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THE FERN BULLETIN.

VOL V.

JANUARY, 1897.

No. I.

ASPLENIUM EBENOIDES IN VIRGINIA.

BY PROF. W. ALPHONSO MURRILL.

IT was on the hottest day of last July that I found my first plant of *Asplenium ebenoides*. Before leaving Blacksburg I discovered six other plants, in five different localities, but none proved quite so interesting as that first one, which added Virginia to the small list of states that grow the rarest one of all our ferns.

By careful search, however, among our limestone formations, I see no reason why the number of stations for *ebenoides* should not be increased, for it thrives in the light, rich soil at the base of limestone rocks, and nearly as well, so far as my experience goes, in exposed but shaded situations on the side of limestone cliffs. Indeed, judging from the localities where *A. pinnatifidum*, its nearest congener, is found, I should not be much surprised to find it on cliffs of sandstone. One of my plants grew on the eaves of a large mass of chert covered with *Polypodium vulgare*; though this chert was formerly embedded in Lower Silurian limestone. I have also found it here in Virginia with *Pellaea atropurpurea*, *Asplenium platyneuron*, *Camptosorus*, *Asplenium parvulum*, *A. rutamuraria*, *A. trichomanes*, *Woodsia obtusa*, and *Adiantum pedatum*.

When first seen, *ebenoides* suggests a small, prim plant of *Camptosorus* which has found its situation uncomfortably sunny and holds up its half-grown tips at a safe distance from the dry earth. On closer examination, the body of the frond is seen to be pinnatifid, and the sori of true *Asplenium* type: so our find must be either *A. ebenoides* or *A. pinnatifidum*. Although these two ferns resemble each other closely in size, color, texture and general outline, I think it is possible with several specimens before me, to point out some well-defined differences.

ASPLENIUM
VITIFOLIUM
—2—



ASPLENIUM EBENOIDES. (One-half natural size.)

The stipe of ebenoides is rich purple and polished, as is also the rachis on its under side, sometimes even beyond the middle of the frond; while the stipe of pinnatifidum is dull purplish only at its base. A few of the lower pinnæ of ebenoides are separate, while in pinnatifidum there is a distinct green wing connecting them all. Pinnatifidum retains its pinnatifid character to the very tip, while the fronds of ebenoides often show extreme jaggedness and irregularity at the base, and become wavy-margined or entire at the apex. The pinnæ of both ferns vary from broadly ovate and obtuse to sharply lanceolate in outline. I have several prolific fronds of ebenoides, but none of pinnatifidum. On the other hand pinnatifidum bears much more fruit, its pinnæ being often entirely covered beneath. Other structural peculiarities of ebenoides, that do not appear to the unaided eye, are mentioned in the discussion of the interesting theory of hybridity, to which we now turn.

Thirty years ago it was suggested that *A. ebenoides* might be a hybrid between *Asplenium platyneuron* and *Camptosorus rhizophyllus*. In Eaton's "Ferns of North America," we read that it

has always been found with these ferns, and that the hybrid theory of Berkely "certainly appears probable." The "Synopsis Filicum" (1868) classes it under *A. platyneuron*, as the fern which it most closely resembles; while the basal sori of nearly every segment, and the proliferous apex seem to connect it with *Camptosorus*. Another interesting link connecting it with the waiking-leaf is the areolate structure of its veins. Eaton's book says: "The veins are everywhere free," and none of the manuals deny the statement; but nearly all the specimens I have examined show a very few areoles between the middle and the apex of the frond. However, a month's experience with the fern in its native haunts has shaken my firm belief in the hybrid theory. To my mind, *ebenoides* has uniformly appeared as a distinct spleenwort, and he who would impeach its title to specific rank must bear the burden of proof. The vascular bundles of *ebenoides* are like those of *pinna-tifidum*, *platyneuron*, and other closely related spleenworts, and though proliferous, as *pinna-tifidum* and *platyneuron* sometimes are, no fronds have been found actually rooting at the tip. With hybrids, there is usually a complete gradation from one parent to the other, but none of the variations of *ebenoides* appear to approach the supposed parents. At Havana Glen, Ala., *ebenoides* is said to grow in profusion, while its supposed parents are present only in small numbers. Young plants, too, are there in abundance, most probably descended from spores; for I find that, though the sporangia of Virginia forms are mostly filled with black, dusty masses, the specimens from Alabama yield several spores that look as if they might grow. But here I need more time for an investigation. Much remains to be learned, and any helpful suggestions will be very gratefully received. I am already deeply in debt to Messrs. W. N. Clute, C. E. Waters and Alvah A. Eaton, and Dr. L. M. Underwood for valuable aid in the preparation of this article.

LYCOPodium ALOPECUROIDES IN MASSACHUSETTS.

ON the 4th of September, 1896, while botanizing on Plum Island, I came across a cranberry bog, of which there are several on the south half, in which I found an abundance of *Lycopodium inundatum*, and what appeared at the time as a very odd form of it, very unripe. Calculating it would be about right on Oct. 5th, I made another trip to the locality, and found

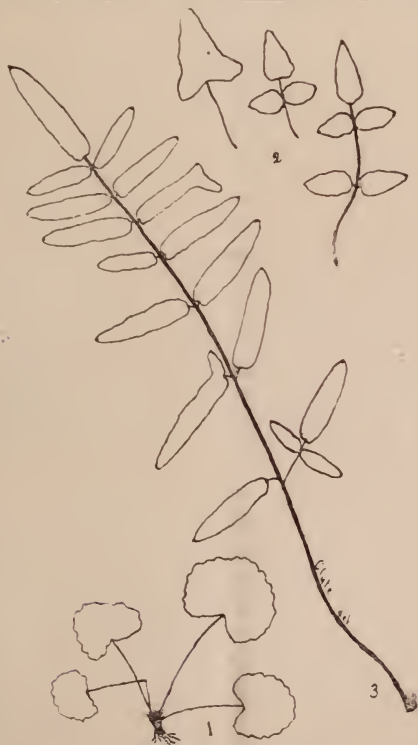
that a part was about right to get, and the rest unripe. Meanwhile the inundatum had ripened, about two weeks or so later than in other localities. It was the best I ever saw, spikes of two inches in length being not uncommon. The then unknown species was taller, with slender spikes, appressed scales, mostly green in color, with longer and stouter sterile branches. I found on getting home that it was identical with some *alopeuroides* I had from Atsion, N. J. As the botanics do not seem properly to distinguish this, I will give the result of my investigation, and of the locality, that others may be on the "look" for it.

Plum Island is a long sand-dune, or series of dunes; "a whale aground," Whittier calls it, about six miles in length, facing the ocean between the Merrimac and Ipswich rivers. Among these dunes, especially at the south end, are depressions in which cranberries grow, and often various trees, as poplar, juniper, maple, alder, etc. The dunes often migrate into these depressions, covering the trees till nothing but the tips of the branches protrude. In such a depression among cranberries, I found the *Lycopodium*. The most striking thing about it is the great number of spikes, from three to seven, while *inundatum* has rarely but one. Another thing is that the sterile stems do not die in the winter, as *inundatum*, but persist till the next summer, and the terminal part becomes bulbous thickened and often proliferous after the year's growth has ceased to sap it, especially in vigorous shoots. The leaves are longer, less spreading, and more ciliate than is *inundatum*. The fertile stems are (here) 6 to 8 inches high, the scales less spreading than in *inundatum*, and fruit ripening later. The most peculiar thing is, that the vigorous shoots have two spikes or more that are about equal in size, and one to five more or less abortive ones gradually decreasing in height and fertility till the middle of the stem is reached. Those farthest removed from the base are nothing but sterile stems or spikeless peduncles, often showing a tendency to revert in depauperate forms, by being variously divided at top and often the divisions bent down as if trying to find the earth to root in. This is a migratory species. The vigorous shoots are always on the outside of the patches, traveling away from the center. The inner ones are always depauperate, as if the first growth had exhausted the soil. The patches are usually small and the plants of the center often have sterile stems but 1-3 inches long not rooted at end, sending up 1-3 peduncles, but having little or no fruit, in fact, are about to die

at once. The general aspect of this is that it is unhappy in this northern locality. This species should be sought in the cranberry bogs of Cape Cod.—A. A. Eaton, Seabrook, N. H.

YOUNG FERN FRONDS.

NOT all the interest in fern study is confined to the mature plants; the first tiny fronds that spring from the prothallus are worth our attention. Very little has been done in this field, although few offer better opportunities for original work. Our knowledge of the shape and appearance of most young ferns



PELLEA ATROPURPUREA.

Fig. 1.—Young plant, natural size. Fig. 2.—Small fronds from older plants natural size. Fig. 3.—Mature frond, reduced one-half.

is so limited at present that few of us are prepared to name a species with certainty until it has fruited. So greatly do the early fronds of some species differ from the mature ones, that one may easily confuse them with other species. This is especially true of *Dryopteris spinulosa* and its varieties. The young fern must be nearly a year old before we can be sure that it is not some other member of the family. Another fern with even a more striking metamorphosis is *Pellaea atropurpurea* illustrated herewith. The young plants (Fig. 1) have very thin fronds, roundish-heart-shaped in outline and do not in the least resemble the thick heavy fronds found on mature plants; (Fig. 3.) These juvenile, round-leaved fronds do not fruit, though close beside them may be found plants no larger with pinnate fronds bearing sporangia (Fig. 2.) which shows that age and not size is responsible for the change in outline. With a little care one may select a series of fronds showing just how the change is made. Starting with the cordate fronds, we find the next inclined to become triangular or auricled at base, and in subsequent fronds these auricles become distinct pinnæ. Later fronds show two pairs of pinnæ, both apparently derived from the terminal one, and it may well be questioned whether the dozen or more pairs of pinnæ sported by larger fronds were not also derived in their turn from the single terminal pinna. It is probable that investigation of the infant fronds of other species will yield as interesting results. To the courtesy of Mr. C. E. Waters, of Baltimore, Md., we are indebted for several valuable notes on this subject, and also for the specimens from which the drawings for our illustrations were made.—*Willard N. Clute.*

LYCOPodium SELAGO L

THIS little plant grows within our range on high mountain tops, and was collected by the writer on the sub-alpine summit of Roan Mt., N. C., this summer, at an altitude of about 6,400 feet, 200 feet higher than Mt. Washington. It grows there in abundance, usually rooted under the edge of small rocks or stones, and sending out stems which curve up and fork into flat-topped clusters, the whole effect reminding one a little of tiny candelabra. At first sight the plant might be mistaken for a dwarfed form of *L. lucidulum*, the general structure and appearance of the two being very similar, and the spores in both species being borne in bright yellow sporangia in the axils of the upper

leaves, not in spikes. The specimens of *L. selago*, however, which came under my notice, lacked the brilliant, shiny green of their larger cousin, and were from about $1\frac{1}{2}$ to 4 inches in height. This species is a lover of the cold, and according to Hooker's "*Flora Boreali-Americana*," is found northward to the extreme Arctic shores and islands. In the valuable herbarium of the Academy of Natural Sciences at Philadelphia, specimens are preserved which were collected by Dr. Kane's polar expedition, and also some brought from Greenland by the Heilprin expedition of 1891. The presence of the plant so far south as North Carolina is therefore very interesting, but it has congenial company on its cool mountain top in *Arenaria Groenlandica*, *Alnus viride*, *Potentilla tridentata*, *Solidago virgaurea* (var.), etc.—characteristic northern species. *L. Selago*, in common with the other species of the genus, discharges its spores in the form of a copious yellow powder, which is very inflammable. Anyone desiring an inpromptu pyrotechnic display, may have it by shaking the mature plant over a lamp flame, the falling spore-dust changing like magic to a shower of brilliant stars.—*C. F. Saunders, Philadelphia.*

ABNORMAL FRUITING FORMS OF *OSMUNDA CINNAMOMEA*.

