocks, the larger plants 3 dm. high, strict, usually not branching above the base, white with a close tomentum, the leaves becoming darker on the upper surface: lower leaves pinnate with usually five slender divisions of the upper half, 2–2.5 cm. long and the divisions 1 cm. long, the edges revolute; upper leaves less divided and the bracts entire: the upper half or two thirds of the stem flower-bearing in a rather strict panicle of numerous small heads of about 6 imperfect and 8 perfect disk-flowers, 3.5 mm. × 2.5 mm., the involucral bracts in about three series, tomentose.

Collected near Dale Creek, Larimer Co., Colorado, September 7, 1899 (no. 2010), and in Estes Park, Larimer Co., Colorado, August, 1895 (no. 1322).

Artemisia spiciformis

A shrubby perennial, the fastigiate branches about .5 m. high, the leaves and newer growth canescently pubescent, the older growth retaining some pubescence: leaves oblanceolate, the longer ones 3.5 cm. long, tapering to a slender petiole, irregularly toothed or notched at the apex, some tridentate, occasionally a pair of teeth below the three terminal ones, some trifid with the divisions toothed: heads comparatively few in a spike-like raceme, obconical, rather large, 6 mm. long, single and sessile in the axils of the bracts or terminating the branches, about 12-flowered, the flowers all perfect and fertile; the accessory bracts of the involucre ovate, pubescent, the inner oblong, scarious, showing a green medial line.

The heads resemble those of *Artemisia cana*, while the leaves are like those of *A. tridentata*. Collected in North Park, Larimer Co., Colorado, September 3, 1899 (no. 2011).

ARTEMISIA CANA viscidula

Shrubby, fastigiately branched, 6–8 dm. high, green and somewhat glutinous, the light tomentum of the stem and leaves obscured by the glutinous coating: leaves 3–4 cm. long, 2 mm. wide, tapering to both ends: heads numerous in a leafy panicle 4 mm. long, five- to eight-flowered, all perfect and fertile, the outer bracts having the glutinous character of the leaves, usually subtended by one or two linear accessory bracts: immature achenes granular, glutinous.

Probably a good species, but having so much resemblance to *A. cana* that I have thought best for the present to make it a variety of that. Collected at Steamboat Springs, Routt Co., Colorado, September 1, 1899 (no. 2012).

Agoseris montana

Perennial from a several-stemmed rootstock: the scapes leafless, flowering when about 1 dm. high and elongating to 2.5 or 3 dm., woolly-pubescent beneath the involucre and at the base: leaves oblanceolate, 1–2 dm. long including the narrow winged petiole, glabrous at the time of flowering or nearly so, entire or some of the larger with few teeth : flowers yellow, the ligules little exceeding the bracts, the fruiting heads about 3 cm. high ; involucral bracts woolly-pubescent, especially so on the edges, in three series, the outermost ones lanceolate-acuminate, the second series ovate, acuminate, exceeding the outermost, and equaling the narrow inmost series : achenes 10-striate, a little less than 1 cm. long, tapering into a slender filiform beak of the same length, which is crowned by the bright white pappus of about the same length.

A species somewhat related to *Agoseris grandiflora* and its allies of the Pacific Slope. Collected on the western slope of the mountains west of North Park, Colorado, at an altitude of about 3000 m., September 2, 1899 (2009).

NEW WINDSOR, COLORADO.

A new Variety of Azalea nudiflora L.

BY THOS. C. PORTER

Azalea nudiflora glandifera var. nov.

In studying the *Azaleas* of eastern Pennsylvania, this plant has been under my observation for a number of years and I am now convinced that it deserves varietal distinction.

Instead of having its peduncles and corolla-tubes clothed with a dense coat of long-acuminate glandless hairs of unequal length, they are sparsely supplied with a single set of gland-tipped hairs of nearly equal length. Both frequently grow together, but no case has been found of the intermixture of the two kinds of hairs on the the same shrub. They are exactly alike in their habit of growth and their foliage, although the corollas of the variety are often larger and sometimes of a deep rose-color.

Specimens have been collected at Pocono Summit and Mount Pocono in Monroe County ; at three stations near Easton ; at two in Lancaster County, and at two in Delaware County, Pa.

Index to recent Literature relating to American Botany

Allen, T. F. Three New Charas from California. Bull. Torr. Club, **27**: 299–304. *pl. 10–15.* Je. 1900.

Bates, J. M. The Flora of a Neglected Dooryard. Asa Gray Bull. **8**: 58–63. Je. 1900.

Best, G. N. Revision of the North American Species of *Pseudoleskea.* Bull. Torr. Club, **27**: 221–236. *pl. 7, 8.* My. 1900.

Bicknell, E. P. Studies in *Sisyrinchium.*—VII: The Species of British America. Bull. Torr. Club, **27**: 236–246. My. 1900.

Bicknell, E. P. Studies in *Sisyrinchium.*—VIII: *Sisyrinchium Californicum* and related Species of the neglected Genus *Hydastylus.* Bull. Torr. Club, **27**: 373–387. Jl. 1900.

Blodgett, F. H. *Darluca* upon Carnation Rust.—A Preliminary Note. Bull. Torr. Club, **27**: 289–290. *f. 1.* My. 1900.

Blodgett, F. H. Vegetative Reproduction and Multiplication in *Erythronium.* Bull. Torr. Club, **27**: 305–314. *pl. 16–18.* Je. 1900.

Bogue, E. E. The Fruit of the Oleander. Meehan's Monthly, **10**: 68. My. 1900.

Brandegee, K. Notes on Cacteae.—II. Zoe, **5**: 1–9. Je. 1900.

Brandegree, T. S. Cleistogamous Flowers in Scrophulariaceae. Zoe, **5**: 13. Je. 1900.

Bruncken, E. Botanical Notes from the Green Bay Peninsula. Bull. Wis. Nat. Hist. Soc. **1**: 85–99. Ap. 1900.

Campbell, R. North American Golden Rods. Can. Rec. Sci. **8**: 192–195. Ja. 1900.

Campbell, R. The Flora of the Rocky Mountains. Can. Rec. Sci. **8**: 163–192. Ja. 1900.

Clinton, G. P. The Smuts of Illinois Agricultural Plants. Bull. Univ. Ill. Agric. Exper. Sta. 57: 289–349. *pl. 1–21.* Mr. 1900.

Eastwood, A. Notes on *Cupressus Macnabiana.* Zoe, **5**: 11–13. Je. 1900.

Fletcher, J. Manitoba's Wild Flowers. Ottawa Naturalist, **14**: 19–20. My. 1900.

Groenicher, S. The Fertilization and Insect Visitors of our earliest Entomophilous Flowers. Bull. Wis. Nat. Hist. Soc. **1**: 73–84. Ap. 1900.

Harper, R. M. Notes on the Flora of Middle Georgia. Bull. Torr. Club, **27**: 320–341. *pl. 22.* Je. 1900.

Hasselbring, H. A New Species of *Globulina.* Bull. Torr. Club, **27**: 402–404. Jl. 1900. [Illustr.]

Henderson, L. F. New Plants from Idaho and from other Localities of the Northwest. Bull. Torr. Club, **27**: 342–359. Je. 1900.

Hicks, G. H. The Germination of Seeds as Affected by Certain Chemical Fertilizers. Bull. U. S. Dept. Agric. (Div. Botany) 24: 5–15. *pl. 1, 2.* 1900.

Hitchcock, A. S. Studies in Subterranean Organs. II. Some Dicotyledonous Herbaceous Plants of Manhattan, Kansas. Trans. Acad. Sci. St. Louis, **10**: 131–142. 3 Ap. 1900.

Hoff, R. L. Notes on Wyoming Plants. Asa Gray Bull. **8**: 63–64. Je. 1900.

Hopkins, C. G. Composition and Digestibility of Corn-Fodder and Corn-Straw. Bull. Univ. Ill. Agric. Exper. Sta. 58: 361–370. Ap. 1900.

Johnson, D. S. On the Development of *Saururus cernuus* L. Bull. Torr. Club, **27**: 365–372. *pl. 23.* Jl. 1900.

Kellerman, W. A. First Annual Supplement to the Fourth State Catalogue of Ohio Plants. Bull. Ohio State Univ. IV. 28: 1–10. Ap. 1900.

Kellerman, W. A. & Mrs. W. A. The Non-Indigenous Flora of Ohio. Bull. Ohio State Univ. IV. 27: 3–26. Ap. 1900.

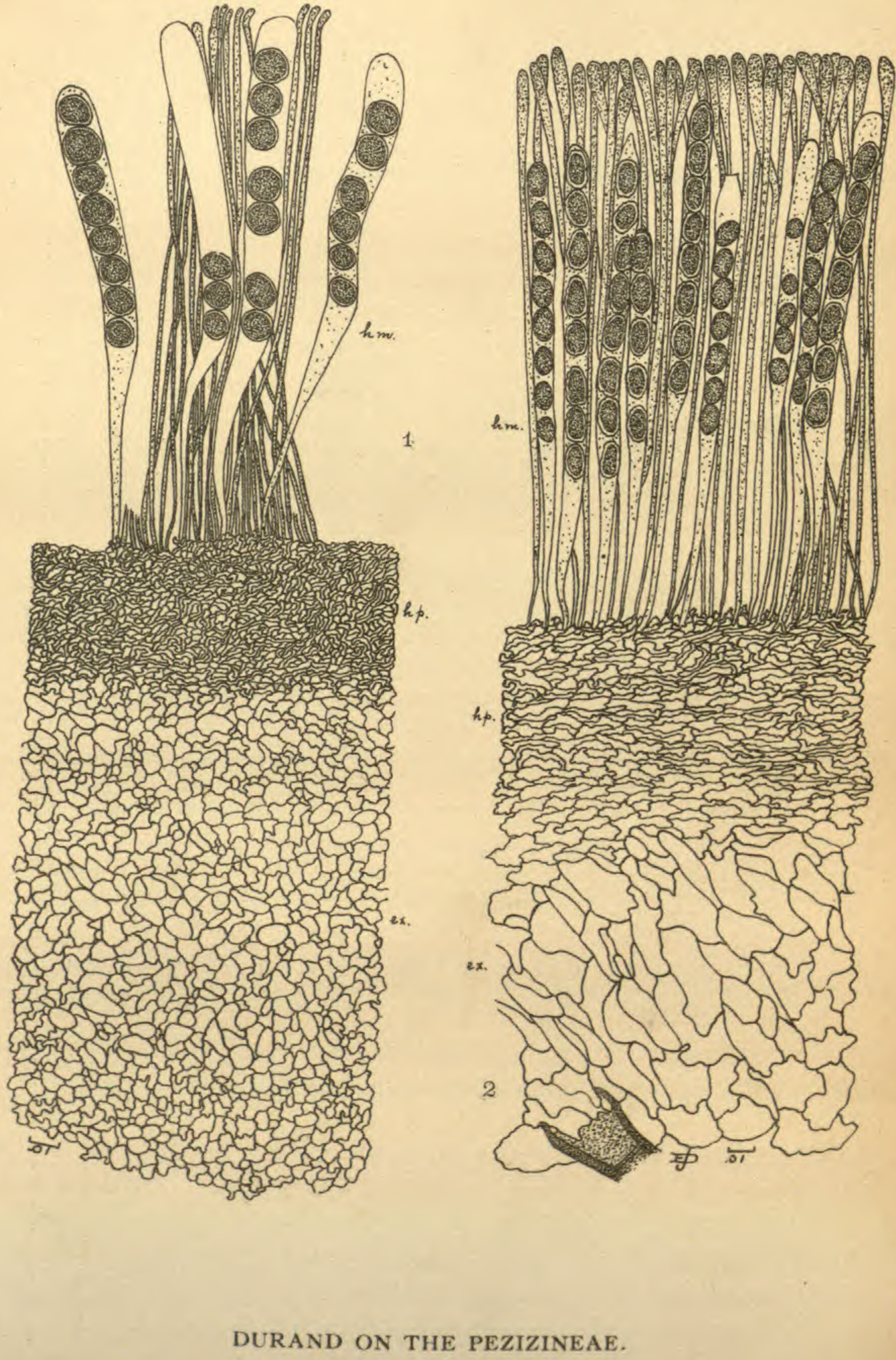
Kennedy, P. B. Coöperative Experiments with Grasses and Forage Plants. Bull. U. S. Dept. Agric. (Div. Agrostology), 22: 1–86. *pl. 1–13.* 1900.

Meehan, T. *Polypteris Hookeriana.* Meehan's Monthly, **10**: 65, 66. *pl. 5.* My. 1900.

Nelson, A. New Plants from Wyoming.—XII. Bull. Torr. Club, **27**: 258–274. My. 1900.

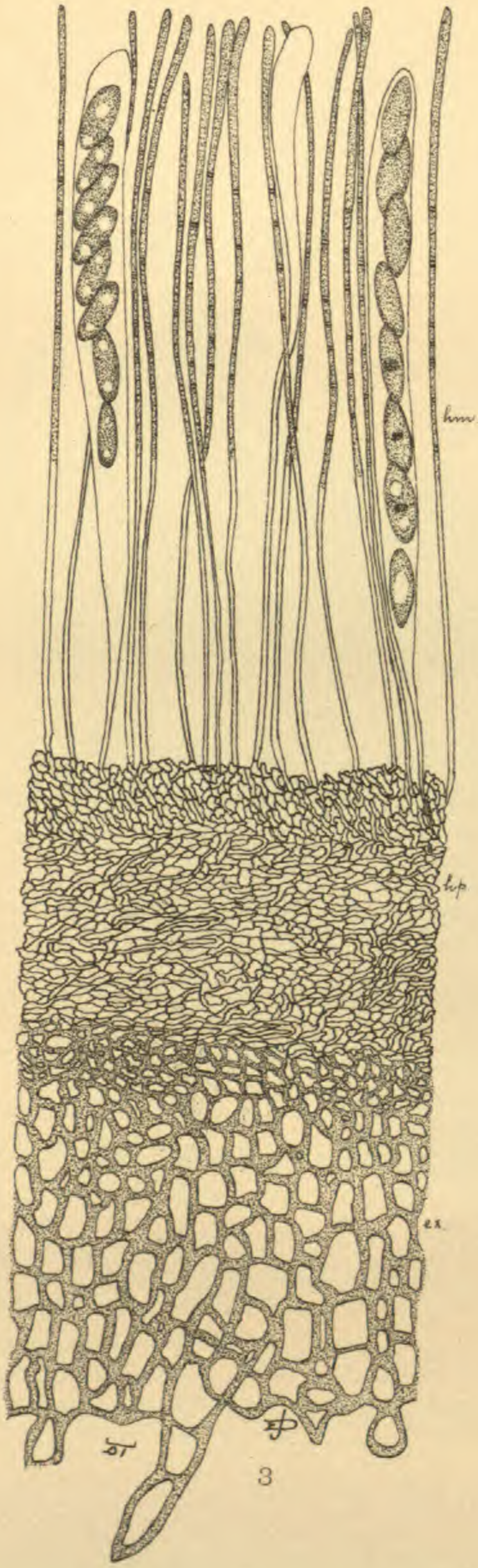
Parish, S. B. Southern California Forms of *Phacelia circinata* Jacq. Zoe, **5**: 9–11. Je. 1900.

Patterson, F. W. New Species of Fungi. Bull. Torr. Club, **27**: 282–286. My. 1900.

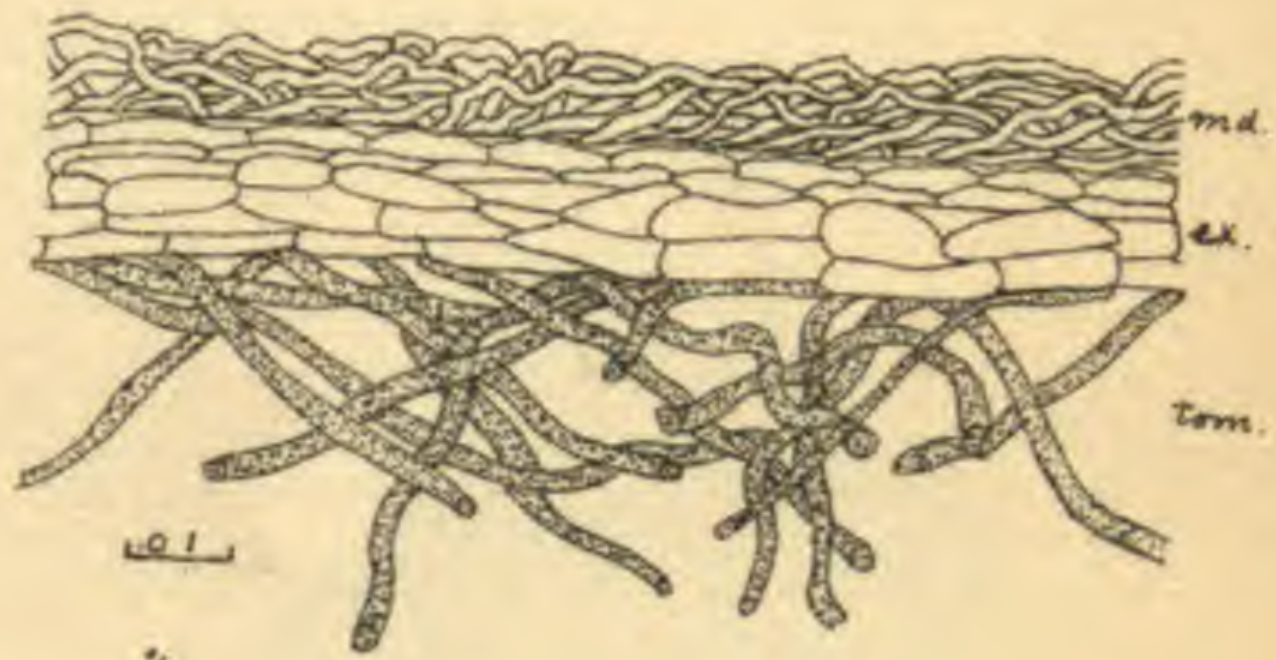


DURAND ON THE PEZIZINEAE.

THE HELIOTYPE PRINTING CO., BOSTON.



3

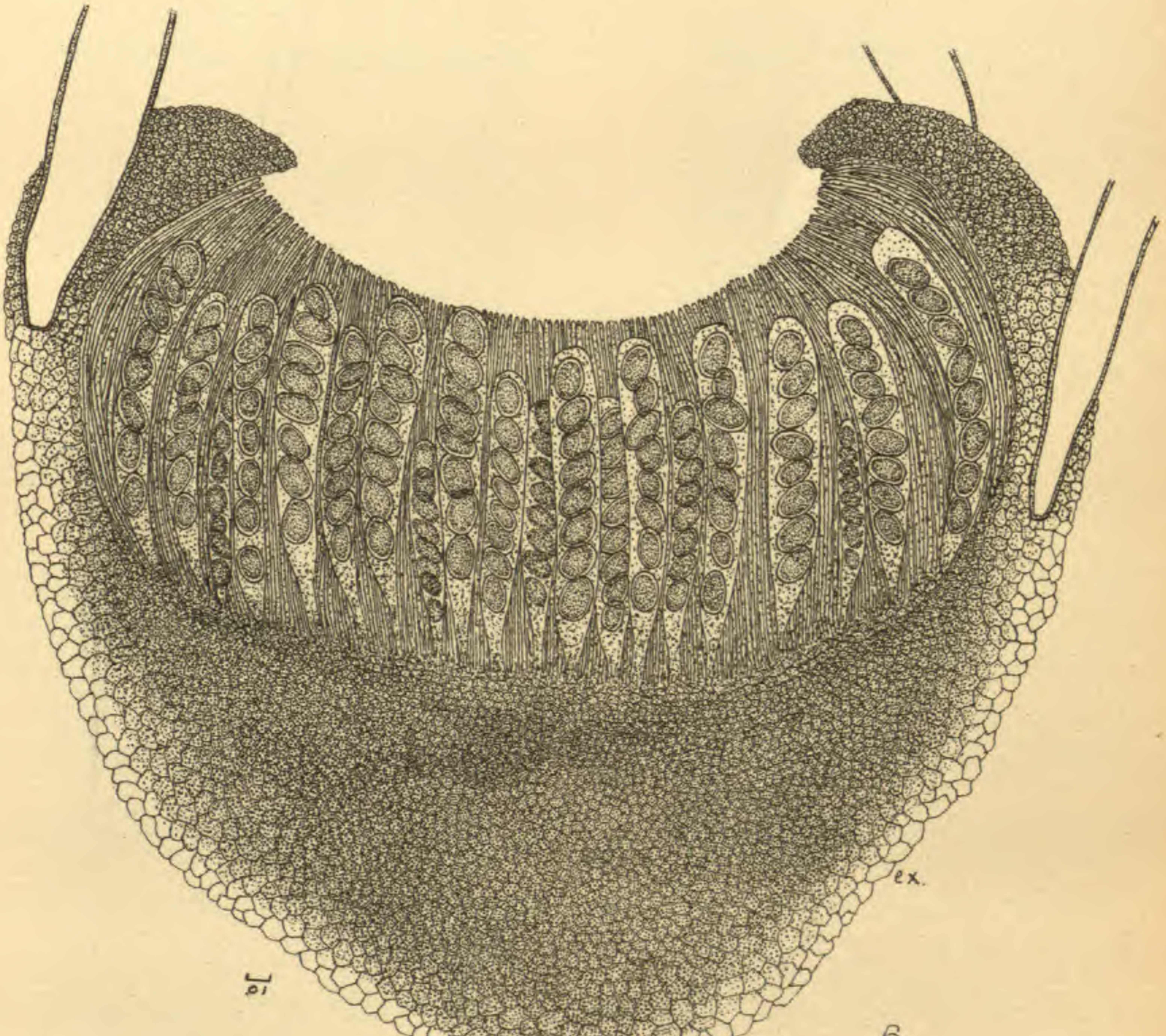


4

5

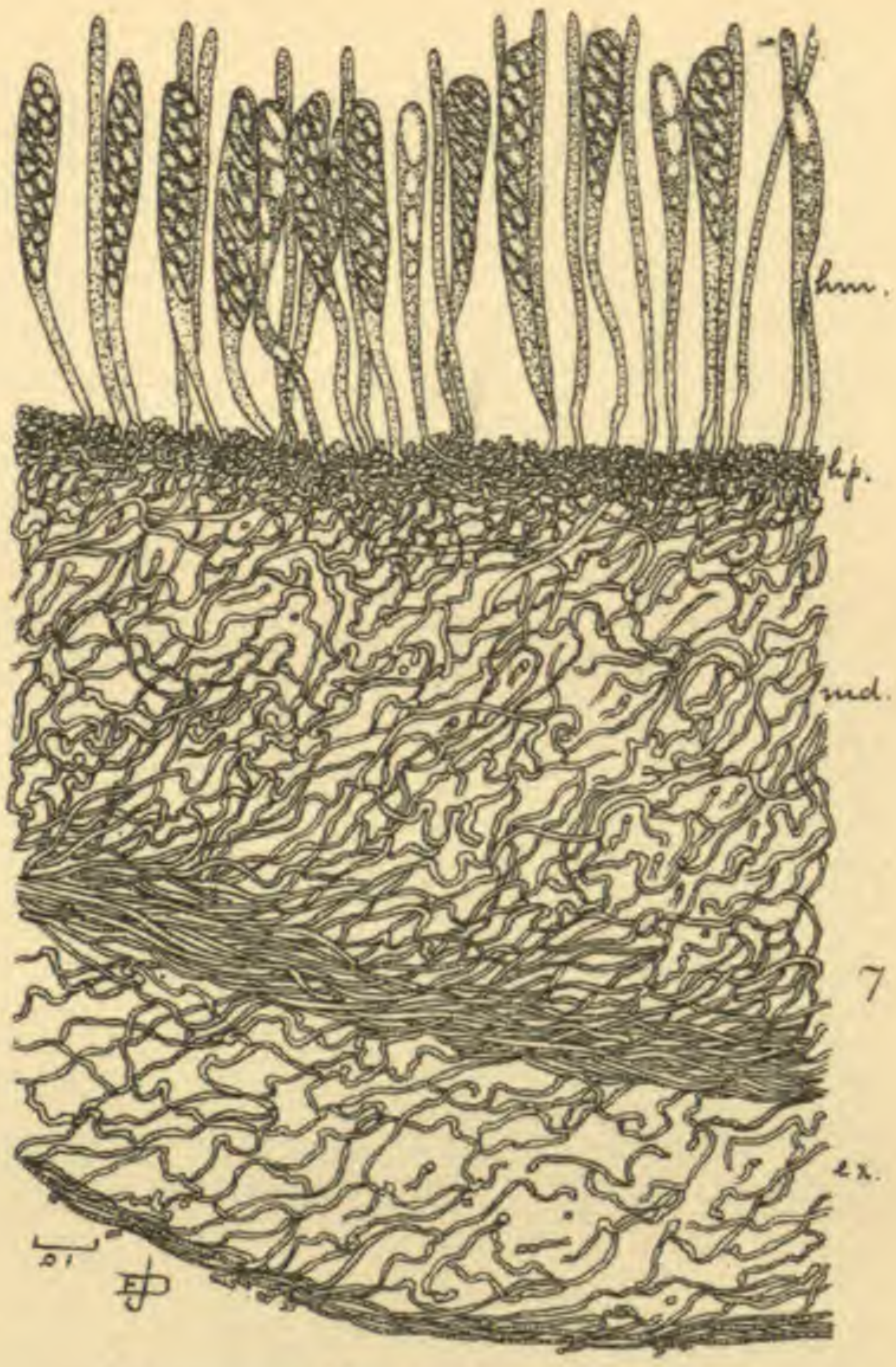
DURAND ON THE PEZIZINEAE.

THE HELIOTYPE PRINTING CO., BOSTON.

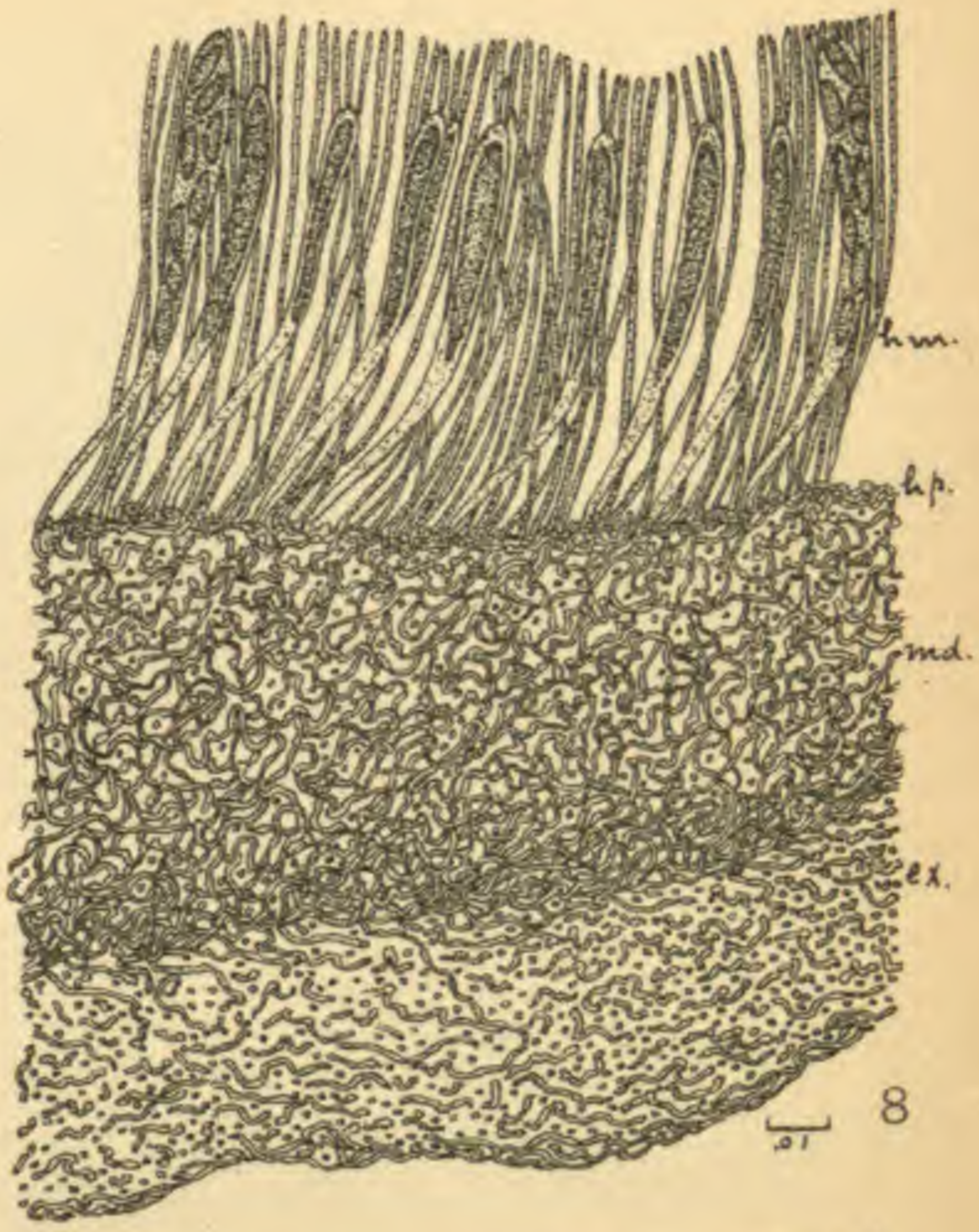


DURAND ON THE PEZIZINEAE.

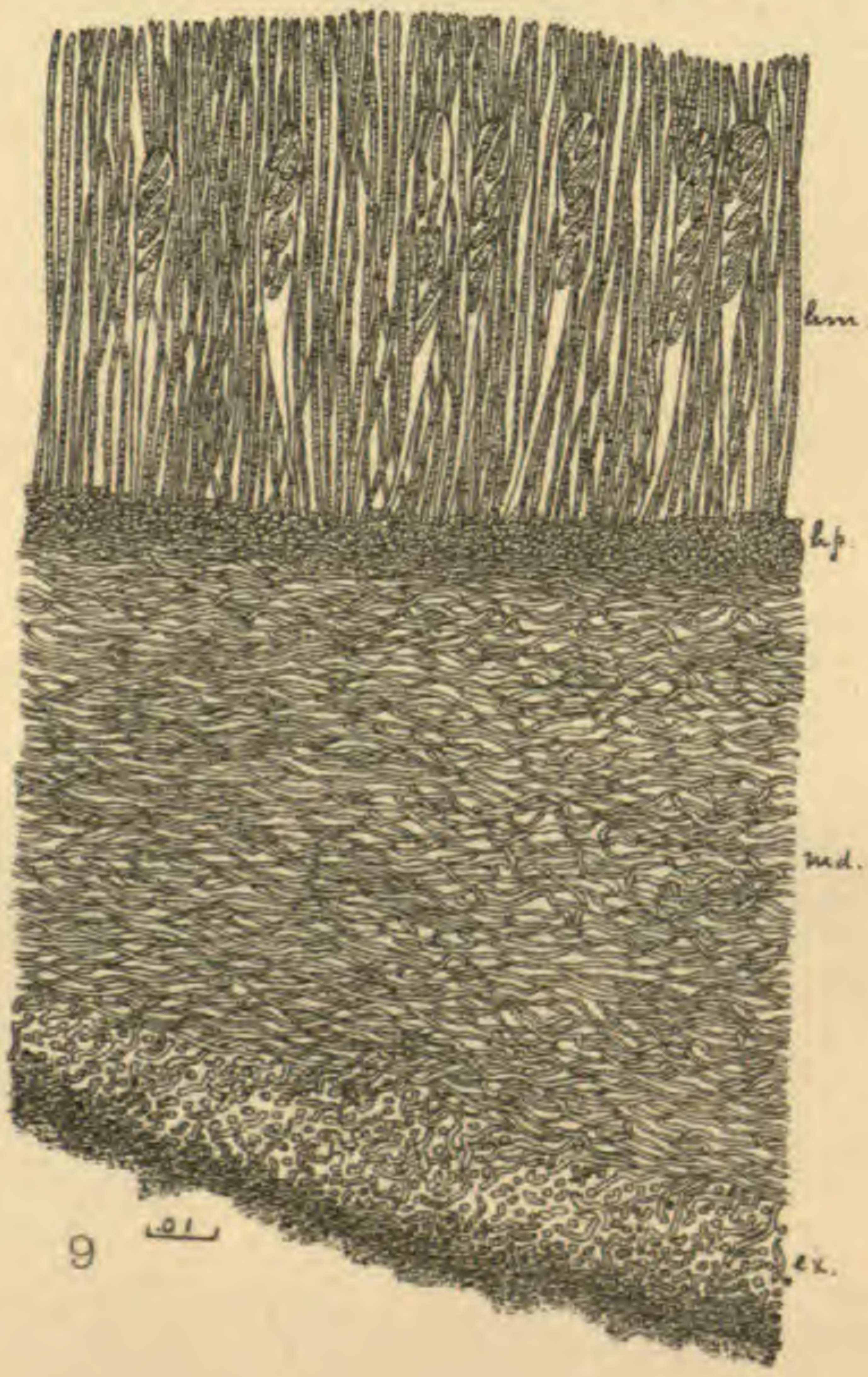
THE HELIOTYPE PRINTING CO., BOSTON.



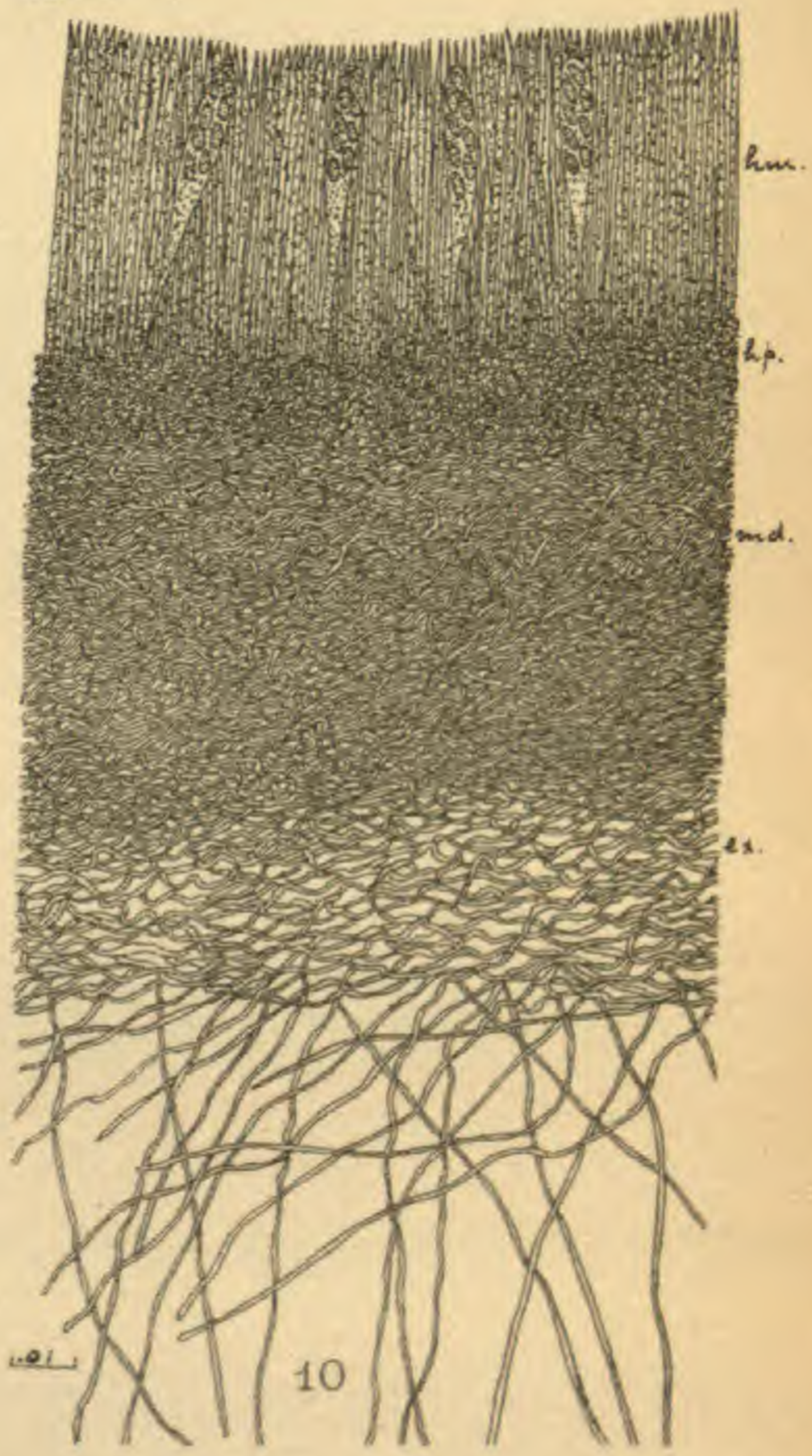
7



8



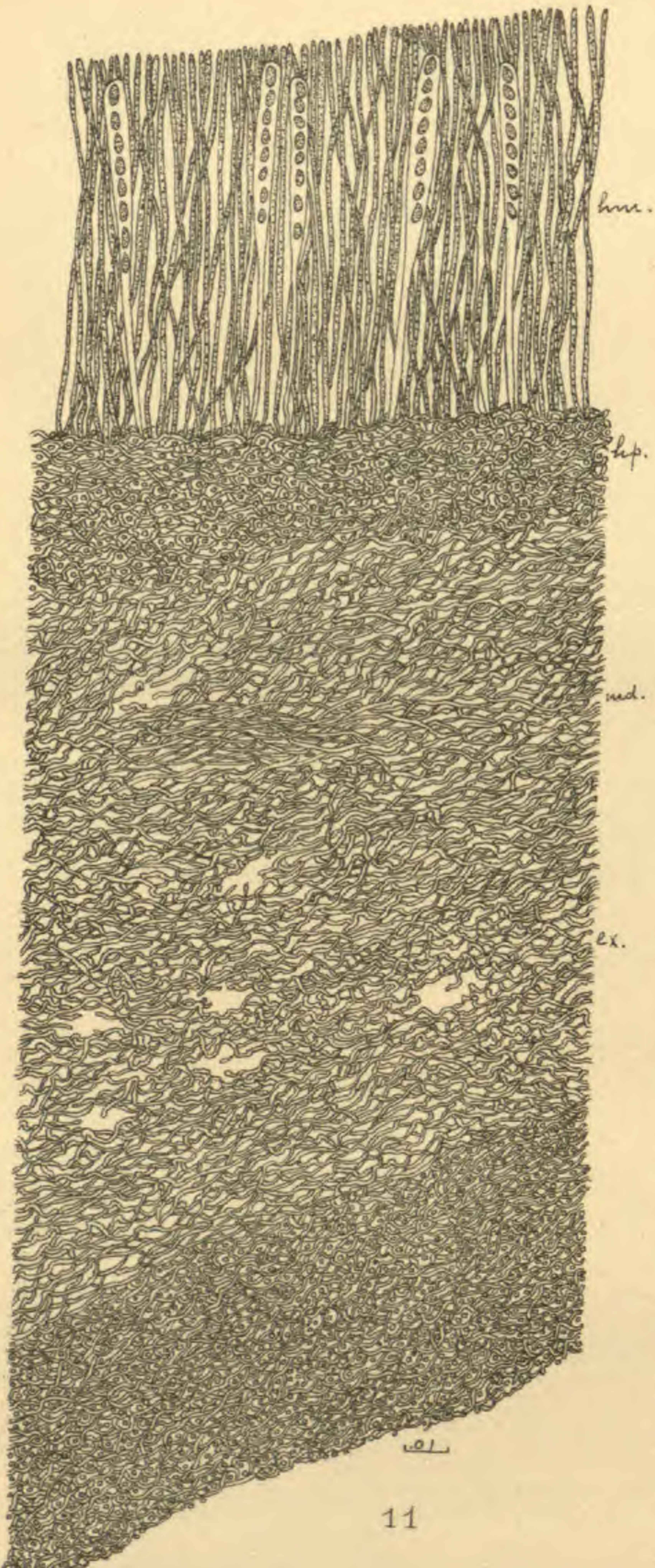
9



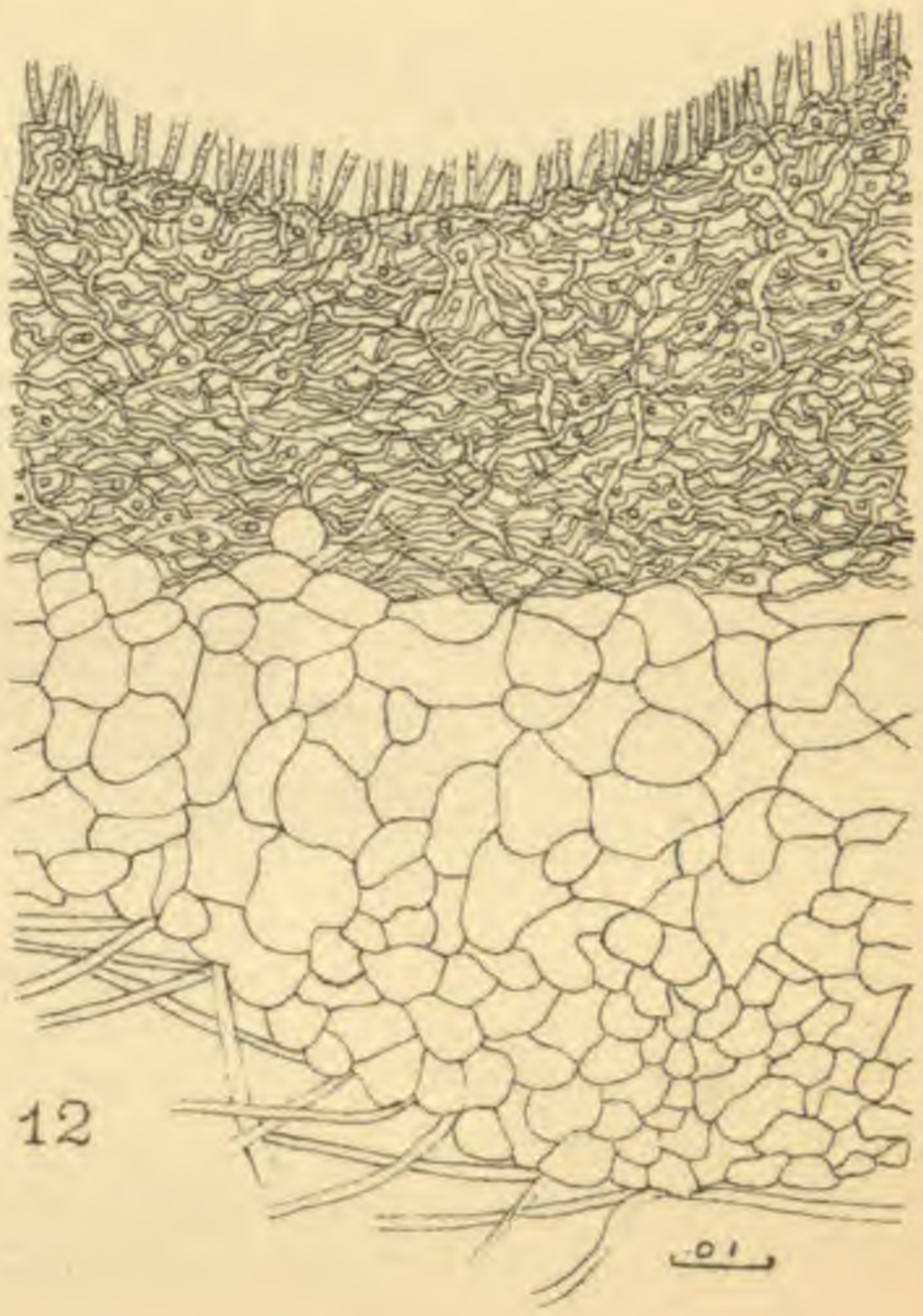
10

DURAND ON THE PEZIZINEAE.

THE HELIOTYPE PRINTING CO., BOSTON.