THE explanations offered in the July BULLETIN by Geo. F. Atkinson and A. A. Eaton to account for the cause of so-called varieties of *Onoclea*, *Osmunda* and other ferns, have recently been verified to me by accidental circumstances. On the 10th of September I visited the swamp where I found the specimens which were described in the BULLETIN of last January. The swamp is gradually being transformed into a celery garden and fire has been used to a considerable extent in clearing the surface. At my last visit I found a considerable area of thirty square rods or so that had been burned over within a very few weeks so that every green thing had been destroyed. Over this blackened space there was scarcely a fresh growth to be found except at the summits of the numerous rootstalks of *Osmunda cinnamomea*. Nearly all of these had put forth new fronds, the number from each stalk ranging from one to a dozen. In nearly every case the first frond to appear had been fertile in a greater or less degree, a few seeming as perfect as those produced in the usual season. Unquestionably the fire had induced the ferns to send up the fronds

that were most advanced in preparation for next season's work of fruiting and growth. It seems perfectly clear to me now that any apparent deviation in a frond from the sterile towards the fertile form is in reality a reversion from an intended fertile form, and that the degree of reversion is inversely proportioned to the development of the embryo frond at the time of the accident that affects its destiny. It is not clear to me why the reserve fronds should be put forth so late in the season. The leaves destroyed by the fire had nearly or quite completed their work and must have been in a dying condition when burned away. That there was need of more leaves to elaborate growth material does not appear probable, and it seems as if the fire must have had a stimulating effect not entirely in the nature of a necessity.

I collected and preserved the out-put of some sixty stocks, keeping each separate. If any member of the Chapter is wanting such material, I shall be pleased to send to such as may request it a selected series illustrating the steps of modification. One who is collecting merely to make up a beautiful herbarium will have no use for these, as most of the specimens are dwarfed and unsightly from various causes. Many of the more fertile ones were brown and withered when found.—*C. D. McLouth, Muskegon, Mich.*

THE SPORES OF DRYOPTERIS MARGINALIS.

THE spores of *Dryopteris marginalis* are really brown, although in many cases the sori and even the spores while still in the sporangia appear to be black. Attention was called to this on page 46 of the July BULLETIN and the matter was looked into. The sori were scraped off and placed under the microscope and pressed down gently, so as to squeeze out the spores as there were present both green and black sporangia. When a drop of strong alcohol was allowed to run in under the cover glass the spores were discharged, and it could be seen that those from the black-looking sporangia were brown. The others of course were green. It must not be imagined that the function of the jointed ring in "discharging the spores" is the rather passive one of straightening out, thus rupturing the sporangium and letting the spores drop out. That used to be my idea of the operation until one day I was startled by seeing the ring straighten out and instead of stopping, keep on its course until it had made almost a complete ring in the opposite direction. Then it suddenly straight-

ened and shot the spores out of the field. Anyone with even a "boys" microscope can see this by taking sporangia and letting a drop of alcohol or glycerine run in under the coverglass. My first surprise was with sporangia that had been kept moist some days in a tin box. As they dried in the air the above mentioned result was obtained. It can be easily seen that the spores will not be shed in rainy weather, when they would be beaten down to the ground without much chance to be spread with the wind. Several other species besides *Dropteris marifinalis* has black sporangia frequently. *Woodwardia areolata*, *Cystopteris fragilis*, *Onoclea sensibilis*, *O. Struthiopteris* and *Dicksonia punctilobula* may be mentioned.

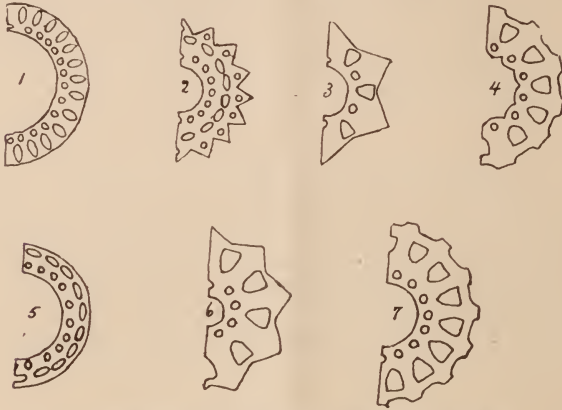
THE SPINY SHIELD FERN IN ALASKA.

ASPIDIUM spinulosum dilatatum (wood fern) is abundant in rich, open woods near sea level, and the rootstock or caudex is highly relished by the natives who cook and eat it in large quantities, it being the first vegetable food which they obtain in early spring. The method of preparation is as follows: The rootstocks are dug from the ground soon after the snow disappears, before the fronds are developed, and are trimmed and washed. A round, well-like hole, three feet in diameter and two and one-half feet deep is then dug, hot stones are placed in the bottom, or stones are placed there and a fire built upon them until they become hot. The fire is then removed, a layer of damp moss or kelp is laid on the stones and the cleaned rootstocks placed therein until the hole is full. A little water is then thrown on the pile which is then hastily covered with a layer of damp moss, or a couple of cedar bark mats are laid on and earth to the depth of about ten inches is put over it. On this a fire is built and kept up all night. The next day the contents are taken out and are then ready to be eaten, the outer rind being removed with the fingers or a small knife. It has a slightly sweetish taste but is too smoky and tobacco-like in flavor for the average white man's palate except under stress of hunger, though I have no doubt it is quite nutritious — *M. W. Gorman, in Pittonia.*

Mr. Stewart H. Burnham has a plant of *Scolopendrium* in cultivation which has had more than forty living fronds at one time.

IDENTIFYING EUISETUMS.

AN interesting method of identifying the horsetails is by the examination of their stems. Nearly all have very characteristic outlines. Below is an illustration of several of our common species, which we reprint from "Wayside and Woodland Blossoms," by permission of Messrs. F. Warne & Co., N. Y.



HALF-SECTIONS THROUGH HORSETAIL STEMS.

- | | |
|-------------------------------|---------------------------|
| 1.— <i>Equisetum maximum.</i> | 4.— <i>E. sylvaticum.</i> |
| 2.— <i>E. pratense.</i> | 5.— <i>E. fluviatile.</i> |
| 3.— <i>E. arvense.</i> | 6.— <i>E. palustre.</i> |
| | 7.— <i>E. hyemale.</i> |

LYCOPODIUM CAROLINIANUM.

ONE of the daintiest of our American Lycopodiums is *L. Carolinianum*. Its furthest habitat north seems to be New Jersey, in the pine barrens of which state it is abundant, loving to frequent sandy swamps. The sterile stems lie flat on the ground and clings so tenaciously to their sandy bed that it is difficult to collect the plant except in fragments. At first sight it might readily remind one of a rather coarse selaginella, but the slender, delicately poised fruit spikes will readily distinguish it from that tribe.—*C. F. Saunders.*

Mr. E. C. Kent of East Wallingford, Vt., has discovered a form of *Lycopodium clavatum* in his vicinity that produces sterile stems twenty inches high.

Two Odd Ophioglossums.

While collecting *Ophioglossum vulgatum* on July 12, I found two that present an interesting case of reversion. One of these has a spike with 19 sporangia on one side, on the other side the six terminal sporangia were normal. Below this there was no evidence of fruiting, the axis being expanded and leaf-like. The other plant had a spike 1 in. long, the lower half being normal, and the upper flat and leaf-like. This shows that the spike is a modified leaf, which, of course, was known before; but it is remarkable that in a plant of such simplicity the essential organs should be so completely aborted. *Botrychium* presents fertile sporangia, or even fertile spikes, on the sterile branch, but I have never found the spike reverting to a leaf.—*A. A. Eaton.*

OUR MISCELLANY.

Mr. Howard P. Wells of Philadelphia, has recently collected a plant of *Asplenium ebenoides* in Monroe county, Pa., some ten miles above the Delaware Water Gap. The plant was surrounded by luxuriant specimens of the walking fern and ebony spleenwort.

Polypodium polypodioides is quite common here. Its favorite places of growth are on rocks and tree trunks near the ground. It is most commonly found on rocks where there is but little earth, and often a mass of it may be stripped from the rock leaving it bare. In time of drought it will roll up and seem dead, but a little moisture will soon revive it. I have rarely found it on tree trunks, though Chapman gives that as its place of growing.—*H. A. Green, Chester, S. C.*

In the article "*Dryopteris simulata* in Maryland," it may have struck many of the readers of the BULLETIN as strange that the sterility of *D. thelypteris* growing near *D. simulata* was particularly mentioned. In Mr. Davenport's original article it was stated that the latter species is found "growing naturally and fruiting heavily under conditions where *D. thelypteris* is invariably weak-growing and sterile." My mention of the fact was to confirm this argument against the hybridity of *D. simulata*, first advanced by Mr. Davenport.—*C. E. Waters.*

Having lived not far from Atsion, N. J. for some years, I visited the *Schizæa* locality several times. At Quaker Bridge the plant was found; I think on the left side of the bridge going from

Atsion, but not abundantly. But on the right of wagon road, a mile or so nearer Atsion, and along the brink of the river, I found considerable quantities. My experience was that the fern was found more easily by the fruiting fronds, which were the full size—3 to 5 inches. The sterile fronds look so much like grass as not to be readily recognized.—*H. A. Green, Chester, S. C.*

Lycopodium alopecuroides and *Woodwardia areolata* are reported from a bog on Mt. Pocono, Monroe county, Pa., by Mr. Howard P. Wells, who remarks that this is rather far from the coast for these plants.

Mrs. C. B. Graves, New London, Conn., reports a plant of *Botrychium ternatum* which has an extra fertile stem rising from the stalk of the fertile segment. She also records the occurrence in her locality of *Dryopteris cristata* \bowtie *marginalis*.

Although the fronds of *Asplenium angustifolium* are simply pinnate, while those of *Asplenium acrostichoides* are bipinnatifid, there is a great resemblance between them. Both frequent the same places, and at a little distance it is hard to distinguish one from another.

Miss Imogene C. Stickler notes that last summer at Point Albino, Ont., she collected a frond of *Asplenium angustifolium* that measured forty-eight inches in length. Others collected at the same time ranged from thirty-nine to forty-six. This is much larger than this fern usually grows.

Mr. Howard P. Wells sends a drawing of a peculiar form of *Osmunda cinnamomea* which he has observed in the Cattskill mountains and in Monroe county, Pa. In this there is a smaller pinna at the base of each of the main pinnæ, and several of the pinnules on the large pinnæ are lobed on the side towards the rachis.

In the so-called variety, *campestre*, of *Equisetum arvense*, nature shows us how both fertile and sterile stems of the plant are derived from the same source, although they are so different when mature. The pale, brownish-yellow fertile spikes that appear in early spring seem most unlike the green, branched sterile stems that push up later, but the former sometimes show their relationship by producing a few green branches at the base, while the latter frequently develop small fruiting spikes at the summit.

Equisetum robustum and *Adiantum capillus veneris* have been found in Delaware County, Pa., by Mr. T. C. Palmer.

Mr. C. F. Saunders reports collecting *Asplenium ruta-muraria* in North Carolina last summer. The plants were very scarce. This seems to be this fern's southern limit. Does anyone else know of its occurrence so far south?

Mr. Geo. E. Davenport writes that the bases of the previous year's stipes remain on the rootstalk of *Dryopteris Novboracensis* and *thelypteris* as well as *simulata*, and that in consequence this character cannot be relied upon for distinguishing *simulata* from its near relatives.

The original locality for *Asplenium ebenoides* is on the Schuylkill river, above Manayunk. The Herbarium of Lafayette College has a specimen from this locality, collected in 1867. The other known stations for this plant are Havana, Ala.; Canaan, Conn.; Poughkeepsie, N. Y., Jackson Co., Ill., and Hanover, Ind.

The statement made in the July number that *Asplenium viride* has been collected in Connecticut is now found to be a mistake, *A. ruta-muraria* having been mistaken for it. In Mr. James N. Bishop's list of Connecticut plants, *A. viride* is reported from Waterbury, but is said to need verification. An authentic record of the occurrence of this fern in Connecticut is yet to be made.

Under date of Nov. 26, 1896, Prof. Murrell writes: "A trip to Weyer's Cave, Va. to-day discovers a beautiful plant of *Asplenium ebenoides* among the *A. parvulum* above the entrance. This encourages the hope I had entertained of finding this species almost anywhere in our valley, but very rare. The plant has been reported from several widely separated localities and probably exists at numerous stations in the intervening territory. Fern students should be on the watch for it."

One thing about *Dryopteris simulata* not noted is its proneness to the attacks of a worm that eats the spores as they mature. In some places where it is abundant it is almost impossible to get a perfect frond for this reason, especially in the latter part of September. The nuisance attacks other ferns also, but none so bad as this. It spins a fine thread that makes a kind of shelter for it. It is a bad thing to "go to press" as it often eats and completely destroys good specimens after you think you are rid of it. It is apparently the larva of one of the leaf-rollers, of the family Tortricidae.—A. A. Eaton.

Lycopodium selago is said by Dr. Thomas C. Porter to have been collected at the famous Delaware Water Gap in Pennsylvania.

In the *Bulletin of the Torrey Botanical Club* for April, 1896, Mr. John K. Small records two additional stations for *Asplenium Bradleyi*, namely: Kings and Crowder's mountains in North Carolina. It grows both on the cliffs at the summits and in crevices on large boulders on the slopes.

In *Garden and Forest* for October, 1896, Mr. George E. Davenport has an article on *Dryopteris cristata* \times *marginalis* in which he reaffirms the right of this plant to recognition. The article is accompanied by a full-page plate showing the principal differences between this and the ferns nearest like it.

Writing of the occurrence of *Asplenium ebenoides* in Havana Glen, Ala., Prof. Underwood says in the November *Botanical Gazette*: "Many have regarded it as a hybrid, but the display of the species at Havana clearly demonstrates that it is not a hybrid at all. Its nearest congener is *Asplenium pinnatifidum*, but the frond is much thinner and more irregular than that species. In habit, however, it is very close to that species, growing far under overhanging rocks; in this respect it is totally unlike both *A. platyneuron* and *Camptosorus rhizophyllus*, its supposed parents. It appears to be multiplying, as many young plants were seen in the rock crevices. This myth of hybridity may be put aside, for *Asplenium ebenoides* is as clearly defined a species as we possess in the genus *Asplenium*, and has no near relations outside its own genus."

The list of forking fronds continues to grow longer. Messrs. C. E. Waters and Will R. Maxon record forking fronds of *Asplenium platyneuron*; Mr. Maxon notes the forking of *Pellaea gracilis* and *Dryopteris noveboracensis*; Miss Imogene C. Strickler mentions a forking frond of *Onoclea Struthiopteris*; and Mrs. M. E. Russell sends a frond of *Dryopteris cristata* that forks. This brings the list of species up to thirty-seven. Doubtless the fern that forks most commonly is the *Scolopendrium*, a plant with long entire, plantain-like leaves, the very species in which one would not expect to find this trait. Last September the editor spent a day with Mr. Will R. Maxon in the haunts of the *Scolopendrium* and more than twenty-five forked fronds were collected without making any special effort to find them. One much divided specimen was forked six times.

Fern lovers who are searching for *Dryopteris simulata* should not base its identification upon the sterile fronds. *Asplenium acrostichoides* has sterile fronds almost exactly like those of *simulata*, and to make the difficulty still greater, both are veined alike.

The statement in our number for July, 1897, that *Dryopteris fragrans* has been found growing in great quantities on Spruce Knob, West Virginia is shown to be erroneous, *Dicksonia punctilobula* having been taken for it. The fern is locally known as Sweet Fern.

In response to several requests we herewith publish the list of American ferns with forking fronds, using the numbers of the "Fern List," 2, 13, 40, 51, 67, 68, 90, 92, 93, 99, 102, 104, 107, 108, 109, 110, 111, 112, 120, 128, 131, 133, 138, 140, 142, 145, 146, 147, 151, 152, 154, 155, 156, 163, 165, 172, 181, 183.

THE LINNÆAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

—The reports of the Chapter officers for 1896 will soon be printed in pamphlet form and sent to all members.

—During the first week of last July one of our active members made a collecting trip on foot, through one hundred and twenty-five miles of the Virginian Alleghanies.

—Members of the Chapter whose dues are paid to the end of 1897 will receive a copy of Dodge's "Ferns and Fern Allies of New England" free. Copies will be sent to others as soon as the remittance for dues is received.

—The October election gave us officers for 1897 as follows: President, C. E. Waters, John's Hopkins University, Baltimore, Md. Vice-president, Mrs. A. D. Dean, 329 Washington Ave., Scranton, Pa. Secretary, Alvah H. Eaton, Seabrook, N. H. Treasurer, James A. Graves, Susquehanna, Pa.

—The annual dues of the Chapter are payable in January of each year. The Treasurer will send notice to each member of the amount due, and it is hoped that none will pay beyond the end of the year, unless it is to pay up to the end of some other year. It will save much confusion in the Chapter if all memberships expire with the end of each year.

--The Fern Chapter is now represented in twenty-three states and claims to be the largest corresponding Chapter of the Agassiz Association, both as regards the number of members and the area over which it is spread. Maine, Florida, California and Washington contain members of the Chapter, with a liberal sprinkling of students at intermediate points.

--In spite of the fact that there has been a general depression in business, the Fern Chapter continues to grow. More new members have been admitted during the last quarter than for any like period in its history. The names of these new members, as well as the names of all others who have joined since our last list of members was issued, will be printed in the pamphlet containing the officers report for 1896.

The Chapter Ferns.

During the past season our members have had less fortunate ones in mind when collecting rare ferns and the result is the excellent list of rarities offered herewith. Mr. C. F. Saunders heads the list with specimens of *Lycopodium selago*, collected on Roan mountain, N. C.; *L. Carolinianum*, from Egg Harbor, Pine Barrens, N. J.; *Asplenium montanum*, collected on limestone along the Susquehanna at Lancaster, Pa., and *A. ruta-muraria*, collected along Bushkill creek, Northampton, Co., Pa.; Mr. H. A. Green, Chester, S. C., sends plants of *Cheilanthes lanosa* and *Polypodium Polypodioides* from South Carolina; from Mr. Alvah A. Eaton, Seabrook, N. H., comes a series of specimens of the genus *Equisetum*. This comprises *Equisetum litorale elatius*, *E. l. arvensiformis*, *E. l. gracile*, *E. l. humile*, *E. Arvense campestre forma macro* and *microstachya*, and *E. a. decumbens*, *Pteris serrulata*, a fern rather common in greenhouses is also offered. These have been made up into packets and offered to members only, as follows: the six specimens of *Equisetum*, 15 cents; the two *Aspleniums*, 5 cents; the two *Lycopodiums* and *Polypodium polypodioides*, 7 cents; *P. polypodioides* and *C. lanosa*, 5 cents. The packages will not be broken. Part of the *Cheilanthes* was wrongly labelled; it is all *lanosa*. To those who have sent ferns for distribution within a year, any of these will be sent free upon request. In the majority of cases the supply of ferns is exhausted within ten days after the BULLETIN is issued. Those who would be sure of specimens should write at once. Address everything upon this subject to Willard N. Clute, Binghamton, N. Y.

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To Our Friends:—

Contrary to the expressed wishes of many of our subscribers we have again enlarged the pages of this journal. This step was taken in answer to a demand for more space and also with the hope that a larger size may dispel the idea (current in some quarters) that small pages must contain matter of small importance written by novices. To all, we now say that so long as the journal remains under its present management, the size of the page will not be changed again. Further enlargement will come through an increased number of pages or more frequent issues.

With this volume the subscription price has been raised to fifty cents a year. This increase in price will not affect any of our present subscribers. Those whose names are on our books may renew as often as they please at the old rate of thirty-five cents, but after January 31st, all **new** subscriptions must be made at the new rate.

It has not been an easy task to make a journal devoted entirely to ferns, self-supporting. Our success has been due, in no small part to the assistance rendered us by fern students, in sending us subscriptions and in making the journal known to others. We take this occasion to acknowledge our appreciation of their support.

The future of the FERN BULLETIN is largely in the hands of fern lovers. With a wider circulation we shall be able to pub-

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We believe we now reach more people interested in ferns than any other botanical journal, but we shall be unable to render the best service possible, until the names of all who are interested in ferns are on our subscription list.

* * *

A COPY of this issue goes to every person who has asked for a sample copy since the FERN BULLETIN was started. A change in our mailing lists will prevent subsequent numbers going to these addresses from which a subscription has not been received in the meantime.