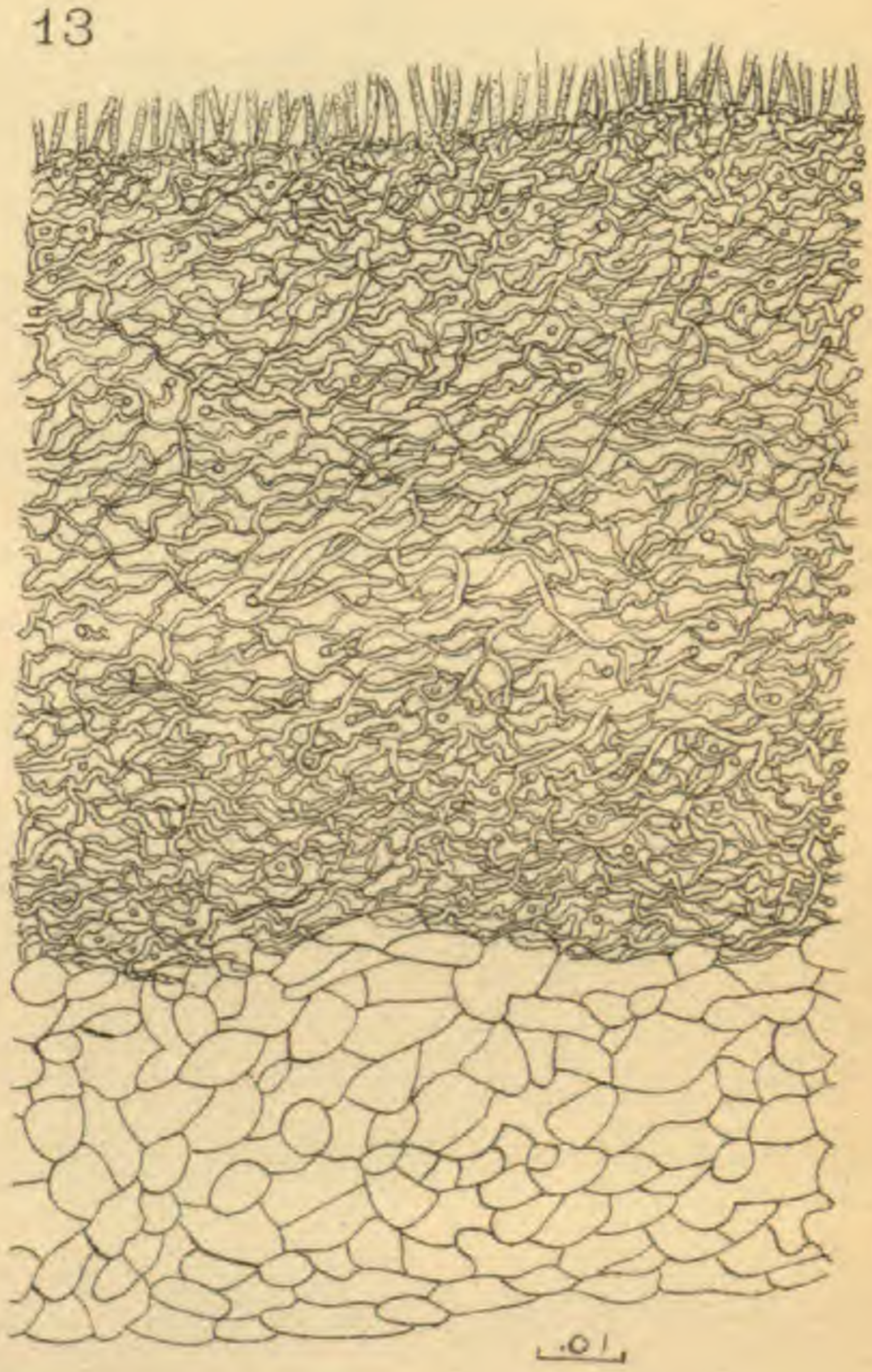


11



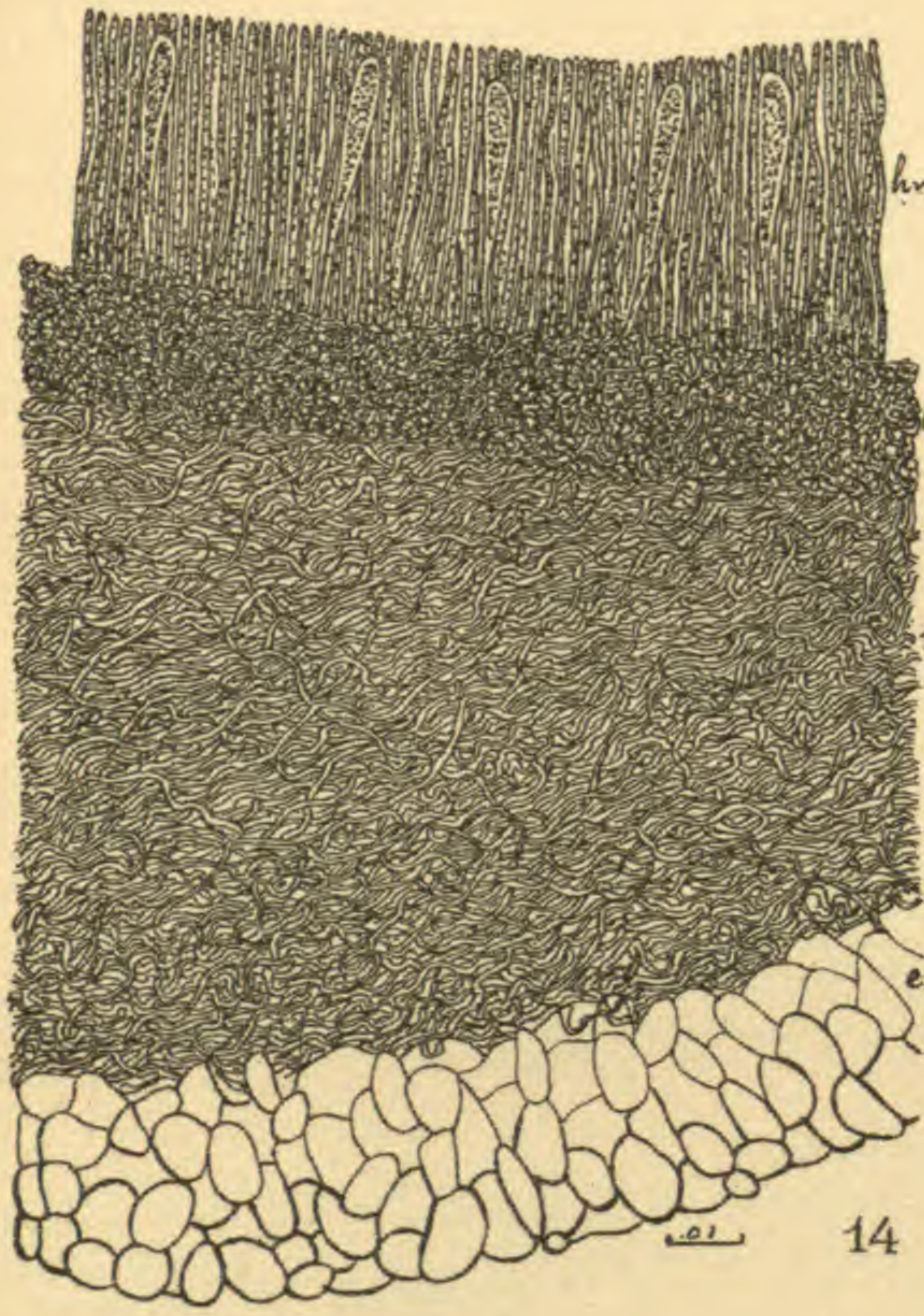
12

13

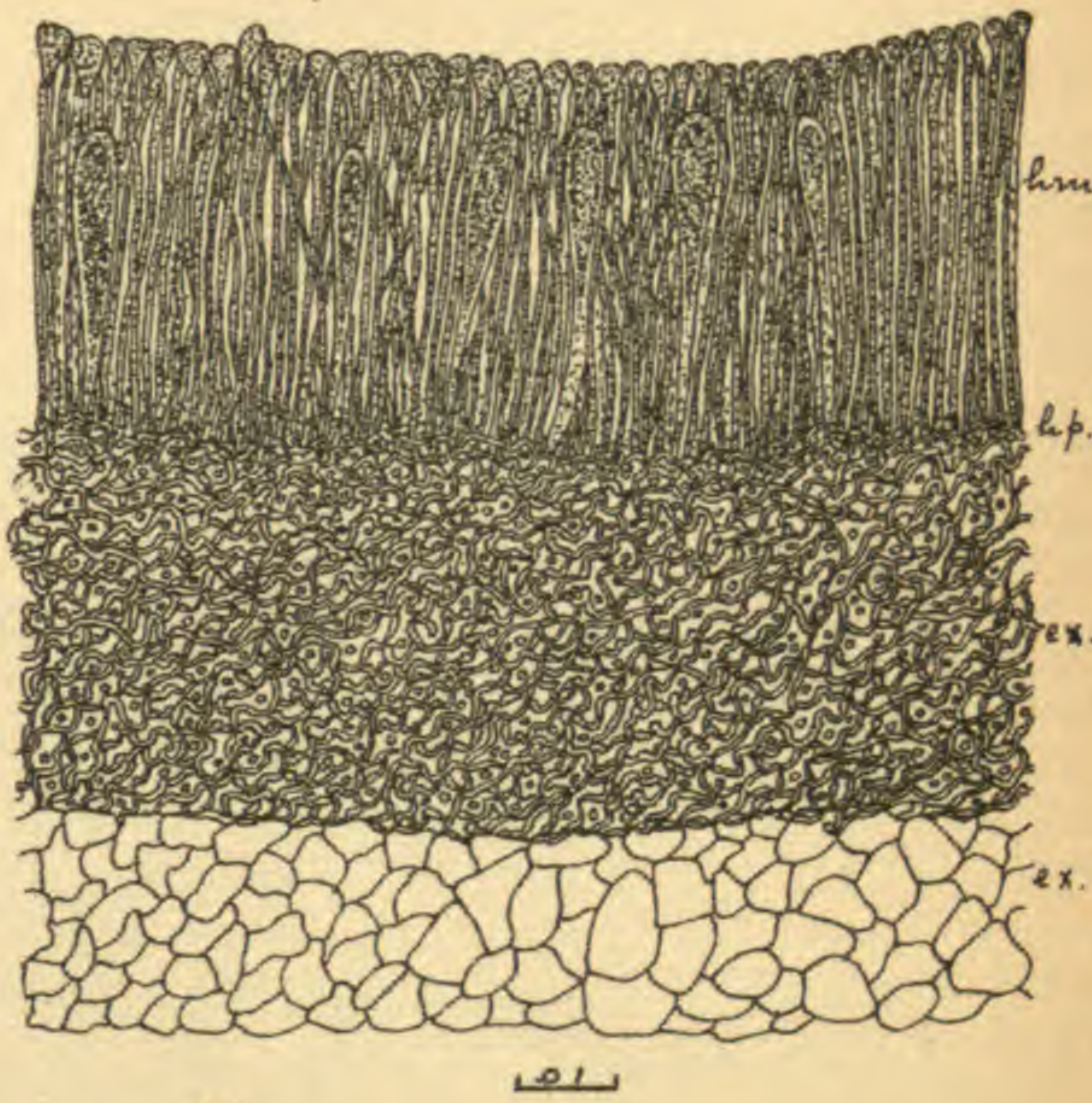


DURAND ON THE PEZIZINEAE.

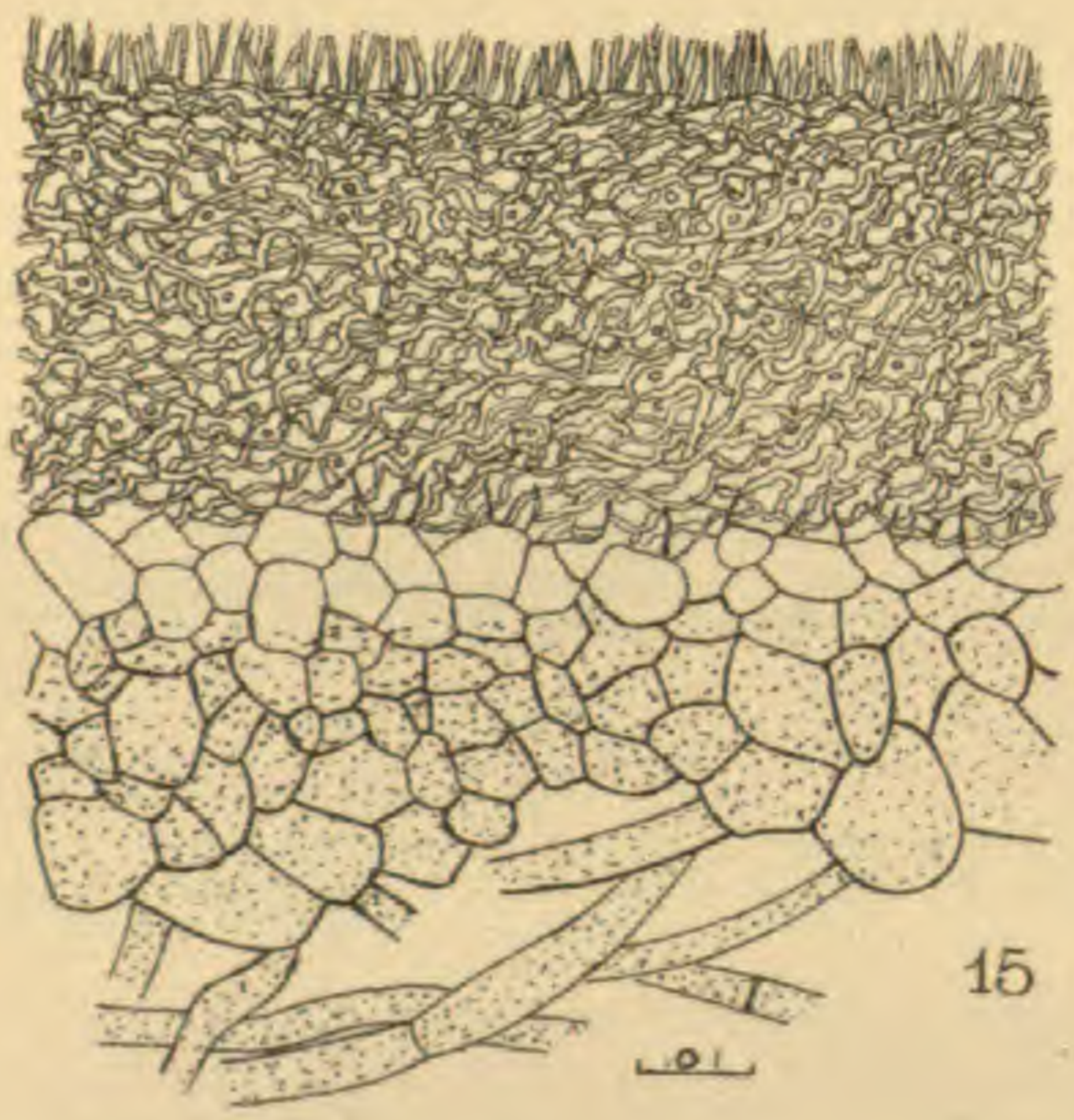
THE HELIOTYPE PRINTING CO., BOSTON.



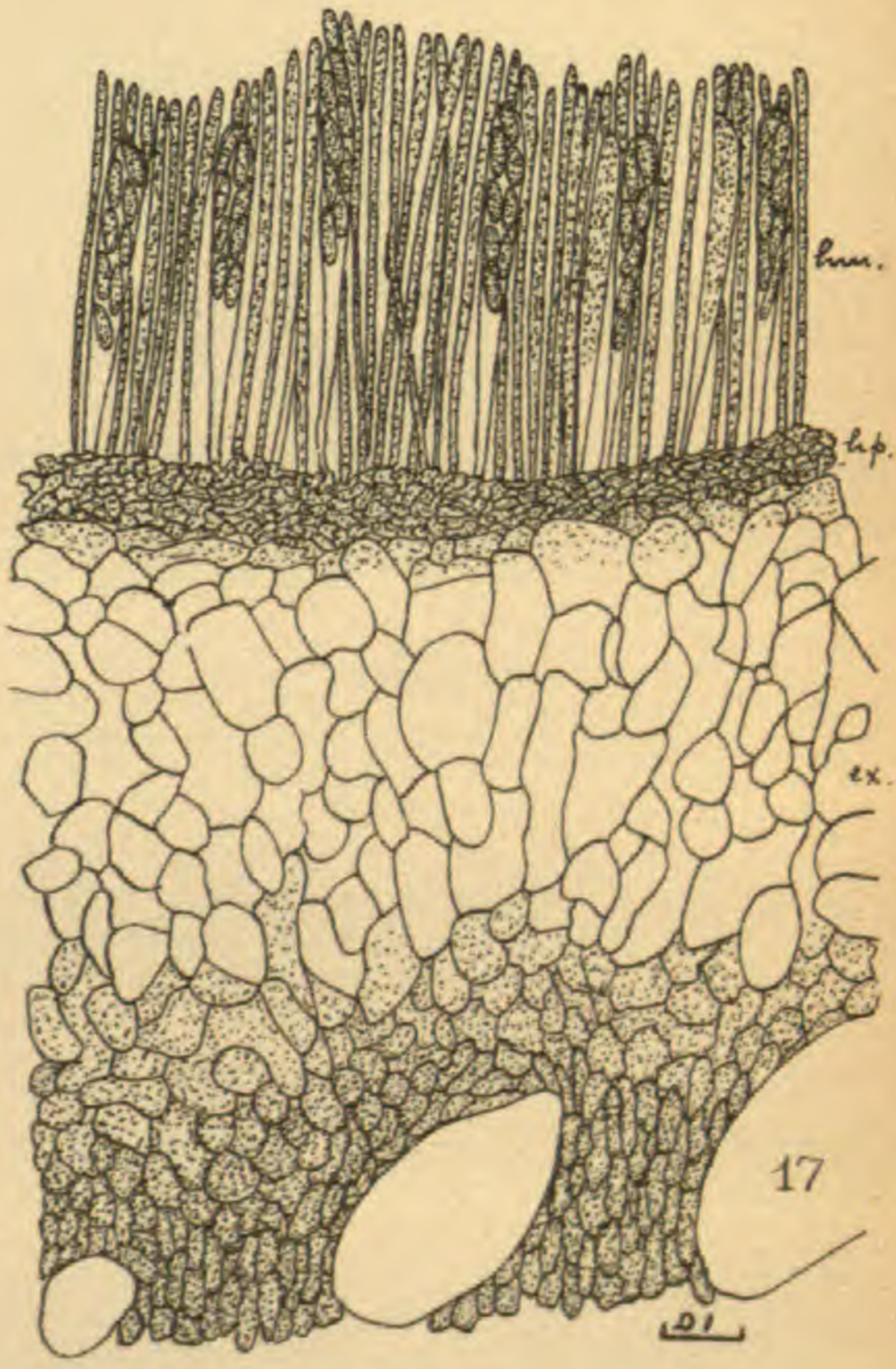
14



16



15



17

DURAND ON THE PEZIZINEAE.

THE HELIOTYPE PRINTING CO., BOSTON.

HILL ON CELTIS.

THE HELIOTYPE PRINTING CO., BOSTON.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. Memoirs of the Department:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. Contributions from the Department:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS OF THE TORREY BOTANICAL CLUB.

(1) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates. Price $2.00 per annum. For Europe 10 shillings. Dulau & Co , 37 Soho Square, London, are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898), are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(2) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume 1, No. 1—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume 2, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. 3. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. 4. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents.

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No. 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. 5. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S Price, $3.00.

Vol. 6. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*) With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. 7.—The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol. 8. No. 1, Part 1.—The Comparative Embryology of the Rubiaceae. With our plates. By Francis Ernest Lloyd. Price, 50 cents.

---

(3) The Preliminary Catalogue of Anthophyta and Pteridophyta reported as growing within one hundred miles of New York, 1888. Price, $1.00.

Address: **L. M. UNDERWOOD,**

COLUMBIA UNIVERSITY, NEW YORK CITY.

VOL. 27 OCTOBER, 1900. NO. 10

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL, BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D., CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D., PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D., MARIE L. SANIAL,
HELEN M. INGERSOLL, ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH, EUGENE SMITH,
MARIE L. SANIAL, W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 10

BULLETIN

OF THE

TORREY BOTANICAL CLUB

OCTOBER 1900

Juncus tenuis Willd. and some of its North American Allies

BY K. M. WIEGAND

Several years ago while working over the forms of *Juncus* occurring in the flora about Ithaca, N. Y., the writer was led to the conclusion that there are really several good species included in the *tenuis* group instead of only one or two as most writers have heretofore affirmed. Since that time many field notes have been accumulated, and these together with the information derived from a large series of herbarium specimens have led to the results presented in the present paper.

Juncus tenuis and its allies may be treated in either of two ways. They may all be referred to one or two composite specific types as has heretofore been done by most authors, including Buchenau in his elaborate monograph of the genus ; or the composite types may be broken up into their component parts. The latter method seems more proper since the lines of development are all quite distinct, and the various forms really represent separate kinds of plants. The endeavor has been to treat these forms as conservatively as possible, admitting new species only when appearing quite distinct and when represented by a sufficient number of specimens to guarantee constancy of characters. This has led to the result that in a few cases quite diverse forms are still united under one species. Some of these quite likely will be raised to specific rank when more material is available.

The characters used, it will be seen, are in many cases quite different from those commonly employed for the separation of species of *Juncus*. Considerable stress has been placed upon the

[Issued 26 October.]

vegetative characters, especially those referring to the sheath and its auricles as well as upon the leaf-blade, perianth and capsule. The seeds have not been found of great service since in this group except in one or two cases they are very much alike. Neither has the density of the inflorescence served definitely to distinguish species, since in many species this seems to be influenced greatly by the conditions of growth, soil, exposure, etc. The species are all perennial and all have six stamens, consequently these characters are omitted from the following descriptions.

Through the kindness of Professor Robinson it was possible to supplement the Cornell Herbarium material with all the material in the Gray Herbarium. The New England Botanical Club also loaned many specimens from the Eastern States, and Mr. M. L. Fernald placed at the writer's disposal a large mass of material from various localities in Maine.

Synopsis of the Species

Sheaths covering one half the length of the stem or more ; perianth parts obtuse, equaling or shorter than the 3-celled capsule. 1. *J. Gerardi.*

Sheaths covering only about one fourth of the stem ; perianth segments acute or pungent.

- Seeds long-caudate ; leaves terete, bracts scarcely exceeding the stramineous inflorescence ; perianth (3.5–4.5 mm.) equaling the oblong 3-celled capsule. 2. *J. Caseyi.*
- Seeds not caudate.
  - Capsule longer than the small (2.5–3 mm.) perianth, 3-celled ; leaves terete, bracts much exceeding the fuscous cyme. 3. *J. Greenei.*
  - Capsule equaling or shorter than the commonly larger (2.5–5 mm.) perianth ; leaves various.
    - Leaves flat but often involute, cross-section lunate.
      - Auricles at summit of sheath membranous, whitish, scarcely scarious, rarely produced beyond the insertion ; capsule 3-celled or nearly so ; perianth scarcely spreading, often appressed.
        - Perianth small (2.5–4 mm.), equaling the capsule.
          - Flowers conspicuously secund, 2.5–3.5 mm. long ; capsule oval ; plant slender with close sheaths ; bract shorter than the cyme. 4. *J. secundus.*
          - Flowers scarcely secund, 3–4 mm. long ; capsule ovate-oblong ; plant taller and stouter, much looser sheaths ; bracts 2, exceeding the cyme. 5. *J. interior.*
        - Perianth larger (4.5–5 mm.), exceeding the capsule.
          - Plant stout, 4–7 dm. high ; anthers and style very short. 6. *J. Arizonicus.*
          - Plant more slender, 3 dm. high ; anthers linear, exceeding the filaments ; styles often 1–1.5 mm. long. 7. *J. Georgianus.*

Auricles scarious, whitish, conspicuously produced beyond the point of insertion.

Capsule oblong, often narrow, 3-celled, equaling the perianth or nearly so, segments of the latter erect or appressed, cyme not crowded.

Stem stout; leaves short and broad (1.5–2 mm.); perianth 4 mm. long, scarious at the base, very acute, stramineous; cyme somewhat open. 8. *J. brachyphyllus.*

Stem slender; leaves narrow and longer; perianth 3.5–4 mm. long, scarious to the apex, acute, not pungent, fuscous; flowers few, densely congested. 9. *J. confusus.*

Capsule ovate or oval, 1-celled, three-fourths the length of the perianth or less, segments of the latter more or less spreading.

Flowers fuscous, congested; perianth parts nearly erect, 4–5 mm. long; capsule oval, firm; plant very stout, with conspicuous broad sheaths. 10. *J. occidentalis.*

Flowers greenish, distant (rarely congested); perianth conspicuously spreading, 3–4.5 mm. long; capsule ovate-oval, thin-walled; plant more slender. 11. *J. tenuis.*

Auricles cartilaginous, yellowish-brown; inflorescence greenish, small, usually congested; perianth spreading; capsule ovate, thin-walled. 12. *J. Dudleyi.*

Leaves terete, barely grooved on the upper side; inflorescence brownish, usually open; auricles nearly cartilaginous; capsule ovate, 1-celled; perianth spreading. 13. *J. dichotomus.*

1. JUNCUS GERARDI Loisel. Journ. d. Bot. 2: 284. 1809

J. bulbosus Bigelow, Torrey and Pursh. Not L.

Stems loosely tufted, rather stout and strict below, 3–6 dm. high, slightly compressed, slender at the summit: leaves erect or spreading, flat or slightly involute, grass-like, nearly equaling the culm; sheaths 4–6, all blade-bearing, the lower loose, the upper close and reaching the middle of the stem or even higher, margins and small auricles membranous: inflorescence small, 2–7 (rarely 12) cm. long, many-flowered, open but not diffuse, ultimate branches short, bearing 1–2 flowers at the extremity; bracts usually equaling the inflorescence; bracteoles ovate-subrotund, small, rounded: perianth small, 2.5–3 mm. long, the parts dark-fuscous with green midrib, nearly equal in length; the outer linear, convex, apex obtuse and incurved, margins narrowly scarious; the inner oval obtuse with broadly scarious margins: stamens nearly as long as the perianth, anthers linear, much exceeding the filaments; style long and stout, stigmas very long: capsule broadly oval or obovoid, rounded above and strongly apiculate, equaling or slightly exceeding the perianth, placentae meeting at the axis or nearly so: seeds broadly oblong (.5–.6 mm. × .3–3.5 mm.), short-blunt-pointed at each end, marked with 12–15 distinct longitudinal ridges, the spaces between inconspicuously reticulated.

Salt marshes along the coast from Newfoundland to Florida, also inland in central New York, and on the Pacific Coast at Vancouver Island (Macoun). Specimens were examined from nearly all parts of this region.

In America this is a very distinct species seeming to be quite constant in its characters over our whole region, but in Europe *J. compressus* Jac. is so close a relative as to make distinction difficult. The position of the leaves upon the stem and the short blunt perianth divisions form two very conspicuous characters, and by these it may be distinguished from all other species treated in this paper.

2. JUNCUS VASEYI Engelm. Trans. St. Louis Acad. Sci. **2**: 448. 1866

Stems more or less tufted, tall and stiff, erect, rather slender (3–8 dm. high), nearly terete: leaves very long (25–40 cm.), about ¾ length of culm, rigid and erect, terete, the groove very shallow or wanting; blade-bearing sheaths commonly only one, rarely two, short, rather close, the margins and short auricles semi-membranous, not scarious, lower sheaths bladeless and purple: inflorescence small, rather crowded (10–35 mm. long), branches erect, each with 2–4 sessile scattered flowers; bracteoles obtuse and rounded: perianth 3.5–4 mm. long, green or stramineous, rigid, the parts erect or appressed, equal and similar, lanceolate, all acute and narrowly scarious margined: stamens one half the length of the perianth, anthers linear-oblong, nearly as long as the filaments: stigmas short, sessile or nearly so: capsule 4–5 mm. long, oblong-cylindrical, obtuse, slightly exceeding the perianth; placentae meeting at the axis: seeds .85–1.10 × .1–.15 mm. including the tail, sigmoid-spindle-shaped, caudate at each end, the tails over one half the length of the body, marked with about 15 very low longitudinal anastomosing ridges, not reticulated between.

Moist shores and wet woods, Maine and Ontario along the lakes to the Saskatchewan, Iowa and Colorado. Specimens examined from various places both in the East and in the West.

Easily distinguished from other allies of *J. tenuis* by the spindle-shaped, distinctly caudate seeds, to which character must be added the terete leaves and fuscous oblong capsules slightly exceeding the perianth. *J. Vaseyi* and *J. Greenei* form a distinct and easily recognized group among the forms of grassy-leaved *Junci.*

3. JUNCUS GREENEI Oakes & Tuck. Am. Journ. Sci. **45** : 37. 1843

Perennial, tufted : stem stiff and erect, quite stout, 3–7 dm. high, terete, strongly grooved : leaves half as long as the culm or less, flexuous, terete, the groove deeper than in the last ; at least two sheaths blade-bearing, loose, not scarious : auricles very short, thickish : inflorescence short (2–5 cm. long), crowded and many-flowered, fuscous : bracts long and flexuous, much exceeding the culm, filiform, spreading or reflexed ; bracteoles short, rounded : perianth small (2.5 mm. long), fuscous, the parts all nearly similar, triangular-subulate, acute, broad and short, midrib green, margins broadly scarious : stamens 6, one half the length of the perianth, anthers oblong-linear, equaling the filament : style very short and stout, stigmas short : capsule narrowly oblong-ovate, obtuse, much longer than the perianth, placentae meeting at the axis : seeds oblong (.48–.54 × .20 mm.), apiculate at each end, coarsely reticulated, longitudinal ridges inconspicuous.

In damp woods or grassy places, New Brunswick to New Jersey near the coast, and sparingly through the lake region to Wisconsin. Specimens examined from Maine, Massachusetts, Rhode Island, New Hampshire, Vermont and Michigan.

4. JUNCUS SECUNDUS Beauv. ; Poir. Encyc. Suppl. **3** : 160. 1813

J. tenuis secundus Engelm. Trans. St. Louis Acad. Sci. 2, 450. 1866.

Densely tufted, slender, wiry, strict and erect (3–5 dm. high): culm nearly terete, strongly 6–8-grooved above, light green : leaves densely tufted, flat, one third length of culm or less, short and very narrow ; sheaths narrow (2 mm. wide or less) the upper rather close, margins and rounded auricles membranous, not scarious, all blade-bearing ; bracts one (rarely two), setaceous, shorter than the medium-sized (3–8 cm. long) open inflorescence ; branches of the latter strongly ascending, 3–7-flowered, conspicuously secund : bracteoles ovate-oblong, scarious, obtusish or cuspidate : perianth stramineous, rather small (2.5–3.5 mm. long), the parts erect or only slightly spreading, all similar, broadly lance-subulate, acute, midrib green, margins moderately scarious: stamens two thirds length of the perianth, anthers oblong-linear, slightly exceeding the filament: capsule oval-oblong, obtuse, scarcely apiculate, nearly equaling the perianth; placentae meeting at the axis: seeds oblong or ovate, irregularly curved, apiculate at each end (.28–.37 × .14–.17 mm.), with about 12–14 rows of transversely oblong shallow areoles.

Dry soil, Massachusetts to North Carolina along the coast.

Specimens examined:

MASSACHUSETTS: Medford (Boott, 1872); Winchester (G. P. Huntington, 1879).

RHODE ISLAND: (Olney).

PENNSYLVANIA: Lancaster (Porter and Leidy, Junc. Bor. Am. Engelm. no. 23, 1866).

DELAWARE: New Castle Co. (W. M. Canby, 1874).

NEW YORK: Pine Plains (L. H. Hoysradt, 1878).

In general appearance *J. secundus* is very distinct. It is especially characterized by the slender culm bases, membranous auricles, tufted leaves, short bracts, small secund flowers, scarcely spreading perianth, long anthers and placentae meeting at the axis. It seems to be confined to the Atlantic coast, while the Mississippi Vally forms heretofore ascribed to it are to be referred to a distinct species, *J. interior*.

5. **Juncus interior** sp. nov.

Tall and rather stout (5–10 dm. high), light green: stem erect, nearly terete, coarsely grooved: leaves several, about one third length of culm, blades narrow (1–1.25 mm. wide), flat or involute: sheaths nearly all blade-bearing, large and loose, margin and short rounded auricles membranous, often slightly yellowish: inflorescence large and open, very many flowered, 3–10 cm. long, branches conspicuously ascending: flowers distant and scattered, not secund, pale stramineous: bracts commonly two, exceeding the inflorescence: bracteoles acuminate: perianth 3–4 mm. long, its parts nearly equal, broadly subulate, very acute, scarious margin narrow, extending on the inner to the tip, all appressed or erect: stamens one half the length of the perianth: anthers short-oblong, much shorter than the filaments: styles very short: capsule oblong or rarely ovate-oblong, obtuse, barely apiculate, equaling the perianth; placentae not quite meeting at the axis except at the ends: seeds oblong, rather small (.35–.50 × .14–.17 mm.), apiculate at both ends, shallowly areolate.

Illinois to Wyoming, in dry woods and prairies.

Specimes examined :

ILLINOIS : Richmond (Vasey in Gray Herb.; type), between Urbana and Centralia (Vasey), Athens (E. Hall,—Junc. Bor. Am. Engelm. no. 21); Illinois Dr. Mead, no. 23.

WYOMING : Grand Enchantment Creek (A. Nelson, no. 3982, 1897).

Juncus interior has previously constituted the main part of the so-called *J. secundus* of the Mississippi valley. Closer observation shows however that it is quite distinct as well in structure as in area of distribution. *J. secundus* is always a slender plant with rather close sheaths, while the present species is commonly tall and stout with much broader sheaths. The two species also differ in the larger inflorescence of the latter, with larger flowers which are not secund, shorter anthers and more oblong capsule. The bracts also much exceed the inflorescence, while in *J. secundus* they usually do not.

6. **Juncus Arizonicus** sp. nov.

Sparingly tufted, tall and stout (4–7 dm. high), erect and rather stiff, quite pale ; culm terete or slightly compressed, coarsely grooved : leaves ⅓–½ the length of the culm, large, broad and flat, rarely involute, sometimes lax (often 1 mm. wide) ; sheaths numerous and conspicuous, nearly all blade-bearing, very loose and papery, often expanded, stramineous or brownish, margins and rounded auricles membranous, scarcely scarious : inflorescence stramineous, many-flowered, open but rather crowded (4–7 cm. long), the branches erect ; bracts 2–3 foliaceous, much exceeding the inflorescence ; bracteoles strongly cuspidate : flowers large and rather distant : perianth large (about 5 mm. long), the parts lance-subulate, rigid and very acute, nearly equal, erect or appressed, rarely at all spreading : stamens about one half the length of the perianth ; anthers elongated-oblong, about equaling the filament : style very short : capsule rather narrow, ovate-oblong, obtuse, barely apiculate, triangular above, firm in texture, conspicuously shorter than the perianth ; placentae meeting at the ends and nearly so at the middle : seeds oblong or ovate, irregularly curved (.30–.37 × .17–.21 mm.), apiculate, marked with about 12–14 rows of shallow transversly oblong areoles.

Arizona and New Mexico.

Specimens examined:

N. MEXICO: Copper Mines (Geo. Thurber, type in Gray Herb.); N. Mexico (A. Fendler, no. 856).

ARIZONA: Apache Pass (Lemmon, no. 310).

Juncus Arizonicus curtiflorus var. nov.

Commonly more slender, sheaths frequently closer: leaves nearly filiform: inflorescence smaller (3–5 cm. long): flowers smaller, perianth only 4 mm. long, scarcely exceeding the broader and shorter, more ovate capsule; placentae more widely separated.

Arizona, New Mexico and Texas. Possibly a distinct species.

Specimens examined:

ARIZONA: Flagstaff (D. T. MacDougal, no. 305, type in Gray Herb.).

NEW MEXICO: (C. Wright, no. 1922).

TEXAS: Houston (E. Hall, no. 661, 1872).

Intermediate in some respects between *Juncus confusus* and *J. tenuis*; differing from the former in its membranous auricles, larger perianth, comparatively shorter capsule, open stramineous inflorescence, and stouter habit; and from the latter in its membranous auricles, more oblong firm-walled capsule, scarcely spreading perianth, and erect branches. It is one of the largest species of this group. The tall stout culms are densely clothed at the base with the numerous papery and very loose sheaths. Some of the specimens differ markedly in their smaller flowers and other characters, thus warranting their separation as a distinct variety as above.

7. JUNCUS GEORGIANUS Coville, Bull. Torr. Club, **22**: 44. 1895

Densely tufted, 3 dm. high, erect, but somewhat weak, slender: culms striate-grooved, nearly terete: leaves very numerous, rather long (1/3–1/2 length of culm), blade narrow, quite thick and rigid, but flattish with a broad open groove, coarsely striate on the back; sheaths close except the lower which are bladeless and expanded, all greenish-stramineous, margins membranous, auricles short, rounded, membranous, or slightly cartilaginous in some cases, not scarious: inflorescence large for the plant (6–10 cm. long), very lax and distantly flowered: bracts filiform, equaling the inflorescence or usually much shorter: bracteoles ovate, acute: perianth 4.5–5 mm. long, the parts nearly equal, lance-subulate, very acute, midrib green with a fuscous stripe on each side and a narrow scarious margin extending to the tip of the inner parts: stamens about one half the length of the perianth: anthers long-linear, much exceeding the filament: style quite long (1 mm.) for this group: capsule about three fourths length of the perianth, narrowly oblong-lanceolate, obtuse or broadly acute, mucronate, 3-celled: seeds about .4–.5 mm. long, oblong, reticulated, the areoles linear and transversely arranged in about sixteen longitudinal rows.

Georgia, Stone Mountain (Canby, Small), Little Stone Mountain (Small).

Specimen examined:

Stone Mountain, Georgia (Canby in Gray Herb.).

The above description of this extraordinary *Juncus*, with the exception of the part relating to the fruit, was drawn from a portion of the type material in the Gray Herbarium. This was in the flowering condition, and the fruit characters were added from Mr. Coville's original description.

The species seems to be very local in distribution having been found only in the limited locality given above, where it was first discovered by Mr. Canby, and later according to Mr. Coville was again collected by Dr. Small. In general appearance it is not very different from *J. tenuis*, but lacks the scarious auricles while the very long anthers and style designate it as a very anomalous form for this group where all other species except *J. Gerardi* have short anthers and styles.

8. **Juncus brachyphyllus** sp. nov.

Culm stiff, erect and very stout, 4–5 dm. high (1.25–1.5 mm. diam.), slightly compressed, very conspicuously grooved; leaves short, ¼–⅓ the length of the culm, the blade unusually broad and flat but rather thick, stiff and spreading (1.5–2 mm. wide), rarely at all involute; sheaths all but the lowest blade-bearing, loose and mostly free, pale, margins membranous, auricles produced and mostly scarious: inflorescence short, crowded, many-flowered (2–6 cm. long), stramineous, the branches ascending, sometimes elongated to 2.5 cm., sometimes all capitate; bracts 2–9 cm. long, leaf-like, usually exceeding the inflorescence; bracteoles acute or cuspidate: perianth rather large, the parts appressed, 5 mm. long, slightly unequal, subulate, very acute, narrowly scarious toward the base, inner scarious all around: stamens about one half the length of the perianth; anthers oblong nearly equaling the filament: styles short (.5 mm. long): capsule firm, rather narrowly oblong, triangular above, obtuse or retuse, equaling the perianth; placentae completely meeting at the axis: seeds quite large, oblong (.5–.55 × .2 mm.) rather slender and strongly, often obliquely, apiculate at each end, areolate.

Arkansas to Idaho.

Specimens examined:

ARKANSAS: (Between Morka and Red Fork) (Marcy's Exped. Herb. G. Thurber); Upper Platte (Hayden in Gray Herb. type).

IDAHO: (Lake Waha) (Heller, no. 3410, 1896).

The limited material of this species makes its range rather doubtful. It is closely related to *Juncus confusus* in flower and fruit characters, indeed differs from that species only in its more acute perianth segments, more open paler inflorescence, and especially in the stout culm and short broad leaves. It differs from *J. interior* in the large scarious auricles and larger perianth.

9. JUNCUS CONFUSUS Coville, Proc. Biol. Soc. Wash. **10**: 127. 1896

Strict but slender, 4–5 dm. high, erect, light green: culms moderately grooved, sparingly tufted: leaves very narrow, nearly filiform, two thirds the length of the culm or less, flat and unusually thick, commonly also involute; sheaths short, narrow, close, some of the lower bladeless and looser, yellowish-white, margins and produced auricles scarious, the latter whitish: inflorescence very short, compact, capitate (.5–2 cm. long), pale fuscous; bract 2–7 cm. long, filiform, exceeding the inflorescence; bracteoles large, ovate, scarious, obtuse or acutish: perianth small (3.5–4 mm. long), the parts nearly equal, appressed, lanceolate, acutish, stramineous with a fuscous stripe on each side, margins all rather broadly scarious to the apex: stamens one-half the length of the perianth: anthers oblong, shorter than the filament: styles quite short: capsule firm, oblong, a little shorter than the perianth, conspicuously triangular and retuse at the apex, placentae completely meeting at the axis: seeds large, oblong, apiculate and often oblique at the ends (.45–.50 × .2 mm.), coarsely and shallowly areolate.

Colorado to Montana and possibly Idaho.

Specimens examined:

COLORADO: (Hall and Harbour), Chicken Creek (Baker, Earle and Tracy, no. 742, 1898).

WYOMING: Battle Lake (A. Nelson, no. 4004), Laramie Peak (A. Nelson, no. 1631).

Juncus confusus includes all of the so-called *J. tenuis* var. *congestus* of the Rocky Mountain region except that here ascribed to *J. brachyphyllus*. It differs from the true *J. tenuis congestus* Engelm. (*J. occidentalis*) in its more slender habit, longer capsule, smaller flowers and more congested heads, and from *J. brachyphyllus* in its much denser heads, more slender habit, and especially in its narrow leaves and fuscous perianth. It seems rather widely distributed but does not appear abundantly in the herbaria.

10. **Juncus occidentalis** (Coville) nom. nov.

J. tenuis congestus Engelm. Trans. St. Louis Acad. Sci. **2**: 450. 1866. Not *J. congestus* Thuill.

J. tenuis occidentalis Coville, Proc. Biol. Soc. Wash. **10**: 129. 1896.

Tall, stiff and erect (3–6 dm. high), from a stout base, pale green; stem nearly terete, finely striate; leaves one third to one half the length of the culm, numerous and densely tufted at the base, rather coarse, flat and flexuous, 1–1.5 mm. wide; sheaths all blade-bearing, loose and expanded, brownish, the margins and short auricles whitish and scarious: inflorescence several- or many-flowered, glomerate or more commonly somewhat open (1.5–3 cm. long), fuscous; bract one, leaf-like, about 5 cm. long, exceeding the inflorescence; bracteoles broadly ovate, obtuse or mucronate: perianth large (4–5 mm. long), the parts lance-subulate, slightly unequal in length, erect or somewhat spreading, fuscous with green midrib and rather broad scarious margin extending to the apex, the inner more broadly scarious and with a narrower midrib: stamens one half the length of the perianth, anthers oblong, much shorter than the filaments: styles very short: capsule firm, broad, ovate-oval or oblong-oval, obtuse, when mature strongly retuse, not over three fourths the length of the perianth, fuscous, placentae extending only about one half way to the axis: seeds oblong or irregular, apiculate at each end (.34–.43 mm. long), areolate-reticulated, not striate.

Central California to Oregon.

Specimens examined.

CALIFORNIA: (Bolander, also Oakland Hills, no. 417, and no. 23), Berkeley (J. W. Blankinship), Bolinas Bay (A. Kellogg, Junc. Bor. Am. Engelm. no. 22), Redwood Hills, Watsonville (A. Wood, 1868), Yosemite Val. (Torrey, no. 534, 1865), Sonoma Co. (J. W. Congdon) (Kellogg and Harford, no. 1043).

OREGON: Klamath Co. (E. I. Applegate, no. 748), Waldo (Howell, 1884).

Differs from *Juncus tenuis* in the larger, fuscous, congested flowers with scarcely spreading perianth, more oval and firmer capsule, stouter, taller stem with more numerous basal leaves, and from *J. confusus* in its short capsule and coarser leaves. It sometimes becomes quite robust, in which case the inflorescence may become more open. In general, this species is decidedly more strict than *J. tenuis*.

It differs from its closest relative, *Juncus brachyphyllus*, in its larger, fuscous, more spreading perianth, much shorter retuse oval capsule, which is only three fourths the length of the perianth, the placentae not meeting at the axis, and the seeds not being quite so long. It agrees with *J. confusus* in having the same retuse apex to the capsule and very scarious margins to the perianth segments, but the whole flower is much larger.

11. JUNCUS TENUIS Willd. Sp. Pl. **2**: 214. 1799

J. bicornis Michx. Fl. Bor. Am. **1**: 191. 1803.

Tufted, rather low, bright green: culms 2–6 dm. high, commonly spreading, slightly flattened and finely striate, often stout: leaves long, one half to nearly the full length of the culm, narrow (1–1.25 mm.), lax, flat and soft, rarely slightly involute; sheaths all blade-bearing, short, loose and often expanded, greenish-brown, margins and the large extended auricles (often 1.5 mm. long) very scarious: inflorescence pale green, many-flowered, moderately open (1–7 cm. long), flowers somewhat aggregated near the ends of the very unequal branches: bracts 2 rarely 3, foliaceous, much exceeding the inflorescence: bracteoles triangular-ovate, acutish: perianth variable in size (3–4.5 mm. long), parts all nearly similar but the inner slightly shorter, lanceolate, very acute, green with white-scarious margins, conspicuously spreading: stamens one half the length of the perianth; anthers short, oblong, much shorter than the filament: capsule thin-walled, broadly ovoid, shorter than the perianth, obtuse, very obscurely triangular above, scarcely apiculate: placentae not reaching half way to the axis: seeds (.33–.40 × .14–.17 mm.) oblong, bluntly apiculate at each end, reticulated, areoles large, transversely oblong.

Dry roadsides and grassy places, Newfoundland to Florida and westward to Texas, northwestward to Oregon and Washington.

Specimens examined:

NEWFOUNDLAND: (Robinson and Schrenk, no. 130).

QUEBEC: (Mrs. Sheppard, 1827).

MAINE: Many localities (Fernald, Parlin, Furbish).

NEW HAMPSHIRE: Jaffrey (B. L. Robinson, nos. 174, 303).

MASSACHUSETTS: Many localities about Boston (N. E. Bot. Cl., Gray Herb.).

RHODE ISLAND: (Olney), Providence (J. F. Collins).

CONNECTICUT: (L. Andrews, no. 189), New Haven (J. A. Allen).

NEW YORK: Many specimens from near Ithaca.

PENNSYLVANIA: Lancaster (Porter in Gray Herb., also Junc. Bor. Am. Engelm. no. 20).

VIRGINIA: Princess Anne Co. (Heller, no. 1070).

NORTH CAROLINA: Swain Co. (Beardslee and Kofoid).

SOUTH CAROLINA: (Ravenel).

FLORIDA: (A. H. Curtiss, no. 2985).

LOUISIANA: (J. Hale).

MICHIGAN: Keweenaw Co. (O. A. Farwell, no. 468a), Port Huron (C. K. Dodge, no. 27).

MINNESOTA: Mille Lacs Co. (E. P. Sheldon).

ARKANSAS: (F. L. Harvey, no. 24).

IOWA: Stone City (R. Combs & C. R. Ball, no. 414).

IDAHO: Nez Perces Co. (Sandberg, MacDougal and Heller, no. 379).

WASHINGTON: Pullman (Piper); Seattle (Piper, no. 1134), Chehalis Co. (Heller, no. 4074), near var. *anthelatus.*

OREGON: (E. Hall, no. 540).

Juncus tenuis anthelatus var. nov.

Tall and rather stiff (5–9 dm. high); leaves broader; sheaths numerous and loose, often causing the base of the stem to appear very stout: inflorescence very large, open and diffuse (5–15 cm. long), the flowers more scattered and, except in a few cases, smaller (2.5–3.5 mm. rarely 4 mm.): capsule not over three fourths the length of the perianth, round-ovate, shining, rarely larger.

Maine to Florida and Texas, mostly along the coast; possibly also in the State of Washington.

Specimens examined:

MAINE: Hartford (J. C. Parlin), Orono (M. L. Fernald).

MASSACHUSETTS: Lexington (C. H. Knowlton).
VIRGINIA: Carroll Co. (Small).
SOUTH CAROLINA: (M. A. Curtis).
TEXAS: Houston (E. Hall, no. 663).
MISSOURI: Butler Co. (H. Eggert).

This is much more common and more widely distributed than any other species in the group, being especially abundant throughout the eastern United States. Although Willdenow's type has not been studied there seems little doubt from the locality and description given that it really was of this species. The more diffuse habit, scarious auricles, many-flowered inflorescence with flowers mostly near the ends of the branches, spreading sepals, and thin-walled one-celled capsule make *J. tenuis* a very distinct species indeed. It is, however, very variable and future study may separate several more good species. In Washington and Oregon the perianth shows a tendency to become fuscous, although never so dark as in *Juncus occidentalis* and *J. confusus*.

The var. *anthelatus* seems to be distinct from *J. tenuis* var. *laxiflorus* E. Fisk. Ber. d. Schles. Gesells. 168, 1890.

11. **Juncus Dudleyi** sp. nov.

Pale green: stems tufted, often very large and stout, 3–10 dm. high, stiff, erect and wiry, prominently striate-grooved: leaves short, one half the length of the culm or usually less, narrow but flat, frequently involute; sheaths rather close, all blade-bearing, margins not scarious, auricles rounded, thick and cartilaginous, yellowish or reddish in color: inflorescence small and rather dense 2–5 (rarely 7) cm. long, few-flowered, exceeded by the short filiform 4–8 cm. long bract: flowers contiguous at the ends of each branchlet, not at all secund, green or pale-stramineous; bracteoles ovate, obtuse or acutish; perianth 4–5 mm. long, the parts firm, nearly equal, lance-subulate, acute, strongly spreading, yellowish-green with a distinct scarious margin: stamens one half as long as the perianth, anthers oblong, slightly shorter than the filaments: style very short: capsule broadly ovate-oval, $\frac{3}{4}$–$\frac{7}{8}$ the length of the perianth, rounded apiculate and very obscurely triangular at the apex, placentae reaching half way to the axis: seeds oblong (.37–.45 × .17–.21 mm.), apiculate at each end, coarsely areolate with 5–7 rows of transversely oblong areoles.

Damp soil in open places, from Maine and New York westward to the Saskatchewan, Colorado and Arizona.

Specimens examined :

MAINE : Aroostook Co. (Fernald, no. 109, K. Furbish), Kennebec Co. (Fernald, no. 2747), Somerset Co. and Orono (Fernald).

VERMONT : (Eggleston & Churchill, no. 404), Willoughby (G. G. Kennedy).

NEW YORK : Ithaca (Dudley and others) ; Truxton (K. M Wiegand, Cornell Herb., type) ; also many other localities.

MICHIGAN : Detroit (Wm. Boott, C. F. Wheeler), Keweenaw Co. (O. A. Farwell, no. 468b).

WISCONSIN : (J. A. Lapham).

MISSOURI : Dixon Co. (F. Clements, no. 2598), Springfield (S. Weller).

KANSAS : Riley Co. (J. B. Norton, no. 528).

NEBRASKA : Hooker Co. (Rydberg, no. 1374), Thomas Co. (Rydberg & Wright, nos. 1845 and 1487).

WYOMING : Lander (A. Nelson, no. 699).

IDAHO : Boise (A. I. Mulford).

COLORADO : Mancos (Baker, Earle & Tracy, no. 424).

ARIZONA : Willow Spring (F. Palmer, no. 550).

The cartilaginous brown auricles, stiff stem and small contracted inflorescence with spreading calyx distinguishes this species from all others of the group. In the vicinity of Ithaca, N. Y., it is quite common, and may be found either in damp open meadows along water courses or preferably in marly soil in which latter situation it reaches its greatest perfection. In the Cayuga Flora Professor Dudley refers to this species as an unnamed variety of *J. tenuis* with tall stems and crowded glomerate heads occurring on the moist meadows of Marl Creek.