* * *

A LITTLE investigation has seemed to prove that nearly every fern occasionally bears forking fronds. A trait much less common and even more curious is found in ferns that root at the apices of the fronds or at the ends of pinnae. The walking fern easily leads in this respect and the few others that are known to have this peculiarity are all its near relatives. Besides *Camptosorus*, the list includes *Scolopendrium*, *Asplenium*, *pinnatifidum*, *A. Ebenoides* and *A. platyneuron*. Who can add others?

* * *

IN connection with the notes on *Asplenium Ebenoides* in this number, it may be remarked that this fern possesses one prominent characteristic of hybrids in its extreme variability. We have recently seen specimens of this fern collected by Prof. L. M. Underwood in Alabama, in which the length and cutting of the pinnae varied to a remarkable degree, even in the same fronds. It may also be of interest to note that the illustration for this number is an exact reproduction of a plant sent from Alabama by Prof. Underwood. The three smaller fronds are apparently sporelings analogous to the round leaved forms of *Pellaea* shown in this issue.

* * *

MR. ALVAH A. EATON of Seabrook, N. H. is preparing a series of studies in the genus *Equisetum* for this journal, and is desirous of obtaining specimens belonging to the group from all parts of the country. He offers in exchange many rare and desirable ferns. It is hoped that a large number will respond to Mr. Eaton's request for material, and thus aid in making a good monograph of the genus.

NOTES.

—An excellent article on the Hart's-tongue fern appears in the *University Forum* of Syracuse, N Y, in the issue of Nov. 3, 1896. It is from the pen of Mr. Will R. Maxon.

—The *Observer* of Portland, Conn., which has been for the past seven years one of the prominent natural history magazines, suspended recently. The general depression in business is given as the cause.

—In the *Botanical Gazette* for November, 1896, Prof. L. M. Underwood reinstates a species of *Botrychium* which has long been known as *B. ternatum* var. *lunarioides*, but which is there shown to be a very distinct species possessing characteristics which clearly separate it from its allies. The plant was first collected by Michaux in South Carolina, and was described by Lamarek in 1797 as *Osmunda biternata*. Subsequent authors have called it *Botrypus lunarioides* and *Botrychium lunarioides*. It is now given its rightful place by Mr. Underwood as *Botrychium biternatum*.

—We have left just ten sets of Vol. iv, minus the first number. While they last the price will be thirty five cents a set. Prior to Vol. iv the BULLETIN was issued expressly for the Fern Chapter. In addition to the Chapter business, it contains forty-three articles on ferns, besides hundreds of other notes. One of these issues was the "fern list." We have no complete sets of these early issues, but will send eight different numbers, including Nos. 2 and 4 of Vol. iv, for twenty cents. The supply is limited; order early. We have secured some copies of Vol. i, No. 1. Those whose files lack this number may have a copy for a two-cent stamp.

—The *Bulletin of the Torrey Botanical Club* for November, 1897, contains an account of a new *Gymnogramme* from Venezuela, with remarks on some other Venezuelan ferns, by J. D. Gilbert. The new species was collected last Spring by Dr. H. H. Rusby, and Mr. R. W. Squires, and was found climbing on tree trunks in the deep forests about Santa Catalina. Mr. Gilbert names it *G. heterophlebia*, and remarks that its nearest relative is probably *G. membranacea* of the Malay and Phillipine Islands. Although there is a rather close resemblance between them the species are distinct. A curious fact in this connection is that while the genus *Gymnogramme* occurs in both the Eastern and Western hemispheres, no single species is known to be common to both.

—We have been unable to fill several orders for back numbers of the BULLETIN through lack of No. 1, Vol. IV. We will pay any reasonable price for a few copies of this issue. If you have a copy to spare, kindly let us know the price at once.

—The announcement is made that a new scientific magazine to be known as the *Natural Science Journal*, will make its appearance this month from New Bedford, Mass. There are to be seven departments devoted to the Natural Sciences, each with its own editor. Mr. F. G. Hillman, of New Bedford, will act as managing editor.

—The newly issued "Ferns and Fern Allies of New England," by Raynal Dodge, is a book unique in many respects. In upwards of sixty pages the ferns and allied plants of New England are clearly described in scientific language making it easy for anyone with this book in hand to identify all the species with certainty. The species are numbered according to the "Fern List," and Mr. Davenport's new fern, *Dryopteris cristata* \times *marginalis*, is here given a place for the first time. Special attention has been given to that perplexing group, the Quillworts, with the result that two species new to science have been added. In the chapter entitled "Remarks on the Genus *Isoetes*," much valuable information on the collection and identification of these plants is given. The book ends with a chronological list of the species, in which they are catalogued by their time of fruiting, making it easy for the collector to ascertain what plants are fit to collect on any particular day. The book is 16-mo in size, just suitable to go in one's pocket, and may well accompany the fern lover on his excursions. It is published by Willard N. Clute & Co., Binghamton, N. Y.; cloth, 50c.; paper, 35c.

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VOL. V.

APRIL, 1897.

No. 2.

ASPLENIUM BRADLEYI.

BY C. E. WATERS.

THE entire coast-line of the Chesapeake Bay is very irregular, giving rise to numerous tidewater estuaries and inlets, which in this region are called "rivers" or "creeks," according to their size. The streams proper are occasionally called "creeks" also, but more often "runs" or "branches," or by the familiar designation of "falls." The Patapsco river, on which Baltimore is situated, has escaped these diminutives and is called a river. Along most of its course it has carved out for itself through granite and gneiss and schist a deep valley, which is considered a splendid example of "gorge erosion" by our local geologists. But the botanists know it also, and the four-mile walk down the river from Ilchester to Relay is a favorite one for an all-day trip. Ferns and flowering plants abound in summer, while at other times of the year hepatics, mosses and fungi are very plentiful.

Mr. J. H. Brummell, one of my fortunate friends who is continually coming across rarities, visited this region in the fall of 1893 and found on a couple of huge rocky walls close by the roadside a fine lot of the rare fern, *Asplenium Bradleyi*. On visiting the locality the next spring, my search was successful beyond my expectations, for growing with the *A. Bradleyi* was another fern that had eluded me for years—*A. montanum*. The two species were growing side by side, and the latter would hardly have been overlooked by Mr. Brummell had it not resembled very closely undeveloped *A. Bradleyi*. That this was not the case was shown conclusively by an examination of the stems. In *A. montanum* the stipe is brown only at the base, and the upper part of the stipe and the entire rachis are flattened, with two parallel grooves in front. In *A. Bradleyi* the entire stipe and the lower part of the rachis are brown, while in place of the two grooves we have

a single distinct one with a slight ridge running down its center. The similarity between the two species is at times so great that it requires close observation to distinguish them. In a small glass fernery in my room is a plant that until very recently, in fact until the preceding paragraph was written, I had taken for *A. montanum*, but which is undoubtedly *A. Bradleyi*. This particular plant, with one of its companion species, was transplanted to a rock about ten miles away from its original home, and after several months was again removed to my fernery. The other



ASPLENUM BRADLEYI.

FIG. 1.—Plant one-half natural size. FIG. 2.—Fructifying pinna.

plant died, but of course no conclusion as to the relative hardness of the two species can be drawn from this one instance. All the other ferns growing with this plant—*Cheilanthes lanosa*, *Pel-læa atropurpurea*, *P. hastata*, *Dryopteris acrostichoides*, etc., have bent over towards the window in order to get as much light as possible. but the *Asplenium* has adopted an entirely different plan. Its fronds are spread out so that their upper surfaces are perpendicular to the brightest rays of light. It is very interesting to see the largest frond growing back from the window at an angle of about forty-five degrees

Asplenium Bradleyi was first found in Tennessee, by Prof. F. H. Bradley, where it was growing with *A. ebenum*, *A. pinatifidum* and *A. montanum* on sandstone. It has since been discovered in Kentucky, Arkansas, New York, Pennsylvania and Maryland. At the Patapsco river it is found on gneiss. Some of the best plants were growing in the cracks of a huge rocky wall that was exposed to the sun from mid-day until sunset. Yet on August 6th of last year, after a long drought, they were perfectly fresh and green, and the spores were just ripening. Some heavily fruited fronds were moistened and kept in the vasculum until the next evening, when on exposing them to the air the sporangia dried and opened in such rapid succession that a slight crackling noise could be heard when the fronds were held up to the ear. Unlike very many plants that grow in such exposed situations this fern has no scales or hairs covering the fronds, such as we find in *Cheilanthes lanosa*; nor is there any great development of the so-called "palisade tissue" of the leaf. The cuticle is very well developed however, and it is no doubt owing to this that the plant is enabled to resist long periods of dry weather.

Prof. Eaton suggested in his "Ferns of North America" that if there were a hybrid between *A. ebenum* and *A. montanum* it would probably closely resemble *A. Bradleyi*. It would lead us too far to discuss this question of hybridity at present, especially as no one now considers *A. Bradleyi* as a hybrid. Some of the arguments in Prof. Merrill's article in the January BULLETIN on *A. ebenoides*, might be advanced here. It is, however, interesting to note that the stem of this fern is a sort of intermediate between its two closest allies. *A. ebenum* has a brown stipe and rachis, the latter grooved in front; the stipe is not grooved, or noticeably flattened. The stems of the other two species have already been spoken of.

WIND-BLOWN FERNERIES.

IMMEDIATELY back of my house rises an abrupt, but somewhat broken ledge, facing south, in the crevices of which I counted last season twenty three plants of *Asplenium trichomanes*, a fern that is exceedingly rare in this vicinity. When we came here to live in 1875 there was not a fern growing on this ledge, and the only two plants of *Trichomanes* that I ever found within a mile, or more, of our home disappeared suddenly—probably being taken by some eager collector who chanced to discover their hiding place in the deep woods—long before the specimens made their appearance on my own ledge.

At first only a tiny plant was discovered in one of the pockets of the ledge, and this plant developed and grew without companionship for three or four years, when gradually other plants made their appearance and continued to increase until the present number was reached. If this increase continues as it has during the past five years, this ledge promises to become a prolific abiding-place for this lovely fern, and I shall have the pleasure of knowing that it will be under my own control and guardianship.

Two plants of *Asplenium ebeneum* and *Woodsia obtusa* have also made their appearance here. The former grew sparingly along the natural extension of the ledge not far away, but of the latter, a half dozen plants three-fourths of a mile away, are all I have ever seen within two miles of my residence. Now these ferns have made their new home with me spontaneously, and have done so in no other way than through the agency of wind blown spores lodging in the crevices of the rocks.

Some years ago my attention was called to the presence of several species of ferns growing in the chinks of the wall on the north side of the State prison in Charlestown, by Mr. C. E. Perkins, of Somerville (a very promising young botanist who has since died). At that time the prison was not in use, and taking advantage of its accessibility I made an investigation, which resulted in finding not only such ferns as *Aspidium spinulosum*, *Asplenium filix-fœmina*, *Dicksonia* and *Cystopteris fragilis*, but some others, and quite a variety of flowering plants, mosses, lichens and liverworts, all of which had apparently originated from wind-blown pollen and spores lodging in the damp joints of the granite wall.

In June, 1878, Mr. E. S. Wheeler found in Berlin, Mass., *Botrychium simplex* growing in the sandy soil of an unfenced

cemetery on a flat upland situated in the direct line of the valley coming down from the mountainous region to the west, and when later I visited the locality with Mr. Wheeler, it seemed to me that the presence of the plant in so strange a place was to be accounted for through the agency of wind-blown spores from the higher regions above. Other instances might be cited, and no doubt similar instances will suggest themselves to others, to show that oftentimes new stations for rare or common plants originate in this way, but this will suffice for the present.—*Geo. E. Davenport, Medford, Mass.*

A NEW QUILLWORT FROM MEXICO.

IN March, 1895, I received from Mr. C. G. Pringle a lot of Isoetes, one specimen of which, labelled Mexicana, proves distinct not only from that, but from all other described species. As it was collected in the State of Mexico, Mex., the ancient seat of empire of the Aztecs, the only North American people who possessed an organized government and were at all advanced in civilization, I deem it not inappropriate to name it *I. Montezumæ*, the Isoetes of the Montezumas.

ISOETES MONTEZUMÆ n. sp. Terrestrial, polygamous, with the aspect of *I. Butleri*; *trunk*, very deeply bilobed, 10–15^{mm} broad and high, the dead cortical layer persistent; *leaves*, 15–20.8–14^{cm} high, very stiff, slender, erect, triangular, 1^{mm} wide and .8 deep in the middle, with four stout bast-bundles and many stomata; *dissepiments*, thick, 6–12 cells wide; *sheaths*, hard, light-colored, rough on the back, 3^{mm} across the base, lower part usually turning black and persisting as a small scale; *wings*, 1^{mm} wide, disappearing at surface of the ground; *velum*, very narrow in the female, absent but edges of cavity sharp in the male; *labium* usually produced and covering fovea; *sporangia*, 5^{mm} x 3^{mm} with a few scattered brown spots; *macrospores*, 350–460 μ , rather sparsely beset with low, blunt tubercles, naked for about 8 μ from the equator; the tubercles are often elevated into spinules, and are sometimes retuse; the equator is wide, thin and fragile, the commissures lower and thicker: *microspores*, ashy, very large and rotund, often as broad as long, averaging 40 x 35 μ , varying in length from 35 μ to 48.4 μ , densely tuberculate or spinulose.

Habitat: Damp soil; plains near Flor de Maria, State of Mexico. (C. G. Pringle, 1890. No. 3459)

Placed beside *I. Nuttalli*, *I. Butleri* and the European *I. Hystrix*, this could not be separated save by a more or less close examination. Its persistent leaf-bases, though small, and its horny, scale-like leaf rudiments, found between the annual cycles of growth, connect the American with the European terrestrial species. This group is quite marked, and has, indeed, been separated as a different genus.

I. Montezumæ differs from *I. Mexicana* Undw., with which it was at first confounded, by its fewer, shorter leaves, spotted sporangia, shorter ligula, persistent leaf-bases, larger and more prominently tubercled macrospores, and larger spinulose microspores—the largest yet observed in the genus. (I have seen *I. Mexicana* only from immature, doubtfully typical specimens from lower California. My comparison is made with Underwood's description in *Bot. Gaz.* XIII. 4.)

From *I. Butleri*, its nearest congener, *I. Montezumæ* differs in having a narrower wing, smaller more prominently marked macrospores, more densely spinulose microspores, more slender and attenuate leaves, persistent cortex and leaf-bases. Of nine specimens, three are wholly male; among the remaining six, I found one with two microsporangia mixed in with macrosporangia, and there were microspores in the old cortex, indicating an alternation of generations, as is sometimes the case with European terrestrial species.—*A. A. Eaton, Seabrook, N. H.*

ASPLENIUM MONTANUM.

THIS little evergreen fern is found in considerable abundance on the shaded limestone cliffs and outcroppings upon the steep, wooded hills which line the lower Susquehanna river, in York and Lancaster counties in Pennsylvania. It loves to grow in the crevices of rocks and along ledges, often rooted deep in the horizontal chinks, so that only the upper part of the frond shows, protuding like so many green tongue-tips from half open jaws. The color is a rather dingy green, which makes the plant somewhat difficult to detect against the gray back-ground of the rock. The fronds, which are often quite numerous from one bunch of roots, have a reclining habit, according to my observation, even when growing on the surface of the rock. Speci-

mens collected in October last, at the locality above mentioned, showed many forking fronds, and in some instances the rhizomatous character of the plant first noted, I believe, with respect to this fern, by Thomas Meehan, though generally the plant grows in tufts, and is so described in books.



ASPLENIUM MONTANUM.

FIG. 1.—Plant one-half natural size. FIG. 2.—Fruiting pinna.

A. montanum is a genuine American, and its habitat is limited, so far as reported, to the eastern half of the United States, (Arkansas included). It seems to have been first discovered by Michaux early in this century in the mountains of Carolina, where, according to Britton & Brown's *New Illustrated Flora*, it ascends to 4,500 feet above the sea. In the lower Susquehanna

region, the fern is not only found far up upon the precipitous hillsides, but also grows on the rocks down in the bottom lands amid debris brought down by the floods which are often so disastrous on this river in the spring. Specimens so labelled, recently collected by Joseph Crawford, are in the herbarium of the Philadelphia Academy of Natural Sciences. These plants, however, are quite small, some of them only an inch or so high, but apparently healthy and well fruited.—*C. F. Saunders, Philadelphia.*

THE VARIETIES OF BOTRYCHIUM TERNATUM.

IT is particularly desirable at this time to have special attention given to the various forms or varieties of the so called *Botrychium ternatum*, and that full notes be made of the habitat, time of fruiting and local variation of this species or group of species. It is by no means certain that any of the American forms of *Botrychium* are the same as the original *Osmunda ternata* of Thunberg, which was described from Japan. Out of the group of forms which Milde in his monograph (1869) included under *B. ternatum*, Prantl in his revision (1884) makes eight species, of which three are found in North America. One of these, recently figured in the *Botanical Gazette*, I believe to be entirely worthy of specific rank. Its period of maturing spores (early spring), added to its structural characters, render it a very distinct species. I wish to investigate thoroughly the remaining forms and determine, if possible, their proper rank, and would invite the readers of the FERN BULLETIN to send notes and specimens showing the range of variation in their various localities. If in any locality the species grows both in dry pastures or meadows and also in low shaded ground, I would like specimens from each station, carefully noting date when spores are first matured, relative abundance, and any other data of interest; particularly I would like specimens of the so-called variety *dissectum*, which Sprengel described as a distinct species. I find, for instance, that the plant, passing under that name, which grows in the low woods in the vicinity of New York, is entirely different from the forms with which I have always been familiar from Central New York and New England, which grow in dry, unploughed pastures or along neglected headlands, mostly in the open sunlight. In case two forms grow in the same vicinity, I would like specimens of each.

It is only with an abundance of material and field notes that any valid conclusions can be reached, and the readers of the FERN BULLETIN can render an excellent service in bringing this material together.—*L. M. Underwood, New York City*

GET IT IN YOUR EYE.

IT is a curious fact that things are more easily discovered a second time than the first. I suppose this is owing to an involuntary mental noting of the peculiarities of the locality. For instance, I found *Ophioglossum vulgatum* in a meadow with *Habenaria lacera* and a small panicum last July. It was scarcely as tall as the grass and the discovery was partially accidental. I afterwards found it in three other localities, two when not looking specially for it. I must have passed over this many times as it was within a stone's throw of my garden. The last locality attracted my attention from the road by the amount of *Sporobolus serotinus* growing there. It was in early September. I crossed a cranberry bog and found about an acre literally covered with *Ophioglossum*.

Lycopodium inundatum may be found among the same grass with *Viola lanceolata*. I have repeatedly found it by seeing the "call" plants and hunting for it. The variety *Bigelovii* grows best in cranberry bogs; in fact, the type locality at Chebacco Lake, Essex, Mass., is a cranberry bog with considerable sphagnum in it. This so-called variety is merely a luxuriant form of the type. In looking for *Isoetes*, a muddy bottom is a sign of *I. echinospora Braunii*; sand of *I. e. Boottii* and *I. Tuckermanni*. The peculiar reddish-purple color of the latter, with its leaves in an ascending spiral, distinguishes it immediately. *I. Engelmanni* grows in shallow brooks in clay. *Woodwardia Virginica* is likely to be found in deep peat near a swamp; I found my first last year, and now know seven localities, one beside a road within half a mile of home. *W. areolata* often grows near the latter, but I have never found it mixed. *Dryopteris simulata* grows in its utmost luxuriance—often three feet high—amongst areolata.

If you have hunted for a plant and despaired of finding it, go, if possible, to a locality where it grows and see it growing, and try again. I have found many rarities by noting the "call" plants while riding by on a bicycle.—*Alvah A. Eaton, Seabrook, N. H.*

BOTRYCHIUM BITERNATUM.

THROUGH the courtesy of the *Botanical Gazette*, we are able to present herewith an illustration of the fern which Dr. L. M. Underwood has recently given specific rank as *Botrychium biternatum*. The plant itself is not a new one, having been known since 1797, but until the present it has been confused with the varieties of *B ternatum*. The plant is described



BOTRYCHIUM BITERNATUM (Lam.) Underw.

in the *Botanical Gazette* for November, 1896, as follows: "Sporophyte with fleshy roots from which rises a short common stalk 1.5^{cm} or less high, bearing a nearly sessile, broadly triangular, ternately compound leaf 8 to 10^{cm} wide, 5^{cm} long; middle division slightly larger than the lateral ones and like them nearly bipinnate: ultimate divisions somewhat lunate, usually not exceeding 5 to 6^{mm} in width, the outer margin crenulate, the lateral margins decurrent into the short branches of the rachis: sporophyll on a rather stout slightly elongate stalk (8^{cm} or more long), bipinnate, with a rather broad rachis: spores pale alutaceous, 39 to 44 μ in diameter: bud for the succeeding year enclosed in the base of the common stalk, smooth, the segments erect or with the apices barely incurved. Spores maturing in early spring (February or March in the latitude of southern and central Alabama)." It is remarkable that this species which fruits early in the season should have been so long confounded with *B. ternatum* since the latter is found in the same localities and does not fruit before August. The writer further says: "The species is readily distinguished from *B. ternatum* by its nearly sessile and more compound sterile leaf, as well as by the form of its ultimate divisions which are distinctly rounded and short, lacking the characteristic long, more or less pointed form, common to that species."