Juncus Dudleyi is extremely variable in size, although the floral characters are constant. The largest specimens are coarse, tall and robust with looser sheaths, thinner auricles and more open inflorescence ; but all gradations may be found down to the very slender low forms with close sheaths and capitate flowers. These extremes may all be found about Ithaca, N. Y.

13. JUNCUS DICHOTOMUS Elliott, Bot. S. Car. and Ga. 1 : 406. 1817

Sparingly tufted, very stout, especially at the base (7–9 dm. high), strict, dark green : culms terete or flattish, shallowly striate :

leaves very long (two thirds the length of the stem) and commonly stout, nearly terete, rarely much channelled; sheaths usually all more or less distinctly blade-bearing, very loose and broad, brownish or purple, margins and rounded auricles almost cartilaginous, not scarious: inflorescence many-flowered, rather large and normally diffuse, rarely contracted, 2–8 cm. long, more or less fuscous; bracts 5–15 cm. long, similar to the leaves, either longer or shorter than the inflorescence; bracteoles acutish, often fuscous: perianth 3.5–4 mm. long, the segments spreading, pungent, nearly equal and similar, greenish-brown with a narrow scarious margin: stamens one half the length of the perianth, anthers oblong, shorter than the filaments: style very short: capsule ovate oblong, rounded, minutely apiculate and very obscurely triangular at the apex, ¾–⅞ the length of the perianth; placentae extending half way to the axis: seeds nearly as in *J. tenuis*.

In dry or wet sandy places, Massachusetts to Florida along the coast.

Specimens examined:

MASSACHUSETTS: Chelsea Beach (H. Mann).

NEW JERSEY: Atsion (J. A. Allen), Keyport (G. Thurber), Camden (C. F. Parker, Herb. Junc. Bor. Am. Engelm. no. 24).

DISTRICT OF COLUMBIA: (M. S. Bebb).

VIRGINIA: Princess Anne Co. (Heller, no. 1068).

SOUTH CAROLINA: (G. Thurber, M. A. Curtis), Aiken (Ravenel, Herb. Junc. Bor. Am. Engelm. nos. 25 and 26).

GEORGIA: Summit of Stone Mt. (J. K. Small).

FLORIDA: Apalachicola (Dup. Chapman Herb. Biltmore, no. 2615a), Jacksonville (A. H. Curtiss. nos. 2969 and 5660), Lake Co. (Nash, nos. 555, 1086 and 1881), Middle Fla. (G. Thurber).

Very similar to *Juncus tenuis* but seems to differ strangely from all other forms in the combination of pale fuscous flowers and terete leaves, the latter character apparently being quite constant. The sepals are strongly spreading as in *J. tenuis*, and it also goes through the same characteristic variations as that species in the condensation and expansion of the inflorescence. The extremes are quite unlike in appearance but not essentially different in structure. Small stunted forms are also commonly wiry, slender and strict with filiform leaves. This condition is well exhibited by the two specimens from Lake Co., Fla. (Nash), which are both low and very slender with narrow sheaths. They seem however to be connected with the ordinary form by numerous transitional specimens especially in the South. A peculiar specimen from Florida and also one from Massachusetts has the auricles and floral characters of this species but possesses more or less distinctly flattened leaves. In case the leaves are slightly flattened *Juncus dichotomus* may still be easily distinguished from *J. tenuis* by the thick auricles, general dark color and sheaths which are commonly tinged with purple. From *J. Dudleyi* it may be known by the diffuse inflorescence with darker flowers and by the purple sheaths.

CORNELL UNIVERSITY.

Studies on the Rocky Mountain Flora—II

By P. A. Rydberg

THE ROCKY MOUNTAIN SPECIES OF MELANTHACEAE

There has been a great deal of misunderstanding regarding the species belonging to the family Melanthaceae (perhaps more commonly regarded as a sub-family of Liliaceae). Especially is this true with respect to the species growing in the Rocky Mountain region. In order that some of the confusion may be cleared up and a way may be opened to further study of the group my present views are here offered.

The family is represented in the Rockies by at least five genera and seventeen species. Of these I have found myself obliged to describe one genus and seven species as new. The genera are as follows:

TOFIELDIA Huds.

This is represented by three species, distinguished as follows:

Stem glabrous, scapose; seeds unappendaged. *T. palustris.*
Stem viscid-pubescent at least above; seeds appendaged.
 Bractlets broadly triangular, connate for two thirds of their length. *T. intermedia.*
 Bractlets lanceolate-triangular, connate half their length or less. *T. occidentalis.*

Tofieldia palustris Huds. Fl. Ang. Ed. 2, 1: 175

A subalpine species of wet places, growing in America from Greenland to Alaska and from the Arctic coast south to Quebec and British Columbia. It is also found in subarctic Europe. The following specimen from the Rockies is in the New York Herbaria:

British Columbia: Rocky Mountains, 1890, *John Macoun.*

Tofieldia intermedia sp. nov.

Tofieldia glutinosa Hook. Fl. Bor. Am. **2**: 179, in part. 1838. Wats. Bot. Calif. **2**: 184. Not Pursh.

A slender perennial with more or less leafy stem, 1.5–3 dm. high, viscid-pubescent above. Leaves 5–20 cm. long, 2–5 mm. wide, obtuse or acute: raceme short, dense, 1–2 cm. long: bracts broad, ovate: pedicels usually 3 together, very short, in fruit 1–4 mm. long: bractlets under the flowers 3, broadly triangular, connate for about two thirds their length: flowers yellow: sepals obovate, 4–5 mm. long: petals somewhat narrower and longer: capsule ovoid, about 5 mm. long: beaks about 1 mm. long, spreading: seeds appendaged.

This has been confused with the eastern *T. glutinosa* Pers. which has an elongated raceme, longer pedicels, and oblong subequal sepals and petals, about 4 mm. long. All specimens from the west referred to *T. glutinosa* may belong to *T. intermedia*. At least all that I have seen do so. *T. intermedia* grows in bogs to an altitude of 2,700 m. from Saskatchewan to Alaska, British Columbia and Wyoming. The following specimens belong to it:

ALASKA: Sheh-Shooh Lake, 1895, *M. W. Gorman, 78* (type); Yes Bay, 1895, *Thos. Howell, 1666;* Khantaak Island, 1892, *F. Funston, 47;* Sitka, *Bongard.*

BRITISH COLUMBIA: Summit of Selkirk Mountains, 1890, *John Macoun.*

WASHINGTON: Totoish Mountains, 1897, *O. D. Allen 274.*(?)

MONTANA: Flathead River, 1892, *R. S. Williams, 915;* Granite, 1892, *Kelsey;* Upper Marias Pass, 1883, *Canby, 328.*

WYOMING: Cement Creek, 1897, *F. Tweedy, 336.*

TOFIELDIA OCCIDENTALIS Wats. Proc. Am. Acad. **14**: 283. 1879

This species is distinguished from the preceding by the narrower, less connate bractlets, longer pedicels, narrower sepals, larger capsule, 8 mm. long, and longer ascending beaks. The following specimen from the Rocky Mountain region is in the New York Herbaria.

BRITISH COLUMBIA: Avalanche Mountain, 1890, *J. M. Macoun.*

XEROPHYLLUM

This genus is represented by two species:

Petals and sepals 7–10 mm. long.	*X. tenax.*
Petals and sepals 4–6 mm. long.	*X. Douglasii.*

XEROPHYLLUM TENAX (Pursh) Nutt. Gen. Am. **1**: 235. 1818

Helonias tenax Pursh Fl. Am. Sept. 243. 1814.

X. Douglasii Rydb. Mem. N. Y. Bot. Gard. **1**: 92; not Wats.

This has been greatly confused with the following. Watson stated that *X. Douglasii* was collected on the Hayden Surveys of the Yellowstone Park, but does not cite any locality in the Rocky Mountains for *X. tenax.* Coulter in his Manual of the Rocky Mountain Region included consequently a description of the former, but none of the latter. As this book is the one most used by Rocky Mountain botanists, all specimens of *Xerophyllum* from that region have therefore been labeled *X. Douglasii.* I made the same mistake in preparing my Catalogue of the Flora of Montana. All the specimens cited there belong to *X. tenax* instead of *X. Douglasii.* Besides the Montana specimens there cited, the following Rocky Mountain specimens belong to this species:

BRITISH COLUMBIA: Toad Mountain, Kootenay Lake, 1890 *J. M. Macoun.*

IDAHO: Kootenay Co., 1888, *J. H. Saunders;* Wiessner's Peak, 1892, *Sandberg, MacDougal & Heller, 588.*

XEROPHYLLUM DOUGLASII Wats. Proc. Am. Acad. **14**: 284. 1879.

I have not seen any Rocky Mountain specimen of this species, but include it on the authority of Dr. Watson who referred to it the specimens from the Hayden Collection metioned above.

Stenanthella gen. nov.

Erect bulbous glabrous herbs with few narrow leaves and racemose or paniculate perfect greenish, brownish or purplish flowers. Petals and sepals each 3, subequal, withering-persistent, narrowly lanceolate, acuminate, with reflexed tips, and at last involute, without gland and distinct claw. Stamens 6, free, included; anthers reniform, confluently 1-celled. Ovary ovoid, superior; styles 3. Capsule lance-ovoid, 3-beaked, septicidal to the base, wholly superior. Seeds oblong, winged.

Dr. Gray included the species belonging here in *Stenanthium,* but the genus is better defined than many of the recognized genera in the family. In *Stenanthium,* the flowers are polygamous, open, not campanulate in outline, the base of the ovary is inferior, the tip of the petals and sepals not reflexed and the general habit different. The genus *Stenanthella* contains two known species, one from the island Sachalin, **S. Sachalinensis** (*Stenanthium Sachalinense* F. Schmidt), and the following:

Stenanthella occidentalis (A. Gray) Rydb. n. n.

Stenanthium occidentale A. Gray, Proc. Am. Acad. **8**: 405.

The species ranges from Alberta and British Columbia to Oregon and Idaho. The following specimens are from the Rockies:

MONTANA: Deer Lodge, 1892, *Miss Emma Ware;* Flathead River, 1883, *Canby, 332;* Big Blackfoot, *Canby;* divide between Hell Gate and Blackfoot, 1880, *Watson;* Columbia Falls, 1894, *R. S. Williams.*

ALBERTA AND BRITISH COLUMBIA: Rocky Mountains, 1858, *E. Bourgeau;* Kicking Horse Lake, 1887, *John Macoun.*

IDAHO: Kootenay Co., 1890, *J. B. Leiberg, 4912.*

VERATRUM L.

Flowers greenish, bractlets foliaceous, often equaling or exceeding the flowers. *V. viride.*

Flowers white or yellowish white; bractlets membranous, much shorter than the pedicels and flowers. *V. speciosum.*

VERATRUM VIRIDE Ait. Hort. Kew. **3**: 422. 1789

V. lobelianum β Eschscholtzianum R. & S. Syst. **7**: 1555. 1829.

V. Eschscholtzii Gray, Ann. Lyc. N. Y. **4**: 119. 1837.

If the western plant should be included in *V. viride* or not, is doubtful. The eastern plant extends west to Minnesota and the western is found first on the Pacific slope in Idaho and British Columbia. Both are very variable and no good character has been found to separate the two. As a rule the western plant has shorter stamens and bracts; the former scarcely half as long as the petals and sepals. The western range of *V. viride* or *V. Eschscholtzianum*, whatever name it should bear, is from southern Alaska to Oregon and Idaho. The following are the only specimens seen from the Rockies.

IDAHO: Packsaddle Peak, 1892, *Sandberg, MacDougal & Heller, 863.*

Veratrum speciosum sp. nov.

Veratrum Californicum Wats. Proc. Am. Acad. **14**: 277; in part. 1879. Not Durand.

A stout, more or less pubescent, very leafy plant, 1–3 m. high. Leaves, except the uppermost, broadly oval, 2–3 dm. long, 1–2 dm. wide, obtuse or acute, glabrous above, finely soft-pubescent beneath, sessile and sheathing: panicle many-flowered with ascending branches: bracts lanceolate, foliaceous: bractlets membranous, yellowish, ovate, acuminate, shorter than the flowers and pedicels: petals and sepals yellowish white, oval or broadly oblanceolate, mostly obtuse, 5–7-nerved, 8–10 mm. long, 4–5 mm. wide: capsule oblong, about 3 cm. long and 12 mm. in diameter: seeds oblong, 7–8 mm. long with a wide white wing-margin.

In looking over the specimens of *V. Californicum* in the Columbia Herbarium I found one specimen collected in Oregon on the Wilkes' Expedition, which looked very unlike the rest, having a narrower and denser panicle and narrower and more acutish petals and sepals. I took it out and placed it in the cover used for the specimens not named. I found in that cover a similar specimen. On the label was given neither locality nor the collector's name; but on the sheet was pasted a paper with a tracing of the basal leaves, the description of *V. Californicum* E. Durand and some remarks, among others the words "petiole 3–4 inches long." The specimens are presumably a part of the type of *V. Californicum* or at least have been compared with Durand's specimens and the notes made by Durand himself. Durand in his description expressively states that the lower stem-leaves are petioled. As this is never the case in the plant of the northern Rockies and the Columbia Valley, I am certain that the plant generally regarded as *V. Californicum* and from which Dr. Watson's description in his revision was mainly drawn is perfectly distinct from Durand's plant. The latter is a rare plant judging from the fact that I have not seen more than the two specimens mentioned above.

V. speciosum ranges from Montana to Washington, California and Colorado, reaching a maximum altitude of 2,500 m.

MONTANA: Bridger Mountains, 1896, *Flodman, 344* (type); Little Belt Mountains, *344½*; Bozeman, *P. Koch*; Deer Lodge Co., *Emma Ware*; Belt Park, 1886, *R. S. Williams, 475*; Belt Creek, 1883, *Scribner, 287*; Lo-Lo Creek, 1880, *Watson.*

IDAHO: Lake Pend d'Oreille, 1892, *Sandberg, MacDougal & Heller, 741*; Kootenay Co., 1886, *J. H. Sandberg*; Lake Waha, 1896, *A. A. & E. Gertrude Heller, 3380*; 1892, *Isabel Mulford.*

UTAH: Heber Valley, 1869, *S. Watson, 1165*; American Fork Cañon, 1880, *M. E. Jones.*

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

OREGON: *J. S. Newberry.*

CALIFORNIA: Modoc Co., 1893, *M. S. Baker;* 1865, *H. N. Bolander, 6255;* Mt. Shasta, 1897, *H. E. Brown.*

COLORADO: Pagosa Peak, 1899, *C. F. Baker, 258* (?). (This has smaller flowers, petals and sepals being only 6–8 mm. long.)

ZYGADENUS Michx.

Much confusion has existed in this genus. The species of Colorado, Wyoming and Montana have been variously named *Z. Nuttallii, Z. venenosus* and more rarely *Z. paniculatus,* but much complaint has been made that they do not fit Watson's descriptions. Some have complained that those descriptions have been too narrow, others that there is no line to be drawn between *Z. venenosus* and *Z. paniculatus* and that both those species come too near *Z. Nuttallii.* Dr. Watson's descriptions of *Z. venenosus* and *Z. paniculatus* are unusually good and correct. He knew them both from the field. The common Rocky Mountain plants belong to neither. *Z. venenosus* does not grow east of Idaho and *Z. paniculatus* not east of Utah, while *Z. Nuttallii* is a species of the plains and I doubt that it is found at all in the Rocky Mountain States. The Rocky Mountain species are distinguished as follows:

Gland obcordate; base of ovary inferior.
  Petals and sepals 7–8 mm. long, 7–13-nerved. *Z. elegans.*
  Petals and sepals 5–6 mm. long, 3–7-nerved. *Z. Coloradensis.*
Gland obovate or semi-orbicular; ovary wholly superior.
  Petals and sepals more or less clawed; filaments adnate to the base of the claws.
    Petals and sepals rounded or obtuse at the apex.
      Upper leaves without sheaths at the base; both petals and sepals long-clawed and sub-cordate at the base*; gland with a thick margin. *Z. venenosus.*
      All leaves with distinct sheaths; petals long-clawed and sub-cordate at the base; sepals short-clawed; margin of the gland ill-defined.
        Petals and sepals 4–5 mm. long; petals ovate; leaves 3–5 mm. wide. *Z. gramineus.*
        Petals and sepals 6–8 mm. long; petals oblong; leaves 5–9 mm. wide. *Z. intermedius.*
    Petals and sepals acute or acuminate at the apex; all leaves with sheaths; sepals cuneate at the base and short-clawed.
      Leaves less than 5 mm. wide; petals and sepals both cuneate at the base and short-clawed. *Z. acutus.*

Leaves over 5 mm. wide.

Raceme simple; petals long-clawed and sub-cordate at the base. *Z. falcatum.*

Raceme branched; petals short-clawed, not sub-cordate at the base. *Z. paniculatum.*

Petals and sepals clawless; gland obovate with a poorly defined margin; filaments free. *Z. Nuttallii.*

ZYGADENUS ELEGANS Pursh, Fl. Am. Sept. **1**: 241. 1814

The typical *Z. elegans* is a western plant, mainly belonging to the Rocky Mountain region, where it grows in meadows up to an altitude of 2500 m. If the eastern plant or *Z. glaucus* of Nuttall, should be included in this species, is very doubtful. It is always darker green, more glaucous, inflorescence more paniculately branched, the petals and sepals narrower and more greenish. It ranges from New Brunswick to Minnesota and south to Vermont. The range of *Z. elegans* proper is from Saskatchewan to Alaska, south to Colorado and Nevada.

Zygadenus Coloradensis sp. nov.

A rather slender glabrous plant, 2–4 dm. high. Bulb ovoid, about 2 cm. long and 1–1.5 cm. in diameter: leaves narrow, erect, about 2 dm. long, 3–5 mm. wide: flowers racemose, yellowish white-tinged with brownish or purplish: bracts linear-lanceolate, all equaling or exceeding the pedicels: petals and sepals 5–6 mm. long, 3–7-nerved, oblong or narrowly obovate, acute: capsule ovoid, 15–18 mm. long and 7–8 mm. in diameter.

Z. Coloradensis is closely allied to *Z. elegans*, differing in the smaller flowers, greener foliage, long and narrow bracts equaling or exceeding the pedicels and a brownish or purplish tint of the inflorescence, bracts and flowers. It grows in the mountains at an altitude of 2500–3500 m.

COLORADO: Idaho Springs, 1895, *Rydberg* (type); Leroux Creek, 1892, *J. H. Cowen;* La Plata, 1873, *Coulter;* Caribou, 1891, *Dr. E. Penard;* Empire, 1892, *H. N. Patterson, 298.*

ZYGADENUS VENENOSUS Wats. Proc. Am. Acad. **14**: 279. 1879

This species is characterized by its narrow leaves, of which the upper lack the scarious sheaths, and by the thick, prominent

* When the petals or sepals are sub-cordate at the base and long-clawed the gland is at the very base but when they are acute at the base the gland is a little higher up on the blade.

glands. It is more slender and strict than all the species except *Z. acutus*, which is easily distinguished by its acute sepals and petals. *Z. venenosus* grows mostly on hillsides at low altitudes, scarcely ascending higher than 2000 m. It ranges from Idaho and British Columbia to California and Utah. The following Rocky Mountain specimens belong here:

UTAH: Parley's Peak, 1869, *S. Watson, 1163.*

IDAHO: Keeley's Hot Springs, 1892, *Isabel Mulford;* Big Potlash River, 1892, *Sandberg, MacDougal & Heller, 319;* Little Potlash River, *404.*

Zygadenus gramineus sp. nov.

Zygadenus venenosus Rydb. Cont. U. Dep. Ag. **3**: 525. 1896. Mem. N. Y. Bot. Gard. **1**: 93 in part. Not S. Wats.

A slender yellowish-green plant, 2–3.5 dm. high. Bulb elongated ovoid, 2–3 cm. long and 1–1.5 cm. in diameter: leaves narrowly linear, scabrous on the margins and the midrib, 1–2 dm. long, 3–5 mm. wide, conduplicate and somewhat falcate, all with distinct scarious sheaths surrounding the stem: racemes rather short: bracts scarious, lanceolate, long-acuminate: flowers light yellow: sepals broadly ovate, obtuse at the apex, acute at the base and very short-clawed: petals ovate, obtuse, subcordate at the base and with claws about 1 mm. long: glands almost semi-orbicular; upper margin toothed, but thin and not well defined: capsule elongated ovoid, 8–10 mm. long, 3–4 mm. in diameter.

Z. gramineus resembles somewhat the preceding, but is lower, of a yellowish color; its stem leaves are evidently sheathed, the sepals are short clawed, not subcordate at the base and the gland thin and without a distinctly thickened upper border. *Z. gramineus* grows on hillsides up to an altitude of 2500 m.; from Saskatchewan and Alberta, south to western Nebraska and Idaho.

MONTANA: Spanish Basin, 1897, *Rydberg & Bessey, 3848* (type); 1896, *Flodman, 343;* Helena, 1891, *F. D. Kelsey.*

IDAHO: Beaver Cañon, 1895, *Rydberg.*

SOUTH DAKOTA: Hot Springs, 1892, *Rydberg, 1051.*

WYOMING: Yellowstone Park, 1888, *Dr. Chas. H. Hall.*

SASKATCHEWAN: 1858, *E. Bourgeau.*

Zygadenus intermedius sp. nov.

Zygadenus venenosus Rydberg, Mem. N. Y. Bot. Gard. **1**: 93 in part. 1900. Not Nutt.

A rather stout light green plant, 3–6 dm. high. Bulb elongated ovoid, about 3 cm. long and 1.5 cm. in diameter: leaves scabrous on the midrib and margins, 2 dm. or more long, 5–9 mm. wide, keeled and sometimes conduplicate; all with conspicuous scarious sheaths at the base: raceme rather long: flowers light yellow; petal and sepals 6–8 mm. long, obtuse; the former broadly ovate, and acute or rounded at the base and short-clawed; the latter oblong subcordate at the base and with a claw 1 mm. long: glands as in the preceding.

Like the preceding but taller and stouter, in habit resembling mostly *Z. paniculatus*, except that the inflorescence is seldom branched. It is easily distinguished from that species by the obtuse petals and sepals and by the distinct claws and the subcordate bases of the petals. It grows on dry hillsides up to an altitude of 2000 m. in Montana, Idaho, Wyoming and Utah.

IDAHO: Nez Perces Co., 1892, *J. H. Sandberg, 10564* (type); Peter Creek, 1892, *Sandberg, MacDougal & Heller, 114;* Lewiston, 1896, *A. A. & E. Gertrude Heller, 3093.*

UTAH: Farmington, 1881, *M. E. Jones, 2091.*

WYOMING: Laramie Hills, 1894, *Aven Nelson, 254.*

MONTANA: Deer Lodge, 1895, *F. N. Notestein;* Bridger Mountains, 1897, *Rydberg & Bessey, 3849.*

Zygadenus acutus sp. nov.

A very slender light green plant, 3–5 dm. high. Bulb rounded ovate, 1.5–2 cm. long, 1–1.5 cm. in diameter: leaves narrowly linear, scabrous on the margin, about 2 dm. long and 4–5 mm. wide, keeled and often conduplicate: flowers pale yellow: petals and sepals 4–5 mm. long; both acute at the apex and at the base, very short-clawed: glands obovate or cuneate; upper margin toothed, thin and not well defined.

In habit closely resembling *Z. venenosus*, but easily distinguished by the acute, short-clawed petals and sepals, which are both cuneate at the base. The only specimens seen are the following:

SOUTH DAKOTA: Box Elder Creek, Black Hills, 1887, *W. S. Rusby.*

Zygadenus falcatus sp. nov.

Z. Nuttallii Porter & Coult. Syn. Fl. Colo. 133. In part. 1874. Not A. Gray.

A rather stout light green plant 3–4 dm. high. Bulbs rounded ovoid, 3–4 cm. long and about 3 cm. in diameter: leaves scabrous, especially on the margins and midribs, 1.5–2.5 dm. long, 5–8 mm. wide, keeled, conduplicate, and generally decidedly falcate, all with scarious sheaths: raceme short, in fruit elongated: flowers yellow: petals and sepals about 5 mm. long, acute; the former deltoid ovate, acute at the base; the latter ovate, sub-cordate at the base and with claws 1 mm. long: glands semi-orbicular, upper margin toothed, thin and not well defined: capsule ovoid cylindrical.

All the specimens cited below have been named *Z. Nuttallii* though the plant is more closely related to *Z. paniculatus*, from which it differs in the distinctly clawed petals which are subcordate at the base. These characters, together with the more distinct glands and the slightly adnate filaments, distinguish it from *Z. Nuttallii*. *Z. falcatus* inhabits the foothills of Colorado at an altitude of about 1500 m.

COLORADO: Fort Collins, 1893, *C. S. Crandall* (type); 1896. *C. F. Baker*; Denver, 1873, *J. M. Coulter.*

ZYGADENUS PANICULATUS (Nutt.) Wats. Bot. King's Exp. **5**: 343, 1871

Helonias paniculata Nutt. Journ. Phila. Acad. **7**: 57. 1834.

It is well characterized by Watson and easily distinguished by its stout habit, generally branched inflorescence, and rhombic-ovate acute and almost clawless petals and sepals. It grows on hills up to an altitude of 1500 m., ranging from Montana and Washington to New Mexico and California. The following Rocky Mountain specimens belong here:

UTAH: Ogden, *Capt. Stansbury*; City Creek Cañon, 1880, *M. E. Jones, 1674.*

IDAHO: Boise, 1892, *Isabel Mulford.*

MONTANA: Grasshopper Valley, 1880, *Watson* (?).

ZYGADENUS NUTTALLII A. Gray, in Wats. Proc. Am. Acad. **14**: 279. 1879

Amianthium Nuttallii Gray, Ann. Lyc. N. Y. **4**: 123.

This is evidently a species belonging to the plains. All the specimens in the Columbia and N. Y. Botanical Garden herbaria are from Arkansas and Kansas. Dr. Watson included Texas and

Colorado in the range. The Texan plant referred here by him, belongs to an altogether different plant. I think that Colorado also should be excluded, believing that all specimens found there and labeled *Z. Nuttallii* belong to *Z. falcatus*, which resembles it most in general habit, but has an altogether different flower.

Another Note on Buxbaumia

R. S. WILLIAMS

Since writing the note "Buxbaumia in the United States," which appeared in the July, 1900, number of the *Journal of the N. Y. Bot. Garden*, I have received a specimen of *B. aphylla* from Dr. G. N. Best, collected in the State of Washington, by Professor Piper. It is in every way like the eastern *aphylla*, so that the species ranges from one side of the continent to the other, just as *B. indusiata* does. The remaining species, *B. Piperi*, is still unknown from any region east of the Rocky Mountains, I believe. As stated in the note above referred to, this last is entirely distinct from *B. indusiata* in having one-celled immersed stomata, not two-celled and superficial. All the specimens of these three species that I have ever collected were either growing on decayed logs or on fragments of such logs more or less mixed with earth, but Professor Piper states that he has collected specimens on the sides of comparatively recent railway cuts, growing on earth with apparently no sign of decayed wood mixed in.

N. Y. BOTANICAL GARDEN.

A Correction

The name *arenicola* having already been used in the genus *Allium*, I therefore substitute the name *Allium sabulicola* for the species published as *Allium arenicola*, in the Bulletin of the Torrey Botanical Club for September, 1900 (**27**: 506).

GEORGE E. OSTERHOUT

Dr. Torrey as a Botanist*

BY NATHANIEL LORD BRITTON

The botanical work of John Torrey is a grand contribution to science, and among the most permanent of that of all students of the North American flora. Born in New York, Aug. 15, 1796, he was early associated with Major LeConte, who later contributed largely to the literature of the biological sciences, with Dr. David Hosack, who, during Torrey's youth, was engaged in the development of the Elgin Botanical Garden, where Torrey studied under the direction of that eminent physician and naturalist, and he early came into relations with Professor Amos Eaton, the most prominent American botanist of that time. Hosack used to refer to him as "the young man with an old head" and this title was taken up by his class in the College of Physicians and Surgeons, he being called the "old head" of the class.

During his youth he collected and observed plants of the vicinity of New York with great assiduity, and on May 5, 1817, he was appointed by the Lyceum of Natural History, then recently founded, and of which he was one of the original members, in conjunction with Dr. C. W. Eddy and Mr. D'Jurco V. Knevala, as a committee, to prepare a catalogue of the plants growing in the neighborhood of the city. The celebrated Dr. Samuel L. Mitchell was at that time president of the Lyceum. Torrey must have been even then familiar with the flora, for the note book used by him, and on which the catalogue is apparently based, is preserved as one of the most cherished records of his early studies, and the work was presented to the Lyceum for publication, December 22d of the same year. It was actually published at Albany, in 1819, the advertisement bearing date of February 16th, the year following his obtaining his degree of Doctor of Medicine. His botanical studies, therefore, were prosecuted extensively during his medical course of study. He soon became well and

* This article and the two following formed a part of the exercises of TORREY DAY, celebrated at the New York Botanical Garden, June 27, 1900, in connection with the Botanical Section of the American Association for the Advancement of Science.

favorably known as a botanist; in 1822, in the preface to the third edition of his "Manual of Botany" Professor Eaton says: "Dr. Torrey, of New York, suggested the most valuable corrections and improvements to be found in this edition. And I believe I may encourage the reader with the hope that the extensive collection of materials in his possession will, very soon, appear before the public in the form of an enlarged system of the botany of the northern States. Such an extended view of the subject would be an invaluable treasure to all lecturers, private teachers, and to all others who are disposed to enter deeply into the study." These statements, it may be remarked, are not alone appreciative of Torrey's work, but indicate considerable generosity on the part of Eaton. In the second edition of "Florula Bostonensis," 1824, Dr. Bigelow refers to Torrey's work as follows: "To students of the present volume who may wish to extend the sphere of their inquiries I have great pleasure in recommending the flora of the middle and northern section of the United states, by Dr. Torrey, of New York, now in the course of publication. The accuracy and constancy of pursuit manifested by this gentleman entitle him to all praise from those who appreciate the amount of perseverance necessary to accomplish labors of this sort."

The work thus heralded by Eaton and Bigelow was published during the year 1824 under the title "A Flora of the Northern and Middle States, or Systematic Arrangement and Description of all the plants heretofore discovered north of Virginia." Dr. George Thurber, on the occasion of his election as President of the Torrey Botanical Club, April 29, 1873, in an inaugural address, in which he presented an account of Torrey's life and work, records that the last pages of this Flora were written on the morning of Torrey's wedding day.

Further appreciation of his early work is shown in the writings of other contemporary botanists. In the second volume of the "Sketch of the Botany of South Carolina and Georgia," 1814, Dr. Stephen Elliott says, that to Dr. John Torrey, of New York, he is indebted for many of the plants of New Jersey and New York, for an opportunity of comparing many doubtful species, and of ascertaining many of the plants of Pursh, which were to him uncertain or obscure. Dr. William Darlington in "Florula

Cestrica," 1826, remarks, "After this catalogue went to press I had the good fortune to commence an occasional correspondence with that distinguished naturalist, Professor Torrey, of West Point, which correspondence has, to me, been a source of instruction and pleasure—alloyed only by a regret that I had not earlier enjoyed that advantage. For the information, and specimens, received from him, I beg leave here to offer my sincere and grateful acknowledgements."

Interest centered about this time among botanists on the availability for practical purposes of teaching and the arrangement of floras, of the "Natural System" of Jussieu, as elaborated and modified by Lamarck, DeCandolle, Lindley, and other European authors. Eaton, had, already in the earlier editions of his Manual, referred to this topic, but did not adopt the innovation. The first American edition of Lindley's "Introduction to the Natural System of Botany," was edited by Torrey and published in New York in 1831, and to it he appended a "Catalogue of North American Genera of Plants arranged according to the Orders of Lindley's Introduction to the Natural System of Botany, with the number of species belonging to each genus so far as they are at present determined." Torrey thus gave to American students the first comprehensive view of the system as applied to their own plants, and, like most other suggestions for a radical change of method, it was received with some consternation. Eaton says of this book, in the sixth edition of his Manual, 1833, "Since Dr. Faustus first exhibited his printed bibles in the year 1463, no book has, probably, excited such consternation and dismay as Dr. Torrey's edition of Lindley's Introduction to the Natural System of Botany. And to make the horrors of students, as well as of ordinary teachers, still more appalling, Dr. Torrey's Catalogue of American Plants at the end of his Lindley, was so singularly presented that it would seem to indicate an awful catastrophe to all previous learning." And Eaton never did accept it in his books, though he discussed it at great length at this point and subsequently; neither did Bigelow. It was accepted, however, with minor modifications by Dr. Lewis C. Beck in his "Botany of the Northern Middle States," published at Albany in 1833, and later by Darlington. Torrey and Beck were, therefore, the American leaders in this forward step, and there can be no doubt that if their lives could have been extended into the period of the next overturn of taxonomy by the development of the revolutionary line of thought, that they would have promptly accepted the Eichler and Engler systems of to-day. Naturally, all Torrey's subsequent writings were based on this so-called Natural System.

Dr. Torrey early became especially interested in the Cyperaceae, and accumulated collections of sedges very extensive for the time. His studies were presented to the Lyceum of Natural History in 1836, and published during the same year in the Annals under the title "Monograph of North American Cyperaceae." He did not publish much additional on the family, however, though he kept a copy of the paper posted up, which has been of much service to subsequent students. In fact the great mass of miscellaneous specimens which now began to pour in on him from all over the country, and especially the determination and description of much of the material obtained by the numerous government exploring expeditions, the preparation of the Flora of the State of New York, and of the Flora of North America, the latter in conjunction with Dr. Asa Gray, who made the acquaintance of Torrey while serving as Curator of the Lyceum as early as 1831, left him no time for the monographing of groups. In fact his only other considerable treatment of a large group is the "Revision of the Eriogoneae," jointly with Dr. Gray, published in 1870.

He was appointed Botanist of the Geological Survey of New York, at its organization in 1836. In the prosecution of his duties in this capacity he was aided by all the botanists resident at that time within the State, in bringing together the voluminous material which was published in 1843 as "A Flora of the State of New York," in two large quarto volumes, illustrated by 161 plates, a work which stands to-day as the most noteworthy, elegant and complete presentation of a local flora of any produced in the United States. It is recorded that he had to purchase a copy of this work in order to secure one, such restrictions having been made by those in charge of its publication. A roll of proof sheets was found subsequently, however, and given by Dr. Torrey to Dr. Thurber, who in 1873 said of them, "handsomely bound, it is one of the prized works in my library, and is unique as being the only copy in existence 'presented by the author.'" This copy is now the property of Professor Byron D. Halsted, and through his courtesy we are able to exhibit it to you to-day.

During the progress of this great work on the flora of New York, the Torrey and Gray "Flora of North America" was also in preparation. Dr. Gray says of this "Early in his career Dr. Torrey had resolved to undertake a general Flora of North America, or at least of the United States arranged upon the natural system, and had asked Mr. Nuttall to join him, who, however, did not consent * * * It was in the year 1836 or 1837 that he invited the writer of this notice—then pursuing botanical studies under his auspices and direction—to become his associate in the Flora of North America." The first part of the first volume was published in July, 1838, the second in October, 1838, the remainder of the first volume in 1840; the first part of the second volume in 1841, the second in the spring of 1842, and the third, the last of February, 1843. Dr. Gray further remarks "from that time to the present, the scientific exploration of the vast interior of the continent has been actively carried on, and in consequence new plants have poured in year by year in such numbers as to overtask the powers of the few working botanists of the country, nearly all of them weighted with professional engagements. The most they could do has been to put collections into order in special reports, revise here and there a family or a genus monographically, and incorporate new materials into older parts of the fabric, or rough hew them for portions of the edifice yet to be constructed. In all this Dr. Torrey took a prominent part down almost to the last days of his life."

Remarking on the suspension of publication of this great desideratum Dr. Thurber says: "Its authors pursued the best course; instead of giving their time to the completion of the flora and allowing the new materials to pass—as they inevitably would have done—into the hands of European botanists, they turned their attention to studying and recording them. Now these discoveries of American plants are mainly recorded by American botanists in American publications, and to secure this result it was well that the *Flora* was suspended." With the further prosecution of the plan of Torrey, subsequent to his death, by Dr. Gray and his assistants and successors at Harvard University we are all familiar; the first part of "Synoptical Flora of North America" appeared in 1878, and during twenty-two years a small part of the field has been covered. The work is one of stupendous magnitude, and the amount of new material yet being collected in nearly all parts of the country still pours in, placing the present endeavor in much the same difficult position as the one faced by Torrey and Gray in 1843. The extensive studies of the lower plants have brought a new element into the problem, and our territorial extension another one, while still another is apparent in the critical studies of American botanists on the flora of the continent south of the Rio Grande, this latter making it almost necessary that the descriptive botany of Central America should be written by American botanists. The systematic North American Botany of the future, may then readily be foreseen to cover the continent in its broadest definition, not excluding the West Indies. How this may be accomplished in a reasonable space of time, is a problem to which the attention of all North American botanists may advantageously be given.

During the two decades subsequent to 1843, Dr. Torrey's studies were mostly concentrated upon the determination and recording of the botanical results of the numerous expeditions sent out to the far West by the United States government, and in this work he was associated with Dr. Gray, Dr. Newberry and others. He worked up the collections of Nicollet, Frémont, Emory, Stansbury, Marcy, Sitgreaves, Pope, Beckwith, Gunnison, Whipple, Williamson, Parke, and Ives, as well as the enormous collections made by Parry, Wright, Bigelow, and Schott on the survey of the United States and Mexican Boundary.

Shortly after the publication of the Botany of the Mexican Boundary in 1859, Dr. Torrey transferred his herbarium and botanical library to Columbia College, and for the next ten years he was chiefly occupied in herbarium work. A large part of the herbarium was mounted by himself, and his constant observations are recorded in the great number of sketches of floral dissections with which it is enriched; in fact most of his critical studies on plant morphology are thus recorded by his pencil. He was in this work accurate and painstaking to an astonishing degree; the identification of the specimens actually examined by him leaves nothing to be desired. His last published works are the "Revision of the Eriogoneae," jointly with Dr. Gray, and "Phanerogamia of Pacific North America" issued in 1874, subsequent to his death, which occurred on March 10, 1873.

Dr. Torrey's botanical correspondence was very voluminous, and much of it is preserved both at Columbia and at Harvard. He was in correspondence with practically all the prominent taxonomists of his time. He was little given to argument, criticism or discussion, and, while difficult to divert from a course once determined upon, there is little left to show that he was acrimonious or unpleasant to any of his contem poraries. Even with the original and discursive Constantine Schmalz Rafinesque, whose letters to Torrey extend from 1819 to 1840, friendly and peaceful relations were evidently maintained. An extract from one of Rafinesque's letters written at Philadelphia in 1838 is of interest in this connection:

"My good friend. Your letter of 25th Jan'y was delivered by Dr. Gray quite lately with the 3 small pamphlets. I now send you some pamphlets of mine also, in which you will see that I have been engaged in various labors for a year past and it is a wonder that I could attend to Botany all the while as an amusement and relaxation, if you knew all what I had to attend to last year, in order to bring forth at last my great labors and prepare the means for future activity in the midst of pecuniary difficulties and disappointments. But with zeal and patience I overcame all at last and I have long ago concluded 600 pages of my supplemental Flora and Flora Telluriana or 6 parts. If I had not undertaken these two works together, the first would have been completed ere now, but will be ere 1840. As it is quite a mantissa and you do not admit my improvements, we shall not clash in the least. But between 10 and 20 years hence you will admit of all my discoveries and new genera as you now begin to do for those of 1808 to 1825. * * * I have published so many works that I dont know which you lack yet. I send most of them and a list to the Lyceum for the series of their Annals brought me by Dr. Gray. We had some botanical conversation together and I find he calls himself a lumper, like you, belonging to the putting off school of knowledge, although his writings are expansive and dive into the invisible anatomy of plants. It is that putting off school that is now impeding the Exploring Expedition, as it is impeding the rapid progress of knowledge in all the sciences but times bring on the due changes and improvements in spite of all delays. As usual your old friend,'&c. C. S. RAFINESQUE.

Such, in brief was the botanical lifework of the man whose memory we meet to honor. When we consider that his profession was medicine, and his livelihood chemistry, he having lectured on that science at West Point, New York and Princeton during the period of his greatest botanical activity, as well as occupying the post of United States assayer in New York, we can but wonder that he could have accomplished so much.

His life and works have been the principal inspiration which has enabled his associates and successors to uphold the cause of botany in New York, and to that inspiration may be referred the long and honorable record of the Club which bears his name, and through it, by the coöperation of civic and private philanthropy, the development of the institution where we meet to-day.

A bibliography of the writings of Dr. John Torrey is hereto appended.

A Catalogue of Plants growing spontaneously within thirty Miles of the City of New York. 8vo, pp. viii, 100. With a supplementary page by Amos Eaton. Prepared by John Torrey, C. W. Eddy, and D'Jurco V. Knevala a committee of the Lyceum of Natural History of New York. Albany, 1819.

Notice of the Plants collected by Prof. D. B. Douglas during the Summer of 1820 around the Great Lakes and the Upper Waters of the Mississippi. Am. Journ. Sci. **4**: 56–69. 1822.

Description and Analysis of a new Ore of Zinc. Am. Journ. Sci. **5**: 235–238. 1822.

Description of a new Species of *Usnea* (*U. Acharises*) from New South Shetland. Am. Journ. Sci. **6**: 104–106. 1823.

Description of some new or rare Plants from the Rocky Mountains, collected by Dr. Edwin P. James. Ann. Lyc. N. Y. **1**: 30–36. 1824.

Notice of a Locality of Yenite in the United States. Ann. Lyc. N. Y. **1**: 51. 1824.

An Account of the Columbite of Haddam (Connecticut) with Notices of several other North American Minerals. Ann. Lyc. N. Y. **1**: 89–93. 1824.

Flora of the Northern and Middle Sections of the United States, or Systematic Arrangement and Description of all the Plants heretofore discovered north of Virginia. Vol. 1, pp. xii, 297–518. New York, 1824.

Descriptions of some new Grasses. Ann. Lyc. N. Y. **1**: 148–156. 1824.

Monograph of the North American Species of Carex (with L. D. de Schweinitz). Ann. Lyc. N. Y. **1**: Part II. 1825.

Compendium of the Flora of the Northern and Middle States, containing Descriptions of all of the Plants exclusive of the Cryptogamia north of the Potomac. 8vo, pp. 403. New York, 1826.

Some Account of a Collection of Plants made during a Journey to and from the Rocky Mountains in the Summer of 1820 by Edwin P. James, M.D., Assistant Surgeon, U. S. Army. Ann. Lyc. N. Y. **2**: 161–254. 1827. Also reprint "Account of a Collection," etc., New York, 1827.

An Introduction to the Natural System of Botany. By John Lindley. First American Edition with an Appendix, by John Torrey. 8vo, pp. 393. New York, 1831.

Catalogue of North American Genera of Plants. (From the first American Edition of Lindley's "Introduction to the Natural System of Botany.") 8vo, pp. 22. New York, 1831.

Monograph of the North American Cyperaceae. Ann. Lyc. N. Y. **3**: 239–244. 1836.

Notes on some American Minerals. Ann. Lyc. N. Y. **3**: 9–86. 1836.

Flora of North America, containing Descriptions of all Plants north of Mexico (with Asa Gray). 8vo, Vol. 1: pp. 711. 1838–1840. Vol. 2: pp. 504. 1841–1843.

Experiment on the Condensation of Carbonic, Sulphurous and Chrochromic Acid Gases. Am. Journ. Sci. **35**: 374, 375. 1839.

Notice of a Flora of North America. Am. Jour. Sci. **41**: 275–283. 1841.

Catalogue of Plants in U. S. War Department Topographical Engineering Bureau : Report to illustrate a Map of the Hydrographical Basin, 143–165. Washington, 1843.

Flora of the State of New York, containing Descriptions of all Plants discovered in the State with their economical and medicinal Properties. 2 volumes, 4to. Albany, 1843.

Botany of Nicollet's Report.

Catalogue of Plants collected by Lieut. Frémont in his Expedition to the Rocky Mountains (in the year 1842). Senate Document, 174, pp. 83–98. Washington, 1845.

Descriptions of some new Genera and Species of Plants collected in Capt. J. C. Frémont's Exploring Expedition to Oregon and North California in the Years 1843–44 (with J. C. Fremont). In Rep. of Exp., pp. 311–319. *4 pl.* Washington, 1845.

Botany of the Emory Expedition. In Rep. of Exp., App. 2: 135–156. *pl. 1–12.* Also List of Plants collected by Lieut. Abert, App. 6: 406–414. Washington, 1848.

Discovery of the Vauquelinite, a rare Ore of Chromium in the United States. Ann. Lyc. N. Y. **4**: 76–79. 1848.

An Account of several new Genera and Species of North American Plants. Ann. Lyc. N. Y. **4**: 80–96. 1848.

Catalogue of Plants of the State of New York, of which Specimens are preserved in the Cabinet at Albany. 2d Rep. Reg. Univ. N. Y. 41–64. Albany, 1849.

On some new Plants discovered by Col. Frémont in California. Proc. Amer. Assoc. Adv. Sci. 1850: 190–193.

On the Structure and Affinities of the *Genus Batis* Linn. Proc. Amer. Assoc. Adv. Sci. 1850: 405, 406.

Observations on the *Batis maritima* Linn. Smithson. Contr. **6**: 1854.

On the *Darlingtonia Californica*, a new Species of Pitcher Plant from Northern California. Smithson. Contr. **6**: 1854.

Plantae Fremontianae, or Descriptions of Plants collected by Col. J. C. Frémont in California. Smithson. Contr. **6**: 1–24. *pl. 1–10.* 1854.

Catalogue and Description of Plants collected on Stansbury's Expedition to the Great Salt Lake. Expl. Surv. Valley of the Great Salt Lake of Utah, by Howard Stansbury, 383–397. Philadelphia, 1852.

Botany of the Sitgreaves' Expedition down the Zuni and Colorado Rivers. In Rep. of Exp., pp. 155–178. *20 pl.* Washton, 1854.

Report on the Botany of the Pope Expedition from the Red River to the Rio Grande, Pac. R. R. Rep. (with A. Gray) **2**: part 2: 159–185. *10 pl.* Washington, 1854.

Description of the plants collected during the Marcy Expedition to the Red River of Louisiana. In Rep. of Exp. 267–289. *20 pl.* Washington, 1854. Senate Executive Document, 33d Congress. Two editions of this were issued.

Botanical Report upon the collections made by Capt. Gunnison, and Lieut. E. G. Beckwith, 1853–1854 (with A. Gray). Pac. R. R. Rep. **2**: 119–132. Washington, 1855.

Sur la Distribution Géographique des Sarraceniacées. Belg. Hort. **6**: 146, 147. 1855.

Whipple Expedition near the 35th Parallel. Descriptions of the general Botanical Collections. Pac. R. R. Rep. **6**: 61–182; *25 pl.* Washington, 1857. [1856 on title page.]

Botany of the Parke Expedition in 1854–1855. List and descriptions of the plants collected by John Torrey. Pac. R. R. Rep. **7**: 9–28. *8 plates.* Washington, 1856. (Synoptical tables of botanical localities, by Thomas Antisell.)

Botany of the Williamson Expedition. Description of the Plants collected along the Route by W. P. Blake, and at the Mouth of the Gila. Pac. R. R. Rep. **5**: 359–370. *10 pl.* Washington, 1856.

Williamson Expedition. Route from Sacramento Valley to the Columbia River in 1854–55. General Catalogue of the Plants collected on the Expedition. I.: Exogenous Plants, by Asa Gray, John Torrey and J. S. Newberry. II.: Endogenous Plants by John Torrey. Pac. R. R. Rep. 6: 65–93. *pl. 11–16.* Washington, 1857.

Botany of the Mexican Boundary. Rep. U. S. and Mex. Bound. Surv. **2**[1]: 27–270; *61 pl.* 1859.

Notice of the California Nutmeg. Journ. Pharm. **3**: 49–51. New York, 1864.