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Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Some misunderstanding has arisen regarding the statement in the January BULLETIN that a copy of Dodge's "Ferns and Fern Allies of New England" would be sent to members of the Chapter. It was not intended to offer this as an inducement for others to join, but was simply for those loyal members who have stood by the Chapter when it needed assistance. We could not in any event give new associate members a subscription to this journal and the book for fifty cents. It has been decided, how-

ever, that all who join as active members, and date their membership from the beginning of the year, shall be sent a copy of the book free.—C

—The following new members have been gained by the Chapter since the January BULLETIN was issued; we welcome them all to our ranks: Active—C. H. Bissell, Southington, Conn.; J. M. Dickson, Hamilton, Ontario, Canada; Miss Mary A. Fleming, 13 West Chippewa st., Buffalo, N. Y.; Miss Edna L. Luttrell, Staunton, Va: F. O. Carpenter, 25 Montview st., West Roxbury, Mass; Miss Catherine M. Bates, Bedford, Westchester county, N. Y. Associate—Dr. Julia Russell, Main st., Malden, Mass.; Miss Charlotte N. S. Horner, Georgetown, Mass; William M. Canby, Wilmington, Del.; Miss Gertrude Bedell, Squaretop, Pa.; C. C. Kingman, Reading, Mass. We now have 48 active and 24 associate members, a total of 72 in all, and it is not too much to hope that the end of the year will find more than a hundred names on our roll.—C.

The Chapter Ferns.

More than seventy-five packets of ferns were made up last December and offered to the Chapter in January. In less than two weeks requests for the entire number had been received and others came too late to secure any. This is all the more remarkable because of the fact that a large number of our members have collections so extensive that they seldom ask for specimens, and shows how eager our younger members are to add new species to their collections. This quarter we are offered a fern that many older students do not possess—*Dryopteris simulata*. This is the gift of Mr. C. E. Waters, who finds it plentiful near Baltimore, Md. Mr. Waters was one of the first to find this fern outside of New England.

During the year 1897, some changes in the distribution of the Chapter ferns will be made. But one species of fern will be sent out in each packet, and the packets will be mailed by the one who offers the fern. Members who wish a specimen of the fern offered this quarter will receive it by sending six cents in stamps to C. E. Waters, Johns Hopkins University, Baltimore, Md. Those who have sent ferns for distribution within a year may have a specimen by requesting it on a postal card. Those who can help less fortunate members by offering a species of fern for distribution later in the season are requested to communicate with President Waters.—C.

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THE fault is not ours that the FERN BULLETIN begins each volume without having complete sets of the preceding volume on hand. At present a few odd numbers of various issues are all that we have to offer. We have endeavored to retain enough copies of each issue to supply the subsequent demand for them, and each time we have under-estimated it. There are now less than fifty copies of the January, 1897, issue on hand, and those who would have their file of Volume V complete should order at once. We cannot supply any complete volumes of the BULLETIN, but we will undertake to pick up any missing numbers our subscribers may desire, if we are notified at once. The charge for this will be five cents per copy. It is probable that the July issue will find this journal without a back number on hand.

* *

THE articles upon the genus *Equisetum* which Mr. Alvah A. Eaton is preparing for this journal, will be increased in value by a unique plan for illustrating the series. At the time when each is published, sets of the specimens treated will be made up and sent to subscribers to this journal, or members of the fern Chapter who desire them, for about the cost of postage. As Mr. Eaton contemplates studies of all the North American species, and their numerous varieties, the value of the specimens to students in connection with the notes upon them is not to be lightly estimated. Information of any kind relating to *Equisetum* will be welcomed, and may be addressed to Mr. Eaton, or to the editor of this journal.

A SECOND glance at the illustration of *Asplenium montanum* in this number will show a great difference in the shape of the fronds. The three fronds did not grow on one plant, but they do belong to one species. They are here figured side by side in order to give some idea of the variation of which this fern is capable.

* *

THE notes on *Botrychium biternatum* in this number afford a text from which a pertinent sermon might be preached to botanists upon the value of keeping one's eyes open and thinking about what he sees. As *Botrychium ternatum lunarioides*, this fern has long been known, but no one looked at it close enough to see that it was a distinct species. Even now its exact range is not known, and those who have specimens of this so-called variety would do well to examine them with a view of throwing light upon the subject. When we come to a closer study of our ferns we shall doubtless find that we have overlooked many interesting facts in the history of our common species

* *

A GREAT deal of confusion exists among botanists because of the ambiguous use of the term frond. To one the word may mean simply the expanded leafy portion of a fern, while to another it may also include the stalk or stipe. It is certainly desirable that some uniformity be attempted in the use of the term. Mr. Geo. E. Davenport has recently suggested in the *Botanical Gazette* that the word *frond* be used to designate the combined blade and stalk, the blade itself being called the *lamina*, and the stalk the *stipe*. This use of the term has been adopted in Dodge's "Ferns and Fern Allies of New England," and will be followed as much as possible in the pages of this journal. The tendency at present among botanists is to drop the word frond entirely, using in its stead the word, leaf. Fern lovers, however, will be loath to make this change. The idea conveyed by the word, frond, is so appropriate, and its use in literature has been so wide-spread, that it is unlikely that any except the most matter-of-fact botanists will long favor the change

Although the text books are silent regarding the anastomosing of the veins of *Asplenium ebenoides*, several observations of this character have been put on record. This is true of the specimens collected in the State of New York in most of which the areolate structure of the veins is well shown.

NOTES.

—In the *Botanical Gazette* for February, 1897, Mr. L. F. Henderson describes a new species of *Isoetes* from Idaho, which he dedicates to Dr. L. M. Underwood.

—The *Observer* of Portland, Conn., has returned to the field from which it retired last October. The numbers lacking for 1896 have been printed and the journal starts the new year with fair prospects of success.

—Under the title "Among the Ferns," Mr. C. F. Saunders has contributed to the March number of *Godey's Magazine* a charming sketch of several of our native ferns. Eight fine illustrations by Miss Elizabeth M. Hollowell add interest to the article.

—On Feb. 5th and 6th, 1897, a very successful meeting of botanists was held at Burlington, Vt., the occasion being the second annual meeting of the Vermont Botanical Club. About twenty botanical papers were read. The Club will also hold a "field meeting" in July. The organization contains sixty members and cordially invites all botanists in the State of Vermont to join. The secretary, Prof. L. R. Jones, Burlington, Vt., will be glad to answer any inquiries about membership, etc.

—A new Quillwort is described and figured in the *Botanical Gazette* for January, 1897, by Mr. Raynal Dodge. It has been named *Isoetes Eatoni*, in honor of the discoverer, Mr. Alvah A. Eaton. The plant in question is peculiar in being the largest species known to North America. The trunk is sometimes two and three-fourths inches in diameter, with leaves twenty inches or more in length. Some investigations into the chemical nature of the clear white covering of the macrospores of this species lead the writer to conclude that it is mainly silica.

—Considerable interest attaches to a paper by Prof. Edward C. Jeffrey on "The Gametophyte of *Botrychium Virginianum*," published in the Proceedings of the Canadian Institute for 1896, from the fact that our knowledge of this phase of the plant has until recently been very meagre. The prothallium of *Botrychium* is subterranean and the difficulty of finding it has hitherto prevented anything like a complete study. In 1895 Prof. Jeffrey discovered several hundred prothallia on the margin of a peat bog: with this material in hand a knowledge of all the lacking stages in the development of the young sporophyte has been supplied.

—*Garden and Forest* for November, 1896, contains an article on *Dryopteris simulata*, by Mr. George E. Davenport, with a full-page plate of the fern drawn by Mr. C. E. Faxon.

—The initial number of the *National Science Journal* has just been issued at New Bedford, Mass. This publication starts with a very creditable appearance and contains articles on entomology, botany, mineralogy, anthropology, conchology, etc. Each number is to contain twenty-four pages. An article on "Fern Spores" appears in the current number.

—"The Transformation of Sporophyllary to Vegetative Organs," by Prof. Geo. F. Atkinson, has been received from the author. This is reprinted from Biological Lectures delivered at Woods Holl in 1895, and details Prof. Atkinson's experiments with *Onoclea sensibilis* and *O. Struthiopteris* with reference to changing fertile fronds to vegetative organs by cutting off the sterile fronds. It is proved that the intermediate fronds occasionally found on these species may be produced at will by removing the sterile fronds early in the season. Eight plates, showing the more striking forms developed, are included.

—A most important contribution to the literature of American botany has recently appeared in the shape of the first volume of "An Illustrated Flora of the Northern United States and Canada," by Dr. N. L. Britton and Hon. Addison Brown. The authors of this work have attempted the great task of representing every species in the territory covered, by accurate drawings, and have also added concise and full descriptions for their identification. Other points that make the work of value are the excellent Keys to the Genera and Species, the Synonymy of each species and the common names that are given. The nomenclature is also brought up to date. The present volume contains 625 Royal octavo pages with 1425 illustrations. Among the families included are the ferns, conifers, sedges, rushes, grasses, orchids, lilies, willows, pond-weeds, etc. Two more volumes of like size will be issued sometime this year, completing the work. Some idea of the estimation in which this work is held by botanists may be gleaned from the fact that in less than six months nearly two thousand copies have been sold. We can supply the first volume, bound in cloth, for \$3.25, and will give a year's subscription to the FERN BULLETIN with every order. Those who are now subscribers may have their time extended one year with each order. Address the editor of this journal.

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THE FERN BULLETIN.

VOL. V.

JULY, 1897.

NO. 3.

JAMAICA, THE FERN-LOVER'S PARADISE.*

By B. D. GILBERT.

THE island of Jamaica has long been known among botanists as especially prolific in ferns. From the time of Sir Hans Sloane, who went to Jamaica as early as 1687, and whose library and natural history collections, including the plants of the island, formed the foundation of the British Museum, down to the present time, the known number of fern species in Jamaica has continually increased and is still increasing to-day. Olaf Swartz, the Swedish pteridologist, who first put the study of ferns on a scientific basis, visited Jamaica in 1783-6. and his well-known work, the "Species Filicum," published in 1806, was founded largely on the ferns gathered in that island and in the other islands of the West Indies.

Since the time of Swartz, at least a dozen botanists have made a specialty of collecting ferns in Jamaica. The most complete catalogue published down to 1864 was the one given by Griesbach in his "Flora of the British West Indies." His list credited three hundred species to the island. But since the publication of Griesbach's flora, such enthusiasts as Wilson, Nock, Sherring and Jenman have scoured the Blue mountains in search of fern novelties, and have not only discovered scores of species already known in Cuba or on the South American continent, but have added many new species not previously collected elsewhere. There is no doubt in my mind that no other area of land in the world, of the same extent, produces one-half the number of fern species and varieties that grow in Jamaica. Well may we call it the fern-lover's paradise.

*From a paper read before the Torrey Botanical Club, Mar. 9, 1897.

There are good reasons for this exceeding richness of the fern flora in Jamaica. The island lies between $17^{\circ} 48'$ and $18^{\circ} 32'$ north latitude, the northern limit being more than five degrees south of the Tropic of Cancer, and the southern shore more than six degrees south of the same Tropic. The Blue mountain range in the eastern extremity of the island rises from 6,000 to 7,000 ft. above sea level, and Blue Mt. peak towers to the height of 7,360 ft., or nearly a mile and a half perpendicular in the air. The southern shore of the island, besides lying fifty miles farther south than the northern, is sheltered by these lofty ranges of mountains from cooler breezes, and at some points is said to be as torrid in climate as Barbadoes or Trinidad. In fact, Kingston, the capital, has the reputation of being one of the hottest places in the West Indies. Thus the climate ranges from the extreme heat of the tropics on the southern shore, to the cool temperature of the northern temperate zone on the mountain tops; while the various gradations between these are found as one travels from the level of the coast to the higher altitudes of the mountains. In addition to this variation in temperature, there is a great variation in moisture. On the Liguanea plain, which extends six or seven miles inland from Kingston and is somewhere near fourteen miles long from east to west, rain does not fall more than two or three times during the six months of the dry season; but the mountains are famous for attracting the clouds, so that rain falls there all the year around and nearly every day, often in deluges of water. Moisture and heat therefore, which are prime requisites for the growth of ferns, are here in abundance; while on the mountain summits a much colder temperature prevails, and gives a wonderful variety to the climate. This is evidenced by the fact that *Cystopteris fragilis*, which is a cold temperate species, and has even been found as far north as Iceland, and *Dryopteris filix-mas*, which grows throughout northern Europe, in Greenland, and at an elevation of 15,000 ft. in the Himalayas, have recently been discovered on Blue Mt. peak, the only known habitat of these species in the West Indies.

The Blue mountains proper is the place to see the tree ferns growing in perfection. Jenman states that the trees of *Cyathea arborea* form unmixed groves, "while the stems constitute the only wood used or easily procurable in certain districts as posts in the houses of the peasantry." This species reaches the height of thirty feet; while *C. pubescens* often attains a height of forty feet. The tallest fern of the island, however, is *Alsophila armata*,

which frequently occurs thirty to fifty feet high, although the stem is very slender, being only two to four inches in diameter. Probably the stoutest trunk is that of *Hemitelia horrida*, which, although not more than eight to twelve feet high, is often six to ten inches in diameter. *Cyathea pubescens* also becomes very large in girth by sending out aerial rootlets, which form a matted growth over the original stem of the tree. I have seen trees thus covered which it would not be easy to reach around with one's arms, and the whole circumference is sometimes draped with the shining green of masses of filmy ferns, especially *Trichomanes trichoides*, and *Hymenophyllum asplenoides*.

Now let me give you some idea of what may be seen in a stroll along a country road in Jamaica. These roads are as hard and smooth and fine as you will find anywhere in England. Always they are bordered with stone walls on either side, while between the road and the wall there intervenes a strip of green from two to six feet in width. These walls are the nestling places of the common ferns of the particular region where they are situated. The grassy border of the road frequently has its quota of ferns also, but these are generally of larger size. In the eastern part of the island the commonest roadside fern is *Blechnum occidentale*. In the central and western parts its place is taken by *Polypodium reptans*, which has half a dozen different forms and tempts one to gather it notwithstanding one knows perfectly well what it will prove to be. Here it is a creeping plant with round-lobed or hastate pinnae; there it grows upright, as a self-respecting fern should; here it is long and narrow, there it is quite broad and resembles a true *Nephrodium*. Indeed, pteridologists are at variance as to whether it is a *Polypodium* or a *Nephrodium*. After you have risen 1,000 or 1,500 feet above the sea, *Anemia adiantifolia* becomes a common roadside fern: and occasionally you will come upon a bank of *Gleichenia pectinata*. I saw one such bank or rock, which must have been thirty feet long by twenty feet high, completely covered with this trailing fern, bright green on one side and glaucous on the other. On the north coast and under the lee of shelving rocks there is always *Pteris longifolia* and some of the *Adianta*. *A. cristatum* and *A. striatum* both grow in dry and dusty places. In the central parishes *Dicksonia rubiginosa* stands up in the borders four to five feet high, and the large form of *Nephrodium cicutarium* is conspicuous. Or perhaps you come along to a boulder on the face of which clings the running rhizome of *Polypodium salicifolium*,

or *P. Swartzii*, or *P. vacciniæfolium*. Or possibly it may be a tree, up whose trunk and along whose branches one of these ferns is climbing, or which harbors in a cleft of its bark some pretty plants of *P. plumula*, or in the crotch of a branch a plant of *P. Phyllitidis*, with its long stiff leaves sticking up like a bunch of plumes. All these, you must remember, are the common things that meet your eyes every day without going out of the highway of travel; and they are varied with the sight of cocoanut groves and royal palms and coffee plantations and banana plantations, and everything that goes to make up a tropical landscape.

One of the most interesting features of the Jamaica fern flora is the large number of endemic species that are peculiar to that island alone. It would seem as if the work of differentiation had gone on there with greater activity and more vital power than in almost any other country in the world. There is not a genus of any importance in this Order which does not contain from one to a dozen species that are not found elsewhere. Nineteen genera of ferns in Jamaica possess endemic species; and one genus, *Enterosora*, with a single species, has been found only in one other locality, viz., on Mt. Roraima, British Guiana. This feature of Jamaica ferns renders the business of collecting there something more than a mere search for what has been gathered before by previous investigators. There is always the zest that comes from a possibility of procuring some species that is still new to science, as Wilson and Nock and Sherring and Jenman have done. The possibilities seem to be by no means exhausted; and I have no doubt that if what is known as "The Cockpit country"—comprising something like one hundred square miles—ever comes to be thoroughly explored and investigated, it will yield a substantial addition to the new species of the island.

BOTRYCHIUM TERNATUM SWZ., AND ITS VARIETIES.

THE notes on these plants in the April BULLETIN contain so much that is, by implication, misleading, that I am led to offer some comments in reply. One not well acquainted with the Botrychiums and their history, might very naturally infer from the statements made in the notes alluded to, that they had never received more than a superficial investigation, and that the whole genus was sadly in need of revision. With this view I can have no sympathy whatever, as it has no grounds to rest upon, exactly the contrary being true. I regret very much

indeed being placed in seeming antagonism to Dr. Underwood, who has done and is doing so much valuable work that I trust will live long after my own is forgotten, and for whom I entertain the strongest feelings of friendship, but fidelity to my own convictions compels me to dissent from his views and to place my own on record, as I believe that here, at least, he is wholly in the wrong.

The Botrychiums have always had for me a singular fascination, and I have neglected no opportunity to increase my knowledge of their characters during my more than twenty years' familiarity with them. Since 1873 innumerable specimens, in a great variety of forms, and from a wide range, have passed through my hands, so that I feel justified in claiming to have some knowledge of them and their relations to one another. I was the first in this country to publish an account of their spore* and bud† characters, and to call attention to Milde's masterly analysis.

Heretofore I have supposed that Lamarck's species (*Osmunda biternata*) had received a very careful consideration and its position properly determined, not from any superficial examination of which Milde was incapable, but from a thorough study of its structural characters and all available material, yet at last I learn through the medium of the notes alluded to, that "no one had looked at it close enough to see that it was a good species!" Pray then, why did Lamarck, and upon what grounds publish it? Why Michaux? No one questioned its specific rank until Milde's masterly analysis demonstrated its varietal character.

I have myself, in *Botanical Gazette* for April, submitted evidence enough to show that there are no structural characters of specific value, and that its early fruiting period is of varietal importance only. I have shown also that the bud is not smooth, as a rule, but pilose, and that the spores are exactly the same as in all of the other forms, including the European and Japan forms, and there is not a scintilla of new evidence to show that any character has been overlooked, or any not already known, and disposed of, brought forward. So that in my judgment, the resurrected claim for specific recognition cannot be maintained, nor is there any grounds for the assertions in the BULLETIN.

At the same time I hope the readers of the BULLETIN will respond generously to Dr. Underwood's request for notes and

*Notes on *B. Simplex*, Salem, 1877.

†Vernation in *Botrychia*, *Bull. Torr. Bot. Club*, Jan. 1878.

material, for I feel sure that the more material he has the stronger he will find the evidence against his present views to be. The species exhibits the most astonishing variations, and what is most remarkable is the duplication of these variations in the variety *dissectum*, specimens of which may be found showing the lunate segments of *lunarioides*, the oblique segments of *obliquum*, and the obtuse, or even rounded segments of the European forms of *ternatum* itself, with every possible degree of incision of the margins from the simplest dissection to the deepest lacinated divisions of the form *millefolium*.

Dr. Underwood has sent to me a portion of a frond from the New York form which he thinks is distinct from the New England forms of *dissectum*, but I find, as I expected, for I have long been familiar with it, that it is only a finely lacinated form of *dissectum*, which is frequently collected in New England and elsewhere. I have collected it many times, and received it from others, and there are specimens from Essex county, Mass., collected by John Robinson, in the Davenport Herbarium (Mass. Hort. Society) that match it exactly. *B. dissectum* Sprengel, was well disposed of by John Milde, who gave Sprengel's original description verbatim in the body of his own monograph. It connects *lunarioides* and *obliquum* with typical *ternatum* through innumerable intergrading variations, and the medium of its bud, spores and structural characters.

I have in *Botanical Gazette* (l. c.) alluded to one of Mrs. Barnes' North Woods (N. Y.) plants as resembling *lunarioides*, but I might have gone further. I have five specimens from Mrs. Barnes mounted on the same sheet with other specimens of *ternatum* that show a varying length of stalk to the sterile division, the longest being scarcely longer than in Chapman's Florida specimen of *lunarioides* in the Gray Herbarium, and with small, rounded segments, some of which are quite lunate in form. These plants if collected in Alabama would not be considered in any way distinct from *lunarioides*, but here, on account of their surroundings I have preferred to keep them with my series of *ternatum* forms, though I am not sure that I would not be justified in mounting them separately and labeling them *lunarioides*, as there is no difference whatever in their buds and spores. Milde mentioned seeing similar specimens from Lapland, and this shows the difficulty of attempting to separate the different varieties into distinct species.

Rev. Arthur W. Stanford, of Lowell, Mass., who has passed much time in Japan and collected largely of the ferns, tells me that he found *B. ternatum* frequent, but never noticed any difference between it and what he had collected about Amherst, Mass., when a student at the college there. The specimen which he has given to me represents the variety *obliquum*, with bud and spores as in our own forms. Milde records *rutaceum* and *Australe* as ordinary Japanese forms, and whether we take one or the other of these forms to represent Thunberg's type the result will be the same. The outline drawing of *B. ternatum* in the "Illustrated Flora" is a very good representation of *obliquum*.