Catalogue of Plants collected during the Exploration of the Colorado River of the West, by Lieut. J. C. Ives, in 1851–58 by

Messrs. Gray, Torrey, Thurber and Engelmann. Report of Exp., Part IV., pp. 30. Washington, 1860.

On *Ammobroma*, a new Genus of Plants allied to *Corallophyllum* and *Pholisma*. Ann. Lyc. N. Y. **8**: 51–56. 1867.

A Revision of the Eriogoneae (with A. Gray). Proc. Amer. Acad. **8**: 145–200. 1873.

Phanerogamia of Pacific North America. Report U. S. Expl. Exp. **17**: 210–514. Philadelphia, 1874.

The Work of the Torrey Botanical Club

By Edward S. Burgess

The final organization of the Torrey Botanical Club under its present name, was on April 29, 1873, the evening of the inaugural address of the second president, Dr. George Thurber. The club had received a previous charter on April 21, 1871. But its first published list of officers and members dates from the previous year, 1870, with which year the publication of its monthly Bulletin commenced. A previous special organization in 1867 proves to have been a re-organization or concentration, knitting together more firmly the members who were meeting as a club, said Mr. Leggett, "at a date not later than 1865," and who were gathering with some regularity for field work, on the local flora, from a time as early as the year 1858, when Dr. Allen, discovering a locality for *Clematis ochroleuca*, brought his prize to Dr. Torrey. From that time on, says Dr. Allen, an informal band of collectors continued to meet for excursions, and formed the nucleus of the club. This nucleus included Dr. Torrey, Dr. T. F. Allen, Mr. W. H. Leggett, Mr. F. J. Bumstead, Mr. James Hogg and brother, Dr. Hyatt and the young D. C. Eaton, afterward professor of botany at Yale. Accepting this latter date of 1858, the club is now 42 years old. Even with this estimate, the club still resembles the lady of the census-taker's story, for the club is still understating its age: said President Thurber, "We have no record of the beginning of the club, its growth was so gradual." The few botanists of the city gathered and visited at the rooms of the Columbia College Herbarium, drawn there by the genial welcome and wide botanical knowledge of its presiding spirit, Dr. Torrey. Visiting botanists naturally sought these rooms. After many meetings by chance, finally came the suggestion to meet by appointment. That suggestion was thought, says President Thurber, to have come from one who was the club's first Vice-President, and whom we enjoy as our senior Vice-President still, the well-known specialist in the Characeae, Dr. Timothy F. Allen.

But behind this date of 1858 there remains the more casual and informal continuance of friendly botanical association on this island during still earlier years. Botanists have ever been friends, and collecting in company has been one of the pleasant features of their pursuit. Little remains on record, however, regarding early coöperation among botanical workers in New York. Miss Jane Colden (afterward Mrs. Dr. Farquhar), who left a long list of the native plants of the Hudson River region at her death in 1754, had studied with her father, Lt. Gov. Cadwallader Colden, and the father and daughter formed a working partnership in botany, a botanical club of two, which produced the first genuine botanical writing in New York. The next botanist to write of New York, Major John LeConte, publishing his list of the plants on Manhattan Island in 1811, had also pursued his collections in company. One of Dr. Torrey's first recollections is said to have been the sight of two lads coming into the city dusty with tramping and laden with plant-collections. One of these he was told was "the LeConte boy." Soon afterward the Elgin Botanical Garden grew up here under the fostering care of Dr. Hosack; and had it continued it is probable that a botanical club would have developed then. As it was, the Lyceum supplied both meeting-place and a medium of publication for scientific workers, and no botanical club as such developed, though botanical workers still worked in pairs; as witness Torrey himself with Gray in the Torrey and Gray Flora, 1838–43, and, to descend to less important work, the Flora of Central Park, which was also the joint product in 1857 of two workers, Rawolle and Pilat, the latter an Austrian botanist who had become the first Chief-Gardener of Central Park.

The spirit of fraternity and good-fellowship which during the earlier years of Dr. Torrey's life had led to frequent but informal meetings of fellow-workers, and had given them a certain regularity in 1858, reached crystallization in what was termed the Torrey semi-centennial celebration of Dec. 20, 1867, at the expiration of fifty years since Torrey's presentation of his Catalogue of the Plants within 30 miles of New York, to the New York Lyceum (published in Albany 1819, but completed and presented in 1817). This night, which was one of deep snow and typical December storm, was to the select company within, with Dr. Torrey himself as guest of honor, one of the warmest and cheeriest of celebrations, and was one of the brightest spots in the memories of the early members of the Torrey Club. As already stated, the club at first did not know itself by that name, but appears in print simply as "The Club," 1870, and received its first charter 1871 as the New York Botanical Club, amended next year to its present name, The Torrey Botanical Club. But that it had been for years the intent to call the club by Dr. Torrey's name appears from Mr. Leggett's so entitling the Bulletin when first publishing it in January, 1870.

Dr. Torrey was the first president, then unostentatiously termed chairman, and P. V. LeRoy, his herbarium curator, was the first secretary. In 1870, when the first list was published in the Bulletin, there were 30 members; including one who had just died, Mr. W. W. Denslow, then the chief authority on the flora of the northern part of the island, but whose knowledge was unfortunately not preserved by any printed memoranda.

The Club meetings were then as for many years held in the Columbia College Herbarium on 49th street; they early averaged as many as 17 members present, often also with three or four visitors. The exhibition and discussion of new or unusual species of plants formed a principal part of the decidedly social and cheerful meetings; another feature then prominent was the exhibition of new books; for instance on the evening of February 27, 1872, there were shown among new accessions to the Herbarium Library (together with works by Grisebach, Osten Sacken, Reichard, etc.), the newly received Flora of the Galapagos Islands, by Sir J. D. Hooker, and his Sketches of the Flora of Pennsylvania by our honored fellow member Prof. T. C. Porter.

It was just as the organization of the Club was being perfected that Dr. Torrey passed away. On Jan. 7, 1873, the permanent charter was read and adopted, and on the second meeting for that month, Jan. 29, 1873, Dr. Torrey presided for the last time. He was taken with pleurisy the next day, and though rallying, was not well enough to attend another meeting. To the meeting of February 25th he sent a cheerful note stating his interest, and that he had not in nearly fifty years had a sickness of more than a few days. It was on this evening that he sent to the Club the picture of the Herbarium showing Dr. Torrey sitting at his work, painted by his niece Mrs. Daniell. His death occurred March 10th following, and his funeral at the West Presbyterian Church on 42d street, March 13th, was attended by the members of the Club in a body, each wearing a sprig of "Torreya," among the bearers being Professor Asa Gray, Professor Joseph Henry, and President Barnard of Columbia.

Professor Torrey was succeeded in charge of the Club by Dr. Geo. Thurber, who remained president seven years. The succeeding presidents have been Professor Newberry, ten years, and Judge Addison Brown, also ten years.

The Recording Secretaries have included F. V. LeRoy, 1870+, Dr. Arthur Hollick, also of Columbia University, 1883–1888, Miss Maria O. Steele, 1889+, followed by Dr. H. H. Rusby, of the College of Pharmacy, and by E. S. Burgess, of the Normal College in 1897.

The membership has greatly increased in recent years. The total number of persons who had been recorded as active members at any time was in 1887, 184. The current active membership January, 1885, was 76, rising next January to 89, in 1887 to 106, in 1888 to 114, in 1896 to 191, in January, 1900, to 237; the total present membership, June, 1900, including corresponding members, being 385. Even the active members are scattered widely—one has just gone to Manila, and one is on the Nile.

During these 42 years of its history, the Torrey Botanical Club has formed a continuous nucleus for botanical workers and lovers of plants. It has been a constant stimulus to botanical work in the city and neighborhood. At its meetings the attrition of mind on mind has helped to sharpen botanical interest. One of the most important parts of its work has been its maintenance of field excursions on Saturdays throughout the warmer parts of the year, with the successful introduction last year of such excursions during the winter for collection and study of algae, bryophytes, etc.

In the very earliest days of the Club, as early as 1858, these field excursions, zealously maintained by Messrs. Allen, Bumstead, Eaton, and Leggett, resulted in very thorough exploration of the outlying swamps and hills, as well as very many nearer localities now occupied by city streets. Excursions now reach out through Westchester County, through Long Island and Staten Island, over northern New Jersey, across into the Pocono plateau of Pennsylvania, and southward into the Jersey Pines. Lists of plants noted during these field days are held in the Club minutes for use toward a permanent catalogue. Among the genera which have received recent additions or corrections as the result of these field days are *Ophioglossum*, *Dryopteris*, *Sisyrinchium* and *Picea*. For some years a joint excursion with Philadelphia botanists has been an annual feature. The pleasurable incidents of recent three-day excursions to the Pocono, the Delaware River, and the Tom's River and Forked River regions will not soon be forgotten by their participants. And to the great effect of these field days in promoting good fellowship among lovers of nature, and stimulating that love of nature to fresh activities, it would be impossible to do justice.

One of the most valued results from the labors of the Torrey Club has been the work of individual members on the local flora. Early local catalogues prepared by members, later than the catalogue by Torrey in 1817, were those on Staten Island by Drs. N. L. Britton and Arthur Hollick, on Stissing Mountain by Lyman O. Hoysradt, on Westchester Co. by O. R. Willis, on Manhattan Island by O. W. Morris, on Central Park by Prof. E. A. Day (the latter two in manuscript) and, in recent months, on Long Island by Dr. S. E. Jelliffe, extending the earlier partial catalogues of E. R. Miller, Henri W. Young and others. Most valuable work contributory to the New York local flora was done by Mr. W. H. Leggett, C. F. Austin, Dr. T. F. Allen and Mr. H. Schrenk in earlier years, and in recent periods by Rev. Mr. Lighthipe, Mrs. Britton, Miss Sanial, Mr. E. P. Bicknell, and especially by Dr. Britton, who is still the head of the club's Committee on the Local Flora.

The "Preliminary Catalogue of Anthophyta and Pteridophyta growing within 100 miles of New York," was the result of the labors of Dr. Britton with Mr. E. E. Sterns and Mr. Julius Poggenburg. A full and definite catalogue with ecological and quantitative features as well as accurate localities, is an end toward which the club is working. Before advancing to this end much work has been done on general nomenclature of North American plants, by N. L. Britton and others, resulting in the present revised catalogue of names of North American plants.

Another feature of the botanical work accomplished through the Torrey Club has been that of monographs on special genera; among which that of *Lechea* early attracted the attention of Mr. W. H. Leggett, who published his first appeal for material in December, 1871, and who was still accumulating great masses of it in 1876, when it was my own privilege to see him and look over the specimens piled upon his library table, and receive from him my first introduction to the Torrey Club. Mr. Leggett's partial publication on *Lechea* was later taken up and revised as is well known, by Dr. Britton.

Another of the earliest members to begin monographic work was C. F. Austin, who began publishing "New Hepaticae" in the Bulletin in 1872, but had already been collecting for many years.

The previous year Dr. T. F. Allen had first published in the Bulletin a call for material on Characeae, March, 1871, and his thirty years' devotion to that order is, as all know, unabated and his primacy undisputed.

Monographic work has since continued to be a leading feature of the activities of the club. It was Dr. Torrey's practice to suggest such work to different members from time to time. It was at Dr. Torrey's suggestion that the studies on Characeae and *Lechea* were undertaken by Dr. Allen and Mr. Leggett; and many similar studies have since been taken up at the suggestion of Dr. Britton. I can but allude in a word to the monographic work since done by Dr. Britton on the Cyperaceae, etc., by Mrs. Britton and Dr. Grout on the Musci, by Dr. M. A. Howe on the Hepaticae, by Miss Anna M. Vail on Asclepiads, by Mr. E. P. Bicknell on *Sisyrinchium*, *Scrophularia*, *Agrimonia*, etc., by Drs. Rydberg on *Potentilla*, Small on *Oxalis*, etc., and Burgess on *Aster*.

Last but perhaps greatest of all the agencies in the work of the Club have been its regular publications, its *Memoirs* now in their tenth volume, commencing 1889, mostly by workers still active in the Club; and its monthly *Bulletin*, once the only botanical journal of our country, begun as a four-page sheet in January, 1870, now reaching about 60 pages monthly; then priced at one dollar a year, and now only at two; long under the editorship of W. H. Leggett, later of W. R. Gerard, afterward of Dr. and Mrs. Britton, and now of Dr. Underwood and reaching out in its influence far over the United States and Europe.

There are other forms of work and many other names of workers who should be given special mention, did time permit. But it certainly would not be fair to the Club to fail to refer to the great work done by its members in publications outside of its own series; as by Dr. Newberry and Dr. Hollick on paleobotany, by Dr. Britton and President Brown in their new "Illustrated Flora" by Dr. Underwood in his works on ferns, hepatics and fungi. And it was from the councils of the Torrey Club that the society of the New York Botanical Garden took its rise.

Reminiscences of John Torrey

By Dr. James Hyatt*

I send a few rather trivial jottings relating to early times in the Torrey Club. To recall my earliest residence in New York city turns my mind back over sixty years ; and now early in my eighty-fourth year, I am reminded of the growing infirmities of life.

It was at Albany, in 1856, that I became a member of the American Association for the Advancement of Science, listening to Agassiz, James Hall, and others, and to Dawson, LeConte, and others, at Montreal in 1857. In my sixteenth year I became interested in plant-studies. Several years previous to 1856 I had seen Dr. Torrey for the first time at his chemical lecture in the College of Physicians and Surgeons in upper Crosby St., and was delighted with his illustrations of osmosis. Not long after I fell into the way of seeing Dr. Torrey rather frequently in the Herbarium of Columbia, at 49th St., bringing him there an *Usnea*, a *Diplopappus*, a *Luzula*, and other plants, to name. At one of my informal calls Mr. Austin was starting out equipped, in February, to collect mosses in North Jersey and Rockland for Sullivant. Before long I began at stated times to meet with Mr. Leggett, the Hoggs, and others, at the Herbarium. Afterward the project was started for incorporation at Albany, a constitution was drawn up, the name Torrey Club selected and the whole submitted to Dr. Torrey. Modestly he struck out Torrey from the title, but the name was afterward reinserted. There were regular club meetings, interesting discussions, the scrutiny of specimens, etc., and as a finish Dr. Torrey furnished, each time, a nice lunch of biscuits and cakes, and a cup of the most exquisite coffee ever tasted. Occasionally a visiting botanist would be present ; sometimes Dr. Gray, or Mr. Redfield from Philadelphia ; and once Professor Boeck of Christiania, who brought us pressed specimens from the Norwegian mountains. Through the Hogg brothers we secured Japanese

* Dr. James Hyatt, of Honeymeadbrook, Bangall, Dutchess Co., N. Y., who, as one of the earliest members of the Torrey Club, was asked to furnish his recollections of Dr. Torrey and the Club.

specimens, especially dwarf maples. *Darlingtonia* was shown from California and the southern species of *Sarracenia.* We received from Dr. Mellichamp the nutmeg hickory and the pecan. Packages of plants were constantly arriving from Dr. Torrey's former students. At one time I learned that a former student seeing Dr. Torrey so much and so constantly at work, said to him, "Dr. Torrey, I don't like to see you doing so much drudgery, here is a thousand dollars, take it and get you an assistant." It was in that way that Mr. LeRoy became curator at the herbarium.

Once deploring to me the rapid and wide encroachments of the city on his wild-plant regions, Dr. Torrey thanked God for the great swamps and mountains which would be barriers to such inroads. His love for wild nature was shown in his selection of a country residence, near the top of a wooded hill in southeastern Rockland County, overlooking the Hudson.

Once I was showing Dr. Torrey, without using it, a little amorphous silicon in a bottle, which I prized, as a mere dust of it had cost me a dollar. To see what he would say, I asked, "Dr. Torrey, what is that?" He looked at it a minute and said: "It appears like ashes." I said, "Suppose it is the most abundant thing in the world that can be made visible?" "Then," said he, "it must be silicon!" When I next called, it was Dr. Torrey's turn to show me specimens. One was tellurium, then more costly than gold, grain for grain. Another was selenium, that proteid element, in a small black shining cylinder. More still to be prized was a tube as large and long as a quill, containing a fine lot of shining crystals of silicon, which had been obtained by Prof. Wolcott Gibbs, of Harvard—who had learned chemistry under Torrey, and, when a lad, had listened to my own chemical lectures at Dr. Muhlenberg's St. Paul's College, near Flushing. After I had admired the specimens to his content, Dr. Torrey said, "Take them along with you." I could not refuse.

Dr. Torrey was for years the chief of the U. S. Assay in Wall St., where he earned more money and had more leisure than ever anywhere else. It was a position of great responsibility. I remember calling at his office in the assay, the Doctor sitting at his desk, while assayers would come in occasionally to report the result of the examination of some mass of gold. On his desk then was a specimen of Quincy granite, and Dr. Torrey demonstrated to me that it was not syenite.

Now, so far as I am aware, I am the only one who remains of the original members of the club. As these have one by one dropped into the other life a pang has rent me as I realized that I should no more enjoy the profit and pleasure of their companionship; as of Ruger, the most unpretending and one of the most devout, faithful and capable. They were all like Dr. Torrey himself, possessed of the true spirit of a laborer in the fields of the infinities. No man was more kind than Dr. Torrey. He was ever ready to aid the learner, and was in everything as confiding as an ingenuous youth. Dr. Newberry, who followed, was my kind and valued friend, and was of great assistance to me. Professor Alphonso Wood I knew intimately, and worked with him considerably and with profit. He was a kind and most scholarly man, thorough and correct and I do not think he was fairly appreciated.

Finally I send congratulations to every member of the Torrey Club. I salute all those whom I have known. May every success attend them.

BY PROF. THOMAS C. PORTER.

It affords me special pleasure to offer here to-day a slight tribute, in the shape of reminiscences, to the memory of one whom I have long held in high esteem both as a scientist and as a gentleman of noble character.

My first acquaintance with Dr. Torrey began at the meeting of the American Association in Albany, in the year 1850, and his treatment of me, so much younger than himself, was most cordial and friendly. When walking together along the street, he went a considerable distance out of his way in order to show me, growing in a waste place, a very rare plant, specimens of which I collected and still have, *Amaranthus crispus*, a foreigner of uncertain origin.

At another meeting of the American Association, held in Baltimore in the year 1858, Mrs. Lincoln-Phelps, who before her second marriage had published a little volume, amongst the earliest of our floras, and was still as fond as ever of her favorite science, gave an elegant evening entertainment to the members of the Botanical Section. Her fine mansion was beautifully decorated with ferns, palms and a profusion of shrubs and odorous plants in flower. The assemblage of guests was large, and amongst them I remember Drs. Torrey, Gray, Darlington, and Pitcher, who were exceedingly polite and courteous to the lady of the house and her daughter.

A few years later, Mr. Durand, of Philadelphia, gave a dinner to Drs. Torrey and Gray, then in the city, to which a number of gentlemen were invited, amongst whom it was my good fortune to be included. An amusing incident happened on that occasion. The question was asked why Professor Tuckerman, of Amherst, had been so long silent, and the reply was made that he had been engaged in courting, and had just married a wife. "How was that brought about?" inquired one of the company, to whom another responded, "I suppose he must have taken a great *lichen* to her."

In the year 1867, under the direction of the late Dr. George Thurber, a banquet was held at the Astor House, of this city, in honor of Dr. John Torrey. The guests were numerous and many of them came from a distance, for the celebration was not a local one. In the buttonhole of each could be seen a sprig of *Torreya*. Enthusiasm and good-fellowship prevailed, and the addresses delivered showed that the homage paid to the distinguished botanist was sincere and hearty. The only portion of what was then spoken which has not yet faded from my memory is the conclusion of my own address. I said that Dr. Torrey lived fully up to the famous motto of Linnaeus, *Famam extendere factis.* Void of jealousy, gentle, just to all, loving science for its own sake and averse to controversies and quarrels, he was content to let his excellent work speak for itself.

In the summer of 1870, Dr. Torrey attended the commencement of Lafayette College at Easton, and by his request, and on his recommendation the faculty conferred the honorary degree of Ph.D. on Mr. Bolander, of California. When he left, he invited me and my two daughters to visit him in New York. The invitation was accepted and we reached his dwelling in the Columbia College buildings some time in the month of August. The Doctor had planned a botanical excursion for us two to Tom's River, New Jersey, whither we went, and entertained by old friends of his, who resided there, devoted several days to exploration over and around Barnegat Bay. Not a few interesting plants were collected, but we failed to find the *Schizaea*, or *Lycopodium Carolinianum*, which usually grows with it. Toward the close of the week, our host and hostess drove us up, seven miles through the deep sand, to the town of Manchester, where we were to pass the night, at the thought of which my heart sank within me, when I saw a dozen or more of the natives seated on benches in front of the inn, each with a branch of a tree or bush, fighting off the bloodthirsty mosquitoes. But my fears were needless. The landlord slipped me into a little back chamber on the ground floor, where wire-screens kept out the insect pests, and I slept soundly.

The next morning Dr. Torrey debated with himself, *pro* and *con*, whether it would be prudent to pay a visit to his botanical friend, Dr. Knieskern, who lived in the neighborhood. The obstacle in the way was this: Dr. K.'s wife cherished an intense dislike to his botanical work and had once opened her mind to Dr. Torrey, and reproached him for encouraging her spouse to waste his valuable time on worthless weeds, to the detriment of his medical practice. He now shrank from again facing such music, and so I lost the opportunity of making the personal acquaintance of Dr. K., whose striking photograph adorns my album, and his *Rynchospora* my herbarium.

Those days of pleasant intercourse can never be forgotten. They enlarged our acquaintance with each other, and I found him uniformly kind, patient, quiet in his manner and yet genial and full of spirit, without assumption and ready to enrich me from his ample stores of knowledge. One thing I remember well. In describing his experiences in California, he said that he had counted 1,200 rings on the felled trunk of one of the giant sequoias, and that those between 6 and 700 years ago were much closer than either before or after, and thus chronicled the slower growth of a century.

It is a matter for regret that, whilst the generic name of this magnificent and long-lived tree on the Sierra Nevada, and of the redwood along the coast, is likely to stand for ages to come in commemoration of the Indian, George Guesto, the *Torreya* of the Yosemite Valley and of Florida is already superseded by *Tumion.* This, however, cannot obscure the fame of the great botanist. He has other monuments near at hand, just as durable and far more eloquent. Passing by his mountain in the Rockies of Colorado, close to that of Dr. Gray, his name meets us in the title of the Club at whose call we are now assembled, and look where we may, we see everywhere around us fruit from seed sown by a master, for no doubt it is chiefly to his example, inspiration, and labors in the past that Columbia University and the City of New York owe this grand edifice with its thorough equipments, its economic museum, and its extensive herbarium, the superb conservatory opposite, and the broad and beautiful garden and park in the midst of which they stand. Had he foreseen all this in dim prophetic vision his heart would have been gladdened. Had he lived to behold it, his joy would have been greater still.

"Honor to whom honor is due!"

BY CHARLES H. PECK, STATE BOTANIST

It was not my good fortune to be personally acquainted with Doctor Torrey, but I none the less have learned to esteem him, and I would emphasize all that has been said here this day in his praise and honor. We all delight to honor the benefactors of our race, whether they are scientists, theologians, philanthropists, statesmen or generals of the army. Dr. Torrey, by his botanical work and leadership, has been a benefactor, not only to the botanists of his day, but also to all those who have or shall come after him. In my work, as his successor, in trying to complete and perfect the State Herbarium, the foundation of which he so well laid, and in trying more fully to elucidate our state flora, I am constantly reminded of him, and in my references to the specimens he placed in the herbarium, and to the plant descriptions he wrote and published in the *New York State Flora*, I seem to be consulting him and looking to him for advice and information, so that my acquaintance with him seems to me to be scarcely less intimate than that of those more fortunate botanists who associated with him personally and who met him face to face. It is, therefore, a great pleasure to me to unite with you all this day in giving expression to our common feelings of love and admiration of him as a man and a botanist. I doubt not, if he could be with us in this magnificent building, erected as a memorial to him, he would say to us that the warm place he holds in our hearts and the expressions of our esteem and kind remembrance are more precious to him than this great and visible structure, noble and enduring a monument as it is.

Index to recent Literature relating to American Botany

Barker, B. T. P. A Fragment "Mycoderma" Yeast, *Saccharomyces anomalus* (Hansen). Ann. Bot. **14**: 215–244. *pl. 13*. Je. 1900.

Best, G. N. Injury done to Mosses by Insects. Bryologist, **3**: 33. Jl. 1900.

Boodle, L. A. Comparative Anatomy of the Hymenophyllaceae, Schizaeaceae and Gleicheniaceae.—I. On the Anatomy of the Hymenophyllaceae. Ann. Bot. **14**: 455–496. *pl. 25–27*. S. 1900.

Britton, E. G. *Entosthodon Leibergii* sp. nov. Bryologist, **3**: 34. Jl. 1900. [Illust.]

Britton, E. G. *Fissidens grandifrons* Brid. Bryologist, **3**: 28, 29. Jl. 1900.

Britten, J. & Baker, E. G. Notes on *Eryngium*. Jour. Bot. **28**: 241–246. *pl. 411*. Jl. 1900.

Cardot, J. & Theriot, I. New or unrecorded Mosses of North America.—I. Bot. Gaz. **30**: 12–24. *pl. 2–5*. 19 Jl. 1900.

Clute, W. N. Further Notes on mounting Mosses. Bryologist, **3**: 39. Jl. 1900.

Cordley, A. B. Some Observations on Appletree Anthracnose. Bot. Gaz. **30**: 48–58. 19 Jl. 1900. [Illust.]

Dawson, M. On the Biology of *Poronia punctata* (L.). Ann. Bot. **14**: 245–262. *pl. 14–15*. Je. 1900.

Fairchild, D. G. Notes on Travel.—III. Rio and Petropolis, Brazil Bot. Gaz. **30**: 125–130. 15 Au. 1900.

Fernald, M. L. A Revision of the Mexican and Central American Solanums of the Subsection *Torvaria*. Proc. Am. Acad. **35**: 557–562. 12 Je. 1900.

Solanum Madrense, S. ochraceo-ferrugineum, S. Hayesii and *S. erythrotrichum*, sp. nov.

Fernald, M. L. A Synopsis of the Mexican and Central American Species of *Salvia*. Proc. Am. Acad. **35**: 489–556. 12 Je. 1900.

217 Salvias are recognized, many of them new.

Fernald, M. L. Some undescribed Mexican Phanerogams, chiefly Labiatae and Solanaceae. Proc. Am. Acad. **35**: 562–573. 12 Je. 1900.

New species and varieties in *Pelexia, Scutellaria, Stachys, Calamintha, Cuni'a, Hyptis, Lycium, Margaranthus, Athenaea, Physalis, Solanum, Datura, Cestrum, Aster* and *Encelia*.

Fontaine, W. M. Notes on Fossil Plants collected by Dr. Ebenezer Emmons from the older Mesozoic Rocks of North Carolina. Ann. Rept. U. S. Geol. Surv. **20**^{2}: 277–315. *pl. 38–48*. Je. 1900.

Fontaine, W. M. Notes on Mesozoic Plants from Oroville, California. Am. Rept. U. S. Geol. Surv. **20**^{2}: 342–368. *pl. 49–67*. Jl. 1900.

Grout, A. J. Two new species of *Brachythecium*. Bryologist, **3**: 36–39. *pl. 1*. Jl. 1900.

Brachythecium Noveboracense Grout and *B. Washingtonianum* Eaton MSS.

Harper, R. A. Sexual Reproduction in *Pyronema confluens* and the Morphology of the Ascocarp. Ann. Bot. **14**: 321–400. *pl. 19–21*. S. 1900.

Holzinger, J. M. Some new North American Mosses. Bot. Gaz. **30**: 122–125. *pl. 11*. 15 Au. 1900.

Johnson, D. S. On the Endosperm and Embryo of *Peperomia pellucida*. Bot. Gaz. **30**: 1–11. *pl. 1*. 19 Jl. 1900.

Knowlton, F. H. Description of a small Collection of Fossil Wood from the Triassic Area of North Carolina. Ann. Rept. U. S. Geol. Surv. **20**^{2}: 272–274. *pl. 37. f. 1–9*. Jl. 1900.

Describes *Arauearioxylon Woodworthi* and *A. Virginianum*.

Knowlton, F. H. Description of a new species of *Arauearioxylon* from the Cycad Bed of the Freezeout Hills, Carbon County, Wyoming. Ann. Rept. U. S. Geol. Surv. **20**^{2}: 418, 419. *pl. 178. f. 1–6*. Jl. 1900.

Arauearioyxlon ? obscurum n. sp.

Knowlton, F. H. Description of a new Genus and Species of Fossil Wood from the Jurassic of the Black Hills. Ann. Rept. U. S. Geol. Surv. **20**^{2}: 420–422. *pl. 179. f. 1–6*. Jl. 1900.

Pinoxylon Dacotense gen. et sp. nov.

Lang, W. H. Studies in the Development and Morphology of Cycadean Sporangia, II. The Ovule of *Stangeria paradoxa*. Ann. Bot. **14**: 281–306. *pl. 17, 18*. Je. 1900.

Lawson, A. A. Origin of the Cones of the multipolar Spindle in *Gladiolus*. Bot. Gaz. **30**: 145–153. *pl. 12*. 15 S. 1900.

Linn, A. *Fissidens hyalinus*. Bryologist, **3**: 28. 1900.

Macoun, J. Note on *Cinclidotus fontinaloides*. Bryologist, **3**: 30. 1900.

Moore, G. T. New or little known unicellular algae. I. *Chlorocystis Cohnii*. Bot. Gaz. **30**: 100–112. *pl. 10*. 15 Au. 1900.

Mottier, D. M. Nuclear and Cell Division in *Dictyota dichotoma*. Ann. Bot. **14**: 163–192. *pl. 11*. Je. 1900.

Murbach, L. Note on the Mechanics of the seed-burying Awns of *Stipa avenacea*. Bot. Gaz. **30**: 113–117. 15 Au. 1900.

Nelson, A. Contributions from the Rocky Mountain Herbarium. Bot. Gaz. **30**: 189–203. 15 S. 1900.

Nelson, E. Some new Species of Wyoming Plants. Bot. Gaz. **30**: 117–122. 15 Au. 1900.

Parkin, J. Observations on Latex and its Functions. Ann. Bot. **14**: 193–214. *pl. 12*. Je. 1900.

Petunnikov, A. Ueber den Wert anatomischer Merkmale zur Unterscheidung der Abies-Arten. Allg. Bot. Zeitsch. **6**: 125–128. 15 Jl. 1900.

Piper, C. V. New and noteworthy northwestern Plants.—IV. Bull. Torr. Club, **27**: 392–401. Jl. 1900.

Reineck, E. M. Floristisches vom Strande von Bahia Blanca (Provinz Buenos Aires, Argent.). Allg. Bot. Zeitsch. **6**: 132–135. 15 Jl. 1900.

Rendle, A. B. New Orchids from Costa Rica. Jour. Bot. **28**: 274, 275.

Pleurothallis Simmleriana and *Physosiphon minor*, sp. nov.

Riley, W. A. Variations in the Maturing of *Plowrightia morbosa* Spores. Bull. Torr. Club, **27**: 287, 288. My. 1900.

Rimbach, A. Physiological Observations on some perennial Herbs. Bot. Gaz. **30**: 171–188. *pl. 13*. 15 S. 1900.

Robertson, C. Another note on the Flower Visits of oligotropic Bees. Bot. Gaz. **30**: 130. 15 Au. 1900.

Robinson, B. L. New Caryophyllaceae and Cruciferae of the Sierra Madre, Chihuahua, Mexico. Bot. Gaz. **30**: 58–60. 19 Jl. 1900.

Rothrock, J. T. Poverty Pine, Table Mountain Pine, Prickly Pine (*Pinus pungens* Michx. f.). Forest Leaves, **7**: 120. *pl.* Ap. 1900.

Rowlee, W. W. North American Willows. Bull. Torr. Club, **27**: 247–257. *pl. 9.* My. 1900.

Schrenk, H. von. A severe Sleet-Storm. Trans. Acad. Sci. St. Louis, **10**: 143–160. *pl. 10, 11.* 12 Ap. 1900.

Sellards, E. H. Note on the Permian Flora of Kansas. Kans. Univ. Quart. Ser. A. **9**: 63, 64. Ja. 1900.

Scott, D. H. & Hill, T. G. The Structure of *Isoetes Hystrix.* Ann. Bot. **14**: 413–453. *pl. 23–24.* S. 1900.

Shear, C. L. Our Puffballs.—III. Asa Gray Bull. **8**: 49–53. *pl. 3.* Je. 1900.

Shove, R. F. On the Structure of the Stem of *Angiopteris evecta.* Ann. Bot. **14**: 497–525. *pl. 28, 29.* S. 1900.

Small, J. K. Notes and Descriptions of North American Plants.—II. Bull. Torr. Club, **27**: 275–281. My. 1900.

Smith, A. M. *Fissidens* in Northeastern North America. Bryologist, **3**: 25–27. Jl. 1900. [Illust.]

Thomas, E. N. Double Fertilization in a Dicotyledon—*Caltha palustris.* Ann. Bot. **14**: 527–535. *pl. 30.* S. 1900.

Timberlake, H. G. The Development and Function of the Cell Plate in higher Plants. Bot. Gaz. **30**: 73–99. *pl. 8, 9.* 15 Au. 1900; **30**: 154–170. 15 S. 1900.

Toumey, J. W. An Inquiry into the Cause and Nature of Crown-Gall. Bull. Univ. Ariz. Agric. Exper. Sta. 33: 7–64. *f. 1–31.* 13 Ap. 1900.

Dendrophagus globosus gen. et sp. nov. (Mycetozoa).

Underwood, L. M. Our Native Ferns and their Allies. Sixth Edition, pp. viii, 158. New York. Jl. 1900.

Includes *Botrychium pumicola* Coville and *Polystichum Lemmoni* sp. nov.

Wager, H. On the Fertilization of *Peronospora parasitica.* Ann. Bot. **14**: 263–279. *pl. 16.* Je. 1900.

Wanner, A. & Fontaine, W. M. Triassic Flora of York County, Pennsylvania. Ann. Rept. U. S. Geol. Surv. **20**[2]: 233–255. *pl. 21–34.* Jl. 1900.

Ward, L. F. Status of the Mesozoic Floras of the United States. 1st Paper: The Older Mesozoic. Ann. Rept. U. S. Geol. Surv. **20**[2]: 211–748. *pl. 21–179.* 1900.

Waugh, F. A. & McFarland, J. H. Photography in Botany and in Horticulture. Bot. Gaz. **30**: 204–206. 15 S. 1900.

Webber, H. J. Work of the United States Department of Agriculture on Plant Hybridization. Jour. Roy. Hort. Soc. **24**: 1–18. *f. 1–8.* 1900.

Wiegand, K. M. Some Notes on *Saxifraga* and *Primula.* Bull. Torr. Club, **27**: 388–391. Jl. 1900.

Wiegand, K. M. The Development of the Embryo-sac in some Monocotyledonous Plants. Bot. Gaz. **30**: 25–47. *pl. 6, 7.* 19 Jl. 1900.

Williams, N. *Subularia aquatica.* Meehan's Monthly, **10**: 67, 68. My. 1900.

Williams, R. S. Two new Species of *Grimmia* from Montana. Bull. Torr. Club, **27**: 316, 317. *pl. 19, 20.* Je. 1900.

Woods, A. F. Stigmonose: A Disease of Carnations and other Pinks. Bull. U. S. Dept. Agric. (Div. Vegetable Physiology and Pathology) 19: 6–30. *pl. 1–3. f. 1–5.* 1900.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. Memoirs of the Department :

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895 ; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. Contributions from the Department :

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth) ; $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896 ; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages ; Vol. 2 642 pages ; Vol. 3, 588 pages ; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes ; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895 ; Tutor in Botany, 1895–.

Octavo, 360 pages ; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

VOL. 27 NOVEMBER, 1900. D No. 11

BULLETIN

OF THE

TORREY BOTANICAL CLUB

EDITOR

LUCIEN MARCUS UNDERWOOD

ASSOCIATE EDITORS

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D.
HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL,
BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D.,
CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D.,
PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph. D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE.
WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D.,
MARIE L. SANIAL,
HELEN M. INGERSOLL,
ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD,
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH,
EUGENE SMITH,
MARIE L. SANIAL,
W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY,
DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 NO. 11

BULLETIN

OF THE

TORREY BOTANICAL CLUB

NOVEMBER 1900

New Species of Fungi from various Localities

BY J. B. ELLIS & B. M. EVERHART

Asterina agaves E. & E.

On *Agave atrovirens*, Apam, Mexico, April, 1900 (Professor Wm. Trelease, no. 194).

Perithecia in suborbicular groups .5–1 cm. across, superficial, subglobose, 80–100 μ in diameter, astomous: asci obovate, 50–60 × 20 μ: sporidia crowded-biseriate, clavate oblong, uniseptate near the broader end, constricted at the septum, ends obtuse, 15–27 × 6–8 μ.

Between and around the perithecia the leaf is thinly clothed with short, brown, subfasciculate hairs.

Dothidella heucherae E. & E.

On living leaves of *Heuchera cylindrica*, Waitesburg, Wash., Mar. 11, 1900 (R. M. Horner, no. 1418).

Forming a thin, suborbicular, black crust on the upper surface of the leaf, .5–1 cm. diameter and becoming more or less distinctly bullate and surrounded by a narrow, reddish-purple zone: ascigerous cells (perithecia) globose, small, 80–100 μ, numerous, monostichous, buried in the stroma the surface of which is roughened by the erumpent ostiola: asci sessile, oblong-cylindrical, 22–35 × 8–10 μ: sporidia biseriate, oblong, hyaline, 3–4-nucleate, then uniseptate in the middle but scarcely constricted, 15–20 × 3–3.5 μ.

Phyllosticta heucherae E. & E., Am. Nat. **31**: 428. 1897, is the spermogonial stage of this.

Urocystis gei E. & E.

On leaves of *Geum ciliatum* Pursh, Waitesburg, Wash., May 7, 1900 (Robert M. Horner, no. 1430).

Sori epiphyllous, bullate, elongated, .5–1 cm. long, opening along the middle as in *U. anemones*, formed by the inflated epidermis; central spores paler, subglobose, 12–16 μ diam.; peripherical spores darker, slightly granular-roughened, globose, 10 μ diam., or ovate, 10 × 6–7 μ.

Puccinia bicolor E. & E.

On leaves of *Hieracium Scouleri* Hook., Waitesburg, Wash., May 7, 1900 (Robert M. Horner, no. 1433).

Mostly hypophyllous but also amphigenous. Teleutospore sori small (.25–.5 mm.), subcuticular straw-yellow, flat and scale-like at first, gregarious and subconfluent on pallid, subindefinite, orbicular, subconfluent spots 3–5 mm. diam. The central sori soon become black and thickened and burst the cuticle which, however, still partly envelops them. Teleutospores clavate- or obovate-oblong, smooth, upper cell subglobose, the epispore strongly thickened above, often subtruncate and almost opake, lower cell mostly narrowed to the stout pedicel which is of about the same length as the spore, which is distinctly constricted.

Very different from *P. hieracii*.

Phyllosticta similispora Ell. & Davis.

On *Solidago rigida*, Racine, Wis., Sept., 1898 (Davis, no. 984).

Epiphyllous, spots small, scattered, black, convex, 1–2 mm. diam., sometimes confluent, without any definite border resembling small black swellings on the leaf; perithecia prominent, black, 100–150 μ diam., 1–6 on a spot; sporules almost exactly like those of *P. sphaeropsispora* E. & E. on *Solidago confinis* from California, obovate-elliptical, shaped much like apple seeds, some of them globose (perhaps because seen endwise).

The California species is on large, 1 cm., thin, white spots with a narrow but distinct margin.

Phyllosticta smilacis E. &. E.

On leaves of *Smilax*, Oldtown, Me. (Prof. F. L. Harvey). Common also around Newfield, N. J., and sent from various other sections.

Spots brick-color, round, .5–1 cm. diam. with a sharply defined border, often paler in the center; sporules oblong-elliptical or broad-fusoid, 15–20 × 7–9 μ.

This has been observed on various smooth-leaved species of *Smilax*, for twenty years or more, but it does not appear to have been described. Specimens occur with uniseptate spores (*Ascochyta*) but usually there is no septum.

Phoma zeicola E. & E.

On dead leaves of *Zea Mays*, Tuskegee, Ala., July, 1897 (Geo. W. Carver, no. 259).

Perithecia innate, thickly but evenly scattered, visible on both sides of the leaf, 80–100 μ diam.; sporules fusoid-oblong or oblong-elliptical, 4.5–5.5 × 1.5 μ.

Phoma orthosticha E. & E.

On leaves of *Typha latifolia*, Orono, Maine, October, 1899 (P. L. Ricker).

Perithecia subcuticular, minute (40–50 μ), arranged in narrow strips 3–6 mm. long between the nerves of the leaf; sporules oblong-elliptical, minute, 2.5–3 × .75–1 μ.

Comes near *P. gyneriicola* Cke., but that has the perithecia scattered or gregarious. Differs from *P. typharum* Sacc. and *P. serialis* Pat. in the size and shape of the sporules.

Sphaeropsis nubilosa E. & B.

On bark of exposed root of *Fraxinus viridis*, Rooks Co., Kansas, (Bartholomew, no. 2772).

Gregarious, superficial, forming a round, black patch 1 cm. or more across. Perithecia globose or slightly depressed-globose, with the base only slightly sunk in the bark, 300–400 μ diam. with a papilliform ostiolum; sporules oblong-elliptical 15–20 × 7–8 μ.

Differs from *S. biformis* Pk. and *S. Pennsylvanica* B. & C. in its superficial growth. This can not be confounded with *Diplodia rhizogena* E. & B. which has the same habitat.

Hendersonia kalmicola E. & B.

On dead twigs of *Kalmia latifolia* killed by fire a year ago. Newfield, N. J., May 20, 1900.

Perithecia 2–3 lying side by side in the blackened substance of the bark which is split longitudinally and slightly raised, the papilliform ostiola being visible in the narrow chinks; sporules elliptical or slightly obovate, 3-septate, pale brown, 12–15 × 6–8 μ, on slender pedicels about 15 μ long.

SEPTORIA MEGASPORA Speg. ? Fung. Arg. Pug. 1, 188

Kellermannia mutica E. & E. in herb.

On leaves of *Yucca filifera*, Monterey, Mexico, March, 1900, and on leaves of *Agave Lechngrulle*, Peyotes, Mexico, April, 1900 (Dr. Wm. Trelease).

Perithecia scattered, sunk in the substance of the leaf, .5–1 mm. diam., raising and throwing off a circular piece off the cuticle directly over them: sporules clavate-cylindrical, hyaline, multi-septate, scarcely constricted, 70–100 × 8–10 μ, attenuated above to an obtuse point, sessile, fasciculate.

Differs from Spegazini's description in the multiseptate spores and might properly be placed in the genus *Phleospora*.

Septoria annua E. & E.

On partly dead leaves and culms of *Poa annua*, London, Canada, May, 1900 (J. Dearness).

Perithecia scattered, black, depressed-globose, pierced above, 75–110 μ diam.; sporules abundant, filiform, mostly attenuated below, nucleolate, hyaline, 30–40 × 1.5 μ, slightly curved. Comes very near *S. tenella* C. & E.

Septoria cylindrica E. & E.

On *Anemone cylindrica*, Bozeman, Montana, July, 1878 (J. W. Blankenship, no. 78).

Perithecia hypophyllous, globose, 100–110 μ diam., black, erumpent, scattered on pallid, indefinite spots; sporules fusoid-cylindrical, moderately curved, 25–35 × 2.5–3 μ, 3-(pseudo-)septate, nucleate at first.

Melanconium angustum E. & E.

On dead hickory limb, Newfield, N. J., Feb., 1900.

Acervuli minute, raising the epidermis into small pustules, then erumpent, often compressed; conidia oblong, olive-brown, 2–3-nucleate, straight or nearly so, 12–16 × 4–5.5 μ, narrower and darker than in *M. pallidum* Pk., and acervuli smaller.

Melanconiopsis E. & E., gen. nov.

This is *Melanconium* with the cellular stroma of *Cytispora*, and with the spores of *Melanconium*. Doubtless the stylosporous stage of *Melanconis* or *Massariovalsa*.

Melanconiopsis inquinans E. & E.

On dead limbs of *Acer dasycarpum*, Louisville, Kansas, May, 1900 (Bartholomew, no. 2519).

Stroma sunken in the bark, which is raised into pustules and blackened by the ejected spores; cells 6–10, globose, circinate, about .5 mm. diam., finally confluent, their slender necks convergent and united above in a single papilliform or short-cylindrical, erumpent ostiolum; sporules oblong-elliptical, brown, 20–30 × 12–15 μ on short basidia.

Cylindrosporium ariaefolium E. & E.

On leaves of *Spiraea ariaefolia* Wats., Latah Co., Idaho, July, 1899 (R. M. Horner, no. 1216).

Spots small, 1–2 mm., deep-brown, purplish-brown at first with the margin lighter, numerous, of irregular shape; acervuli epiphyllous, rather large and flat, brown; conidia lunate, nucleate becoming 3-septate above, 30–45 × 3.5–4 μ.

Differs from *C. spiraeicolum* E. & E. in the different color of the spots, curved and rather broader spores attenuated towards each end.

In the description of *C. spiraeicolum* the conidia are erroneously stated as 3.5–5 μ thick, whereas they are mostly only 3–3.5 μ.

Cylindrosporium smilacis E. & E.

On *Smilax* sp., Tuskegee, Ala., July, 1897 (Geo. W. Carver).

Spots ferruginous-brown, 4–5 mm. diam., orbicular or partly limited by the veinlets of the leaf, sometimes with a narrow, darker colored border; acervuli epiphyllous, covered by the cuticle, 80–110 μ diam., conidia discharged in little white heaps, curved, 3-septate, hyaline, 20–30 × 2.5 μ.

Pestalozzia bicolor E. & E.

On dead leaves of *Salix* sp., Tuskegee, Ala., Dec., 1897 (G. W. Carver, no. 387).

Acervuli amphigenous, subcuticular, scattered and here and there subcespitose, small, raising the cuticle into little yellowish-white pustules which become darker. Conidia fusoid-oblong, 4-septate, three inner cells brown, terminal cells conical and hyaline, the colored part $13-15 \times 5-7\,\mu$, or including the terminal cells $20-22\,\mu$ long; crest of 3-5 spreading, hyaline bristles $13-15\,\mu$ long.

The light colored acervuli are all that distinguish this from *P. guepini* Desm.

PESTALOZZIA COCOLOBAE E. & E. Botan. Series Field Columbian Museum, **1**:

Specimens of this species sent from southern Florida by H. H. Hume on the same host as the Yucatan specimen (*Cocoloba uvifera*) have spores only $3.5-4\,\mu$ wide or exceptionally $5\,\mu$, making it altogether probable that *P. cocolobae* is only a form of *P. guepini* Desm.

SEPTORIA FULVESCENS Ell. & Halst. Bull. Torr. Club, **27**: 57. 1900

This name should be **S. flavescens.** There is already a *Septoria fulvescens* Sacc. on *Lathyrus*. See Sacc. Syll. Fung. **3**: 110.

Ramularia brevipes E. & E.

On leaves of *Monarda Clinopodia?* Tuskegee, Ala., May, 1897 (Geo. W. Carver, no. 224).

Hypophyllous. Appearing at first as pale indefinite spots which soon become confluent over the greater part of the leaf and gray from the abundant conidia, and the leaf finally becomes brown and dead: conidia filiform, nucleolate, hyaline, mostly curved, $30-60 \times 2-2.5$, arising from short, fasciculate, elliptical or short cylindrical, $8-12 \times 3-4\,\mu$, basidia being hardly more than elongated cells of the proligerous layer.

No indications of any *Entyloma* were observed in connection with this.

RAMULARIA AGOSERIDIS E. & E., in Ell. & Evrht. N. A. F. 3079

On *Agoseris pulchella*, Berkeley, Calif. (Blasdale) and on *Troximon grandiflorum*, Waitesburg, Wash., May, 1900 (Robert M. Horner, no. 1437.

Spots definite, often terminal or marginal, dirty brown, .5-1 cm. diameter, hyphae amphigenous, in compact, punctiform tufts, simple, mostly straight, continuous, often attenuated above and subdentate, 20–25 × 4 μ, hyaline, conidia oblong or cylindrical, hyaline, nucleate, obtuse, 12–22 × 5–6 μ.

This was issued in N. A. F. but as far as we can find has not heretofore been described.

Ramularia sphaerioides E. & E.

On living leaves of *Thermopsis montana* Gray, Waitesburg, Wash., May, 1900 (Robert M. Horner, no. 1458).

Hypophyllous, on small (1–2 mm.) irregular pallid spots which finally become more definite and rusty-brown above; hyphae densely fasciculate in small sphaeroid tufts 75–80 μ diameter of a slaty-gray color, the single hyphae 20–30 × 2–2.5 μ, septulate and smoky hyaline, subdentate above, conidia ovate-elliptical, uniseptate, slightly roughened, filled with small nuclei, 12–22 × 7–10 μ.

Differs from typical *Ramularia.*

Cercospora phyllitidis Hume

On *Polypodium Phyllitidis* L., Hobe Sound, east coast of Florida, March 14, 1900 (H. H. Hume).

Spots brown, of irregular outline, 1–2 cm. diameter: fertile hyphae, brown, sparingly septate, undulate, 60–80 × 3.5–4 μ, in dense, spreading tufts thickly scattered over the spots on both sides of the leaf but more abundant below, conidia lanceolate, 3–5-septate, hyaline, 40–80 × 3–3.5 μ.

Cercospora smilacinae E. & E.

On leaves of *Smilacina sessilifolia* Nutt., Latah Co., Idaho, July, 1899 (Robert M. Horner, no. 1293).

Spots amphigenous, oblong-elliptical, 2–4 × 1–2 mm., grayish-white, bounded by a red line; fertile hyphae mostly epiphyllous, very short, 10–12 × 3 μ, crowded in dense tufts 35–50 μ diameter which are soon obscured by a subcrustaceous, black mycelium occupying the center of the spots. The tufts of hyphae also appear on dead areas of the leaf outside the spots, arranged in a seriate manner between the nerves of the leaf: conidia filiform, subundulate or slightly curved, 40–60 × 2.5 μ, greenish or yellowish-hyaline, with a single pseudoseptum near the middle, exceptionally 2–3 pseudoseptate. The fertile hyphae are hyaline with a brownish tint below.

Cercosporella colubrina E. & E.

On leaves of *Solidago salsuginosus*, Columbia Co., Washington, July, 1897 (R. M. Horner, no. 1354).

Amphigenous, on round or subelongated, definite white spots 1–2 mm. diameter thickly scattered over the leaves, reminding one of the skin of a spotted snake or lizard: hyphae in minute closely crowded tufts in the center of the spots, cespitose, hyaline, delicate, $22–25 \times 1.5\ \mu$, entire or slightly toothed above, continuous: conidia filiform, straight or slightly curved, $30–40 \times 1–1.25\ \mu$, hyaline, straight or slightly curved, faintly nucleolate.

Distinct from *C. nivea* E. & B., or *C. nivosa* E. & E. in its distinct white spots and less robust habit. *C. cana* Sacc. is also different.

The local Distribution and Occurrence of the Fungi of Austin, Texas, and Vicinity

By W. H. Long, Jr.

To understand properly the peculiar fungal distribution and occurrence of this vicinity it is necessary to state briefly the geological conditions and environment.

Austin is located on the Cretaceous, mainly on the Upper Cretaceous, and more specifically on the Austin-Dallas Chalk and Shoal Creek limestone. As the name indicates, this formation is marine and most of it deep-sea deposit.

Our soil is therefore chiefly made from the detritus of these old marine limestone strata. The surface here is very broken, composed of rough, rocky hills with limestone exposed over the greater part of them, with narrow, shallow valleys and arroyos, whose soil has little depth, with here and there an occasional bed of sand and gravel, the remnants of the Tertiary and Quaternary river drift deposits. Austin is situated on the margin of the Edwards Plateau, whose coastward border is the Balcones Escarpment that extends from the northern line of Travis County to the Rio Grande.

The city proper being on the downthrow side of a series of faults that determine this escarpment, is about five hundred feet below the summit of the Edwards Plateau proper, and just east of it and the Colorado River. Practically the same conditions prevail here as on the plateau, viz.: rocky limestone hills, studded with clumps of mountain cedar, barberry, mountain oak, and live oak, none of which make a compact shady forest growth.

While the valleys are sprinkled with a scattering growth of mesquite, and near the edges of the creeks are found elm, hackberry and an occasional cottonwood, near the Colorado River, on the Tertiary and Quaternary gravels, are found clumps of post oaks and black jacks.

Austin is also on the eastern margin of the Lower Sonoran life zone, a zone characterized by a semi-arid xerophytic vegetation, which corresponds well with the geological conditions.

Most fungi, owing to their ephemeral nature, need an abundance of water to make their food supply quickly and sufficiently available; therefore in localities visited by long-continued rains or having an atmosphere laden with moisture, as well as in marshy districts and dark damp forests where evaporation is retarded, fungi are found in great quantities and of many species. On the contrary, when an abundance of water is wanting we may expect to find only a limited number of species.

From the geological and climatic environments that exist, the distribution and occurrence of fungi in this vicinity is found to be limited by three very important factors: (1) The nature of the soil, (2) The paucity of densely wooded areas, especially of large damp forests, and (3) The climatic conditions.

Discussing each of these factors more specifically, we find that the soils in the vicinity of Austin, are formed mainly from limestone detritus and with little vegetable débris in them. The innumerable hillsides and slopes cause much of the surface soil, which contains the vegetable matter, to be washed away, leaving a soil deficient in humus and incapable of nourishing fungi.

The habitat of the majority of our saprophytic fungi is in the valleys and under the trees, especially under the cedars where the débris of leaves, etc., cannot easily be washed away. In some localities clay, gravel or sandy soils are found but these are likewise deficient in organic matter to such an extent that unless sheltered by trees, very few species of fungi are found growing in them. As a rule, then, the soil conditions of this vicinity are unfavorable to fungal growths, except in old pastures where the soil is rich from the droppings of stock. Here we often find fungi in great quantities as regards individuals but usually limited to a few species.

The second condition, lack of deep, dense forests with their ever-present humus in the débris at their roots, excludes a large number of shade-loving species. Our trees, mainly oaks and cedars, are not tall and compact, nor are they sufficiently massed to form dark, damp places, consequently the quantity of humus formed and retained in the soil beneath them is small and not sufficient to encourage or promote the growth of fungi to any great extent.

The third condition, that of climate, is the most potent factor of the three; it includes the effects of light, heat and moisture, water especially being needed to properly develop the fructification organs of fungi.

Austin is subjected as a rule to sudden and violent variations in temperature, to long periods of exceedingly hot dry weather accompanied by intense sunlight, all of which tax the vitality of the higher green plants much more than that of the fungi. If the quantity of moisture in the air were great it would permit some species to exist here that are otherwise excluded, but the vapor density in this locality is at a minimum.* These climatic forces all operate to deter and limit, or even exclude many species from thriving here that otherwise might be expected. These forces also play an important part in the distribution and number of the parasitic species. The xerophytic character of this region causes a large percentage of the native plants to protect themselves from too much sunlight, heat and evaporation, by clothing their leaves and other green parts with a thick, tough epidermis, with a dense coating of hairs, with stomata so arranged as to remain closed, much of the time, or so sunken beneath the surface as to become inaccessible. The entire plant thus becomes hard, woody and impervious. The spores, therefore, have great difficulty in ever reaching the epidermis as the clothing of long, dense hairs tends to catch and hold them away from the surface. The few that chance to reach the epidermis and germinate are often unable to pierce it with their delicate hyphae and the stomata being closed or inaccessible the germ tubes cannot enter by that route.

The spores, after finding lodgment on the epidermis, often fail to even germinate from lack of sufficient moisture or the intense heat and sunlight may even destroy their vitality. These facts account for the comparative freedom from fungal attacks of most of our oaks, barberry, mesquite, cedar, etc. In the spring when the leaves are young and tender and when moisture is abundant, the fungi may obtain a foothold and often do, or in the summer during protracted rainy periods,† the spores may germinate and often do so,

---

* The months of July, August, and September during the past season have been a remarkable exception in possessing a high degree of humidity, which has been most evident in foliage and in the development of parasitic fungi.

† As during the past summer.

spreading the fungi rapidly over wide areas. In this manner wheat rust becomes very virulent and destructive.

The majority of the introduced species of the cereals and of other plants are often attacked by the ephemeral fungi, to which they are subjected in their older habitat. Such are the various rusts and smuts infesting wheat, oats, corn, clover. As a rule, the parasitic fungi of this vicinity are very limited in number of species. In this group come two species of *Gymnosporangium G. macropus* on *Juniperus Virginiana*, the other a new form found on mountain cedar, *Sabina sabinoides*, which does not form galls or "apples," but the teleutospore masses break out directly from the stem or leaf in rows, like the teeth of a comb, common during March on the mountain cedar, but never found on *J. Virginiana*. Several species of *Puccinia*, one on *Berberis trifoliata* (barberry), aecidium stage, very rare, stages I, II, III, and spermagonia present, only one infected bush found. A species of *Uromyces* on the mesquite (*Prosopis juliflora*), forms large oblong-cylindric galls or "apples" on the petioles and petiolules, about 2 cm. long by 5 cm. thick, covered with oblong brown sori, which are filled with uredospores; not common, only infesting an occasional tree; II and III stages found on leaves in July, after "apples" have fallen. Another fungus attacks the under side of the mesquite leaves, especially those of the small bushes.

Of the saprophytic fungi we find several well-marked types. Group I, includes those inhabiting various kinds of dung. These are few in number, but have a wide range as to time and place of occurrence, their peculiar habitat producing the environments necessary to a quick growth, therefore on the slightest rain or even dew they send up their organs of reproduction and disseminate their spores. Species of *Ascobolus*, *Lasiobolus*, *Coprinus*, *Psilocybe* and *Stropharia* form some of this group.

In Group II are those growing in the cedar brakes beneath the trees; the cedars especially form at their bases a mass of decaying débris, which persists year after year, and thus attains a thickness of several inches. This being shaded by the overhanging boughs, produces and retains a humus, thereby securing more favorable conditions for fungal growths than in the open, unshaded places. We therefore find quite a diversity of species in such localities.

They form a distinct group, having few or no species in common with the other geographical groups. Several of the Lycoperdales are found here, also a large *Sarcosphaera* with an oil drop in the center of its hyaline spore. In this group comes a *Helvella* with spores like those of *Sarcosphaera*; a large *Morchella* nearly one foot tall, with pileus the color and texture of beeswax; and two species of *Lepiota* with perfectly smooth pilei.

In Group III are those found under the post oaks (*Quercus minor*) and black jacks (*Q. Marilandica*), generally in sandy, gravelly soil, or in the débris of leaves that the winds have collected into heaps, often one foot deep and several yards wide. Here is a totally different fungal vegetation. Not a species has been found in this habitat that is common to the other groups. Here the volvate and annulate species of Agaricales flourish, also several large fleshy species with bright colored pilei. In the leaf débris mentioned, several species of *Boletus* are found. These are all, without exception, Spring fungi.

Group IV includes those growing in grassy places, on lawns, etc., where the ground is frequently watered and the turf permanent. The Phallales are prominent members of this group, especially *Phallus rubicundus*, which was found in several widely separated localities, each time in lawns, open and unshaded. One yard especially had them in great abundance; at least one hundred specimens were collected in various stages of development, from the hyphae just forming a weft, to the mature and deliquescing plant. The parties living at this place said the fungus had appeared in their yard every year during the last ten years. All the specimens were found during April and May; none appeared from May to September, probably because exceedingly hot dry weather has prevailed since then. Two specimens of *Simblum rubescens* were found close together, on a partially shaded lawn; this is much rarer here than *P. rubicundus*, as the two specimens were all that have been found after careful and continued search during the entire spring, which has been exceedingly rainy and wet, and therefore unusually favorable to fungal growths of every description; many fungi have undoubtedly been collected during this season that will probably not be seen again in years.

Group V contains the epixylous species, the wood being in a more or less rotten condition; these are further limited by the fact that most of the wood here, such as mesquite (*Prosopis*), cedar (*Sabina*) and mountain oak (*Quercus*) do not readily decay; the fungi are thus confined mainly to elm (*Ulmus crassifolia*), cottonwood (*Populus monilifera*), hackberry (*Celtis Mississippiensis*), etc., which do not form a very prominent part of the timber in this vicinity. Polyporaceae are especially common in this group, over twenty species having been found, *Clavaria*, *Coprinus* and *Xerotus* are also represented by several species, one very large club-shaped *Clavaria* being quite conspicuous on old elm stumps. The beautiful geaster-like *Urnula* belongs in this group; it is strictly a Winter species.

Group VI contains those growing in the open rocky or gravelly soils, consisting of few species, usually of Lycoperdales and their allies. These are all strongly xerophytic, mainly terrestrial, the early stages of their existence being passed beneath the soil thus securing better protection. They seem to have adapted themselves better than any of the other fungi to their environments.

Their spores show a special adaptation to xerophytic conditions, being more or less oily, often hyaline and capable of resisting great heat. Being disseminated by the wind they ought to be widely distributed. These characters have been selected by the necessity of existing in this hot dry climate.

The most abundant and widely distributed of this group is a species of *Polysaccum*, which is found in open rocky, gravelly soil or in the mesquite flats. Two rare and unique species closely related to *Gyrophragmium* come in this group; the larger is an annulate species 10–14 cm. tall, with short thick stipe, an agaric-like pileus and lamellae, spores slate-black, ovate-spheroid and wind-disseminated; the other species is much smaller, being only 4–7 cm. tall, with pileus 3 cm. broad, lamellae naked, attached at one end to a central disc and forming a plant somewhat like *Montagnites*, only the lamellae are persistent and dry and the spores wind-disseminated. Both species are evidently connecting links between the Agaricales and Lycoperdales, *Mycenastrum* has two species here, one * with a leathery peridium,

* Found also under elm tree in leaf débris; young stages of the species were found in August at same place.

short thick spiny capillitium and dark brown spherical spores; the other is two inches in diameter with a thick corky peridium and yellow spore mass, the capillitium is longer and more branched.

These species mentioned above indicate a relationship to our Western fungi.

Characteristic representatives of the various groups of fungi as indicated above are as follows:

PARASITIC FUNGI

Gymnosporangium macropus on *Juniperus Virginiana*. March.

Gymnosporangium sp. on *Sabina sabinoides*. March.

Balansia sp. on *Stipa leucotrica*. May.

Puccinia xanthi on *Xanthium strumarium*, III. July–Sept.

Puccinia sp. on *Verbena encelioides*, II. and III. Nov.

Puccinia tanaceti on *Helianthus annuus*, II and III. July.

Puccinia gonolobi on *Gonolobus laevis*, III. July.

Puccinia asparagi on *Asparagus*, III. July.

Puccinia pruni-spinosa, on *Prunus Americana*, II. and III. July.

Puccinia pruni-spinosa on *Prunus Persica*, II. Sept.–Oct.

Puccinia sp. on *Ruellia tuberosa*, II. July–Aug. II. and III. Sept.–Oct.

Puccinia vexans on *Bouteloua racemosa*, II. and III. Sept.–Oct.

Puccinia sp. on *Vernonia altissima* and *V. angustifolia*, II. and III. August.

Puccinia smilacis on *Smilax tamnoides*, II. April–Sept.

Puccinia graminis on wheat and oats, II. and III. June.

Puccinia sp. on *Gaura*, I. and II. March.

Puccinia sp. on *Berberis trifoliata*, I., II., III. March–April.

Puccinia sp. on *Anemone Virginiana*, I., II., III. and *spermagonia*. March–April.

Uromyces trifolii on *Trifolium Carolinianum*, I., II., III. March–May.

Uromyces sp. on *Prosopis juliflora*, II. May–June. II. and III. July–August.

Uromyces euphorbiae on various species of *Euphorbia*, II. and III. July–October.

Uromyces sp. on *Asclepiodora decumbens*, II., III. July.

Uromyces appendiculatus on *Indigofera leptosepala*, II., III July.

Uromyces sp. on an unknown legume, II., III. July.

Uromyces terebrinthi, on *Rhus toxicodendron*, II. July–Aug.

Uromyces spermacoces, on *Diodia teres*, II. and III. Aug.

Accidium xanthoxyli, on *Xanthoxylum clavis-Hercules* var. *fruticosum*.

Accidium euphorbiae on various species of *Euphorbia*. Aug.–Oct.

Accidium dracontium on *Arisaema dracontium*.

Ustilago segetum, on oats and barley. May.

Ustilago utriculosa, on *Polygonum* sp. Oct.

Ustilago sp. on sheaths and leaves of *Boutelona racemosa*. Sept.–Oct.

Ustilago maydis on *Zea Mays*. Sept.

Ustilago sorghi on *Sorghum vulgare*. July.

Ustilago sp. on *Cenchrus tribuloides*. Aug.–Sept.

Tilletia sp. on *Hordeum nodosum*. June.

Uredo fici on *Ficus carica*. Sept.–Oct.

Uredo sp. on *Commelina Virginica*. Oct.

Coleosporium vernoniae on *Vernonia angustifolia*. Aug.

Coleosporium sp. on *Salix nigra*. July.

Coleosporium ipomoeae, on *Ipomoea bona-nox* and *I. purpurea*. Oct.

Albugo amaranthi on *Amaranthus* sp. June–Sept.

Albugo portulacae on *Portulaca oleracea*. Aug.

Albugo ipomoea-pandurata, on various species of *Ipomoea*. July.

Albugo Platensis on *Boerhavia decumbens*. July.

Albugo candida on *Lepidium Virginicum*. Spring.

Peronospora geranii, on *Geranium Carolinianum*. April.

Periconia pycnospora, on *Ligustrum Californicum*. Sept.–Oct.

Saprophytic Fungi

Group I. Dung-inhabiting Species

Coprinus, 3 sp.

Lasiobolus, 2 sp.

Humaria, 1 sp.

Peziza (*Tazetta*), 1 sp.

Pilobolus, 1 sp.

Poronia oedipus.

Lachnea, 1 sp.

Cyathus striatus.

Sphaerobolus, 1 sp.

Sordaria, 1 sp.

Mucor, several sp.

Panaeolus, 1 sp.

Psilocybe, 1 sp.

Stropharia, 1 sp.

also two species of Myxomycetes.

Group II. Cedar Brake Fungi

Astraeus, 1 sp.	*Sarcosphaera*, 1 sp.
Tylostoma, 1 sp.	*Morchella*, 1 sp.
Lycoperdon, 1 sp.	*Helvella*, 1 sp.
Cantharellus, 2 sp.	*Lepiota*, 3 sp.
Protodermium, 1 sp.	*Tricholoma*, 1 sp.
Geaster, 1 sp.	

and many undetermined species of Agaricales.

Group III. Post Oak Land Species

Amanita, 3 sp.	*Lactarius*, 2 sp.
Amanitopsis, 7 sp.	*Russula*, several sp.
Agaricus, 1 sp.	*Hebeloma*, several sp.
Lepiota, 3 sp.	*Boletus*, several sp.
Inocybe, 2 sp.	*Clitocybe*.

A large number of species of this group yet await identification.

Group III. Species of grassy Places and Lawns.

Phallus rubicundus.	*Clitopilus*, 1 sp.
Phallus impudicus.*	*Lepiota*, 2 sp.
Simblum rubescens.	*Polyporus*, 1 sp.

and several small species of Agaricales.

Group V. Epixylous Species

Polyporus, 20 sp.	*Guepinia*, 1 sp.
Clavaria, 3 sp.	*Ulocolla*, 2 sp.
Coprinus, 3 sp.	*Lentinus*, 2 sp.
Bolbitius, 1 sp.	*Xerotus*, 2 sp.
Schizophyllum, 1 sp.	*Lachnea*, 1 sp.
Lepiota, 1 sp.	*Panus*, 2 sp.
Urnula Geaster.	*Sphaerobolus*, 1 sp.
Ascophanus, 1 sp.	*Cyathus*, 1 sp.
Hydnum, 1 sp.	*Stemonitis*, 2 sp.
Hebeloma, 1 sp.	*Arcyria*, 1 sp.
Dacryomyces, 1 sp.	

* Local habitat not known definitely.

Group VI. Species of open rocky Soil.

Lycoperdon, several sp.	*Calvatia*, 2 sp.
Bovistella, 1 sp.	*Polysaccum*, 1 sp.
Gyrophragmium (?) 2 sp.	*Mycenastrum*, 2 sp.
Scleroderma, 1 sp.	*Coprinus*, 1 sp.

A complete list and descriptions will be prepared for publication as early as possible. From present indications this new and unworked field will prove exceedingly fruitful in new species and of much interest to mycologists.

UNIVERSITY OF TEXAS, SCHOOL OF BOTANY.

Heteromorphism in Helianthemum

By John Hendley Barnhart

It is no new discovery that in some of our common North American species of *Helianthemum* the flowers are of different forms on the same plant. In 1824, Dunal, in the first volume of DeCandolle's Prodromus, described 112 species of *Helianthemum* known to him; only seven of them were American, and of these he constituted the section *Lechioides*, but no mention is made of the occurrence of heteromorphism. In the same year, however, Elliott (Bot. S. C. & Ga. **2**: 5), at the end of his description of *H. corymbosum*, remarks: "Frequently in a corymb, one or two flowers rise conspicuously above the rest, and the capsules then become much larger."

Sweet's great illustrated work on the Cistineae was published in parts from 1825 to 1830, and it is easy to trace through its pages the development of the author's ideas about heteromorphism in the American species of *Helianthemum*. Under No. 11, *H. polygalaefolium*, published in November, 1825, he says: "we have not seen any perfect flowers of *H. Brasiliense*, as it did not bloom till autumn, and the flowers were all apetalous, which was also the case with the autumn flowers of the present species, and all the other species of this section that we have had an opportunity of examining this season; the apetalous flowers all produce perfect seeds, but we cannot understand the reason of their producing perfect flowers only in summer."

Under No. 21, *H. Canadense* (May, 1826): "Its handsome flowers are produced in abundance in July and August; after that time it continues to bloom and ripen seeds plentifully until October; but the flowers after August are all without petals, the calyx and capsules are also smaller and of a different form from those produced by the flowers with petals; this is also the case with *H. polygalaefolium* and *Brasiliense*, and we expect with the whole of this section." Under No. 43, *H. Brasiliense* (March, 1827): "the present drawing was taken last May, the first time that it produced perfect flowers; those that were produced the preceding autumn being all apetalous, as are the autumn flowers of all the species of this section that we have had an opportunity of seeing; but those apetalous flowers produce as perfect seeds as the complete flowers."

Under No. 99, *H. Carolinianum* (July, 1829), no mention of heteromorphism is made, although it is placed in the section *Lechioides;* yet under No. 110, *H. glomeratum* (January, 1830), is given the following broad generalization: "Like all the other American species that we have yet seen or heard of, it belongs to the section *Lechioides* of DeCandolle; all the species of which produce flowers with petals, in the spring and early in summer, whereas all those that are produced in autumn, which are much more numerous, are all apetalous."

Spach (Ann. Sci. Nat. II. **6**: 370. D. 1836) segregates all the American species formerly referred to *Helianthemum*, except *H. Carolinianum*, in a new genus *Heteromeris*, characterized by the two kinds of flowers on each plant; Torrey and Gray (Fl. N. Am. **1**: 151. 1838) correctly attribute heteromorphous flowers to all their North American species except *H. scoparium* and *H. Carolinianum*; and the investigation here reported shows that of all the species since described from the same territory (California excepted) none is truly homomorphous.

My attention was first called to this subject by finding an apparently undescribed species of *Helianthemum* in Florida, which upon examination proved referable to the heteromorphic group. Yet its affinity was evidently with *H. Nashii*, which was originally described as having the flowers all alike, and this led to a careful reëxamination, first of the available material of *H. Nashii*, and then of the other North American species.

The most recent review of our species is to be found in Gray's Synoptical Flora ($\mathbf{1}^1$: 189–191. 1895) where four species, *H. Canadense*, *H. majus*, *H. capitatum* and *H. corymbosum*, are said to have heteromorphous flowers, while five, *H. arenicola*, *H. Nashii*, *H. Carolinianum*, *H. scoparium* and *H. Greenei*, are described with the flowers homomorphous. *H. arenicola* and *H. Nashii* must have been placed among the homomorphous species merely because of their original descriptions. Since the appearance of the portion of the Synoptical Flora here referred to, an excellent new species (*H. Georgianum*) has been added (Chapman, Fl. So. U. S.

Ed. 3, 36. 1897); and this, too, contrary to its original description, proves upon careful examination of authentic material to have heteromorphous flowers.

In certain respects the heteromorphism varies in different species. In *H. Canadense* and *H. majus* the petaliferous flowers appear in spring, and are solitary, while the apetalous flowers are autumnal and in clusters; in the remaining species, however, the petaliferous and apetalous flowers appear together, in the same clusters and at about the same time. In *H. Canadense*, *H. majus* and *H. capitatum*, the calyx of the complete flower is much larger than that of the incomplete one; in *H. corymbosum* the contrast is much less striking; while in *H. Georgianum*, *H. arenicola* and *H. Nashii* there is practically no difference in the size of the calyx in the two kinds of flowers. This probably accounts, at least in part, for the fact that heteromorphism has never been suspected in the last three species. The complete flowers are always on longer pedicels than the incomplete ones, in some species many times longer. Flowers intermediate in various degrees between those with perfect expanding petals, and those with no petals whatever, are occasionally present in some (perhaps all) of the species.

Besides the features already noted, which may be seen at a glance—the presence or absence of petals, the size of the calyx, and the length of the pedicels—there are certain less conspicuous but more important differences. In the complete flowers the stamens are from 12 to 30 in number, and the filaments far exceed in length the ovary and even the calyx; the style is very short but distinct, and the ovules are usually numerous (20–60, only 8–10 in *H. capitatum* and *H. Nashii*). The incomplete flowers are cleistogamous, and fertilized very early in the bud; in them the stamens are always less numerous than in the complete ones (only 3–8), the filaments just enough shorter than the ovary, so that the anthers are in contact with the stigma; this rests upon the summit of the ovary, but as it is large, and is contracted to a small point of union with the ovary, it is more exact to say "style obsolete" than "stigma sessile"; and the ovules are always fewer than in the complete flowers of the same species, as a rule less than half the number (6–20, only 3–6 in *H. capitatum* and *H. Nashii*). Of course, the seeds are more numerous in the individual capsules from the petaliferous flower than in those from the apetalous flowers, but it is unusual for all the ovules to mature in either case.

Following is a table showing the number of stamens and ovules in each kind of flower in each of the species under discussion. The material studied, in addition to my own herbarium, is in the herbaria of the New York Botanical Garden and Columbia University. The table is the result of numerous careful dissections, but all the species are not equally well represented, so that in some instances these figures might be slightly altered by a further study of better material.

	Petaliferous Flowers.		Apetalous Flowers.	
	Stamens.	Ovules.	Stamens.	Ovules.
H. Canadense.	30	30–60	4	6–20
H. majus.	30	30–60	4	6–20
H. capitatum.	12–20	8	3	3
H. Nashii.	15	8–10	5	3–6
H. arenicola.	25	20	5	10
H. corymbosum.	25–30	20	3–6	9
H. Georgianum.	12–16	35	8	17

An examination of the available material of the remaining North American species (including the Mexican ones) shows that *H. glomeratum*, *H. argenteum* and *H. Chihuahuense* are heteromorphous, while *H. scoparium*, *H. Greenei*, *H. Mendocinense*, *H. nutans*, *H. patens*, and *H. Pringlei* seem to form quite a natural group, with homomorphous flowers. *H. Carolinianum* is also homomorphous, but otherwise shows a much closer relationship with the heteromorphous species than with the group just referred to. In fact, it seems to me like a heteromorphous species which has lost its apetalous form of flowers; and it would not surprise me, if its origin could be traced, to find that it had heteromorphous ancestors.

TARRYTOWN, N. Y., October, 1900.

A Criticism on certain new Species of Panicum

By Elmer D. Merrill

In 1898 there was published in the Journal of the Elisha Mitchell Scientific Society,* a paper on the dichotomous group of *Panicum* in the Eastern United States which was evidently intended to be a monograph of this group, covering the territory from Maine to Minnesota, south to Florida and Indian Territory.

Whatever the author's intentions may have been in publishing this paper, it is evident from a cursory examination of his work that he had neither the collections nor the literature necessary to a thorough investigation of this very difficult group, and has succeeded in doing for science vastly more harm than good by expounding these species in such an unsatisfactory manner. An examination of this work is convincing only of the fact that the author is imbued solely with the idea of species-making for the satisfaction of seeing his own name after certain combinations rather than with any idea of the advancement of science.

The whole paper shows a carelessness in preparation of the descriptions of species, synonymy, and citation of specimens which could have been easily avoided with little care and trouble. Gross ignorance or neglect is at once shown by the fact that of the twenty-one species described as new, five of them bore names which were homonyms, or at least so considered by the author later, synonymy thus being burdened with so many useless names. One would think that the author did not even know of the existence of the Index Kewensis as the names in question are listed in that work, or granting that he did know of this work, he did not take the trouble to consult it.

It seems advisable to make some comment on certain species mentioned below, in order that those unfamiliar with the species of this group may not be deceived. Our knowledge of these "new species" is based almost entirely on material sent by the author as typical, but we are unable to discuss many of these forms intelligently at present, simply because in many cases this typical

* 15: 22–62. 1898.

material was totally different from the published descriptions of the species to which they were referred. In most cases absolutely nothing can be determined from his descriptions which are mostly short and incomplete, especially those of his first paper.

Panicum commelinaefolium Ashe, 1898, not Kunth, 1833, or Rudge, 1805, = *Panicum Currani* Ashe, 1899.

Panicum maculatum Ashe, 1898, not Aubl., 1775, or Reichb., 1831, = *Panicum Yadkinense* Ashe, 1900.

Panicum Georgianium Ashe, 1898 (*Panicum Cahoonianum* Ashe, 1899). *Panicum Georgianum* is not invalidated by *P. Georgicum* Spreng., 1825.

Panicum annulum Ashe, 1898 (*Panicum Bogueanum* Ashe, 1900). *Panicum annulum* Ashe, is not invalidated by *P. annulatum* A. Rich., 1847.

Panicum glabrissimum Ashe, 1898 (*Panicum Shalotte* Ashe, 1900). *Panicum glabrissimum* Ashe is not invalidated by *P. glaberrimum* Steud., 1855.

While it is unfortunate that the author should apply names in the case of the last three species, so similar to older published ones, we cannot understand on what authority the author proposes new names for the species in question, as there is no reason why the first names should not be retained. *Panicum annulum* Ashe, and *Panicum glabrissimum* Ashe, must stand as a monument to their author's carelessness, while his new names for these two species must be considered only as synonyms. It is very evident that there is little danger of these new names and some others in this paper like *Panicum Mattamusketense* and *P. Huachucae* being homonyms. We have been unable to find any authority for the construction of the word *glabrissimum*.

Of these species *Panicum Georgianum* Ashe (*P. Cahoonianum*) is only the branched state of *P. consanguineum* Kunth, and according to Dr. Small's material in the Herbarium of Columbia University the author is in error in stating that it is a low growing grass as in the type collection the old culms are still attached and match *P. consanguineum* exactly. *Panicum Yadkinense* Ashe was described as a new species under the name of *P. maculatum* Ashe, and is identical with *Panicum dichotomum elatum* Vasey, which is treated in the same paper as a distinct form, the author not recognizing that they were the same. Among other species described in this paper *Panicum calliphyllum* Ashe, we cannot consider to be distinct from *P. xanthophysum* A. Gray. *Panicum Ashei* Pearson, evidently named to gratify the author's desire for fame, as this authority is unknown to systematic botanists, is a small form of *Panicum commutatum* Schultes, but may be worthy of specific rank. In his conception of *Panicum nitidum* Lam., the author is evidently very much at sea as he refers a western form to that species with this remark: "In the extreme west *Panicum nitidum* is represented by *P. thermile* Boland., a rather low, nearly glabrous species." He evidently means *Panicum thermale* Boland., but any one who has seen *Panicum thermale* or even the original description, would certainly not consider it glabrous. *Panicum Mattamusketense* Ashe, 1900, is exactly identical with the type of *Panicum discolor*, co-species *vel. varietas major* Muhl., Desc. 115, 1817, in the Herbarium of the Philadelphia Academy of Sciences. This name, however, will have to be retained as Muhlenberg's var. *major* is antedated by *Panicum nitidum* var. *majus* Pursh, 1814. *Panicum Orangense* Ashe, is exactly *Panicum lanuginosum* Ell., according to a specimen so named by Elliot, in the Herbarium of Columbia University. The first specimen cited under *Panicum haemacarpon* Ashe, is exactly *Panicum Atlanticum* Nash, while other material distributed by the author under this name is *Panicum commonsianum* Ashe. Under *Panicum Huachucae* the mistake is made of applying a local name to a species which, according to the author's statement, extends from Arizona to Iowa and North Carolina, and according to specimens distributed, to New York. We have as yet been unable to separate *Panicum meridionale* and *P. filiculme*, in a satisfactory manner, either by the original descriptions or by comparison of typical material. *Panicum meridionale* may even prove to be unworthy of specific rank. *Panicum microphyllum* Ashe is a doubtful species and the name is invalidated by that of *Panicum zizanioides*, var. *microphyllum* Doell.; Mart. Fl. Bras. 2^2: 229. 1877.

In the same publication * this author publishes another article in which one new species of *Panicum*, and one species and variety of *Andropogon* are described, and two new names proposed for

* Journ. Elisha Mitchell Sci. Soc. **15**: 112–114. 1899.

species previously published by him. Still later * another paper was published describing 14 new species of *Panicum* and proposing three new names. One might suppose that the author would have benefited somewhat from his previous publications regarding his conception of species, but this apparently is not the case. We have not had an opportunity to study all these proposed species, but the following notes on this last paper may indicate its value to science.

Panicum austro-montanum Ashe, 1900, is exactly *P. Earlei* Nash, 1899. *Panicum pauciciliatum* Ashe we cannot consider distinct from *Panicum Nashianum* Scribn., although the spikelets of the former are somewhat smaller than those of typical *P. Nashianum.* In regard to the latter species, in the first-mentioned paper it was referred to the very distinct *Panicum demissum* Trin., a South American species, while in the present paper both *Panicum demissum* and *P. Nashianum* are mentioned, while what is clearly only a form of the latter is described as a new species. *Panicum Onslowense* Ashe, 1900, cannot be distinguished from *Panicum Webberianum* Nash, 1896, a species that was recognized in the first paper mentioned, but unrecognized and published as a new species in the paper under discussion. *Panicum arenicoloides* Ashe, and *Panicum orthophyllum* Ashe, should both be referred to *Panicum angustifolium* Ell., differing only in being slightly more pubescent and with somewhat smaller spikelets than typical *P. angustifolium. Panicum subvillosum* Ashe, 1900, is identical with the form previously described by the same author as *Panicum filiculme*. *Panicum filirameum* Ashe, 1900, is exactly *Panicum arenicolum* Ashe, 1898. *Panicum Mississippiense* Ashe, 1900, not *P. glabrum Mississippiensis* Gattinger, 1887, is practically identical with *Panicum inflatum* Scribn. & Smith, differing from the type of the latter only in its greater height, scarcely inflated sheaths, and pale, not purplish color, characters due entirely to habitat. In this last paper it seems evident that the author is the only botanist in this country so fortunate as to know exactly what *Panicum dichotomum* Linn. is, as he speaks of certain forms as being related to that species.

On further study many more of these proposed "new species" will doubtless be found to be simply forms of previously described

* *Ibid.*, 16: 84–91. 1900.

species and unworthy of specific rank, while some of them will be found to have absolutely no distinctive characters, as illustrated by the "new species" mentioned above.

It is evident from certain collections that we have examined recently that this author purposes to publish more "new species" in this group, as in one small collection in question which had previously been submitted to him, was found three proposed "new species," not one of which is worthy of even varietal rank. In accepting such articles for publication as the ones above discussed, the editor of the Journal of the Elisha Mitchell Scientific Society is open to criticism, as such publications do vastly more harm to science than good.

Proceedings of the Club

TUESDAY EVENING, OCTOBER 9, 1900

Professor Underwood presided, in absence of other officers; ten persons present.

The following resignations were accepted: Mrs. E. K. Dunham, Miss Bernice Mayers, Mr. Gustaf F. Heinen.

Professor MacDougal reported a recommendation from the Editorial Board that beginning January 1, 1901, the price of the BULLETIN of the Club be fixed at $3.00 a year to non-members.

Professor MacDougal moved that consideration of the membership fee and of the price of Memoirs or other matter to others than members be committed to a committee of five, of which the President and Editor be members, to report before January, 1901. The three other members of that Committee, were Dr. MacDougal, the Secretary, and Professor Lyon.

The scientific program followed and consisted of reports of summer work.

Mr. Harper reported collections in Georgia during three and a-half months, traversing all the geological formations from the mountains to the sea, and collecting 754 numbers.

Dr. Rydberg reported two months spent in southern Colorado, with several new species; among them an interesting cactus from elevation of 8,000 feet in the Bitter Root Mountains, now growing at the Botanical Garden.

Dr. Howe reported nine weeks spent in collecting marine algae at three very different stations, Bermuda, Martha's Vineyard (at Edgartown) and at Seguin Island, near the mouth of the Kennebec. Dr. Howe discussed the Bermuda flora in the light of the Challenger report, which recognizes 326 species, of which 144 are indigenous (in 109 genera and 50 families); out of the 144, 109 occur in the southeastern United States and 108 in the West Indies. The Bermuda vegetation is essentially West Indian in character, and includes only 8 endemic species. Among the very few found also here are *Osmunda regalis* and *O. cinnomomea*, *Wood-*

wardia Virginica, *Solidago sempervirens*, and *Typha angustifolia*. Practically the only trees are the Palmetto and the Bermudian cedar, the latter 20 to 50 feet high, and often 1 or 2 feet thick, though some old shells are 5 feet. The oleander is naturalized and in some quarters covered the whole landscape with bloom. Because of the practical absence of frost, tropical trees are acclimated with surprising success. The coffee tree has run wild in the sinkholes. About twenty-five ferns were known, and eight Musci and six Hepaticae had been already observed. There is nowhere any brook and only one moss and one hepatic are common; the others are in the Devonshire marsh and the sinkholes of the Walsingham region. These are open caves 30 or 40 feet deep, with more moisture and shade and less wind, and therefore showing quite a different flora. There Dr. Howe discovered as many as fifteen Hepaticae. He also greatly increased the number of the marine algae beyond the 132 of the Challenger report. The marine flora seems at first scanty on account of the absence of *Fucus* and *Ascophyllum*, but proves to be varied and interesting. It is practically that of southern Florida and the West Indies.

Dr. MacDougal reported work in northern Idaho in the Priest River basin which had perhaps never been visited by a botanist before. There was frost nearly every night. The tangled wild wood could not be penetrated more than four miles a day, except as it is entered by meadows stretching back from the lake. Beaver dams a quarter mile long cross these meadows and convert the upper portions into sedgy marshes. A colony of beavers was active with 400 yards of his camp. Great stretches of *Drosera* carpet the marshes. Interesting plants were collected to 325 numbers.

Professor Lloyd reported upon work on the Gulf coast begun after the close of his classes at the Columbia University summer school. Professor Lloyd and Professor Tracy procured a barge at Biloxi, Miss., by which they explored the flora of the islands of the Mississippi Sound, and of the delta proper. It was necessary to sail for miles in two feet of water, and occasionally to jump out and push. Always a furrow of mud followed in their wake. The islands bear a pine-barren and a sand-dune flora, with masses of *Pinguicula* and *Drosera*. The island surfaces are flat and form remnants of the tertiary Mississippi delta; they average only two feet above water, with a ridge a foot higher on the seaward side, composed of shell-fragments and continually shifted inward by the wind, the waves meanwhile gnawing off the seaward edge at the same rate.

Professor Burgess reported his continued observations on certain asters at stations near Lake Erie, Boston, the White Mountains, New York City, etc., at each of which he has kept certain varying species under scrutiny for some years to determine their range of variation under unchanged environment.

Professor Underwood reported herbarium work at Kew, the British Museum, and Paris, with particular reference to the Cosson herbarium which contains Fée's types and is very rich in ferns especially of South America and the West Indies. A week was given to a trip to Biarritz, France, and San Sebastián, Spain, and an account was given of the turpentine industry now flourishing among the pine forests of the Landes originally planted as a protection from the shifting sands. These pines average about ten inches in diameter. Maize was commonly cultivated in the Basque provinces, the tops being cut off to favor the ripening of the ears, as in our South.

Adjournment followed.

E. S. BURGESS,
Secretary.

Index to recent Literature relating to American Botany

Andrews, A. L. Orchids of Mt. Greylock, Massachusetts. Rhodora, **2**: 179, 180. 13 Au. 1900.

Andrews, L. A List of the flowering Plants and Higher Cryptogams growing upon the Summit of Meriden Mountain, Conn. pp. 1–8. Southington, Conn. 1900.

Andrews, L. *Aster concinnus* in New England. Rhodora, **2**: 166, 167. 13 Au. 1900.

Ashe, W. W. New East American Species of *Crataegus*. Jour. Elisha Mitchell Sci. Soc. **16**: 70–79. 1900.

Eleven species proposed as new.

Ashe, W. W. Some dichotomous Species of *Panicum*. Jour. Elisha Mitchell Sci. Soc. **16**: 84–91. 1900.

Thirteen new species described and three new names proposed.

Bacon, A. E. Some Orchids of eastern Vermont. Rhodora, **2**: 171, 172. 13 Au. 1900.

Barnes, C. R. The Progress and Problems of Plant Physiology. Science, II. **10**: 316–331. 8 S. 1899.

Batchelder, F. W. Flora of Manchester [N. H.] and Vicinity. Proceedings Manchester Inst. of Arts and Sciences, **1**: 158. 1900.

Glyceria borealis (Nash) Batchelder, new name.

Bates, J. M. The Flora of a neglected Dooryard. Asa Gray Bull. **8**: 58–63. Je. 1900.

Beal, W. J. The Work of the Society for Agricultural Education. Science, II. **12**: 328–334. 31 Au. 1900.

Presidential address, Twentieth meeting of the Society for the Promotion of Agricultural Science.

Bessey, C. E. Are the Trees advancing or retreating upon the Nebraska Plains? Science, II. **10**: 768–770. 24 N. 1899.

Bessey, C. E. The international Catalogue of Scientific Literature. Botany. Science, II. **10**: 46–48. 14 Jl. 1899.

Bessey, C. E. The modern Conception of the Structure and Classification of Diatoms, with a Revision of the Tribes and a Rearrangement of the North American Genera. Trans. Am. Micros. Soc. **21**: 61–85. *pl. 5.* My. 1900.

Bissell, C. H. *Plantago elongata* in New England. Rhodora, **2**: 156. 10 Jl. 1900.

Børgesen, F. A Contribution to the Knowledge of the Marine Alga Vegetation on the Coasts of the Danish West Indian Islands. Bot. Tidsskrift, **23**: 49–57. *f. 1–4.* 1900.

Børgesen, F. Et Bidrag til Kundskaben om Algevegetation ved Kysterne af Dansk Vestindien. Bot. Tidsskrift, **23**: 58–60. 1900.

Brandegee, K. Notes on Cacteae.—III. Zoe, **5**: 31–35. Jl. 1900.
Mammillaria Nickelsae and *M. Mainae*, new species.

Brandegee, T. S. Voyage of the Wahlberg. Zoe, **5**: 19–28. Jl. 1900.
Notes on the flora of the islands off the coast of Lower California.

Clute, W. N. A new *Dryopteris* from Jamaica. Fern Bull. **8**: 67. Jl. 1900.
Dryopteris Gilberti.

Clute, W. N., Editor. Helps for the Beginner. I.—The Polypodies. Fern Bull. **8**: 56–58. *f. 1–5.* Jl. 1900.

Clute, W. N. John Goldie. Fern Bull. **8**: 73–75. *Portrait.* O. 1900.

Clute, W. N. *Lycopodium inundatum.* Fern Bull. **8**: 85, 86. O. 1900.

Cockerell, T. D. A. An alien *Clematis* in New Mexico. Science, II. **10**: 898, 899. 15 D. 1899.

Collins, F. S. The marine Flora of Great Duck Island, Maine. Rhodora, **2**: 209–211. O. 1900.

Collins, F. S. The New England Species of *Dictyosiphon.* Rhodora, **2**: 162–166. 13 Au. 1900.
Five species and two varieties.

Congdon, J. W. *Plantago elongata* in Rhode Island. Rhodora, **2**: 194. 8 S. 1900.

Cook, O. F. Rubber Cultivation for Porto Rico. Circ. U. S. Dept. Agric. (Div. Botany) 28: 1–12. 22 Ja. 1900.

Cook, O. F. The Method of Types in Botanical Nomenclature. Science, II. **12**: 475–481. 28 S. 1900.

Driggs, A. W. Notes on the Flora of Hartford, Litchfield and Tolland Counties [Com.]. Pp. 1–3, East Hartford. 1 S. 1900.

Druery, C. F. *Dryopteris* vs. *Lastrea.* Fern Bull. **8**: 87, 88. O. 1900.

Earle, F. S. Diseases of Cotton. Bull. Ala. Exp. Sta. 107: 289–330. Ap. 1900.
Reprinted as "Cotton Diseases."

Eastwood, A. *Aquilegia eximia.* Zoe, **5** : 28–30. Jl. 1900.

Eastwood, A. *Arctostaphylos* as a host-plant for *Phoradendron.* Zoe, **5** : 37. Jl. 1900.

Eastwood, A. On the occurrence of *Rhagadiolus Hedypnois* All. (*Hedypnois polymorpha* DC.) in North America. Zoe, **5** : 35, 36. Jl. 1900.

Eastwood, A. *Pinus Lambertiana* on Mt. St. Helena. Zoe, **5** : 36, 37. Jl. 1900.

Eastwood, A. Some Plants of Mendocino County new to the Flora of California. Zoe, **5** : 58–60. Au. 1900.

Eaton, A. A. A few Additions to the New Hampshire Flora. Rhodora, **2** : 167, 168. 13 Au. 1900.

Eaton, A. A. A new Variety of *Isoetes.* Fern Bull. **8** : 60, 61. Jl. 1900.

Isoetes Engelmanni Caroliniana.

Eaton, A. A. *Parietaria debilis* in New Hampshire. Rhodora, **2** : 158. 10 Jl. 1900.

Eggleston, W. W. New or rare Plants from Pownal, Vermont. Rhodora, **2** : 171. 13 Au. 1900.

Fernald, M. L. *Rubus idaeus* and its Variety *anomalus* in America. Rhodora, **2** : 195–200. *pl. 20.* O. 1900.

Fernald, M. L. Some undescribed Varieties and Hybrids of *Carex.* Rhodora, **2** : 170, 171. 13 Au. 1900.

Carex vestita Kennedyi, C. maritima erectiuscula, C. lupulina × *bullata, C. retrorsa* × *utriculata* and *C. virescens* × *arctata* described as new.

Fernald, M. L. The Distribution of the Bilberries in New England. Rhodora, **2** : 187–190. 8 S. 1900.

Floyd, F. G. *Aspidium simulatum* in New Hampshire. Rhodora, **2** : 155, 156. 10 Jl. 1900.

Gilbert, B. D. Two new Ferns from Jamaica. Fern Bull. **8** : 62–64. Jl. 1900. [Illust.]

Asplenium Clutei and *Polystichum tenue.*

Grinnell, A. L. A remarkable Development of *Steironema lanceolatum.* Rhodora, **2** : 190. 8 S. 1900.

Halsted, B. D. Experience Notes upon Plot Experiments. Science, II. **11** : 726–732. 11 My. 1900.

Presidential address before the Society for the Promotion of Agricultural Science Columbus, Ohio, August 19, 1899.

Halsted, B. D. Genuine Starch Factories. Appleton's Pop. Sci. Mo. **56**: 716–722. *f. 1–6.* Ap. 1900.

Halsted, B. D. Notes upon Grape Mildew (*Plasmopora viticola* B. & C.). Asa Gray Bull. **8**: 78, 79. Au. 1900.