Finally I do not believe that it is possible to maintain specific rank for any of the forms which Milde placed under *ternatum* without first disregarding altogether the intermediate forms, a course wholly against nature.—*George E. Davenport, Medford, Mass.*

A NEW CHEILANTHES OF THE SECTION ADIANTOPSIS.

IT was my fortune to be stationed at the Deer Park school-district, above Dunlap P. O., Fresno county, Calif., from Oct., 1890, to May, 1891. During this time, among other interesting things, I found a small fern which I at first, not having good authorities to consult, referred to *Pellæa densa*. Subsequently I placed it with *Cheilantes Californica*, but doubtfully, owing to its small size and different outline. I sent a root east, and on my return in 1893 it was a fine plant, completely filling a four-inch pot, very densely set with fronds, which numbered several hundred. Having access to Eaton's "Ferns of North America," I was constrained to believe it a very odd form of *C. Californica*, if indeed it belonged there at all. I sent a few fronds to Prof. Eaton, who examined them and replied that by soaking out and pressing out flat they were seen to be a small form of *C. Californica*. This satisfied me until last winter when I received fine specimens of *Californica* from several localities in San Diego county. A most casual examination suffices to show that, though closely related, they are specifically distinct. *Californica* is nearly ternate through the great development of the lower pair of pinnæ, which are over half the length of the frond, the entire breadth usually equalling the length, while in the Fresno county plant the breadth is rarely .8 the length. *Californica* is deeply quadripinnatifid in the lower half, tripinnatifid in the upper ;

the other *tripinnatifid* in the lower part, *bipinnatifid* in the upper. The lower side of the inferior pinnæ of the first is excessively developed, the outline being nearly that of a right isosceles triangle, the base nearly perpendicular to the main stipe, the basal, inferior secondary divisions being about one-third the length of the whole lamina. In the other, the two sides of the inferior pinnæ are nearly equally developed, it being ovate or lance-ovate in outline; the basal secondary segments are only one-fifth to one fourth the length of the whole frond. The fronds of *Californica* sometimes exceed a foot in height, while the other attains habitually less than one-third this size. *Californica* is confined to southern California and Mexico; never, so far as I am aware, having been found in the Sierra Nevada Mts.; while this is found at the exact axis of the State, due east thirty miles from Fresno City.



CHEILANTHES AMCENA.

Fig. 1—Frond natural size. Fig. 2—A pinnule slightly enlarged. Fig. 3—Pinnule of *C. Californica* enlarged.

CHEILANTHES AMCENA, n. sp., the Charming Lip-Fern. *Root-stocks*, densely tufted, chaffy; *stipes*, slender, chestnut brown, smooth, somewhat ridged or winged on sides, concave above, 3-7^{cm} long, crowded, erect; *fronds*, dark-green, 3-4.5^{cm}. long 2-3.5^{cm}. broad, *lance-ovate* in outline, the two lower pairs of pin-

nules *tripinnatifid*, the others *bipinnatifid*, the ultimate segments 1-4^{mm}. long, lanceolate, half as broad as long, with 3-6 clusters of sporangia, the tip abruptly acute, not recurved. It differs from *Californica* in its smaller size, darker color, denser habit, narrower, less divided fronds, the lower secondary divisions not unequally developed. The outline of *Californica* is nearly that of *Gymnogramme triangularis*, while *amœna* approximates *Pellæa dunsæ*, but is narrower, being almost exactly as *Notholæna dealbata* is represented in Eaton's "Ferns of North America." *Californica* is well represented in Eaton's work, as well as in Robinson's "Ferns in Their Homes and Ours." The light color might be thought to be unnatural, but I find that the shade is nearly correct. The ultimate segment represented by Eaton, however, is too broad and not sufficiently acuminate pointed. Probably the reason Prof. Eaton did not detect this as a new species was because the meagre specimens sent were plucked and sent in a letter, becoming disfigured thereby.

Amœna grows in disintegrated granite soil that is apparently impregnated with iron, preferably in the shade, but often in the sun, in crevices of rocks in the mountains just below Pine Ridge, in the belt of live oak chaparrel. at perhaps 3,000 feet elevation, on the west slope of the Sierra Nevada Mts.—A. A. Eaton, *Seabrook, N. H.*

ASPLENIUM FONTANUM.

PROBABLY the rarest fern in North America is *Asplenium fontanum*. It was first collected in this country in July, 1869, by Mr. J. M. McMinn, who found it growing on cliffs of limestone along Lycoming Creek in Lycoming county, Penna. Specimens were sent along with other plants to Dr. Thomas C. Porter, of Lafayette College, who, thinking the fern was collected in foreign lands, paid little attention to it, and it was not until 1890 that *Asplenium fontanum* was known to be a member of our fern-flora. In the interim Mr. McMinn died and with him died the knowledge of the fern's exact location.

As soon as it was known that *Asplenium fontanum* was really a native, search was made along the rocky banks of Lycoming Creek for more specimens, but all efforts to rediscover the fern there have thus far been unavailing. Since then, however, another locality for the plant has been discovered, also by Dr. Porter—but under circumstances that render the exact locality

as elusive as the other. The specimens referred to were distributed without name, along with other plants, by Dr. H. C. Beardslee, the label reading, "Springfield, Ohio, Mrs. E. J. Spence, collector." Specimens from both localities are preserved in the Herbarium of Columbia University, and do not differ in any particular from European specimens.



ASPENIUM FONTANUM.

Fig. 1.—Frond natural size. Fig. 2.—Pinna of "A. Halleri" somewhat enlarged.

It is a curious fact, in connection with the discovery of this fern in America, that it has been reported many times from Great Britain but always with such uncertain data that fern-students there are still divided upon the subject of admitting it to their catalogues as a native species. It is not preposterous to

suppose that the fern may occur in other parts of America. In the Old World it is fairly common from France and Spain to Greece and the Himalaya mountains. Our illustration was made from a frond collected in France. The plant's general appearance is so much like *Cystopteris fragilis*, or some of the smaller *Aspleniums* and *Woodsias* that it might be easily overlooked, even by the fern hunter. There is also considerable difference in the fronds, so much so, that a tall form with slightly differing pinnæ has been described as a separate species, under the name of *A. Halleri*. It is now regarded, however, as a mere form of *fontanum*. A pinna of *Halleri* is also figured.

For the convenience of those who may wish to make a search for the plant along our limestone ledges, I include a description of it, taken from Dr. Underwood's "Our Native Ferns." "Stipes, one to three inches long, scaly at base; fronds three to six inches long, one half inch to one inch wide, tapering both ways from above the middle; pinnæ ten to fifteen pairs, their segments deeply dentate with spinulose teeth; sori, one or two on each segment." As will be seen from the illustration, to characterize the teeth of the segments as spinulose is perhaps too strong an expression, but as the fronds vary so much it is not improbable that specimens possessing this feature often occur.—*Willard N. Clute.*

OUR MISCELLANY.

In the original description of *Asplenium Bradleyi*, Eaton says: "In some of its more compound forms it is related to *A. montanum*, from which it differs in its larger size, more membranaceous texture, narrower outline of the fronds and shorter stalked pinnæ. Some of the denser specimens also resemble somewhat *A. lanceolatum* of Europe."

Those who are investigating the subject of forking fronds will be interested in the following note from Gerard's "Herball," published in 1597. It refers to *Ophioglossum vulgatum*, commonly called Adder's-tongue: "I have seene an other like the former in root, stalke and leafe; and differeth in that that this plant hath two and sometimes more crooked toongs yet of the same fashion, which, if my judgment faile not, changeth *par accidens* even as we see children borne with two thombes, upon one hand. * * * * In gathering of twentie bushels of the leaves a man shall hardly find one of that fashion."

THE LINNÆAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

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Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Secretary Alvah A. Eaton, of Seabrook, N. H., offers to collect and mail to any address a duplicate type herbarium specimen of *Isoetes Eatonii* for ten cents. Each specimen will consist of a plant in its spring dress of long leaves, and one in its summer dress of short leaves and ripe spores.—C.

—Mrs. Julia E. Campbell, Long Beach, Calif., offers a frond of *Cheilanthes Californica* to any member of the Chapter for 5 cts. in stamps. They were collected at Eaton's Canon, Pasadena, Calif. Those who are able to collect our rarer ferns may render a service to less fortunate members by having the free distribution of ferns in mind while collecting this summer, and adding a few specimens to their stock for this purpose.—W.

New Members.

Seventy-six fern students are now members of the Fern Chapter. One year ago, when our list of members was printed, it contained but forty-two names, which shows a gain during the past twelve months of thirty-four members. Those who have joined since the April BULLETIN was issued are nine in number—all active members. The list follows: A. J. Grout, Columbia University, New York; W. A. Bastedo, 121 W. 61st St., New York; H. S. Kitchel, South Bethlehem, Penna.; Miss Laura F. Kimball, National City, San Diego county, Calif.; Miss Mary E. Jones, 1811 Maryland Ave., Baltimore, Md.; Miss Elizabeth Huger, 142 E. 18th St., New York; Miss Carolina M. Wood, Mt. Kisco, Westchester county, N. Y.; Miss Elizabeth Whittlesey, Morris, Ct.; Mrs. J. W. Humphrey, Woodstown, N. J. The many new members added to the Chapter will require a revised list of members to be issued in the near future. All who think of becoming members should join at once in order to appear in this list.

—THE—
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WILLARD N. CLUTE, Editor.

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THE friends of this journal who have worked so earnestly for its success will doubtless be glad to know that it now has a circulation that places it abreast of the more prominent botanical publications. In accordance with this growth, arrangements have been made to add four pages to each issue of Volume VI. These pages will be devoted to the mosses, under the editorship of Dr. A. J. Grout. Notes or queries of general interest relating to this subject, may be directed to him in care of the editor of the BULLETIN.

* * *

OUR thanks are due Mr. Charles T. Druery for a copy of his interesting volume, "Choice British Ferns." In this book a view of fern study is presented which is doubtless quite novel to American students. So little attention is given to fern "sports" on this side of the Atlantic, that a volume devoted almost wholly to an enumeration and description of such forms is both curious and interesting. More than three hundred different varieties of the British fern-flora are recorded, the Hart's-tongue (*Scolopendrium*) alone having upwards of sixty forms to its credit. The numerous branching, tufted, crested and lobed forms of the latter species are all the more remarkable from the fact that fronds of this fern are ordinarily lanceolate linear in outline with entire margins. Spores from these variable forms are capable of developing plants like the parent or even surpassing it in fantastic aberrations. The cultivation of these forms receives much attention in England, and our American readers would doubtless find considerable interest and amusement in assisting the tendency to variation in their own ferns.

ONE of the chief thorns in the young botanist's path to knowledge at present is the frequent changes in the names of plants. No sooner has he learned a set of perhaps, to him, meaningless scientific names, than he is obliged to supplant them with another lot equally unintelligible. Fortunate is he who can console himself in the task with the thought that in all this we are approaching a more stable nomenclature. Even the plants that have been known and studied for centuries have