Harrington, M. W. Fauna and Flora of Puerto Rico. Science, II. **10**: 286–288. 1 S. 1899.

Harvey, L. H. *Pogonia pendula* in Maine. Rhodora, **2**: 211, 212. O. 1900.

Hay, G. U. Notes of a wild Garden. Rhodora, **2**: 159, 160. 13 Au. 1900.

Hennings, P. *Cyttaria Reichei* n. sp. Hedwigia, Beiblatt, **39**: (51)–(54). *f. 1–6.* 10 Ap. 1900.

A new fungus from Chile.

Hennings, P. Einige neue Geasterarten. Hedwigia, Beiblatt, **39**: (54)–(55). 10 Ap. 1900.

Geaster minutus, a new species from Brazil.

Hennings, P. Fungi mattogrossenses a Dr. R. Pilger collecti, 1899. Hedwigia, Beiblatt, **39**: (134)–(139). 10 Au. 1900. [Illust.]

New species in *Marasmius*, *Pluteus*, *Pleurotus*, *Lycoperdon*, *Dimerosporium*, *Pilgenella* (gen. nov.), *Hypoxylon* and *Aschersonia*.

Hennings, P. Fungi paráenses.—I. Hedwigia, Beiblatt, **39**: (76)–(80). 26 Je. 1900.

New species in *Puccinia*, *Meliola*, *Balansia*, *Cordyceps*, *Phyllachora*, *Auerswaldia*, *Septosphaeria*, *Tryblidiella*, *Geoglossum*, *Septoria* and *Melasmia*.

Jones, M. E. Contributions to Western Botany, No. IX. Zoe, **5**: 41–53. Au. 1900.

Astragalus Kentrophyta rotundus nom. nov., *A. Craigi* sp. nov. and *A. Beckwithii Weiserensis* var. nov.

Judd, S. D. Birds as Weed Destroyers. Science, II. **9**: 905, 906. 30 Je. 1899.

Keyse, C. R. Coal Floras of the Mississippi Valley. Science, II. **11**: 898–900. 8 Je. 1900.

Kindberg, N. C. Additions to the North American and European Bryology (Moss Flora). Ottawa Nat. **14**: 77–88. 13 Au. 1900.

Seven new mosses described, of which six are American.

Knowlton, C. H. Further Notes on the Flora of Worcester County, Massachusetts. Rhodora, **2**: 201, 202. O. 1900.

Loew, O. Physiological Studies of Connecticut Leaf Tobacco. Rept. U. S. Dept. Agric. (Div. of Soils; Div. of Veg. Phys. & Path.) **65**: 1–57. 1900.

Loew, O. The Proteids of Living Matter. Science, II. **11**: 930–935. 15 Je. 1900.

Lyman, C. W. The Paper Industry and Forests. The Forester, **6**: 125–130. Je. 1900.

MacDougal, D. T. The New York Botanical Garden. Science, II. **11**: 935–945. 15 Je. 1900.

MacElwee, A. The Flora of the Edgehill Ridge near Willow Grove, and its Ecology. Proc. Acad. Nat. Sci. Phila. 1900: 482–484. Mr.–Au. 1900.

Meehan, T. *Anoda lavateroides.* Meehan's Monthly, **10**: 129, 130. *pl. 9.* S. 1900.

Meehan, T. *Azalea viscosa.* Meehan's Monthly, **10**: 81, 82. *pl. 6.* Je. 1900.

Meehan, T. *Erigeron speciosus.* Meehan's Monthly, **10**: 97, 98. *pl. 7.* Jl. 1900.

Meehan, T. *Grindelia squarrosa.* Meehan's Monthly, **10**: 145, 146. *pl. 10.* O. 1900.

Meehan, T. *Nelumbium luteum.* Meehan's Monthly, **10**: 113, 114. *pl. 8.* Au. 1900.

Merrill, E. D. The Occurrence of *Thamnolia* in Maine. Rhodora, **2**: 155. 10 Jl. 1900.

Millspaugh, C. F. Plantae Insulae Ananasensis. A Catalogue of Plants collected on the Isle of Pines, Cuba, by Don José Blain. Field Columbian Museum. Botany, **1**: 425–439. Au. 1900.
New species in *Salacia, Polygala, Spigelia* and *Heliotropium.*

Millspaugh, C. F. Plantae Utowanae—Part 1 A. Reconsideration of the Cyperaceae. Reconsideration of *Cakile.* Field Columbian Museum. Botany, **2**: 113–133. Au. 1900. [Illust.]
New species, names and hybrids in *Cyperus* and *Cakile.*

Morrison, J. The Kentucky Coffee Tree (*Gymnocladus Canadensis*). Ottawa Nat. **14**: 118, 119. 13 S. 1900.

Morss, C. H. A Colony of *Alnus glutinosa* in eastern Massachusetts. Rhodora, **2**: 157. 10 Jl. 1900.

Needham, J. G. The Fruiting of the Blue Flag (*Iris versicolor* L.). Am. Nat. **34**: 361–386. *pl. 1. f. 1–4.* My. 1900.

Nott, C. P. Nitophylla of California. Description and Distribution. Proc. Cal. Acad. Sci. Botany, III. **2**: 1–62. *pl. 1–9.* 3 Au. 1900.
Nitophyllum corallinarum sp. nov.

Noyes, H. M. Ferns of Alstead, New Hampshire. Rhodora, **2**: 181–185. 8 S. 1900.

Paddock, W. European Apple Tree Canker in America. Science: II. **12**: 297–299. 24 Au. 1900.

Pierce, N. B. Peach Leaf Curl; its Nature and Treatment. Bull. U. S. Dept. Agric. (Div. Veg. Phys. & Path.) 20: 1–204. *pl. 1–30. f. 1–10.* 1900.

Rand, E. L. Plants from the Duck Islands, Maine. Rhodora, **2**: 207–209. O. 1900.

Rehm, H. Berträge zur Pilzflora von Südamerika. VIII. Discomycetes. Hedwigia, **39**: 80–99. *pl. 4–6.* 10 Ap. 1900.

New species in *Phacidium*, *Cocconia*, *Pseudophacidium*, *Briardia*, *Lindauella* (gen. nov.), *Cryptodiscus*, *Dermatea*, *Karschia*, *Agyrium*, *Calloria*, *Ombrophila*, *Mollisia*, *Niptera*, *Belonopsis*, *Tapesia*, *Trichobelonium*, *Pazschkea*, *Mellitosporiopsis*, *Pseudopeziza*, *Belonium*, *Phialea*, *Ciboria*, *Helotium*, *Dasyscypha*, *Solenopezia*, *Dasyscyphella*, *Plicaria*, and *Lachnea*.

Rich, W. P. Some new Acquaintances. Rhodora, **2**: 203–205. O. 1900.

Rolfs, P. H. Variation from the Normal. Asa Gray Bull. **8**: 75–78, Au. 1900.

Rothrock, J. T. Dogwood, Flowering Dogwood, Boxwood (*Cornus florida* L.). Forest Leaves, **7**: 152, 153. *pl.*

Saunders, C. F. Grape Ferns at Mount Ararat, Penna. Fern Bull. **8**: 82–84. O. 1900.

Saunders, C. F. *Marsilea* at Night. Fern Bull. **8**: 52. Jl. 1900.

Schuh, R. E. Notes on two rare Algae of Vineyard Sound. Rhodora, **2**: 206, 207. O. 1900.

Giraudia sphacelarioides Derb. & Sol. and *Pogotrichum filiforme* Reinke.

Setchell, W. A. Daniel Cady Eaton. Fern Bull. **8**: 49–52. *Portrait.* Jl. 1900.

Seymour, A. B. A cluster-cup Fungus on *Lespedeza* in New England. Rhodora, **2**: 186. 8 S. 1900.

Aecidium leucostictum.

Seymour, A. B. The Fruiting of *Riccia natans*. Rhodora, **2**: 161. 13 Au. 1900.

Shear, C. L. A Revision of the North American Species of *Bromus* occurring north of Mexico. Bull. U. S. Dept. Agric. (Div. Agrost.) 23: 5–66. 3 Jl. 1900.

Three new species and fifteen new varieties described.

Stokes, S. G. A new Species of *Chorizanthe* from Lower California. Zoe, **5**: 60. Au. 1900.
Chorizanthe inequalis.

Swingle, W. T. The Dioecism of the Fig in its Bearing upon Caprification. Science, II. **10**: 570–574. 20 O. 1899.

Taylor, Mrs. J. D. Ferns of Southeastern Ohio. Fern Bull. **8**: 78–81. O. 1900.

Toumey, J. W. Practical Tree Planting in Operation. Bull. U. S. Dept. Agric. (Div. Forestry), 27: 1–27. *pl. 1–4. f. 1, 2.* 1900.

Trelease, W. Some Twentieth Century Problems. Science, II. **12**: 48–62. 13 Jl. 1900.
Vice-Presidential address, Section G (Botany) American Association for the Advancement of Science, 1900.

Trelease, W. The Classification of Botanical Publications. Science, II. **10**: 713–717. 17 N. 1899.

True, A. C. The Association of American Agricultural Colleges and Experiment Stations. Science, II. **10**: 110–113. 28 Jl. 1899.

Underwood, L. M. A new *Botrychium* from Jamaica. Fern. Bull. **8**: 59, 60. Jl. 1900.
Botrychium Jenmani.

Underwood, L. M. The Royal Botanical Gardens at Kew. Science, II. **10**: 65–75. 21 Jl. 1899.

Underwood, L. M. The last Quarter—A Reminiscence and an Outlook. Science, II. **12**: 161–170. 3 Au. 1900.
Address of the retiring President, Botanical Society of America, 1900. Also separate, pp. 1–20.

Underwood, L. M. Why *Dryopteris* and not *Lastrea?* Fern Bull. **8**: 52–55. Jl. 1900.

Warnstorf, C. Neue Beiträge zur Kenntniss europäischer und exotischer Sphagnumformen. Hedwigia, **39**: 100–110. 10 Ap. 1900.
Sphagnum Virginianum, *S. Kearneyi*, *S. Henryense* and *S. brevicaule*, new American species from the coast region of Virginia and North Carolina, collected by T. H. Kearney, Jr., in July and August, 1898.

Webster, H. An afternoon Outing for Toadstools. Rhodora, **2**: 191–194. 8 S. 1900.

Webster, H. Boleti collected at Alstead, N. H. Rhodora, **2**: 173–179. 13 Au. 1900.

Webster, J. R. Cleistogamy in *Linaria Canadensis*. Rhodora, **2**: 168, 169. 13 Au. 1900.

White, D. The Stratigraphic Succession of the Fossil Floras of the Pottsville Formation in the Southern Anthracite Coal Field, Pennsylvania. Ann. Rep. U. S. Geol. Surv. **20^2**: 749–930. *pl. 180–193.* 1900.

New species in *Aneimites, Eremopteris, Mariopteris, Sphenopteris, Alethopteris, Callipteridium, Megalopteris, Neuropteris, Asterophyllites, Sphenophyllum, Lepidodendron, Lepidophyllum, Whittleseya, Cardiocarpon* and *Trigonocarpum.*

Wiegand, K. M. Plant Embryo-sacs. Science, II. **12**: 347. 31 Au. 1900.

Wild, L. *Baptisia australis* in Vermont. Rhodora, **2**: 172, 173. 13 Au. 1900.

Williams, T. A. The shaggy-mane Mushroom. Asa Gray Bull. **8**: 69–71. *pl. 4.* Au. 1900.

Wright, W. F. New species of *Galium* and Notes on a few of the Californian Forms. Zoe, **5**: 53–58. Au. 1900.

Galium tinctorium submontanum, G. tinctorium diversifolium, G. siccatum, G. Coloradoense, G. ambiguum, G. sparsiflorum, G. subscabridum, G. muricatum, and *G. chartaceum,* new species and varieties.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT :

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895 ; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT :

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth) ; $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896 ; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages ; Vol. 2 642 pages ; Vol. 3, 588 pages ; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes ; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895 ; Tutor in Botany, 1895–.

Octavo, 360 pages ; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS OF THE TORREY BOTANICAL CLUB.

(1) BULLETIN.

A monthly journal devoted to general botany. Vol. 26 published in 1899 contained 659 pages of text and 23 full-page plates. Price $3 00 per annum. For Europe 14 shillings. Dulau & Co., 37 Soho Square London, are agents for England.

As the supply of several of the volumes is limited, libraries desiring to complete their files should apply at once. Yearly volumes 1–5 (1870–1874), One Dollar each. Vol. 6 (1875–1879), extending over five years, is furnished at the subscription price of Five Dollars. Vols. 7–16 (1880–1889), can only be had complete in orders for full sets.

Vols. 17–25 (1890–1898) are furnished at the published price of Two Dollars each, except Vols. 18 and 21, which can be had only in orders for full sets.

Single copies (20 cts.) will be furnished only when not breaking complete volumes.

(2) MEMOIRS.

The subscription price is fixed at $3.00 per volume in advance. The numbers can also be purchased singly and an invariable price is fixed for each.

Volume 1, No. 1.—Studies of the Types of various Species of the genus *Carex*. By L. H. Bailey. Price, $1.00.

No. 2.—A List of the Marine Algæ hitherto observed on the Coasts of New Jersey and Staten Island. By Isaac C. Martindale. Price, 50 cents.

No. 3.—An Enumeration of the Hepaticæ collected by Dr. H. H. Rusby in South America, with descriptions of many new species. By Richard Spruce. Price, 75 cents.

No. 4.—On Seedless Fruits. By E. Lewis Sturtevant. Price, 75 cents.

Volume 2, No. 1.—On reserve Food Materials in Buds and surrounding Parts, with two plates. By Byron D. Halsted. (Only with full volumes.)

No. 2.—Contributions to the Botany of Virginia, with two plates. By Anna Murray Vail and Arthur Hollick. Price, 75 cents.

No. 4.—A Monograph of the North American Species of the Genus *Polygala*. By William E. Wheelock. Price, 75 cents.

Vol. 3. No. 1.—On the Flora of Western North Carolina and contiguous Territory. By John K. Small and A. A. Heller. (Only with full volumes.)

No. 2.—A Revision of the North American Naiadaceæ with illustrations of all the species. By Thomas Morong. Price, $2.00.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang. By Henry H. Rusby. Price, 50 cents.

Vol. 4. No. 1.—Index Hepaticarum. Part 1, Bibliography. By Lucien M. Underwood. Price, 75 cents.

No 2.—Report on the Botanical Exploration of Virginia during the Season of 1892. By John K. Small and Anna Murray Vail. Price, 50 cents.

No. 3.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—II. By Henry H. Rusby. Price, 50 cents

No. 4.—*Arachis hypogaea* L., with three plates. By Anna Stockton Pettit. Price, 50 cents.

No 5.—Monograph of *Physalis* and related Genera. By P. A. Rydberg. Price, 75 cents.

Vol. 5. List of Pteridophyta and Spermatophyta growing without cultivation in Northeastern North America. Prepared by the Botanical Club, A. A. A. S. Price, $3.00.

Vol. 6. No. 1.—An Enumeration of the Plants collected in Bolivia by Miguel Bang—III. By Henry H. Rusby. Price, $1.25.

No. 2.—A Revision of the North American Isotheciaceae and Brachythecia. By Abel Joel Grout. Price, 50 cents.

No. 3.—The Life History of *Sphaerella lacustris* (*Haematococcus pluvialis*). With two colored plates. By Tracy Elliot Hazen. Price, 50 cents.

No. 4.—A Review of the Genera of Ferns proposed prior to 1832. By Lucien M. Underwood. Price, 35 cents.

No. 5.—Notes on the Lichen Distribution in the Upper Mississippi Valley. By Bruce Fink. Price, 25 cents.

Vol. 7. The Hepaticae and Anthocerotes of California. With thirty five plates. By Marshall Avery Howe. Price, $3.00.

Vol 8. No. 1, Part 1.—The Comparative Embryology of the Rubiaceae. With our plates. By Francis Ernest Lloyd. Price, 50 cents.

Vol. 9. Monograph of the Erysiphaceae. By E. S. Salmon, F. L. S Price, $3.00.

---

(3) The Preliminary Catalogue of Anthophyta and Pteridophyta reported a growing within one hundred miles of New York, 1888. Price, $1.00.

Address: **L. M. UNDERWOOD,**
COLUMBIA UNIVERSITY, NEW YORK CITY.

VOL. 27 DECEMBER, 1900 NO. 12

BULLETIN

OF THE

TORREY BOTANICAL CLUB

CONTENTS

PUBLISHED FOR THE CLUB

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

THE TORREY BOTANICAL CLUB

OFFICERS FOR 1900

President,
HON. ADDISON BROWN.

Vice Presidents,
T. F. ALLEN, M. D. HENRY H. RUSBY, M. D.

Recording Secretary,
PROF. EDW. S. BURGESS,
Normal College, New York City.

Corresponding Secretary,
DR. JOHN K. SMALL,
Botanical Garden, Bronx Park, New York City.

Editor,
L. M. UNDERWOOD, Ph. D.,
Columbia University.

Treasurer,
MATURIN L. DELAFIELD, JR.
56 Liberty Street, New York City.

Associate Editors,
ANNA MURRAY VAIL, BYRON D. HALSTED, Sc. D.
ARTHUR HOLLICK, Ph. D., CARLTON C. CURTIS, Ph. D.,
MARSHALL A. HOWE, Ph. D., PROF. FRANCIS E. LLOYD.
DANIEL T. MACDOUGAL, Ph.D.

Curator,
HELEN M. INGERSOLL.

Librarian,
PER AXEL RYDBERG, Ph. D.,

Committee on Finance.
J. I. KANE. WM. E. DODGE.

Committee on Admissions.
CORNELIUS VAN BRUNT,
319 E. 57th Street, New York City.
JEANNETTE B. GREENE, M. D.,
135 W. 41st Street, New York City.
JOHN K. SMALL, Ph. D.
Botanical Garden, Bronx Park.

Committee on Library and Herbarium.
PER AXEL RYDBERG, Ph. D., MARIE L. SANIAL,
HELEN M. INGERSOLL, ALICE M. ISAACS.

Committees on the Local Flora,
PROF. N. L. BRITTON, Ph. D.,

PHANEROGAMIA,
EUGENE P. BICKNELL,
H. H. RUSBY, M. D.,
REV. GEO. D. HULST,

CRYPTOGAMIA,
PROF. L. M. UNDERWOOD
MARSHALL A. HOWE, Ph. D.,
MRS. ELIZABETH G. BRITTON.

Committee on Excursions.
DR. L. SCHOENEY,
1670 Lexington Avenue, New York City.
GEORGE V. NASH, EUGENE SMITH,
MARIE L. SANIAL, W. A. BASTEDO.

Committee on Program.
DR. H. H. RUSBY, DR. C. C. CURTIS,
MRS. ELIZABETH G. BRITTON.

The Club meets regularly at the College of Pharmacy, 115 West 68th Street New York City, on the second Tuesday and last Wednesday of each month, except June, July, August and September, at 8 o'clock, P. M. Botanists are cordially invited to attend.

MEMBERS OF THE CLUB will please remit their annual dues for 1900, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

VOL. 27 No. 12

BULLETIN

OF THE

TORREY BOTANICAL CLUB

DECEMBER 1900

New Species of Fungi

By CHARLES H. PECK

Amanita submaculata

Pileus convex or subcampanulate, glabrous, shining, even on the margin, dark brown, more or less marked by whitish stripes or spots; lamellae thin, subdistant, free, white; stem equal, bulbous, glabrous, solid, white, the annulus large, membranous, white.

Pileus 7–9 cm. broad; stem 7–9 cm. long, 6–12 mm. thick.

Scattered or cespitose. Thin woods and open places. North Carolina. July. Miss M. L. Wilson.

The species is easily recognized by the white spots on the pileus. The specimen examined yielded no spores.

Amanita radicata

Pileus subglobose, becoming convex, dry, verrucose, white, margin even, flesh firm, white, odor resembling that of chloride of lime; lamellae close, free, white; stem solid, deeply radicating, swollen at the base or bulbous, floccose or mealy at the top, white, veil thin, floccose or mealy, white, soon lacerated and attached in fragments to the margin of the pileus or evanescent; spores broadly elliptic, 7.5–10 μ long, 6–7 μ broad.

Pileus 5–10 cm. broad; stem 2.5–7.5 cm. long, 8–12 mm. thick.

Woods. New Jersey. July. E. B. Sterling.

The species is closely related to *A. strobiliformis*, from which it is separated by its uniformly white color, radicating stem, peculiar odor and smaller spores. The warts of the pileus are numerous large and firm. They are either white or brown, or white with

[Issued 29 December.]

brown tips. Possibly it may prove to be a variety of *A. strobiliformis*, but it appears to be distinct.

Amanitopsis parcivolvata

Pileus rather thin, hemispherical or convex, becoming nearly plane, glabrous or sometimes adorned with a few small easily separable fragments of the volva, viscid when moist, plicate striate on the margin, orange or yellow, sometimes orange in the center and yellow or whitish on the margin, flesh white tinged with orange, reddish under the cuticle; lamellae free, rounded at the outer extremity, floccose on the edge, pale yellow; stem long, equal or slightly tapering upward, slightly furfuraceous or mealy, stuffed or hollow, pale yellow, rarely fading to white, the volva thin, easily rupturing and forming scales or disappearing, white; spores broadly elliptic, 10–12 μ long, 6–8 μ broad.

Pileus 5–10 cm. broad; stem 8–12 cm. long, 8–12 mm. thick.

Grassy ground in thin woods. New Jersey. July. Miss N. L. Marshall. North Carolina. July. Miss M. L. Wilson.

A beautiful mushroom. Sometimes the whole pileus is brilliant orange. In the North Carolina specimens the center of the pileus is orange or crimson and the margin yellow or whitish. The volva is so slight and so easily destroyed that it is difficult to secure specimens that retain it.

Lepiota felinoides

Pileus thin, convex, subumbonate, brown, purplish brown or blackish brown, often darker in the center, becoming squamose by the rupturing of the cuticle, flesh white; lamellae thin, close, free, white; stem slender, slightly thickened at the base, hollow, silky fibrillose, white, the annulus membranaceous, persistent, white; spores elliptic, 6–7.5 μ long, 4–5 μ broad.

Pileus 2.5–6 cm. broad; stem 5–8 cm. long, 2–4 mm. thick.

Low shaded ground under poison ivy in woods. Near St. Louis, Missouri. August. N. M. Glatfelter.

The species is related to *L. felina*, from which it is separated by its slender silky white stem and its well-developed persistent white annulus.

Armillaria macrospora

Pileus fleshy, fragile, convex, glabrous, viscid when moist, shining when dry, white, sometimes brown in the center, flesh white; lamellae rather narrow, close, decurrent, white; stem short, stout, subequal, white, the annulus thick, white; spores oblong or subfusiform, 12–15 μ long, 6–8 μ broad.

Pileus 5–20 cm. broad; stem 2.5–5 cm. long, 12–20 mm. thick.

Single or cespitose. Dense spruce woods. Colorado. September. E. Bartholomew.

The white color and long spores are prominent characters of this species.

Armillaria solidipes

Pileus fleshy, convex, even, glabrous, tawny or yellowish brown, becoming tinged with red in drying, flesh whitish; lamellae rather close, adnate or slightly decurrent, white or whitish; stem long, firm, solid, colored like the pileus.

Pileus 2.5–5 cm. broad; stem 10–25 cm. long, 6–12 mm. thick.

Densely cespitose. About spruce stumps. Colorado. September. E. Bartholomew. Spores not seen.

Tricholoma Davisiae

Pileus fleshy but thin except in the center, very fragile, at first rounded with involute margin, becoming convex or nearly plane, umbonate, dry, pruinose or slightly pulverulent, floccose squamulose toward the margin, bright yellow when young and often tinged with red or green and showing changeable or iridescent hues, becoming paler with age and assuming pinkish or salmon tints, brown or purplish brown in the center, flesh white, taste farinaceous, then disagreeable; lamellae broad, subdistant, rounded behind and somewhat ventricose, adnexed, often split on the margin, whitish becoming tinged with salmon, specially on the edge; stem nearly equal, straight or curved, stuffed or slightly hollow, fibrous, penetrating the earth deeply, white externally and within; spores broadly elliptic or subglobose, 5–6 μ long, 5 μ broad.

Pileus 4–10 cm. broad; stem 5–10 cm. long, 8–15 mm. thick.

Among fallen leaves in pine woods. Near Falmouth, Maine. October and November. Mrs. H. C. Davis.

This is one of the most beautifnl species of *Tricholoma* known to me. Its changeable hues when young and fresh and its delicate salmon tints when mature make it very attractive. Its pileus is so fragile that care is necessary in collecting it to prevent breaking. The thin margin is often split. The umbo may be blunt or acute. It is brown like the center of the pileus. The lamellae are sometimes marked by transverse white stripes. The species belongs to the section *Genuina* and is respectfully dedicated to its discoverer who kindly communicated notes and specimens.

Omphalia subclavata

Pileus thin, submembranaceous, subclavate or tubaeform, deeply umbilicate, glabrous, grayish brown; lamellae subdistant, very decurrent, yellow; stem slender, subpruinose, often tomentose near the base, hollow, whitish; spores elliptic, 6–7.5 μ long, 4–5 μ broad.

Pileus 6–12 mm. broad; stem about 2.5 cm. long, 1 mm. thick.

Dead bark. Missouri. July and August. N. M. Glatfelter.

This species differs from *O. clavata* in its yellow lamellae and elliptic spores and from *O. tubaeformis* in its yellow lamellae, whitish stem and longer spores.

Boletus roseotinctus

Pileus broadly convex or nearly plane, firm, dry, pruinose, pink or pale rosy red, flesh yellowish white; tubes short, adnate, yellowish, their mouths minute, subrotund, the dissepiments uneven on the edge; stem equal, even, yellow above, red or purplish red below; spores oblong, 10–12 μ long, 4–5 μ broad.

Pileus about 5 cm. broad; stem 3–5 cm. long, 8–12 mm. thick.

Blue Ridge. July and August. G. F. Atkinson.

The pileus is firm in the mass but its flesh is soft to the touch and almost friable. It is separable into two strata, the lower being thinner than the other. It belongs to the section *Subpruinosi*.

Boletus amabilis

Pileus fleshy, convex, glabrous, reddish tawny, flesh pallid; tubes short, decurrent to the annulus, yellow, their mouths angular; stem equal or slightly tapering downward, solid, paler than the pileus, reticulate above the slight annulus.

Pileus 5–18 cm. broad; stem 2.5–5 cm. long, 8–16 mm. thick.

Dense spruce woods. Colorado. September. E. Bartholomew.

In the dried specimens the pileus is marked with small brown or blackish brown spots. The tubes have a radiating structure as in the genus *Boletinus*, to which genus the species may possibly belong, but it is not safe to affirm such relationship from the dried specimens. If a true *Boletus* it is nearest the section *Viscipelles* and the pileus is probably viscid when fresh though the dried specimens seen do not show this character, nor do the notes accompanying them speak of it. The annulus is slight and whitish.

Boletinus castanellus

Pileus convex or nearly plane, dry, subtomentose, soft, spongy, dark chestnut, flesh whitish or yellowish white; tubes nearly plane in the mass, adnate or slightly decurrent, brown, their mouths large, angular; stem short, solid, glabrous, colored like the pileus, whitish or grayish within, slightly reticulate at the top; spores 7.5–10 μ long, about 5 μ broad.

Pileus 2.5–4 cm. broad; stem about 2.5 cm. long, 4–8 mm. thick.

Woods. New Jersey. September. E. B. Sterling.

Studies on the Rocky Mountain Flora.—III

BY P. A. RYDBERG

SOME SMALLER GENERA OF COMPOSITES

STENOTUS Nutt.

This genus was established by Nuttall in 1840. It was retained as a genus by Torrey and Gray in their Flora, but merged with several others into *Aplopappus* by Gray in his Synoptical Flora. A few years ago (1894), Professor Greene reëstablished the genus, removing from it, however, a member erroneously placed in the genus by Torrey and Gray, viz., *Stenotus pygmaeus* Torrey and Gray (*Aplopappus pygmaeus* Gray), which he referred to *Macronema.** If such a transfer was the very best is questionable, for that species is as much a stranger in *Macronema* as it is in *Stenotus.* It has the outer bracts foliaceous and the style-appendages long and attenuated which are characters found in *Macronema;* but the habit is very unlike *Macronema* and the outer foliaceous bracts are numerous as in *Pyrrocoma.* I had some transient thought of transferring it to that genus ; but the purely white pappus, the densely cespitose habit, and the lack of the thick taproot, debar it from *Pyrrocoma.* These characters ally it to *Solidago;* but the difference in structure of the outer and the inner bracts makes it unnatural to place it there as well. It is very hard to decide which would be the best course to take, either to place it as an anomalous member of one of these genera or to make it the type of a new genus. Perhaps some other and better relationship may be found.

Of the other species included in APLOPAPPUS § STENOTUS by Gray, *A. Parryi* is, I think, rightly referred to *Solidago.* *A. Lyallii* was altogether omitted by Professor Greene, when he made the segregation in Pittonia. He may have overlooked this, but it is more probable that he omitted it, because he did not know where to place it. The relationship is without any doubt closest with *Solidago*, notwithstanding the solitary head.

* In a recent distribution of plants from Colorado determined by Professor Greene, this was distributed under its original name *Stenotus pygmaeus.*

By removing *Stenotus linearifolius* Torr. & Gray and *S. interior* Greene, which constitute a good genus, the genus *Stenotus* becomes a very natural one, with only one somewhat aberrant member, *S. lanuginosus* which approaches *Pyrrocoma inuloides* and its relatives in habit.

The Rocky Mountain species are distinguished as follows:

Plant glabrous or puberulent; leaves firm and evergreen.
  Leaves linear to filiform. 1. *S. stenophyllus.*
  Leaves mostly oblanceolate.
    Bracts lanceolate, acute.
      Plant puberulent.
        Bracts in 3 series, broad, with broad scarious margins. 2. *S. acaulis.*
        Bracts in 2 series, narrow, with narrow scarious margins. 3. *S. Andersonii.*
      Plant glabrous.
        Stem-leaves oblanceolate, 1–2 cm. long. 4. *S. caespitosus.*
        Stem-leaves linear, 4–7 cm. long. 5. *S. falcatus.*
    Bracts oval or oblong, very obtuse. 6. *S. armerioides.*
Plant floccose; leaves softer, not evergreen. 7. *S. lanugino.us.*

1. STENOTUS STENOPHYLLUS (A. Gray) Greene, Erythea, **2**: 72. 1894

Aplopappus stenophyllus A. Gray, U. S. Expl. Exp. **17**: 347. 1862–74.

This species grows on stony hills and mountains and ranges from western Idaho and Washington to California.

2. STENOTUS ACAULIS Nutt. Trans. Am. Phil. Soc. II. **7**: 334. 1840

Chrysopsis acaulis Nutt. Journ. Phil. Acad. **7**: 33. 1834.

Aplopappus acaulis A. Gray, Proc. Am. Acad. **7**: 353. 1867.

This is a rather common species, growing on dry rocky hills and mountains at an altitude of 1000–2500 m., from Saskatchewan and Washington to Wyoming and California.

3. **Stenotus Andersonii** sp. nov.

A puberulent, cespitose, but less woody perennial than the preceding and the three next following species. Flowering stems about 1 dm. high, leafy at the base, few-leaved above: leaves narrowly oblanceolate, not very rigid, distinctly 3-ribbed, 3–5 cm. long, 3–4 mm. wide: bracts narrowly lanceolate, acute, glandular puberulent, with a very narrow scarious margin, imbricated in 2 series: achenes somewhat fusiform, about 4 mm. long, grayish or white villous as in the other species.

This species is nearest related to the preceding, but characterized by the less rigid leaves, the fewer and narrower involucral bracts, the involucre being more that of *S. lanuginosus*.

The type was collected on dry open hills.

MONTANA: Belt Mountains, 1886, *F. W. Anderson, 3561.**

4. STENOTUS CAESPITOSUS Nutt. Trans. Am. Phil. Soc. II. **7**: 335. 1840

Chrysopsis caespitosa Nutt. Jour. Acad. Phila. **7**: 33. 1834.

Aplopappus acaulis var. *glabratus* D. C. Eaton, King's Exped. **5**: 161. 1871.

This grows on dry hills and mountains, at an altitude of 1000–3000 m., from Montana and Idaho to Nevada, Arizona and Wyoming.

5. **Stenotus falcatus** sp. nov.

A glabrous cespitose perennial, with a woody caudex, resembling *S. armerioides* in habit. Flowering stems 10–15 cm. high, leafy, 1–3-cephalous: basal leaves oblanceolate, rigid, obtuse or acute, 4–5 cm. long, 4–6 mm. wide, 3-ribbed; stem leaves linear, 4–7 cm. long, 2–3 mm. wide, more or less falcate: heads about 1 cm. high: bracts lanceolate, acute, with scarious margin: rays 6–7 mm. long, 2.5–3 mm. wide.

This species differs from *S. armerioides*, which it closely resembles in the narrower and acute involucral bracts. It grows in barren soil at an altitude of about 1500 m.

UTAH: Red Creek, 1877, *Dr. E. Palmer, 202* (type); Milford, 1880, *M. E. Jones, 1804*.

6. STENOTUS ARMERIOIDES Nutt. Trans. Am. Phil. Soc. II. **7**: 335. 1840

Aplopappus armerioides A. Gray, Syn. Fl. 1^2: 132. 1884.

This species grows on dry hills and bad-lands, at an altitude of 1000–2000 m., from Manitoba and Assiniboia to Utah, New Mexico and western Nebraska.

---

* Unless otherwise stated, the types of the new species described are preserved in the herbaria of the New York Botanical Garden or of Columbia University.

7. STENOTUS LANUGINOSUS (A. Gray) Greene, Erythea, **2**: 72. 1894.

Aplopappus lanuginosus A. Gray, U. S. Expl. Exped. **17**: 347. 1862–74.

This species is a rather anomalous member of the genus, as the leaves are not rigid, and scarcely evergreen. In habit it resembles somewhat some species of *Pyrrocoma*, as for instance, *P. inuloides*; but it has the thin involucral bracts and the white pappus of *Stenotus*. It grows on the mountains of Washington, northern Idaho and Montana.

Stenotopsis gen. nov.

Low shrubs with fastigiate branches, narrow fasciculate glandular punctate leaves and large peduncled heads. Involucre broadly hemispherical; its bract subequal, almost in a single series, linear lanceolate, thin scarious-margined, not at all hebaceous. Receptacle naked, alveolar. Ray-flowers about 12, ligulate, yellow, large, pistillate and fertile. Disk-flowers perfect: their corollas tubular-trumpet shaped, deeply 5-lobed. Anthers obtuse at the base. Style branches stigmatic their whole length, with ovate to lanceolate-subulate appendages. Achenes densely silvery-villous. Pappus of white capillary bristles, rather deciduous.

The genus contains two known species. It differs mainly from *Stenotus* in its shrubby habit and glandular punctate leaves.

Leaves 3–4 cm. long; rays 11–14 mm. long.	1. *S. linearifolius.*
Leaves 1–2 cm. long; rays 9–11 mm. long.	2. *S. interior.*

1. **Stenotopsis linearifolia** (DC.)

Aplopappus linearifolius DC. Prod. **5**: 347. 1836.

Stenotus linearifolius Torr. & Gray, Fl. N. Am. **2**: 238. 1842.

This species is a shrub 3–10 dm. high, and grows on dry hills, from Utah to California and Arizona.

2. **Stenotopsis interior** (Coville)

Aplopappus interior Coville, Proc. Biol. Soc. Wash. **7**: 65. 1892.

Stenotus interior Greene, Erythea, **2**: 72. 1892.

Its range is further southwest, from southern Utah to Arizona and southern California.

MACRONEMA Nutt.

This genus was also established by Nuttall in 1840 and re-established by Greene. The latter included, as is stated before, also *Stenotus pygmaeus* Nutt. (*Aplopappus pygmaeus* A. Gray). As the relationship of that species is rather doubtful, I have not included it in the treatment below. The species can be separated as follows:

Heads radiate.
  Heads small, fastigiate clustered; disk 5–8 mm. in diameter.
    Leaves broadly obovate, mucronate-cuspidate. 1. *M. obovatum.*
    Leaves oblanceolate, acute or pointed. 2. *M. Watsonii.*
  Heads larger, solitary: disk 1 cm. or more in diameter.
    Leaves oblanceolate, acute. 3. *M. suffruticosum.*
    Leaves spatulate, obtuse or mucronate. 4. *M. grindelifolium.*
Heads discoid.
  Leaves oblong-oblanceolate.
    Outer bracts oblong, acute. 5. *M. discoideum.*
    Outer bracts broadly oblong, obtuse. 6. *M. obtusum.*
  Leaves linear. 7. *M. lineare.*

1. **Macronema obovatum** sp. nov.

A glandular-puberulent undershrub, 2–3 dm. high, with light yellow bark on the branches. Leaves broadly obovate, 1–2 cm. long, 7–10 mm. wide, mucronate-cuspidate: heads usually 2–3 together, about 10 mm. high, and 8 mm. broad: its bracts firmer than in the other species, oblong-linear, abruptly obcuneate-acute at the apex, unequal, imbricated in about 4 series: rays short, 4–5 mm. long and 1–1.5 mm. wide, about 10 in number.

The species is nearest related to *M. Watsonii*, differing mainly in the broad leaves and the abruptly acute bracts. The type was collected at an altitude of 1600 m.

UTAH: City Creek Cañon, *M. E. Jones, 1081.*

2. MACRONEMA WATSONII (A. Gray) Greene, Erythea, **2**: 74. 1894

Aplopappus Watsonii A. Gray, Proc. Am. Acad. **16**: 79. 1881.

This grows on mountains at an altitude of 2000–2500 m., in Utah and Nevada.

3. MACRONEMA SUFFRUTICOSUM Nutt. Trans. Am. Phil. Soc. II. **7**: 322. 1840

Aplopappus suffruticosus A. Gray, Proc. Am. Acad. **6**: 542. 1865.

This species grows in the mountains of Oregon and California up to an altitude of 3000 m. It has also been reported from Wyoming, but possibly some specimens of the next have been mistaken for it.

4. MACRONEMA GRINDELIOIDES Rydberg, Mem. N. Y. Bot. Garden, **1**: 384. 1900

The habitat of this species is rocky places on mountain-sides, at an altitude of 2500–3000 m. It grows in Montana, Idaho and northern Wyoming.

5. MACRONEMA DISCOIDEUM Nutt. Trans. Am. Phil. Soc. II. **7**: 322. 1840

Aplopappus Macronema A. Gray, Proc. Am. Acad. **6**: 542. 1864.

This species grows on the higher mountains at an altitude of 2500–3000 m., from Wyoming and Colorado to California.

6. **Macronema obtusum** sp. nov.

A dense glandular-pubescent undershrub, 2–4 m. high, with white-tomentose branches. Leaves oblong-oblanceolate, about 3 cm. long and 6 mm. wide, obtuse or mucronate: heads about 18 mm. high, 10–18 mm. in diameter: their bracts linear, acute, scarcely more than half as long as the flowers, subequal, except the outermost, which are foliaceous, broadly oblong, obtuse or mucronate: rays none.

The species is closely related to the preceding, differing in the stouter habit and the larger and broader, more obtuse outer bracts. It grows on high mountains at an altitude of about 2500 m.

COLORADO: South Cottonwood Gulch, 1892, *C. S. Sheldon, 5838* (type); Twin Lakes, 1873, *John Wolfe, 451*.

7. MACRONEMA LINEARE Rydb. Mem. N. Y. Bot. Garden, **1**: 384. 1900

In habit, this species resembles some species of *Chrysothamnus* and Prof. Aven Nelson insists that it should be referred to that genus. It has, however, the foliaceous outer bracts and long style-appendages of *Macronema* and is clearly congeneric with the two preceding species. It cannot very well be referred to *Chrysothamnus*, for it lacks the most essential character of the genus, viz., the arrangement of the involucral bracts in distinct vertical rows. It grows in gravelly places in northern Wyoming, at an altitude of 2000–2500 m.

SIDERANTHUS Fraser

The name *Sideranthus* appears first in Fraser's Catalogue, but there only as a nomen nudum. Pursh in his Flora on page 750 gives *Sideranthus integrifolius* Fraser and *S. pinnatifidus* Fraser as synonyms of *Amellus villosus* and *A. spinulosus* described on page 564. There may be a doubt as to which of these should be regarded as the type of *Sideranthus*. *Amellus villosus* with its relatives was made a genus *Chrysopsis* by Nuttall in 1818 or by Elliott in 1824, according to different interpretations, long before *Eriocarpum* was established (1840). This leaves *Sideranthus pinnatifidus* as the residue of the genus *Sideranthus*. Besides Nuttall, who was the real author of Fraser's Catalogue, made *Sideranthus* a subgenus of *Dieteria* containing the only species *D. spinulosa* (*Aplopappus spinulosus* DC. See Trans. Am. Phil. Soc. II. **7**: 301); and thus shows that he regarded it as the type of *Sideranthus*.*

Leaves spinescent toothed, not pinnatifid.
  Heads discoid; perennial with woody caudex. — 1. *S. grindelioides.*
  Heads radiate; annual. — 2. *S. rubiginosus.*
Leaves pinnatifid.
  Stem more or less floccose, or cinereous especially when young.
    Plant cinereous pubescent, more or less glandular. — 3. *S. australis.*
    Plant more or less floccose, not at all glandular. — 4. *S. spinulosus.*
  Plant neither floccose nor cinereous.
    Plant perfectly glabrous or sparingly glandular puberulent. — 5. *S. glaberrimus.*
    Plant finely puberulent.
      Heads hemispherical; bracts slightly glandular. — 6. *S. puberulus.*
      Heads somewhat turbinate; bracts densely glandular puberulent. — 7. *S. turbinellus.*

1. **Sideranthus grindelioides** (Nutt.) Britton

Eriocarpum grindelioides Nutt. Trans. Am. Phil. Soc. II. **7**: 321. 1840.

Aplopappus Nuttallii Torr. & Gray, Fl. N. A. **2**: 240. 1842.

* Professor Greene (Pittonia **2**: 115) seems to think *Sideranthus* is derived from the Latin *sidus*, star, and the Greek, *ανθος*, flower. It is better to regard the first part also as Greek, *σίδηρος*, iron. Why accuse Nuttall of making a hybrid word, which we would not permit ourselves?

The species is not uncommon on barren hills and in bad-lands, up to an altitude of 1500 m. Its range extends from Saskatchewan and western Nebraska to Colorado and Arizona.

2. **Sideranthus rubiginosus** (Torr. & Gray) Britton

Aplopappus rubiginosum Torr. & Gray, Fl. N. Am. **2**: 240. 1842.

Eriocarpum rubiginosum (Torr. & Gray) Britton, Mem. Torr. Bot. Club, **5**: 316. 1894.

The species was first described as a perennial. Our plant is evidently only annual. Possibly two different species have been confused under the name *E. rubiginosum.* It grows in sandy soil from Texas to Colorado and western Nebraska, reaching an altitude of 1500 m.

3. **Sideranthus australis** (Greene)

Eriocarpum australe Greene, Erythea, **2**: 108. 1894.

This grows on the plains of western Texas, Colorado, New Mexico and Mexico.

4. SIDERANTHUS SPINULOSUS (Pursh), Sweet, Hort. Brit. 227. 1826

Amellus spinulosus Pursh, Fl. Sept. Am. 564. 1814.

Sideranthus pinnatifidus Fraser; Pursh, Fl. Am. Sept. 750. 1814

Aplopappus spinulosus DC. Prod. **5**: 347. 1836.

Eriocarpum spinulosum (Pursh) Greene, Erythea, **2**: 108. 1894.

The species is rather common on plains and dry prairies, from Saskatchewan, Nebraska and Texas to Mexico, Arizona and Idaho.

5. **Sideranthus glaberrimus** sp. nov.

Perennial, with a short woody caudex, perfectly glabrous, or very sparingly glandular-puberulent. Stems several, branched above, very leafy, 1–3 dm. high: leaves rather rigid, about 2 cm. long, bluish green, glabrous, pinnatifid; segments oblong, 2–5 mm. long and 1 mm. or less wide, spinulose-tipped: heads numerous, corymbose, depressed hemspherical, 8–10 mm. high and 8–15 mm. broad: bracts imbricated in 6–7 series, the outer gradually shorter, firm, appressed, with a herbaceous tip, acute; the inner tinged with purplish: rays about 20, 4–5 mm. long and about 1 mm. wide.

The species is closely allied to the preceding, differing mainly in the total lack of tomentum, even when young, the bluer color and the smaller, generally purple-tinged bracts. It grows on plains and hills, from Iowa and Indian Territory to New Mexico and Wyoming.

KANSAS: Osborn City, 1894, *C. L. Shear, 116;* Harper, 1888, *W. A. Kellerman;* Hamilton Co., 1895, *Hitchcock, 222.*

NEBRASKA: 1893, *Rydberg, 1403a* (type); *G. D. Sweezey, 55.*

INDIAN TERRITORY: 1868, *Edward Palmer, 442.*

COLORADO: Platte, *Dr. James.*

WYOMING: Platte, *Fremont,* Dayton, 1899, *Tweedy, 2076.*

6. **Sideranthus puberulus** sp. nov.

A low densely puberulent perennial, less than 1.5 dm. high: Stems ascending, branched above: leaves 2–3 cm. long, pinnatifid or bipinnatifid; segments 1–5 mm. long, less than 1 mm. wide, spinulose-tipped: heads 2–4 in a small corymb, hemispherical, 8–9 mm. high, 10–12 mm. broad: bracts narrowly linear-lanceolate, appressed, acute, with small herbaceous tips, finely puberulent, but only slightly glanular: rays about 20, 8–9 mm. long and about 1.5 mm. wide.

This is perhaps nearest related to *E. australe;* but is easily distinguished by the fine pubescence.

COLORADO: Salida, *Mrs. C. B. Clarke, 174.*

7. **Sideranthus turbinellus** sp. nov.

A low and bushy puberulent perennial, 1.5–2 dm. high. Stems corymbosely branched and very leafy: leaves .5–2 cm. long, pinnatifid or the upper reduced and merely toothed; segments narrow, 1–5 mm. long, about .5 mm. wide: heads numerous, small, hemispherical-turbinate, 7–8 mm. high, and scarcely as broad: bracts imbricated in 6–7 series, linear-lanceolate, acute, appressed glandular-puberulent: rays 10–15, 7–8 mm. long and 1.5 mm. wide.

Perhaps nearest related *E. spinulosum,* the species is easily known by the small, somewhat turbinate heads and the dense and fine pubescence.

IDAHO: Pocatello, 1892, *A. Isabel Mulford.*

PYRROCOMA Hook.

This genus was established by Hooker in 1840, and based on one species, *P. carthamoides.* In 1894, Professor Greene extended the genus so as to include the genus *Homopappus* of Nuttall, the difference between the two genera being only that the ligules of the ray-flowers in the former are very small and inconspicous or wanting.

Heads apparently discoid, the sterile rays being concealed in the pappus.
  Inner bracts recurved cuspidate. 1. *P. subsquarrosa.*
  Bracts not recurved cuspidate.
    Bracts oblong or oval; heads hemispherical.
      Leaves and bracts more or less spinulose-toothed, the latter with a narrow scarious margin. 2. *P. carthamoides.*
      Leaves and bracts not spinulose-toothed, the latter with a broad scarious erose margin.
        Pappus sordid; plant almost glabrous. 3. *P. rigida.*
        Pappus brownish red; plant villous. 4. *P. erythropappa.*
    Bracts lanceolate; head campanulate-turbinate. 5. *P. Cusickii.*
Heads distinctly radiate.
  Bracts except the innermost obtuse, obovate or oblong. 6. *P. crocea.*
  Bracts mostly acute or acuminate.
    Plant not glandular.
      Heads large; disk 2 cm. or more in diameter; bracts in about 3 series.
        Upper part of stem and involucre decidedly villous; bracts wholly foliaceous.
          Bracts oblanceolate, abruptly acute. 7. *P. Clementis.*
          Bracts lanceolate, long-acute. 8. *P. villosa.*
        Stem and involucre almost glabrous; bracts chartaceous at the base with foliaceous tips. 9. *P. integrifolia.*
      Heads smaller; disk less than 2 cm. in diameter.
        Bracts in 2–3 unequal series.
          Leaves 5–15 mm. wide; disk 1–2 cm. wide.
            Inflorescence corymbiform; bracts long-acute. 10. *P. lanceolata.*
            Inflorescence racemiform; bracts abruptly acute. 11. *P. Vaseyi.*
          Leaves 2–4 mm. wide; disk 1 cm. or less wide. 12. *P. tenuicaulis.*
        Bracts nearly of the same length.
          Stem-leaves oblanceolate; bracts long-acuminate. 13. *P. acuminata.*
          Stem-leaves lanceolate; bracts acute or short-acuminate.
            Plant villous. 14. *P. inuloides.*
            Plant, except the upper parts, glabrate in age. 15. *P. uniflora.*
    Plant decidedly glandular. 16. *P. hirta.*

1. PYRROCOMA SUBSQUARROSA Greene, Erythea, 3: 22. 1895

I have seen no specimen of this species; but the description indicates a plant wholly unlike the other species of the Rocky Mountains, that I do not hesitate in accepting it as a good species. The type of *P. subsquarrosa* was collected in northern Wyoming, by Dr. J. N. Rose in 1893.

2. PYRROCOMA CARTHAMOIDES Hook. Fl. Bor. Am. 1: 307. 1833

Aplopappus carthamoides A. Gray, Proc. Acad. Sci. Phila. 1863: 65. 1864.

As treated by Dr. Gray, *A. carthamoides* comprises more than one species, and probably both of the two following species are covered by his description. There is no doubt, however, as to which species shall bear the name, for Hooker's description and figure point clearly to the plant with more or less spinulose-toothed leaves and bracts. The latter are also longer, narrower and more acute than in the other two species. *P. carthamoides* ranges from Alberta and British Columbia to Oregon and Idaho.

3. **Pyrrocoma rigida** sp. nov.

A perennial with a thick woody tap-root. Stems 1–3, erect or ascending, finely pubescent when young, glabrate in age, 2–4 cm. high, leaves pale bluish green, firm, oblanceolate, acute, entire-margined, finely puberulent, or glabrate; the lower petioled, 8–15 cm. long, 1.5–3 cm. wide; the upper smaller and sessile: heads apparently discoid, 15–20 mm. high, 15–25 mm. broad: bracts very firm, imbricated in 3–4 series, broadly oblong, acute or mucronate; the inner at least with broad scarious or semi-chartaceous margins, which generally are erose, but not spinulose-dentate: ligules of the ray-flowers erect, slightly longer than the light brownish or sordid pappus: achenes glabrous, shining.

In general habit, this species resembles closely *P. carthamoides* but has broader leaves and bracts, paler foliage and no indication of spinulose toothing. It grows in sandy places and meadows in Idaho, Montana and Washington.

IDAHO: Granite Station, Kotenay County, 1892, *Sandberg, MacDougal & Heller, 785* (type).

MONTANA: Columbia Falls, 1894, *R. S. Williams.*

WASHINGTON: Loomiston, 1897, *A. D. E. Elmer, 603.*

4. **Pyrrocoma erythropappa** sp. nov.

A finely villous pubescent perennial. Stem 1.5–3 dm. high, with 1–4 heads: stem-leaves 3–6 cm. long, 1–1.5 cm. wide, firm, oblanceolate or oblong, acute, subsessile, finely pubescent, or glabrate on the upper surface: heads very short-peduncled in the axils of the upper leaves, 10–15 mm. high, about 15 mm. in diameter: bracts imbricated in 4–5 series, pubescent, broadly oval or oblong, obtuse, mucronate, or the outer acute, with a thin erose margin: pappus intensely brownish red: otherwise as the preceding.

IDAHO: Clear Water, *Rev. Spalding* (type in Torrey Herbarium).

5. PYRROCOMA CUSICKII (A. Gray) Greene, Erythea, **2**: 59. 1894

Aplopappus carthamoides var. *Cusickii* A. Gray, Syn. Fl. **2**[1]: 126. 1886.

The range of this species is limited to Oregon and western Idaho.

6. PYRROCOMA CROCEA (A. Gray) Greene, Erythea, **2**: 69. 1894

Aplopappus croceus A. Gray, Proc. Acad. Sci. Phila. 1863: 65. 1864.

This species is not uncommon in the mountain regions of Colorado at an altitude of 1800–3000 m.

7. **Pyrrocoma Clementis** sp. nov.

A perennial with more or less villous ascending stem, 1.5–4 dm. high: lower stem-leaves linear-oblong, about 1 dm. long, somewhat fleshy, glabrous except the ciliate margin, saliently dentate; the upper lanceolate or ovate-lanceolate, more or less auricled at the base, dentate or entire-margined; heads solitary; disk about 15 mm. high and 2.5–3 cm. broad: bracts all foliaceous, imbricated in 3–4 series, but the outer almost equaling the inner, oblanceolate, abruptly acute, villous: rays 10–12 mm. long and 2–3 mm. wide, bright yellow: achenes sparingly strigose-hirsute: pappus yellowish white.

COLORADO: Mt. Harvard, 1896, *Frederick Clements, 44.*

8. **Pyrrocoma villosa** sp. nov.

A low perennial with a thick woody tap-root. Stems 1–3, ascending, 1–1.5 dm. high, purplish, more or less villous, especially above: basal leaves oblanceolate, 7–10 cm. long, 1–1.5 cm. wide, somewhat glaucous and rigid, entire-margined or occasionally slightly spinulose denticulate; stem-leaves linear-lanceolate, 2–4 cm. long: heads solitary: disk about 2 cm. broad: bracts foliaceous, imbricated in 3–4 series, but the outer fully as long as the inner, broadly linear or lanceolate, long-acute, more or less villous: rays about 1 cm. long and 2 mm. wide: achenes glabrous: pappus dirty white.

In habit this species resembles most *P. uniflora* and *P. inuloides;* but is easily distinguished by the larger heads and the foliaceous bracts in several series. It grows in meadows at an altitude of about 2700 m.

WYOMING: Willow Creek, Big Horn Mountains, 1899, *F. Tweedy, 2063.*

9. PYRROCOMA INTEGRIFOLIA (Porter) Greene, Erythea, **2**: 69. 1894

Aplopappus integrifolius Porter; A. Gray, Proc. Am. Acad. **16**: 79. 1881.

This species grows in meadows, at an altitude of 1000–2500 m., from Saskatchewan to Idaho and Wyoming.

Pyrrocoma integrifolia pumila var. nov.

Pyrrocoma Howellii Rydb. Mem. N. Y. Bot. Garden, **1**: 382. 1900. Not A. Gray.

Stem low, 1 dm. or less, monocephalous; bracts shorter and less acute.

MONTANA: Butte, 1895, *Rydberg, 2808.*

10. PYRROCOMA LANCEOLATA (Hooker) Greene, Erythea, **2**: 69. 1894

Donia lanceolata Hook. Fl. Bor. Am. **2**: 25. 1834.

Aplopappus lanceolatus Torr. & Gray, Fl. N. Am. **2**: 241. 1842.

The range of this species is from Saskatchewan to British Columbia, Nevada and Wyoming. It ascends to an altitude of 2000 m.

11. **Pyrrocoma Vaseyi** (Parry)

Aplopappus lanceolatus var. *Vaseyi* Parry; D. C. Eaton, King's Exped. **5**: 160. 1871.

I believe that this deserves a specific rank, as the racemose disposition of the heads is accompanied with shorter, closer and oblanceolate, abruptly acute bracts. It ranges from Saskatchewan (according to Gray) south to Utah and Colorado.

12. PYRROCOMA TENUICAULIS (D. C. Eaton) Greene, Erythea, **2**: 69. 1894

Aplopappus tenuicaulis D. C. Eaton, King's Exped. **5**: 160. 1871.

Aplopappus lanceolatus var. *tenuicaulis* A. Gray, Syn. Fl. 2^1: 129. 1884.

This grows in alkali meadows of Utah, Nevada and Oregon, at an altitude of about 2000 m.

13. **Pyrrocoma acuminata** sp. nov.

A low finely villous perennial with a woody tap-root. Stems several, slender, about 1 dm. high, monocephalous: leaves narrowly linear-oblanceolate, with strong midrib, 2–4 cm. long, 2–4 mm. wide, entire-margined, acute, finely villous on both sides: heads on naked peduncles, which are 3–4 cm. long: disk about 1 cm. high and 12–15 mm. broad: bracts in about 2 series, broadly lanceolate, contracted into a long slender tip: rays about 1 cm. long and 1.5 mm. wide: achenes pubescent: pappus tawny.

In habit this species resembles most *P. inuloides*, but differs in the smaller leaves, the shorter pubescence and the acumination of the bracts.

WYOMING: Fort Bridger, 1873, *Dr. J. V. Carter* (type in Columbia Herbarium).

14. PYRROCOMA INULOIDES (Hook.) Greene, Erythea, **2**: 60. 1894

Donia inuloides Hook. Fl. Bor. Am. **2**: 25. 1834.

Aplopappus inuloides Torr. & Gray, Fl. N. Am. **2**: 241. 1842.

Dr. Gray included this in *A. uniflorus*, but I agree with Professor Greene that it ought to be kept distinct. It ranges from Montana to Idaho and Wyoming.

15. PYRROCOMA UNIFLORA (Hook.) Greene, Erythea, **2**: 60. 1894

Donia uniflora Hook. Fl. Bor. Am. **2**: 25. 1834.

Aplopappus uniflorus Torr. & Gray, Fl. N. Am. **2**: 241. 1842.

This species grows in alkaline meadows, up to an altitude of 2500 m., and ranges from Saskatchewan and Montana to Utah and Colorado.

16. PYRROCOMA HIRTA (A. Gray) Greene, Erythea, **2**: 69. 1894

Aplopappus hirtus A. Gray, Syn. Fl. **2**[1]: 127. 1884.

The range of this species includes eastern Oregon, Washington and western Idaho, where it reaches an altitude of 1000 m.

BALSAMORRHIZA Hook.

Leaves entire or bluntly toothed, never pinnatifid.
- Plant white-tomentose.
  - Leaves with entire margins or slightly undulate, oblong-cordate to hastate. 1. *B. sagittata.*
  - Leaves more or less distinctly toothed, ovate-lanceolate, with subcordate base. 2. *B. tomentosa.*
- Plant hirsute puberulent; basal leaves cordate.
  - Rays linear, deciduous; achenes glabrous. 3. *B. deltoidea.*
  - Rays oval, becoming papery, and more or less persistent: achenes puberulent. 4. *B. Careyana.*

Leaves mostly pinnatifid or at least incisedly toothed.
Plant canescent or white-tomentose.
Plants loosely white-tomentose.
Stem 1–3 dm. high; segments of the leaves 1–3 cm. long, ovate, entire or slightly toothed. 5. *B. incana.*
Stem 3 dm. or more high; segments of the leaves 3–5 cm. long, lanceolate, coarsely toothed. 6. *B. floccosa.*
Plant finely canescent, tomentose only on the involucre; some of the leaves merely toothed. 7. *B. terebinthacea.*
Plants more or less hispid, neither canescent nor tomentose.
Disk 3–4 cm. broad; segments of the leaves mostly entire. 8. *B. macrophylla.*
Disk 2–2.5 cm. broad; segments of the leaves mostly toothed. 9. *B. hirsuta.*

1. BALSAMORRHIZA SAGITTATA (Pursh) Nutt. Trans. Phil. Soc. II. 7: 350. 1840

Bupthalmium saggittatum Fl. Am. Sept. 564. 1814.

Growing on hillsides at an altitude of 1000–2500 m., this species is not uncommon from Alberta and British Columbia to California, Colorado and the Black Hills of South Dakota.

2. **Balsamorrhiza tomentosa** sp. nov.

A white-tomentose perennial with thick root; but the tomentum is shorter and finer than in *B. sagittata.* Basal leaves with long petioles; blades about 12 dm. long, ovate-lanceolate with subcordate bases, 15–20 cm. long, acute, coarsely toothed; stem-leaves generally two, including the slender petioles about 1 dm. long, lanceolate to linear elliptic, acute at both ends: stem 3–4 dm. high, involucre densely floccose, over 2 cm. broad: outer bracts half longer than the inner, reflexed: rays about 3 cm. long and 1 cm. wide; achenes glabrous.

Closely related to *B. sagittata* this species differs mainly in the toothed leaves, shorter tomentum and longer outer bracts.

WYOMING: Headwaters of Tongue River in the Big Horn Mountains, 1898, *F. Tweedy, 10.**

3. BALSAMORRHIZA DELTOIDEA Nutt. Trans. Am. Phil. Soc. II. 7: 351. 1840

The name of this plant is rather unfortunate, as the leaves are rarely deltoid, but on the contrary usually broadly cordate. *B. deltoidea* ranges from British Columbia to California and Idaho.

*A specimen collected by Tweedy on Teepee Creek in 1899 (*no. 2114*), may also belong here. It has smaller heads, not reflexed bracts and lanceolate leaves.

4. BALSAMORRHIZA CAREYANA A. Gray, Pl. Fendl. 81. 1849

This species grows on sandy plains of Idaho and Washington.

5. BALSAMORRHIZA INCANA Nutt. Trans. Am. Phil. Soc. II. 7: 350. 1840

Balsamorrhiza Hookeri var. *incana* A. Gray, Syn. Fl. 2^1: 266. 1884.

This species grows on dry stony hills, up to an altitude of 2500 m., from Montana and Washington to California and Wyoming.

6. **Balsamorrhiza floccosa** sp. nov.

Balsamorrhiza Balsamorrhiza Rydb. Mem. N. Y. Bot. Garden, 1: 417. 1900. Not *Heliopsis Balsamorrhiza* Hook.

A loosely white or gray-tomentose perennial with very thick tap-root. Leaves mostly basal, floccose on both sides, 2–3 dm. long, regularly pinnately divided to near the midrib: some sometimes only coarsely toothed: segments lanceolate, acute, 3–5 cm. long coarsely toothed: stem-leaves 2, near the base, similar but smaller, about 1 dm. long: stem scapiform, 3–5 dm. high, villous or the upper portion densely floccose: involucre about 3 cm. broad, densely floccose; bracts numerous in several series, lanceolate; the outer often spreading with recurved tips; rays 3–4 cm. long, about 1 cm. wide; achenes glabrous, cuneate oblong, with truncate apex.

This species has been mistaken for *B. Balsamorrhiza* (Hook.) Heller or *B. Hookeri* Nutt., but the latter has much finer dissected leaves and its pubescence is quite different. The latter is very short and appressed, never consisting of long villous hairs, and there is never dense wool at the base of the head as in this species. *B. Balsamorrhiza* ranges from Washington to California; but is evidently not found in the Rocky Mountain region. All that I have seen from the region and referred to *B. Balsamorrhiza* by Heller, Holzinger and myself belong to *B. floccosa*. Those collected by Parry, and if I am not mistaken, named by Gray, belong to *B. incana*.

B. floccosa grows on hillsides at an altitude of 1000–2500 m. The following specimens are in the New York herbaria:

MONTANA: Spanish Basin, Gallatin Co., 1897, *Rydberg & Bessey, 5175* (type).

IDAHO: Lake Waha, 1896, *A. A. & E. Gertrude Heller, 3298;*

Craig Mountain near Lake Waha, 1892, *Sandberg, MacDougal & Heller, 248.*

WYOMING: Headwaters of Tongue River, Big Horn Mountains, 1898, *F. Tweedy, 11.*

7. BALSAMORRHIZA TEREBINTHACEA (Hook.) Nutt. Trans. Am. Phil. Soc. II. 7: 349. 1840

Heliopsis? terebinthacea Hook. Fl. Bor. Am. 1: 310. 1833.

In this species, as well as in the next, it often occurs that some of the leaves are not pinnatifid, but merely coarsely dentate. It is a rare plant growing in stony soil in eastern Oregon and western Idaho.

8. BALSAMORRHIZA MACROPHYLLA Nutt. Trans. Am. Phil. Soc. II. 7: 350. 1840

This grows on rocky hillsides in Wyoming, Utah and Idaho.

9. BALSAMORRHIZA HIRSUTA Nutt. Trans. Am. Phil. Soc. II. 7: 349. 1840

This species is found at an altitude of 1000–2000 m. in the dry regions of Utah to British Columbia and California.

THELESPERMA Less.

Heads radiate.
- Leaf-segments linear-filiform, 1 mm. or less wide.
  - Annual or biennial; outer bracts subulate-linear, more than half as long as the inner. — 1. *T trifidum.*
  - Perennial from a rootstock: outer bracts linear-lanceolate, half as long as the inner or less. — 2. *T. tenue.*
- Leaf-segments linear, over 1 mm. wide; plant perennial or the first only biennial.
  - Plant with tap-root, leafy throughout. — 3. *T. intermedium.*
  - Plant with creeping rootstock or woody caudex; leafy only near the base.
    - Involucre not cleft below the middle; throat of the disk-flowers campanulate, shorter than the lobes. — 4. *T. ambiguum.*
    - Involucre cleft below the middle; throat of the disk-flowers cylindraceous, longer than the lobes. — 5. *T. subnudum.*

Heads discoid; perennials with rootstock or woody caudex.
- Plant less than 2 dm. high; involucre with very broad scarious margins. — 6. *T. marginatum.*
- Plants 3–6 dm. high; involucre with very narrow scarious margins. — 7. *T. gracile.*

1. THELESPERMA TRIFIDUM (Poir.) Britton, Trans. N. Y. Acad. Sci. **9**: 182. 1890

Coreopsis trifida Poir. Suppl. Lam. Encycl. **2**: 353. 1811.

Thelesperma filifolium A. Gray, Kew Journ. Bot. **1**: 253. 1849.

This species grows in dry soil from Nebraska to Texas and eastern Colorado.

2. **Thelesperma tenue** sp. nov.

A slender, glabrous plant with perennial rootstock. Stems 1–3, slender, less than 2 mm. in diameter, light green, mostly simple and leafy to near the top, 1.5–4 dm. high: leaves twice pinnately dissected into linear filiform segments, mostly appressed to the stem: peduncles 1–3, 5–10 cm. long: outer bracts 6–8, linear-lanceolate, half as long as the inner or less; the inner united to the middle, broadly scarious-margined: rays 8–12 mm. long, 4–6 mm. wide: awns of the pappus very short, about half as long as the width of the summit of the dark shining achenes.

This species resembles most the preceding but has a simpler stem and perennial rootstock. It grows in sandy soil at an altitude of about 2800 m.

COLORADO: Veta Pass, 1900, *Rydberg & Vreeland, 5473* (type); 1870, *Dr. G. W. Hulse*; Plains, 1871, *Wm. M. Canby.*

3. **Thelesperma intermedium** sp. nov.

A glabrous bushy plant with a biennial or perhaps perennial tap-root. Stems several, much branched and very leafy, 2–6 dm. high: leaves once or twice pinnately divided into linear segments, 1–3 mm. wide: peduncles very numerous, 1–1.5 dm. long: involucre about 1 cm. broad: outer bracts very narrowly linear-lanceolate, about half as long as the inner; these united to about the middle, scarious-margined: rays 10–12 mm. long, 6–8 mm. wide, rounded, 3-toothed at the apex: teeth of the pappus longer than the width of the achenes.

This has been confused with *T. ambiguum*, but is of a quite different habit. *T. intermedium* is much branched and very leafy throughout, has a vertical tap-root of short duration, numerous heads, rather long outer bracts and the inner with narrow scarious margins. *T. ambiguum* is leafy only at the base, has a creeping rootstock, very short outer bracts and the inner with a very broad scarious margin.

T. intermedium grows in sandy or loose soil, often taking possession of old fields and acts much like a weed. The following specimens are at hand.

NEBRASKA: Banner County, 1890, *Rydberg, 192* (type); Crawford, 1889, *H. J. Webber.*

WYOMING: Pine Bluffs, 1897, *Aven Nelson, 3503.*

COLORADO: 1862, *Hall & Harbour, 280*, at least in part.

COLORADO or WYOMING: 1843, *Fremont.*

NEW MEXICO: Between Santa Fe and Canoncito, 1897, *A. A. & E. Gertrude Heller, 3747.*

4. THELESPERMA AMBIGUUM A. Gray, Proc. Am. Acad. **19**: 16. 1883

This species seems to be confined to the plains of western Texas, New Mexico and southern Colorado. The specimens reported from Nebraska and Wyoming belong mostly to the preceding, and those from Montana to *T. marginatum.* The latter resembles *T. ambiguum* in many respects, especially as to the involucral bracts; but it is always without ray-flowers.

5. THELESPERMA SUBNUDUM A. Gray, Proc. Am. Acad. **10**: 72. 1874

This is an inhabitant of the more arid regions of New Mexico, Arizona, Utah and Colorado.

6. THELESPERMA MARGINATUM Rydb. Mem. N. Y. Bot. Garden, **1**: 421. 1900

This grows on dry plains of Alberta and Montana.

7. THELESPERMA GRACILE (Torr.) A. Gray, Kew Journ. Bot. **1**: 253. 1849

Bidens gracilis Torr. Ann. Lyc. N. Y. **2**: 215. 1827.

This species is the most common and most widely distributed species of the genus. It is common on dry plains from Nebraska to Montana, Arizona, Mexico and Texas.

HYMENOPAPPUS L'Her.

Throat of the corolla 1–1.5 mm. long, not over twice as long as the lobes.
  Pappus over 1 mm. long, equaling the corolla-tube or nearly so.
    Stem 3–6 dm. high, leafy throughout; heads numerous.

Plant sparingly and loosely floccose; leaves glabrate in age.
1. *H. tenuifolius.*
Plant densely tomentose; leaves permanently tomentose.
2. *H. tomentosus.*
Stem less than 3 dm. high.
Stem-leaves much reduced; stem white-tomentose or nearly so; heads few.
3. *H. scaposus.*
Stem-leaves not much reduced; stem sparingly grayish tomentose.
5. *H. cinereus.*
Pappus 1 mm. or less long, shorter than the corolla-tube; stem-leaves and heads few.
Pappus not hidden by the hairs of the achenes.
Stem permanently densely white-tomentose; achenes silky.
4. *H. arenosus.*
Stem sparingly grayish tom entose, glabrate in age; achenes loosely villous
5. *H. cinereus.*
Pappus hidden by the hairs of the achenes, or sometimes none.
Leaflets glabrate in age, at least above; ultimate segment 5–30 mm. long.
6. *H. filifolius.*
Leaves permanently densely white-tomentose; ultimate segments short, 1–5 mm. long.
7. *H. luteus.*
Throat of the corolla 3–4 mm. long, 3–4 times as long as the lobes. 8. *H. macroglottis.*

1. HYMENOPAPPUS TENUIFOLIUS Pursh, Fl. Am. Sept. 742. 1814

This is generally described as a biennial; occasionally the root is of a longer duration and the plant becomes a short-lived perennial and then hard to distinguish from a large specimen of *H. filifolius* except by the pappus. *H. tenuifolius* grows on prairies, from Nebraska and Wyoming to Texas.

2. **Hymenopappus tomentosus** sp. nov.

A densely and permanently white-tomentose plant, apparently biennial. Stem 3–4 dm. high, leafy and branched above: leaves 5–7 cm. long, bi-pinnately divided into linear segments, 4–10 mm. long, about 1 mm. wide: heads many, corymbose-paniculate, about 8 mm. high and broad; involucre densely woolly, somewhat turbinate: flowers yellow: corolla tube and throat each a little over 1 mm. long; the latter broadly campanulate, of about the same length as the lobes; achenes silky strigose; scales of the pappus a little shorter than the corolla-tube.

Nearest related to the preceding, this species is easily distinguished by the dense permanent tomentum and the yellow flowers.

UTAH: St. George, 1877, *Dr. E. Palmer*, *270* (type in the Columbia Herbarium).

3. **Hymenopappus scaposus** sp. nov.

Hymenopappus luteus A. Gray, Pl. Fendl. 97. 1849. Not Nutt. 1841.

An almost scapose perennial with a cespitose caudex. Stem almost naked, with 1–2 reduced leaves, more or less densely tomentose: leaves mostly basal, 5–7 cm. long, bipinnately divided into linear segments, 3–10 mm. long, more or less densely tomentose, especially at the base: heads few, corymbose, hemispherical, about 1 cm. high and broad: bracts obovate with yellowish or purplish scarious margins: corollas yellow; tube and throat each nearly 2 mm. long; the latter campanulate and longer than the lobes: achenes densely silky, scales of the pappus fully 2 mm. long, longer than the tube of the corolla.

This species has been confused with *H. luteus* Nutt. but is easily distinguished by the long pappus and also by the longer segments of the leaves. *H. scaposus* grows in dry soil up to an altitude of 2200 m. from New Mexico and Arizona to Utah and Nevada.

ARIZONA: Vicinity of Flagstaff, 1898, *D. T. MacDougal, 129* (type).

NEW MEXICO: Santa Fee, 1897, *A. A. & E. Gertrude Heller, 3555;* 1847, *A. Fendler, 456;* 1869, *E. Palmer, 11.*

UTAH: Southern Utah, 1874, *C. C. Parry, 107.*

NEVADA: 1868, *S. Watson, 612.*

4. HYMENOPAPPUS ARENOSUS Heller, Bull. Torr. Club, 25: 200. 1898

This resembles somewhat the preceding, but is taller, more leafy, and has much shorter pappus. It grows in sandy soil, up to an altitude of 2200 m., in New Mexico and southern Colorado.

5. **Hymenopappus cinereus** sp. nov.

A grayish tomentose perennial with a cespitose caudex. Stems about 2 dm. high, branched, with 2–4 leaves: these bi-pinnately divided into linear segments 1–2 cm. long and about 1 mm. wide, sparingly grayish tomentulose: heads corymbose, 8–10 mm. high, 10–12 mm. broad, hemispherical or somewhat turbinate: bracts oblong-obovate, with narrow scarious margins: corollas yellow: tube and throat each about 1.5 mm. long; the latter broadly campanulate, longer than the lobes: achenes loosely villous; scales of the pappus variable, in the type fully 1 mm. long and nearly equaling the corolla-tube, but often shorter, yet never hidden by the hairs of the achenes.

This species has been confused with *H. filifolius* and *H. flavescens.* Baker, Earle & Tracy's specimens were determined as the latter by Professor Greene. The species is, however, much nearer related to *H. filifolius*, from which it differs mainly in the lower habit and the longer scales of the pappus. These characters, together with the longer lobes of the leaves distinguish it from *H. luteus.* It grows on dry hills, at an altitude of 1500–3000 m.

COLORADO: Walsenburg, 1900, *Rydberg & Vreeland, 5479* (type); Mesas near Pueblo, *5477;* Cuchara Valley, *5478;* Durango, 1898, *Baker, Earle & Tracy, 1028;* Garden of the Gods, near Pikes Peak, 1895, *E. A. Bessey.*

6. HYMENOPAPPUS FILIFOLIUS Hook. Fl. Bor. Am. **1**: 317. 1833

This species is common on plains and prairies to an altitude of 2000 m., and ranges from Saskatchewan and Montana to Colorado and Nebraska.

7. HYMENOPAPPUS LUTEUS Nutt. Trans. Am. Phil. Soc. (II.) **7**: 374. 1841

Dr. Gray in his Synoptical Flora referred this species to *H. filifolius*, which, however, does not fit Nuttall's description. Many years before he had named Fendler's specimens *H. luteus.* These agree fairly well with Nuttall's description, except as to the pappus, which in them is much more prominent than in any of the other species. Nuttall states that the scales of the pappus of *H. luteus* are very short and hidden by the hairs of the achenes.

In 1897 Prof. Aven Nelson collected a *Hymenopappus* on Green River, which he intended to describe as new, especially as the type specimen was without pappus. A closer examination revealed, however, that some of the specimens really had some small scales. These agreed perfectly with Nuttall's description. Nelson's specimens and my own, collected two years before, also on Green River, are the only ones that perfectly agree with Nuttall's description of *H. luteus.* His type was collected on the Ham's Fork of the Colorado of the West. What the present name of Ham's Fork is or its exact location I have been unable to find; but from the route that Nuttall took it is undoubtedly some stream of the Green River system.

8. **Hymenopappus macroglottis** sp. nov.

Slightly tomentose perennial with a woody caudex. Stems several, 3–4 dm. high, striate, slightly floccose when young, with 1–3 leaves: leaves mostly basal, about 1 dm. long, bi-pinnately divided into linear lobes 8–25 mm. long, 1–2 mm. wide; stem-leaves generally simply pinnate or the uppermost simple: heads few, corymbose, 12 mm. high and 12–15 mm. broad, hemispherical: bracts oblong, with very narrow yellowish scarious margins: corolla yellow; tube about 2 mm. long; throat deeply campanulate, 3–4 mm. long, 3–4 times as long as the lobes: achenes elongated obpyramidal, about 5 mm. long, hirsute: scales of the pappus about 1 mm. long.

The long and broad lobes of the leaves and the long throat of the corolla distinguishes it from other species of the Rocky Mountains. The latter character it has common with only *H. lugens* Greene from southern California. This has, however, much more finely dissected leaves. *H. macroglottis* grows in arid regions from Texas to Arizona and north to Colorado or Utah.

ARIZONA: Oak Creek, 1883, *H. H. Rusby* (type).

NEW MEXICO: 1851–52, *Wright, 1252.*

TEXAS: Camp 42, 1853, *Bigelow, 730.*

COLORADO or UTAH: 1843, *Fremont.*

A List of the Pteridophyta collected in Alaska in 1900 by Mr. J. B. Flett, with description of a new Dryopteris*

By William R. Maxon

A short time ago Mr. J. B. Flett kindly placed in my hands for determination a set of his collection of ferns and fern allies made in Alaska, largely in the vicinity of Cape Nome, during the summer of 1900. These specimens, which have been deposited in the National Herbarium, have proven of considerable interest, especially since they come in part from a region so little explored botanically. One species is apparently undescribed; the others it seems desirable to catalogue for the record of their occurrence. The notes upon habitat have been furnished by Mr. Flett.

OPHIOGLOSSACEAE

Botrychium boreale (Fries) Milde.

No. 1705. Unalaska; June 19. Rather immature.

POLYPODIACEAE

Polypodium vulgare occidentale Hook.

No. 1510. Dutch Harbor, Unalaska. Growing abundantly among heather on level ground near the shore; June 15. Very abundant all about the island.

This specimen represents a form abundantly collected in Alaska, but less common along the lower coast, with nearly entire and blunter pinnae, for the most part, but otherwise similar to what passes as the variety *occidentale* of Hooker.

Cryptogramma acrostichoides R. Br.

No. 1504. Rocky ledges, vicinity of Nome City; July 21. Not common.

Athyrium cyclosorum Rupr.

No. 1512. Dutch Harbor, Unalaska, June 12.

Phegopteris Phegopteris (L.) Underw.

No. 1502. Sixteen miles west of Nome City; in the shade of alders and willows at the base of the mountain, and among grasses

* Published by permission of the Secretary of the Smithsonian Institution.

near the summit, without shade. Also no. 1519. Unalaska, June 18; not common.

PHEGOPTERIS DRYOPTERIS (L.) Hoffm.

No. 1503. Among grass in crevices of rocky ledges; vicinity of Nome City, August 7.

DRYOPTERIS FRAGRANS (L.) Schott.

No. 1501. In the crevices of loose rocks at the base of a mountain 16 miles west of Nome City, August 20. It was found in its best development at the base of the mountain, but smaller forms occurred at the summit, alt. 800 feet; not abundant, being found in only the one locality.

Dryopteris aquilonaris sp. nov.

Rhizome stout, erect, chaffy with bright-brown concolorous scales; stipes 4–7 cm. long, clustered, sparsely scaly; laminae 5–8 cm. long, narrowly linear-lanceolate, with a few mostly lanceolate scales; pinnae about ten pairs, sub-opposite or alternate, 10–15 mm. long, glandular beneath; oblong-ovate, becoming triangular-oblong below; pinnulae about four pairs to the pinna, obliquely pinnatifid, the divisions with decurrent base, toothed; sori few, 2 or 3 to the pinnula; indusium broadly reniform, ragged.

Type in U. S. National Museum, collected by J. B. Flett, on the summit of a mountain sixteen miles west of Nome City, Alaska, August 7, 1900; no. 1509, altitude 700 feet.

This apparently rare species is most nearly related to *Dryopteris fragrans*, which is common in the same region. However, there seem to be many well-marked differences distinguishing it from that species. The plant is much less rigid, the lower pinnae are not reduced gradually, the pinnae have decidedly fewer pinnules, and the pinnulae are much more dissected. There is noticed also an absence of the dense scaly covering below so characteristic of *D. fragrans*, and a much smaller number of sori. The indusia, too, are rather broader, more irregular, lack the narrow sinus of *fragrans*, and apparently are not glandular at the margin. I have seen no other material referable to the species here described. It was not collected in quantity by Mr. Flett, who found, I believe, only two plants. It is proposed to publish a figure of this species at another time.

DRYOPTERIS SPINULOSA DILATATA (Hoffm.) Underw.

No. 1506. Vicinity of Nome City, ranging from the base of the mountain to the summit, but reaching its best development in the shade at the base; July 20. Also, no. 1511; Dutch Harbor, Unalaska, July 12; in open places.

POLYSTICHUM LONCHITIS (L.) Roth.

No. 1523. Mountains, Unalaska, June 19.

FILIX FRAGILIS (L.) Underw. (*Cystopteris*)

No. 1508. Common in crevices of rocks in the mountains, vicinity of Nome City, July 8 and July 28. Also, no. 1717; common on rocky ledges, Dutch Harbor, Unalaska, June 15.

FILIX MONTANA (Lam.) Underw. (*Cystopteris*)

No. 1507. Growing only in one station, among willows at the base of Anvil Mountain, four or five miles north of Nome City; abundant here within a restricted space; July 8 and August 16.

This species was first recorded from North America upon specimens collected by Drummond in the Rocky Mountains, Lat. 52°–56°. It has since been found in Labrador (*Butler*); on Mt. Albert, Quebec (*Macoun*); near the Current River, north of Lake Superior (*Macoun*); at Kicking Horse Pass, Rocky Mountains (*Macoun*); and near Lake Mistissini, Northeast Territory (*J. M. Macoun*).*

WOODSIA ILVENSIS (L.) R. Br.

No. 1505. Vicinity of Nome City, July 21, August 1 and August 7. Fairly abundant on rocky ledges, but curiously restricted to a belt between 600 and 700 feet in altitude.

WOODSIA GLABELLA R. Br.

No. 1500. Thriving in dry soil in the shelter of minute terraces on the side of Anvil Mountain, four or five miles north of Nome City; widely distributed from base to summit, but nowhere abundant; July 8 and August 16.

The range of this species, originally described from specimens

* See Hooker, Fl. Bor. Am. 2: 260, and Macoun, Cat. Can. Pl., Part V., p. 280, 1890.

collected at Great Bear Lake, is now known to extend from central New York and Vermont to New Brunswick, westward in Canada to the Rocky Mountains, northward to Alaska and the Arctic coast from the Mackenzie River to Baffin Bay. It is apparently rather uncommon in Europe, but has a wide range, occurring in Siberia. The National Herbarium contains specimens also from Arakamtchetchene Island, Bering Straits.

EQUISETACEAE

EQUISETUM ARVENSE L.

No. 1520. Common in the vicinity of Nome City, June 18. This is forma *boreale* (Bong.).

EQUISETUM SYLVATICUM L.

No. 1524. In moist shady places among alders along the border of the tundra, at a point 16 miles west of Nome City; August 5.

EQUISETUM VARIEGATUM Schleich.

No. 1521. Swamps, Unalaska, June 18.

LYCOPODIACEAE

LYCOPODIUM SELAGO L.

No. 1513. Common on hills, Dutch Harbor, Unalaska, June 13. No. 1527; in shady places near the tundra at Nome City, July 22. No. 1526; on the tundra, Nome City, July 22.

These plants represent a considerable diversity with respect to habit and size, but are undoubtedly referable to the single species.

LYCOPODIUM ANNOTINUM L.

No. 1518. On the hills, Unalaska, June 19. No. 1528; in shady places, vicinity of Nome City, July 22. Both numbers represent the form usually known as var. *pungens* Spring.

LYCOPODIUM CLAVATUM L.

No. 1522. Dutch Harbor, Unalaska; June 17; common.

LYCOPODIUM SITCHENSE Rupr.

No. 1514. Common on the hills enclosing the harbor, Unalaska, June 13. No. 1516; Unalaska, alt. 1–2000 ft., June 17.

LYCOPODIUM ALPINUM L.

No. 1515. Unalaska, June 17. No. 1525; in moist shady places, vicinity of Nome City, July 22.

SELAGINELLACEAE

SELAGINELLA RUPESTRIS (L.) Spring.

No. 1529. Common in dry rocky places on mountain summits near Nome City, July 15.

Professor Underwood, who has kindly determined this as the forma *Sibirica* of Milde (Fil. Eu. et Atl. 262), suggests that it probably represents a distinct species.

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Beiträge zur Flechten-Flora Süd-Californiens

VON DR. A. ZAHLBRUCKNER

Von Herrn Dr. H. E. Hasse in Soldiers Home (Los Angeles Co.) dem eifrigen und erfolgreichen Sammler und Beobachter der Lichenen Süd-Californiens erhielt ich eine kleine aber interessante Flechtencollection zur Bearbeitung. Bevor ich zur Aufzählung der mitgetheilten Arten schreite, möchte ich auf ein aus dem Studium der Collection sich ergebendes Resultat in kürze hinweisen, das mir in pflanzengeographischer Beziehung bemerkenswerth erscheint. Die Thatsache, dass die mir übersendete Aufsammlung nicht weniger als zwei Arten der Gattung *Dirina* enthielt, ist für die Verbreitung der Flechten in Nord-Amerika von grossem Interesse. Vertreter dieser Gattung wurden bisher in Nord-Amerika nicht aufgefunden; nider Tuckerman * noch Schneider † führen sie an und auch in den der letzten Zeit entstammenden Listen nord-amerikanischer Flechten von Fink, Hasse, Nylander, Stizenberger, Willey, und Williams findet sich keine Erwänung. Dieses so späte erfolgte Auffinden in Dirinen in Californien ist bemerkenswerth in Bezug auf die Thatsache, dass daselbst bisher nicht weniger als sechs Arten des Flechtentribus der *Roccellei* festgestellt werden.‡ Nach der bisherigen Beobachtungen bewohnen die *Roccellei* und *Dirina*, die auch phylogenetisch enge verwandtschaftliche Beziehungen aufweisen, dieselbe Gebiete. Ihre Fundorte sind die Meeresküsten und die unmittelbar daran angrenzenden Landestheile. Darbishire ‡ kommt zu dem Schluss, dass die Roccellen das maritime Klima bevorzugen; dasselbe möchte ich auch von *Dirina* behaupten, von letzten sogar sagen, dass ihr Vorkommen geradezu an ein maritimes Klima gebunden sei. Die Angaben in der Lokalflora und auch die Funde Hasse's sind geeignet, meine Anschauung zu bestätigen. Es scheint ferner, dass die Sclerolichenen an den Meeresküsten in einem grösseren Gattungsreichthume auftreten, als in Binnenlande.

* Tuckerman: Synopsis of the North American Lichens (Boston, 1882–1884).
† Schneider: A Text-book of General Lichenology (Binghamton, 1897).
‡ Darbishire, O. V.: Monographie Roccelleorum (Stuttgart, 1898, 4o).

Von den beiden in Süd-Californien von Hasse aufgefundenen Arten der Gattung *Dirina* konnte nur die eine mit Sicherheit festgestellt werden, es ist dies eine gut charakteristische neue Art, welche ich zu Ehren des Entdeckers *Dirina Hassei* benannte. Ueber die zweite Art hingegen bin ich derzeit noch nicht in der Lage mir ein definitives Urtheil zu bilden. Äusserlich erinnert sie sehr an *Dirina Ceratoniae* De Notaris und stimmt mit derselben auch in den chemischen Merkmalen des Lagers (KHO flav., $CaCl_2$ erythrin.) überein, doch konnte ich in der scheinbar ihre vollkommene Grösse erreicht habenden Apothecien keine Schläuche mit ausgebildeten Sporen auffinden, mir daher über die Gestalt desselben keine Sicherheit verschaffen. Ohne Kenntniss der Sporen wurde ich aber eine Identification der californische Flechten mit *Dirina Ceratoniae* De Notaris, die bisher nur in den Ländern der Mittelmeeres beobachtet wurde, für ungerechtfertigt betrachten.

In der folgenden Zeilen beschreibe ich fünf Arten und eine Varietät als neu. Daran dass sich in der Collection Hasse's einige neue Flechtentypen finden werden, konnte von vornherein nicht gezweifelt werden. Dann wenngleich für Süd-Californien, wie dies aus Hasse's Zusammenstellung* hervorgeht, in der letzten Zeit eine Reihe von Neuheiten erkannt wurden so ist der Reichthum an solchen in einem klimatologisch und pflanzengeographisch eigenartigen Gebiete gewiss noch lange nicht erschöpft.

STENOCYBE ATREMULICOLA Norrl.; Nyl. Flora, 531. 1883. Hue, Addend. Lichenogr. Europ. 23. 1886.

Ad corticem Sambuci glaucae in montibus Santa Monica (no. 695).

LECANORA CENISEA Ach., Lictgr. Univ. 361. 1810.

Lecanora subfusca var. *cenisea* Th. Fries, Lictgr. Scand. **1**: 240. 1870.

Lecanora atrynea β cenisea Nyl.; Lamy Bull. Soc. Bot. France, **25**: 409. 1878.,

Ad saxa granitica in montibus San Bernardino, circa 1300, mt. j. m. no. 707.

---

* Hasse, H. E.: Lichens of Southern California. Second Edition (Los Angeles, 1898, 89).

Lecidea (Biatora) xanthococcoides sp. nov.

Thallus tenuis, ruguloso-granulatus vel verrucosus, pallide cervino-fuscescens; KHO —, $CaCl_2$ —, non corticatus, hyphis non amyloideis. Gonidia protococcoidea, globosa, 10–18 μ diam. Apothecia parva (0.2–0.3 mm. lata), sessilis, nigra, opaca, primum modice concava vel plana, margine tenui, integro subnitidoque cincta, demum convexa et immarginata. Excipulum et hypothecium fuscum. Hypothecium obscure fuscum, NO_5 —, KHO nubes fuscescentes effundens. Hymenium 160–180 μ altum. I coerulescens, dein obscure fulvescens. Paraphyses conglutenatae, tenues. Asci oblongo- vel ovoideo-cuneati, 8-spori. Sporae ovales vel oblongo-ovales, obtusae, simplices, hyalinae, 12–15 μ longae et 5.5–6 μ latae, episporio tenui.

Habita ad *Lecideam xanthococcam* accedit, sed structura interna apotheciorum ab ea longe distat. *Lecideae hypomelaenae* Nyl. affinis.

Ad truncos Coniferarum in montibus San Bernardino, circa 1700 mt. s. m. (no. 705).

Lecidea cinerata sp. nov.

Thallus exceptis partibus sub apotheciis sitis non evolutus; medulla cretacea, albida, KHO —, I —. Apothecia conferte, parva (0.5–1 mm. lata), anguloso-rotundata, sinuosa vel sinuoso-lobata, primum dense cinereo-pruinosa, urceolata, demum disco plano et minus pruinoso, margina crasso persistente, obtuso, cinereo-pruinoso cincta. Epithecii pars marginalis coeruleo-nigricans, pars interna lutescens. Hypothecium crassum, fulvescens. Hymenium I coerulescens, dein fulvescenti-obscuratum. Paraphyses tenues, eseptatae, conglutenatae, apice olivaceo-nigricantes. Asci oblongo-cuneati, 8-spori. Sporae hyalinae, simplices, 12–14 μ longae et 5–6 μ latae, episporii tenui. Pycnoconidia non visa.

E stirpe *Lecideae lithophilae* Ach.

Ad saxa granitica in montibus Santa Monica, circa 270 mt. s. m. (no. 714).

BUELLIA (CATOLECHIA) BADIA Koerb., Syst. Lich. Germ. 226. 1855; Th. Fries, Lichgr. Scand. **1**: 588. 1874.—*Lecidea badis* E. Fries, Syst. Orb. Veg. 287. 1825.

Ad saxa in montibus San Gabriel (no. 701).

Dirina Hassei sp. nov.

Thallus effusus, continuus, ramulus lata obtegens, tenuis, ruguloso-rimosus, areolas parvas formans, rarius rugulosus lutescentialbidus, opacus, KHO leviter flavescens, $CaCl_2$ et KHO + $CaCl_2$ —, in margine linea obscuriore non cinctus. Apothecia parva, 0.3–0.7 mm. lata, rotunda vel subrotunda, copiosa, dispersa, sessilia primum plana et dense caesio-pruinosa, demum parum convexa, minus pruinosa vel nigricantia, margine thallino albido, integro et persistente cincta. Hypothecium fusconigrum, sat crassum. Hymenium I vinose rubens. Asci subcylindrico-saccati vel saccati et subcuneati, 8-spori, 47–54 μ longi et 8–9 μ lati. Paraphyses filiformes, apice subclavatim incrassatae et fuscae. Sporae leviter curvulae, fusiformes, apicibus obtusis, hyalinae, 3-septatae, 15–20 μ longae et 3–4 μ latae, episporio tenui. Receptacula pycnoconidiorum minutussime, thallo immersa et solum vertice nigro nitidoque prominentia, sterigmatibus versus basin ramosis, brevibus (13–16 μ longis); pycnoconidiis minutis, oblongis, apicibus obtusis, leviter curvulis, 3–4 μ longis et 0.6–0.8 μ latis.

Species thallo tenui, $CaCl_2$ non reagente, apotheciis parvis et tenuiter marginatis, sporis et pycnoconidiis leviter curvulis distincta. A sat simili *Platygrapha Californica* Tuck. (= *Dirina Californica* Tuck. in litt.) jan. apotheciis rotundis et thallino-marginatis longe distat.

In cortice ramulorum *Rhoidis laurinae* ad ora maris prope Santa Monica (no. 671).

OPEGRAPHA VARIA var. LICHENOIDES (Pers.) f. CHLORINA (Jatta Exsicc. 53).

Disco virescenti-pruinoso.

Ad corticem Umbellulariae Californicae (no. 693).

Platygrapha hypothallina sp. nov.

Hypothallus bene evolutus, dendriticus vel connexo-ramosus, albus, laxe contextus. Thallus sat tenuis, plicato-rugulosus, opacus, pallide isabellinus, mollis, laxe cortextus, in hypothallo plagas formans dispersas vel subconfluentes, KHO—, $CaCl_2$ erythinosus. Apothecia solitaria, sessilia, subrotundata, oblonga vel gyrosa, rarius substellata, convexa, albo-farinosa (detrita nigra), usque 1.5 mm. longa et 0.3–0.5 mm. lata, margine proprio nullo, sed thallo in margine accessore cincta et etiam in disco lateraliter hyphis thallinis, demum evanescentibus tecta. Hypothecium crassum, nigrofuscum, KHO—. Hymenium 86–90 μ altum. I. vinose rubens. Epithecium obscure fuligineum, KHO et NO_5—. Paraphyses tenues, ramoso-convexae. Asci saccato- vel subcylindrico-cuneati, apice obtusi at pachydermi, 62–74 μ alti et 12–15 μ lati, 6–8-spori. Pycnoconidia non visa.

Ad saxa schistosa in Catalina Island (no. 692). Legit Blanche Trask.

A corticola *Platygrapha Californica* (Tuck.) differt hypothallo evolutio et apotheciis aliis.

Chiodecton ochroleucum sp. nov.

Thallus tenuis, effusus, inaequalis vel subrugulosus, tartareus, ochroleucus, KHO flavens, $CaCl_2$ erythrinosus, medulla alba, I vinosa fulvescenti. Gonidia chroolepoidea, cellulis ellipsoideis vel oblongis, concatenatis. Pocadostromata thallo immersa vel rarius demum modica prominale, irregulariter oblonga, usque 1 mm. vel parum ultra longa, niveo-pruinosa. Hymenia stellata, substellata, elongata, vel plus minus flexuosa, apicibus obtusis, humectata mollia et turgescentia, ochracea, margine disphana, intus pallida, I vinosa-rubescentia. Hypothecium et epithecium pallidum (lutescens). Paraphyses tenuies, filiformes, connexo-ramosae. Asci ovali-cuneati, 8-spori, 53–62 μ longi et 20–22 μ lati. Sporae ovales vel ovali-oblongae, hyalinae, transversim 4–5-septatae, cellulis cylindricis, 14–18 μ longi et 8 μ latae, episporio tenui. Receptacula pycnoconidiorum punctiformia, nigra, nitida, immersa, excepto vertice; sterigmatibus basi ramosis, cellulis superioribus subinflatis, longioribus, subfasciculatis; pycnoconidiis filiformibus, arcuatis, 11–18 μ in diam. et 1.5–1.8 μ latis.

Species distincta, a *Chiodectone Californica* Tuck. hymenio pallido et sporis minoribus latissibusque distat.

Ad corticem *Rhoidis integrifoliae* in Catalina Island. Legit Blanche Trask, no. 694.

ARTHONIA PATELLULATA **caesiocarpa** var. nov.

Thallus tenuis, albens, determinatus. Apothecia caesio-pruinosa, in margine tamen plerumque nuda et nigra. Hypothecium pallidum. Epithecium coerulescenti-fuligineum. Sporae 15–17 μ longae et 5.5–6 μ latae.

In ramulis *Malvastri Thurberi* in montibus Santae Monicae (no. 690 pr. p.).

Arthothelium pruinascens sp. nov.

Thallus epiphloeodes, tenuis, determinatus, subrugulosus, cinereus vel flavido-cinereus, opacus, KHO —, $CaCl_2$ —, hypothallo indistincto. Apothecia innata, parva, rotundato-angulata vel fere oblonga, 0.2–0.3 mm. lata, plana, nigra, et caesio-pruinosa, humectata turgescentia et nigra. Hymenium pallida fulvescens, I ascis vinosis. Epithecium fuscescenti-nigricans, non granulosus Paraphyses indistinctae. Asci copiosi, pyriformes, 70–74 μ longi et 31–40 μ lati, 8-spori. Sporae ellipsoideae, hyalinae, murali-divisae, septis transversalibus 6–7 et septis longitudinalibus plerumque 4, 16–22 μ longae et 9–13 μ latae. Pycnoconidia non visa.

E grege *Arthothelii spectabilis* Sw. apothecibus innatis, pruinosis et sporis minutis insignis species.

In ramulis *Malvastri Thurberi* in montibus Sanctae Monicae (no. 696 pr. p.).

Bryological Notes.—I

BY ELIZABETH G. BRITTON

Didymodon riparius Aust.—This species was described as *Pottia riparia* Aust. in the Supplement to Sullivant's Icones in 1874, and the fruit was figured on Plate 21. In 1880, Warnstorf described *Barbula lingulata*, which Limpricht later changed to *Trichostomum Warnstorfii* (Laubm. 1 : 587. 1888) the specific name being preoccupied. In 1892, Kindberg in Macoun's Catalogue, described *Leptodontium Canadense*, as a new species, remarking that "it is rather peculiar that this genus had not been represented before in North America." In the Bryineae of Europe and North America, he redescribed this species as *Didymodon Macounii* Kindb. (new name) and referred *Pottia riparia* Aust. to *Didymodon riparius* Aust., the name it bore in Austin's herbarium. I have critically compared all these specimens and am persuaded that they are one and the same species, characterized by very peculiar brood-bodies, borne on long slender filaments, either in clusters in the axils of the leaves or at the summit of the stems, mixed with the archegonia and seeming to replace the paraphyses. Limpricht figured them on page 588, Fig. 171 of the Laubmoose, and Correns in his Untersuchen der Laubmoose has also figured and described them as *Trichostomum Warnstorfii*. The European specimens have not been found fruiting, and Austin's station on the Palisades is the only one thus far discovered where it is known to fruit. It has probably been overlooked in many places, on account of its small size, dirty appearance and sterility. The following stations are recorded for North America: On rocks in streams, Palisades of northern New Jersey and southern New York, C. F. Austin; Niagara Falls, F. Wolle; Watkins; Chilson Lake; Mrs. Harris, Bashbish Falls, R. S. Williams. Penna.: Bethlehem, Rau and Wolle; Pocono Mt., T. C. Porter; Springfield, Ohio, Miss Biddlecome; Owen Sound, Ont., J. Macoun. In Europe it is only known in Switzerland from the Rhine at Schaffhausen and in the lake at Zurich.

Grimmia anomala Hpe.—In a recent number of the Revue Bryologique, Mr. Ernest S. Salmon has described and figured the difference between *Grimmia anomala* and *G. Hartmanni*, two very rare European mosses, of which *G. anomala*, was not known to fruit, and *G. Hartmanni* had only been found once fruiting in Corsica. Both bear propagating gemmules on the leaves, the points of which are abnormally differentiated for their production. The sterile plants may be distinguished by cross-sections of the stem, that of *G. Hartmanni* having a central strand, *G. anomala* being without.

In 1891, I described *Grimmia Philibertiana*, from specimens collected by J. B. Leiberg, in Idaho, and figured it on Plate 114 of the Bulletin of the Torrey Botanical Club. From recent exchanges of specimens, I have discovered that *G. Philibertiana* is the same as the European *G. anomala*, and Mr. Salmon agrees with me. This is the second species of *Grimmia* which Mr. Leiberg has found fruiting, of which the fruit was unknown in Europe.

G. anomala has been found fruiting at Seljestad in Norway, July, 1900, by H. N. Nixon and Nicholson and *G. torquata* was collected in fruit in 1892 at Gausdal, Norway, by E. Ryan.

Typhula muscicola (Pers.) Fries. This species of fungus is usually found growing in wet shady places on mosses and other plants near them. It has been collected on the following species: *Climacium Americanum* Brid., Farmingham, N. Y., Edgar Brown; var. *fluitans* Aust. Garrisons, N. Y., A. J. Grout; *C. dendroides* (L.) Web. & Mohr, Vermilion Lake, E. W. D. Holway; *Entodon seductrix* (Hedw.) CM. H. W. Ravenel, S. C. (Fungi Car. Exsicc. no. 36); *Leskea obscura* Hedw., Emma, Mo., C. H. Demetrio (E. & E. N. Am. Fungi no. 2320); *Plagiothecium striatellum* Lindb. Ringwood, N. J., N. L. Britton; *Pylaisea velutina* Sch., Wilmington, Del., A. Commons; *Thuidium minutulum* (Hedw.) Br. & Sch., S. C. Ravenel, no. 36; *T. recognitum* (Hedw.) Lindb. E. A. Rau. The small capitate sclerotium has been collected by Edgar Brown; when sterile the fungus looks like a slender white *Clavaria* from 2–9 mm. high.

Proceedings of the Club

WEDNESDAY EVENING, OCTOBER 31, 1900

The meeting was held at 4 P. M. in the Conference Room of the Museum of the Botanical Garden at Bronx Park.

Professor Underwood presided in the absence of other officers. Seventeen persons were present.

The following new members were elected: Miss Gail H. Pierce, 128 Lincoln Ave., Newark, N. J.; Mr. Joseph E. Kirkwood, Teachers College, New York City.

The Secretary made announcement of the death during the summer of one of the members of the Committee on Nominations, Miss Jeannette B. Greene, M.D.

The program consisted of a paper by Dr. P. A. Rydberg, on "The Melanthaceae of the Rocky Mountains." Numerous herbarium specimens were exhibited, including the types of seven new species described by Dr. Rydberg in the BULLETIN for October. To these descriptions he now added further particulars regarding habit, distribution and critical characters, presenting also a series of comparative drawings of their petals and sepals. One of these new species of especial interest is *Veratrum speciosum*, to which most of the specimens previously ascribed in herbaria to *V. Californicum* prove to belong. The presence of conspicuous petioles at the lower leaves of typical *V. Californicum* was demonstrated from the type-specimen and also by explicit accompanying statements by Dr. Asa Gray whose manuscript description was produced.

EDWARD S. BURGESS,
Secretary.

TUESDAY EVENING, NOVEMBER 13, 1900

Professor Underwood presided in the absence of the officers of the Club. Thirteen persons were present.

The recent death of Rev. George D. Hulst, a member of the Club was mentioned by Professor Britton, and the Club voted that the Secretary be requested to send an expression of sympathy to the bereaved family.

The program consisted of an account by Dr. Britton of his recent trip to Paris, where he represented the United States at the International Congress of Botanists. The first day, Monday, October 1st, was given up to organization of the Congress. The next day, a visit was made to the Jardin des Plantes under direction of M. Cornu, and some papers were read. An important one was by Professor Flahault of Montpellier on the relations of herbaria and botanical gardens.

On succeeding days, in addition to reading of papers, visits were made to private herbaria and gardens. Dr. Britton remarked that the so-called *Solidago Virga-aurea* of America differs widely from the plant of Switzerland and Wales, particularly in having a very viscid character.

On Friday, October 5th, there was a continuation of a discussion begun previously in regard to future congresses. It was decided that the next congress should be held in 1905 at Vienna.

Dr. Britton also spoke briefly of the botanical and horticultural exhibits of the Exposition, and of the large amount of museum and horticultural material which he was able to secure.

After leaving Paris, Dr. Britton visited the Swiss Botanical Garden at Zurich, and went to Frankfurt and Wiesbaden. He also spent six days in Berlin, which he describes as the most active botanical center of the world.

From Berlin he went to Kew and South Kensington, where he found considerable changes from the conditions at his last visit, nine years previously.

TRACY E. HAZEN,
Secretary pro tem.

Index to recent Literature relating to American Botany

Andrews, A. L. The Orchidaceae of a Series of Swamps in southern Vermont. Rhodora, **2**: 114, 115. 21 Je. 1900.

Arnoldi, W. Ueber die Ursachen der Knospenlage der Blatter. Flora, 87: 440–478. *f. 1–45*. 5 O. 1900.

Arthur, J. C. New Station for the dwarf Mistletoe. Rhodora, **2**: 221–223. N. 1900.

Report of the discovery of this species on Isle au Haut, Maine.

Bailey, W. W. *Solidago tenuifolia* as a Weed in Rhode Island. Rhodora, **2**: 226. N. 1900.

Bailey, W. W. The old-time Flora of Providence. Rhodora, **2**: 213–220. N. 1900.

Baranetzky, M. J. Recherches sur les faisceaux bicollatéraux. Ann. Sc. Nat. Bot. VIII. **12**: 261–332. *pl. 7–10*. 1900.

Beadle, C. D. Studies in *Crataegus*.—II. Bot. Gaz. **30**: 335–346. 15 N. 1900.

C. aprica, *C. sororia*, *C. Alleghaniensis*, *C. venusta*, *C. Ashei*, *C. senta*, *C. Alabamensis*, *C. pinetorum*, *C. rubella*, and *C. straminea* new.

Berry, E. W. Abnormal Forms of Dogwood. Plant World, **3**: 56, 57. *f. 1–3*. Ap. 1900.

Billings, F. H. Ueber stärke corrodirende Pilze und ihre Beziehung zu Amylotrogus Roze. Flora, **87**: 288–298. *pl. 11, 12*. 30 J. 1900.

Bissell, C. H. A new Variety of *Zizia aurea*. Rhodora, **2**: 225. N. 1900.

Zizia aurea obtusifolia.

Bissell, C. H. Abnormal Flowers in *Leonurus Cardiaca*. Rhodora, **2**: 223, 224. N. 1900. [Illust.]

Brandegee, T. S. A new *Tapirira* from Baja California. Zoe, **5**: 78, 79. N. 1900.

Tapirira edulis sp. nov.

Brenner, W. Untersuchungen an einigen Fettpflanzen. Flora, **87**: 387–439. *f. 1–15*. 5 O. 1900.

An experimental investigation of a number of succulents included in *Sedum*, *Crassula*, *Sempervivum*, and *Mesembryanthemum*.

Britton, E. G. Note on *Trichostomum Warnstorfii* Limpr. Rev. Bryol. **27**: 71. 1900.

Britton, N. L. Dr. Torrey as a Botanist. Bull. Torr. Club, **27**: 540–551. 26 O. 1900.

Burgess, E. S. The Work of the Torrey Botanical Club. Bull. Torr. Club, **27**: 552–558. 26 O. 1900.

Burns, G. P. Beiträge zur Kenntniss der Stylidaceen. Flora, **87**: 313–354. *pl. 13–14. f. 1–45.* 5 O. 1900.

A morphological and physiological study of the Lobeliaceae, Campanulaceae, Goodeniaceae, Stylidaceae, and Cucurbitaceae.

Byxbee, E. S. The Development of the karyokinetic Spindle in the Pollen-Mother-Cells of *Lavatera.* Proc. Calif. Acad. Sci. (Botany) III. **2**: 63–82. *pl. 10–13.* 31 O. 1900.

Cannon, W. A. The Gall of the Monterey Pine. Am. Nat. **34**: 801–810. *f. 1–6.* O. 1900.

Celakovsky, L. J. Neue Beiträge zum Verständniss der Fruchtschuppe der Conifereen. Jahrb. wiss. Bot. **35**: 407–448. *pl. 10, 11.* 1900.

Chauvead, M. G. Recherches sur le mode de formation des tubes criblés dans la racine des Dicotylédones. Ann. Sc. Nat. Bot. VIII. **12**: 323–394. *pl. 11–14.* 1900.

Chesnut, V. K. A fatal Case of *Amanita* Poisoning. Plant World, **3**: 8. Ja. 1900.

Chesnut, V. K. Poisonous Properties of the green-spored *Lepiota.* Asa Gray Bull. **8**: 87–93. *pl. 5.* O. 1900.

Clute, W. N. The Making of an Herbarium. Fifth Paper. Arranging for Use. Plant World, **3**: 54–56. Ap. 1900.

Cockerell, T. D. A. *Gaurella = Gauropsis.* Bot. Gaz. **30**: 351. 15 N. 1900.

Coe, M. A. Autumnal Flowering of *Vaccinium Pennsylvanicum.* Rhodora, **2**: 224, 225. N. 1900.

Collins, F. S. Seaweeds in Winter. Rhodora, **2**: 130–132. 21 Je. 1900.

Conn, H. W. Classification of Dairy Bacteria. Rep. Storrs (Conn.) Agr. Exp. Sta. **12**: 13–68. 1900.

Corbett, L. C. An improved Auxanometer and some of its Uses. Rep. W. Va. Agric. Exp. Sta. **12**:—(1–8). *f. 3–6.* 1900.

Corbett, L. C. Fruit Diseases and how to treat them! Bull. W. Va. Agric. Exp. Sta. *66*: 199–235. *f. 1–23.* F. 1900.

Coulter, J. M. Geographical Distribution of Conifers. Plant World, **3**: 20, 21. F. 1900.

eties. *R. Macounii Oreganus*, *R. subalpinus*, *R. canus hesperoxys*, *R. Californicus Ludovicianus*, *R. Bongardi Douglasii*, *R. pedatifidus pinetorum*, *R. Mexicanus*, *R. pygmaeus Sabinii*, *R. ambigens obtusiusculus*, *R. alismaefolius calthaeflorus*, *R. alismellus Populago* and *R. reptans Gormani*, new names and combinations.

Davis, W. F. Observations on a Woodland Fire. Plant World, **3**: 4–6. Ja. 1900.

Davenport, G. E. *Dicksonia pilosiuscula*, var. *cristata*. Rhodora, **2**: 220, 221. N. 1900.

Devaux, M. H. Recherches sur les lenticelles. Ann. Sc. Nat. Bot. VIII. **12**: 1–240. *pl. 1–6.* 1900.

DeCandolle, C. Piperaceae Uleanae e Brasilia. Engler's Bot. Jahrb. Beiblatt, **29**: 24–27. 4 S. 1900.

Three new species of *Piper* and *Peperomia* described.

Dobbin, F. Naturalized Compositae. Plant World, **3**: 134–136. S. 1900.

Dobbin, F. Native Orchids. Plant World, **3**: 88, 89. Je. 1900.

Dooris-Sharp, K. The Passing of the Wildwood. Plant World, **3**: 72–74. My. 1900.

Driggs, A. W. Notes on the Flora of Hartford, Litchfield and Tolland Counties [Connecticut], pp. 1–4. 1 S. 1900.

Durand, E. J. The Classification of the fleshy Pezizineae with reference to the structural Characters illustrating the Bases of their Division into Families. Bull. Torr. Club. **27**: 463–495. *pl. 27–32.* 29 S. 1900.

Eastwood, A. New Species of California Plants. Zoe, **5**: 80–90. N. 1900.

New species in *Salix*, *Chrysopsis*, *Helianthella*, *Sphacele*, *Mimulus*, *Aphyllon*, *Asclepias*, *Cleomella*, *Peucedanum* and *Navarretia*.

Eastwood, A. Rediscovery of *Thermopsis macrophyllum* H. & A. Zoe, **5**: 76–78. N. 1900.

Evans, A. W. Notes on the Hepaticae collected in Alaska. Proc. Wash. Acad. Sci. **2**: 287–314. *pl. 16–18.* 10 O. 1900.

List of 63 species collected by the Harriman expedition with descriptions of several circumboreal species new to America.

Evans, W. H. Notes on the edible Berries of Alaska. Plant World, **3**: 17–19. F. 1900.

Fanning, M. G. Some Algae in ornamental Waters. Plant World, **3**: 49–52. *pl. 1.* Ap. 1900.

Farwell, O. A. Flora of the Park System and throughout the City of Detroit. Ann. Rep. Commissioners of Parks and Boulevards (Detroit, Mich.) **11**: 41–94. 1900.
861 species and varieties enumerated.

Fernald, M. L. Some Jesuit Influences upon our northeastern Flora. Rhodora, **2**: 133–142. 10 Jl. 1900.

Fink, B. Additions to the Bibliography of North American Lichens. Rep. Iowa Acad. Sci. **6**: 165–173. 1899.

Fink, B. Notes concerning Iowa Lichens. Rep. Iowa Acad. Sci. **5**: 174–187. 1898. Also separate pp. 1–14.

Fischer, H. Der Pericykel in den freien Stengelorganen. Jahrb. wiss. Bot. **35**: 1–27. *pl. 1.* 1900.

Fisher, W. L. The Violets on Long Island. Plant World, **3**: 91, 92. Je. 1900.

Fitting, H. Bau und Entwickelungsgeschichte der Makrosporen von *Isoetes* und *Selaginella* und ihre Bedeutung für die Kenntniss des Wachstums pflanzlicher Zellmembranen. Bot. Zeitung, **58**[1]: 107–165. *pl. 5–6.* 16 Au. 1900.

Freeman, E. M. A preliminary List of Minnesota Erysipheae. Minn. Bot. Stud. **2**: 423–430. 15 Au. 1900.
19 species enumerated.

Fritsch, K. Beitrag zur Kenntniss der Gesneriaceen-Flora Brasiliens. Engler's Bot. Jahrb. Beiblatt, **29**: 5–23. 4 S. 1900.
New species in *Hypocyrta*, *Seemannia*, *Vanhouttea* and *Corytholoma*.

Gaucher, L. Du rôle des laticifères. Ann. Sc. Nat. Bot. VIII. 12: 241–260. *f. 1–8.* 1900.

Geheeb, A. Revision des Mousses récoltées en Brésil dans la province de San Paulo par M. Juan J. Puiggari pendant les années 1877–1882. Rev. Bryol. **27**: 65–71. 1900.

Gifford, J. Silvicultural Prospects of the Island of Cuba. Forester, 6: 179–183. Au. 1900. [Illust.]

Gottschall, M. Anatomisch sytematische Untersuchung des Blattes der Melastomaceen aus der Tribus Miconieae. Mem. Herb. Boissier, 19: 1–176. *pl. 1–3.* 25 S. 1900.
211 species studied, all American.

Gould, C. N. Radiate Structure of the wild Gourd (*Cucurbita foetidissima*). Plant World, **3**: 153, 154. O. 1900.

Graebner, P. Die Gattung Linnaea (einschliesslich Abelia). Engler's Bot. Jahrb. **29**: 120–145. 22 My. 1900.
Two species and one variety American.

Grieve, S. Additional Notes on *Andromeda polifolia*. Trans. Bot. Soc. Edinb. **21**: 258–269. 1900.

Grout, A. J. Illustrated Glossary [Musci]. Bryologist, **3**: 2, 3. Ja. 1900; 23, 24. Ap. 1900; 31–33. Jl. 1900; 45–48. O. 1900.

Grout, A. J. *Weissia*. Bryologist, **3**: 43, 44. O. 1900. [Illust.]

Halsted, B. D. Coloration of Leaf for Seed Distribution. Plant World, **3**: 22. F. 1900.

Halsted, B. D. Report of the Botanical Department of the New Jersey Agricultural College Experiment Station. Rep. N. J. Agric. Exp. Sta. **20**: 323–419. *f. 2–16.* 1900.

Harger, E. B. Stations for some of the less usual Plants of Connecticut. Rhodora, **2**: 125–127. 21 Je. 1900.

Harper, R. A. Cell and Nuclear division in *Fuligo varians*. Bot. Gaz. **30**: 217–251. *pl. 14.* 15 O. 1900.

Harper, R. M. Notes on the Flora of South Georgia. Bull. Torr. Club, **27**: 413–436. 6 S. 1900.

Harper, R. M. Notes on the distribution of some of the rarer plants of Central Massachusetts. Rhodora, **2**: 119–123. 21 Je. 1900.

Harshberger, J. W. Philadelphia Botanists commemorated in the Names of Plants. Plant World, **3**: 74–76. My. 1900.

Hastings, G. T. When Increase in Thickness begins in our Trees. Plant World, **3**: 113–116. Au. 1900.

Hefferan, M. A new chromogenic *Micrococcus*. Bot. Gaz. **30**: 261–272. *f. 1–4.* 15 O. 1900.

Hemsley, W. B. *Castilloa Funii* Hemsl. Hook. Icon. Plant IV. 7: *pl. 2651.* Au. 1900.
A new species from Central America.

Hill, E. J. An Observation on the Water-shield (*Brasenia peltata*). Plant World, **3**: 153. O. 1900.

Hill, E. J. *Celtis pumila* Pursh, with Notes on allied Species. Bull. Torr. Club. **27**: 496–505. *pl. 33. f. 1–4.* 29 S. 1900.

Hill, E. J. *Primula Mistassinica*. Plant World, **3**: 104, 105. Jl. 1900.

Hill, E. J. The Southern Limit of *Juniperus Sabina*. Plant World, **3**: 140. S. 1900.

Hitchcock, A. S. Collecting Sets of Plants for Exchange. Plant World, **3**: 148–151. O. 1900.

Hudson, E. R. A new Species of *Neovossia.* Bot. Gaz. **30**: 273, 274. *f. 1.* 15 O. 1900.

Holm, T. Studies in the Cyperaceae; XIII. *Carex Willdenovii* and its allies. Am. Jour. Sci. IV. **10**: 33–47. *f. 1–3.* Jl. 1900.

Holm, T. Studies in the Cyperaceae; XIV. On a collection of *Carices* from Alaska, with remarks upon the affinities of *Carex circinata* C. A. Mey., and *C. lejocarpa* C. A. Mey. Am. Jour. Sci. IV. **10**: 266–284. *f. A–G.* O. 1900.

Carex cryptantha, *C. lugens* and *C. macrocephala bracteata*, new species and variety.

Holzinger, J. M. A *Polytrichum* new to North America. Asa Gray Bull. **8**: 95–99. *pl. 6.* O. 1900.

Holzinger, J. M. Suggestions for Glycerine Jelly Mounts. Bryologist, **3**: 42. O. 1900.

H[ooker], J. D. *Convolvulus macrostegius.* Curt. Bot. Mag. III. **56**: *pl. 7717.* 1 Je. 1900.

Native of Lower California.

H[ooker], J. D. *Mamillaria vivipara.* Curt. Bot. Mag. III. **56**: *pl. 7718.* 1 Je. 1900.

Native of the Rocky Mountains.

H[ooker], J. D. *Cypripedium guttatum.* Curt. Bot. Mag. III. **56**: *pl. 7746.* N. 1900.

Native of N. E. Europe, Asia, and N. W. America.

H[ooker], J. D. *Erigeron leiomerus.* Curt. Bot. Mag. III. **56**: *pl. 7743.* N. 1900.

Native of the Rocky Mountains.

H[ooker], J. D. *Dipladeni eximia.* Curt. Bot. Mag. III. **56**: *pl. 7720.* Je. 1900.

Native of Brazil.

H[ooker], J. D. *Helenium tenuifolium.* Curt. Bot. Mag. III. **56**: *pl. 7721.* Je. 1900.

Native of the eastern United States.

H[ooker], J. D. *Hesperaloe yuccaefolia.* Curt. Bot. Mag. III. **56**: *pl. 7723.* Jl. 1900.

Native of Texas.

H[ooker], J. D. *Dipladenia pastorum* var. *tenuifolia.* Curt. Bot. Mag. III. **56**: *pl. 7725.* Jl. 1900.

Native of Brazil.

H[ooker], J. D. *Robinia Neo-mexicana.* Curt. Bot. Mag. III. **56**: *pl. 7726.* Jl. 1900.

Native of the Rocky Mountains.

H[ooker], T. D. *Cattleya* × *Whitei.* Curt. Bot. Mag. III. **56**: *pl. 7727.* Au. 1900.
Native of Bahia.

H[ooker], J. D. *Hippeastrum Harrisoni.* Curt. Bot. Mag. III. **56**: *pl. 7737.* 1 O. 1900.
Native of Uruguay.

Hough, M. Z. Plant Names of the southwestern United States. Plant World, **3**: 137–139. S. 1900.

Hyatt, J., Peck, C. H., and Porter, T. C. Reminiscences of John Torrey. Bull. Torr. Club, **27**: 559–565. 26 O. 1900.

Hus, H. T. A. Preliminary Notes on West Coast Porphyras. Zoe, **5**: 61–70. N. 1900.
Key to the species; *P. occidentalis* Setchell & Huss, new.

Jones, L. R. *Daphne Mezereum* in Vermont. Rhodora, **2**: 142. 10 Jl. 1900.

Kearney, T. H., Jr. Concerning Saxifrages. Plant World, **3**: 37, 38. Mr. 1900.

Kearney, T. H., Jr. The Plant Covering of Ocracoke Island; a Study in the Ecology of the North Carolina strand Vegetation. Contr. U. S. Nat. Herb. **5**: 261–319. *f. 33–50.* 1 Au. 1900.

Kennedy, G. G. Edwin Faxon. (With portrait.) Rhodora, **2**: 107–111. 21 Je. 1900.

Kiærskou, H. Om danske Samlere of vestindiske Planter. Bot. Tidsskrift, **23**: 35–47. 1900.

Klebs, G. Zur Physiologie der Fortpflanzung einiger Pilze.—III. Jahrb. wiss. Bot. **35**: 80–203. 1900.

Knowlton, C. H. On the Flora of Chesterville, Maine. Rhodora, **2**: 123, 124. 21 Je. 1900.

Knowlton, F. H. Notes for the Beginner in the Study of Mosses. Plant World, **3**: 145–148. *pl. 5.* O. 1900.

Koehne, E. Lythraceae novae. Engler's Bot. Jahrb. **29**: 154–160. 22 My.; 161–168. 4 S. 1900.
Several new species and varieties of *Cuphea* described, all from Mexico and South America.

Kraemer, H. Note on the Origin of Tannin in Galls. Bot. Gaz. **30**: 274, 275. 15 O. 1900.

Kuntze, O. & Post, T. von. Nomenklatorische Revision höherer Pflanzengruppen und über einige Tausend Korrecturen zu Englers Phaenogamen Register. Allg. Bot. Zeitsch. **6**: 110–120. 15 Je. 1900; 148–164. 15 Jl. 1900; 179–191. S. 1900.

Land, W. J. G. Double Fertilization in Compositae. Bot. Gaz. **30**: 252–260. *pl. 15–16.* 15 O. 1900.

Leavitt, R. G. Revisions in *Berberis* and *Sagittaria.* Rhodora, **2**: 149–155. *pl. 19.* Jl. 1900.

Lehmann, F. C., & Kränzlin, F. *Mormodes Oberlanderianum.* Gard. Chron. III. **28**: 317, 318. *f. 96.* 3 N. 1900.

A new orchid from South America.

Lindau, G. Acanthaceae. Symbolae Antillanae **2**: 170–250. 20 O. 1900.

Ancitranthus and *Centrilla* gen. nov. Synopsis of West Indian species.

Livingston, B. E. On the Nature of the Stimulus which causes the Change of Form in polymorphic green Algae. Bot. Gaz. **30**: 289–317. *pl. 17, 18.* 15 N. 1900.

Lloyd, F. E. The Douglas Spruce, *Pseudotsuga taxifolia.* Plant World, **3**: 65–68. *pl. 2.* My. 1900; 85–87. Je. 1900.

Loesener, T. Beiträge zur Kenntniss der Flora von Central Amerika (entschliesslich Mexico).—II. Engler's Bot. Jahrb. **29**: 86–106. 22 My. 1900.

New species in *Piper*, *Peperomia*, *Quercus*, *Microtropis*, *Gyminda*, *Cereus*, and *Hyptis*, described by C. De Candolle, O. von Seemen, K. Schumann and the author.

MacDougal, D. T. The New York Botanical Garden. Pop. Sci. Mo. **57**: 171–178. Je. 1900. [Illust.]

MacMillan, C. Observations on *Lessonia.* Bot. Gaz. **30**: 318–334. *pl. 19–21.* 15 N. 1900.

Masters, M. T. *Passiflora europhylla.* Gard. Chron. III. **28**: 350. 17 N. 1900.

A new species from British Guiana.

Maxon, W. R. Notes on American Ferns.—II. Fern. Bull. **8**: 58, 59. Jl. 1900.

Maxon, W. R. The Hart's-tongue in New York and Tennessee. Plant World, **3**: 129–132. S. 1900. [Illust.]

Macomb, A. The Development of the karyokinetic Spindle in vegetative Cells of higher Plants. Bull. Torr. Club, **27**: 451–459. *pl. 24, 25.* 6 S. 1900.

McDonald, H. E. A Sand Dune Flora of Central Illinois. Plant World, **3**: 101–103. Jl. 1900.

Mez, C. Lauraceae et Bromeliaceae novae. Symbolae Antillanae, **2**: 251–256. 20 O. 1900.

New species in *Ocotea*, *Bromelia*, *Hohenbergia*, and *Tillandsia*.

Nathansohn, A. Physiologische Untersuchungen ueber amitotische Kerntheilung. Jahrb. wiss. Bot. **35**: 48–79. *pl. 2, 3.* 1900.

Nelson, A. Popular Ignorance concerning Botany and Botanists. Plant World, **3**: 33–36. Mr. 1900.

Nelson, A. The Cyptogams of Wyoming. Ann. Rep. Wyo. Exp. Sta. **10**: —— (3–38). 1900.

Nordhausen, M. Ueber basale Zweigverwachsungen bei *Cladophora* und über die Verzweigungswinkel einiger monosiphoner Algen. Jahrb. wiss. Bot. **35**: 366–406. *pl. 11.* 1900.

Osterhout, G. E. New Plants for Colorado. Bull. Torr. Club, **27**: 506–508. 29 S. 1900.

Allium rubrum, *Allium arenicola*, *Artemisia Coloradensis*, *Artemisia spiciformis*, *Artemisia cana viscidula* and *Agoseris montana* new species and variety.

Osterhout, G. E. A Correction. Bull. Torr. Club, **27**: 539. 26 O. 1900.

Allium sabulicola substituted for *A. arenicola.*

Pammel, L. H. The Twin-leaf (*Jeffersonia diphylla*) in Iowa. Plant World, **3**: 41. Mr. 1900.

Parish, S. B. Contributions to Southern California Botany.—I. Zoe, **5**: 71–76. N. 1900.

New species in *Gilia*, *Eupatorium* and *Bidens.*

Pollard, C. L. A new Southern Violet. Proc. Biol. Soc. Washington, **13**: 169. 31 O. 1900.

V. Alabamensis.

Pollard, C. L. A Visit to the Home of *Neviusia.* Plant World. **3**: 136, 137. S. 1900.

Porter, T. C. A new Variety of *Azalea nudiflora* L. Bull. Torr. Club, **27**: 508. 29 S. 1900.

Azalea nudiflora glandifera var. nov.

Porter, T. C. The Twin-flower (*Linnaea borealis*) in Pennsylvania. Plant World, **3**: 133, 134. S. 1900.

Preston, C. E. Non-sexual Propagation in *Opuntia.* Bot. Gaz. **30**: 351. 15 N. 1900.

Preston, C. E. Observations on the Root System of certain Cactaceae. Bot. Gaz. **30**: 348–351. 15 N. 1900.

Price, S. F. Abnormal Leaves and Flowers. Plant World, **3**: 53. *f. 1.* Ap. 1900.

Ramaley, F. The Seed and Seedling of the Western Larkspur (*Delphinium occidentale* Wats.). Minn. Bot. Stud. **2**: 417–421. *pl. 28.* 15 Au. 1900.

Reiche, K. Beiträge zur Systematik der Calyceraceen. Engler's Bot. Jahrb. **29**: 107–119. *pl. 1.* 22 My. 1900.

Robertson, R. A. Variations in *Lycopodium clavatum* Linn. Trans. Bot. Soc. Edinb. **21**: 290–298. *pl. 1–3.* 1900.

Rodrigue, A. Les feuilles panachées et les feuilles colorées. (Rapports entre leurs couleurs et leur structure.) Mém. Herb. Boissier, **17**: 11–75. 30 Je. 1900.

Several American species among those studied.

Rossler, W. Beiträge zur Kleistogamie. Flora, **87**: 479–499. *pl. 16, 17.* 5 O. 1900.

An investigation of *Juncus bufonius* L., and *Oxalis Acetosella* L.

Rothert, W. Die Krystallzellen der Pontederiaceen. Bot. Zeitung. **58**[1]: 75–106. *pl. 4.* 1 Je. 1900.

Rusby, H. H. The botanical Origin of Coca Leaves. Druggist's Circ. and Chem. Gaz.: 220–223. *f. 1–16.* N. 1900.

Rydberg, P. A. Studies on the Rocky Mountain Flora, II. The Rocky Mountain Species of Melanthaceae. Bull. Torr. Club, **27**: 528–538. 26 O. 1900.

Stenanthella gen. nov., *Stenanthella occidentalis* (Gray) Rydb. nom. nov., *Tofieldia intermedia*, *Veratrum speciosum*, *Zygadenus Coloradensis*, *Z. gramineus*, *Z. intermedius*, *Z. acutus*, and *Z. falcatus*, new species.

Salmon, E. S. Bryological Notes. Rev. Bryol. **27**: 59–61, 80–83. 1900.

Includes note on *Erpodium Domingense* (Spreng.) Brid.

Salmon, E. S. The Erysiphaceae of Japan. Bull. Torr. Club, **27**: 437–450. *pl. 26.* 6 S. 1900.

Sargent, H. E. A new *Vicia* for New England. Rhodora, **2**: 225. N. 1900.

Saunders, C. F. Does the catch-fly Grass catch Flies? Plant World, **3**: 104. Jl. 1900.

Saunders, C. F. Etymology of Columbine. Plant World, **3**: 107, 108. Jl. 1900.

Saunders, C. F. New Jersey Pine Barrens in July. Plant World, **3**: 1–4. Ja. 1900. [Illust.]

Saunders, C. F. Quaker Bridge, New Jersey. Plant World, **3**: 124. Au. 1900. [Illust.]

Saunders, C. F. Root System of the snake-mouth Pogonia. Plant World, **3**: 123, 124. Au. 1900. [Illust.]

Saunders, C. F. Some local common Names of Plants. Plant World, **3**: 132, 133. S. 1900.

Saunders, C. F. The small Mistletoe in Pennsylvania. Plant World, **3**: 60. Ap. 1900.

Schrenk, H. von. Two Diseases of Red Cedar, caused by *Polyporus juniperinus* n. sp. and *Polyporus carneus* Nees. Bull. U. S. Dept. Agric. (Div. Veg. Phys. & Path.) 21: 1–22. *pl. 1–7.* 1900.

Schuh, R. E. *Rhadinocladia*, a new Genus of brown Algae. Rhodora, **2**: 111, 112, *pl. 18.* 21 Je. 1900.

Rhadinocladia Farlowii n. sp.

Schumann, K. Musaceae. Das Pflanzenreich, **4**[45]: 1–45. *f. 1–10.* 1900.

Includes descriptions of all American species.

Schütt, F. Centrifugale und simultane Membranverdickungen. Jahrb. wiss. Bot. **35**: 470–534. *pl. 12.* 1900.

Schütt, F. Die Erklarung des centrifugalen Dickenwachstums der Membran. Bot. Zeitung, **58**[2]: 246–273. *pl.* 16 Au. 1900.

Scofield, C. S. Some preliminary Observations on *Dictyophora Ravenelii* Burt. Minn. Bot. Stud. **2**: 525–536. *pl. 29–31.* 15 Au. 1900.

Seemen, O. von. Zwei neue Salices aus der Sammlung: "Plants of Southern Colorado collected and distributed by C. F. Baker, F. S. Earle and S. M. Tracy." Engler's Bot. Jahrb. Beiblatt, **29**: 28, 29. 4 S. 1900.

Salix pseudolapponum and *S. aemulans.*

Setchell, W. A. Critical Notes on the New England Species of *Laminaria.* Rhodora, **2**: 115–119, 142–149. 21 Je., 10 Jl., 1900.

Sodiro, A. Plantae ecuadorenses.—II. Compositae (by G. Hieronymus). Engler's Bot. Jahrb. **29**: 1–85. 22 My. 1900.

New species in *Vernonia*, *Piptocarpha*, *Picqueria*, *Ophryosporus*, *Stevia*, *Eupatorium*, *Mikania*, *Aster*, *Euglion*, *Baccharis*, *Gnaphalium*, *Clibadium*, *Polymnia*, *Wulfia*, *Zaluzania*, *Aspilia*, *Helianthus*, *Vigniera*, *Spilanthes*, *Verbesina*, *Narvalina*, *Calea*, *Tridax*, *Jaumea*, *Artemisa*, *Liabum*, *Culcitium*, *Gynoxys*, *Senecio*, *Lycoseris*, *Barnadesia*, *Mutisia*, *Jungia* and *Crepis*.

Solms-Laubach, H. Graf zu. Cruciferenstudien. Bot. Zeitung, **58**[1]: 167–190. *pl. 7.* 1 O. 1900.

Spegazzini, C. Fungi Argenti novi v. critici. Anales del Mus. Nac. Buenos Aires, **6**: 81–365. *pl. 4, 5.* 1899.

New species in *Lepiota*, (19), *Armillaria* (4), *Tricholoma* (3), *Clitocybe*, *Mycena* (6), *Omphalia* (2), *Pleurotus*, *Marasmius* (7), *Lentinus*, *Lenzites*, *Volvaria*, *Annularia*, *Pluteus*, *Volvariella* gen. nov., *Entoloma*, *Eccilia*, *Claudopus*, *Pluteolus*, *Pholiota* (3), *Inocybe* (5), *Hebeloma* (2), *Flammula* (3), *Naucoria* (6), *Galera* (3), *Tubaria* (3), *Paxillus*, *Bolbitius* (2), *Agaricus* (7), *Stropharia* (2), *Hypholoma*,

Psilocybe, Deconica, Psathyrella (3), *Coprinus* (8), *Montagnites, Polyporus* (3), *Fomes, Polystictus* (4), *Poria* (5), *Trametes* (4), *Daedalea* (2), *Favolus* (2), *Hydnum, Irpex, Cladoderris, Stereum, Corticium, Hypochnus, Cyphella* (2), *Albofiella* gen. nov., *Cyathus, Gyrophragmium, Podaxon, Chlamydopus* gen. nov. (2), *Batarrea* (2), *Geaster* (4), *Lycoperdon* (2), and many others.

Stephani, F. Beiträge zur Lebermoos-Flora Westpatagoniens und des Südlichen Chile. Bihang till k. Svenska. Vet. Akad. Handl. **26**^{6}: 1–69. 1900.

New species in *Metzgeria, Pallavicinius, Jamesoniella, Jungermannia, Lophozia, Tylimanthus, Plagiochila* (9), *Clasmatocolea, Lophocolea* (16), *Chiloscyphus* (2), *Saccogyna, Alobiella, Cephaloziella* (2), *Lepidozia* (3), *Isotachis, Mastigophora, Trichocolea, Schistochila* (2), *Radula* (2), *Cololejeunea* (2), *Colejeunea* (2), *Frullania* and *Anthoceros.*

Strasburger, E. Einige Bemerkungen zur Frage nach der "doppelten Befruchtung" bei den Angiospermen. Bot. Zeitung, **58**^{2}: 293–316. 1 O. 1900.

Sutor, J. H. Railroad Forestry. Railway Age, **30**: 73, 74. 27 Jl. 1900.

A discussion of tree-planting for American railroads.

Ternetz, C. Protoplasmabewegung und Fruchtkörperbildung bei *Ascophanus carneus* Pers. Jahrb. wiss. Bot. **35**: 273–312. *pl. 12.* 1900.

Trelease, W. The Preservation and Protection of native Vegetation. Plant World, **3**: 108. Jl. 1900.

Urban, I. Leguminosae novae vel minus cognitae.—I. Symbolae Antillanae, **2**: 257. 20 O. 1900.

New species in *Pithecolobium, Calliandra, Leucaena, Schrankia, Caesalpinia, Peltophorum, Hebestigma* (gen. nov.), *Poitaea, Desmodium, Rhodopliis* (gen. nov.) and *Galactia.*

Urban, I. Mantissa ad Cyperaceas Clarkeanas. Symbolae Antillanae, **2**: 163–169. 20 O. 1900.

Urban, I. Über einige südamerikanische Umbellifer-Gattungen. Engler's Bot. Jahrb. Beiblatt, **29**: 1, 2. 4 S. 1900.

Urban, I. Über mexicanische Turneraceen. Engler's Bot. Jahrb. Beiblatt, **29**: 3, 4. 4 S. 1900.

Van Wisselingh, C. Ueber Kerntheilung bei *Spirogyra.* Flora, **87**: 355–377. *pl. 15.* 5 O. 1900.

Wainio, E. A. Reactiones Lichenum a J. Müllero Argoviensi descriptorum. Mém. Herb. Boissier, **5**: 1–17. 31 Ja. 1900.

Ward, L. F. Elaboration of the Fossil Cycads in the Yale Museum. Am. Jour. Sci. IV. **10**: 327–345. *pl. 1–4.* N. 1900.

Seven new species of *Cycadeoidea* from the Black Hills and Wyoming described and figured.

Webber, H. J. Xenia, or the immediate Effect of Pollen, in Maize. Bull. U. S. Dept. Agric. (Div. Veg. Phys. and Path.) 22: 1–44. *pl. 1–4.* 12 S. 1900.

Webster, H. *Naucoria Christinae.* Rhodora, **2**: 127–130. 21 Je. 1900.

Wetzstein, A. Range Extension of *Iris hexagona.* Plant World, **3**: 92. Je. 1900.

Wetzstein, A. The velvet Dogbane in Ohio. Plant World, **3**: 40, 41. Mr. 1900.

Wheeler, W. A. A Contribution to the Knowledge of the Flora of Southeastern Minnesota. Minn. Bot. Stud. **2**: 353–416. *pl. 21–27.* 15 Au. 1900.

The plates contain 14 photogravures of Minnesota vegetation.

Wiegand, K. M. *Juncus tenuis* Willd. and some of its North American Allies. Bull. Torr. Club, **27**: 511–527. 26 O. 1900.

J. interior, *J. Arizonicus*, *J. Arizonicus curtiflorus*, *J. brachyphyllus*, *J. tenuis anthelatus*, and *J. Dudleyi*, new species and varieties. *J. occidentalis* nom. nov.

Williams, R. S. Another Note on *Buxbaumia.* Bull. Torr. Club, **27**: 539. 26 O. 1900.

Winkler, H. Ueber Polarität, Regeneration, und Heteromorphose bei *Bropsis.* Jahrb. wiss. Bot. **35**: 449–469. *f. 1–3.* 1900.

SUBJECT INDEX

GENERIC INDEX

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY

1. MEMOIRS OF THE DEPARTMENT:

Vol. 1. A Monograph of the North American Species of the Genus *Polygonum* (1895). By John Kunkel Small, Fellow in Botany, 1893–1895; Curator of the Herbarium, 1895–1898.

Quarto, 178 pages, 84 plates. Price $6.00.

Vol. 2. A Monograph of the North American Potentilleae (1898). By Per Axel Rydberg, Fellow in Botany, 1896–7.

Quarto, 224 pages, 112 plates. Price $6.00.

2. CONTRIBUTIONS FROM THE DEPARTMENT:

Vol. 1. Nos. 1–25. 1886–1892. Price $5.00.
Vol. 2. Nos. 26–50. 1892–1894. Price $5.00.
Vol. 3. Nos. 51–75. 1894–1895. Price $5.00.
Vol. 4. Nos. 76–100. 1895–1896. Price $5.00.
Vol. 5. Nos. 101–125. 1896–1897. Price $5.00.
Vol. 6. Nos. 126–150. 1897–1898. Price $5.00.
Vol. 7. Nos. 151–(current).

3. A Text-book of General Lichenology (1896). By Albert Schneider, Fellow in Botany, 1895–1896.

Octavo, 230 pages, 76 plates. Price $4.25 (cloth); $3.80 (paper). Published by Willard N. Clute & Co. Binghamton, N. Y.

The Department invites propositions relative to exchanges of herbarium material or botanical books for any of the above named publications. Address Professor L. M. Underwood, Columbia University, N. Y. City. A list of the titles of Contributions with prices of such as can be separately supplied, may be had on application. Many of the earlier numbers are out of print, but a few complete sets can be supplied.

4. An Illustrated Flora of the Northern United States, Canada, and the British Possessions from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102d Meridian (1896–1898). By Nathaniel Lord Britton, Professor of Botany, 1891–1896; Emeritus Professor 1896,—andHon. Addison Brown.

Three volumes, royal octavo. Vol. 1, 612 pages; Vol. 2 642 pages; Vol. 3, 588 pages; 4162 figures in the text, illustrating, every species described.

Published by Charles Scribner's Sons, New York. Price, in cloth, $9.00 for the three volumes; with the indexes and keys bound separately, $10.00.

5. Our Native Ferns and their Allies. (Fifth Edition) 1896. By Lucien Marcus Underwood, Professor of Botany, 1896–.

Duodecimo, 156 pages, 35 figures. Published by Henry Holt & Co. New York. Price $1.00.

6. A Text-book of General Botany (1897). By Carlton Clarence Curtis, Assistant in Botany, 1892–1895; Tutor in Botany, 1895–.

Octavo, 360 pages; 87 illustrations. Published by Longmans, Green & Co. New York. Price $3.00.

PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Subscriptions and remittances should be sent to 41 North Queen street, Lancaster, Pa., or Bronx Park, New York City.

Bulletin of the New York Botanical Garden, containing the reports of the Director-in-Chief and other official documents, and technical articles embodying the results of investigations carried out in the Garden. Nos. 1–5, 449 pp, 3 maps, and 12 plates, 1896–1900. Free to all members of the Garden. To others, 25 cents a copy.

Memoirs of the New York Botanical Garden, Vol. 1. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book and including descriptions of 163 new species. ix + 492 pp. Roy. 8vo, with detailed map. Price to members of the Garden, $1.00. To others, $2.00. [Not offered in exchange.]

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each.

No. 1. Symbiosis and Saprophytism, by Dr. D. T. MacDougal.

No. 2. New Species from western United States, by Dr. Per Axel Rydberg.

No. 3. The dichotomous *Panicums*: some new Species, by Geo. V. Nash.

No. 4. *Delphinium Carolinianum* and related Species by Dr. Per Axel Rydberg.

No. 5. Studies on the Rocky Mountain Flora I, by Dr. Per Axel Rydberg.

No. 6. Notes and Descriptions of North American Plants I and II, by Dr. J. K. Small.

No. 7. Vegetative Reproduction and Multiplication in *Erythronium*, by Frederick H. Blodgett.

No. 8. Two New Species of *Grimmia* from Montana, by R. S. Williams.

No 9. Studies on the Rocky Mountain Flora II, by Dr. Per Axel Rydberg.

All subscriptions and remittances should be sent to

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY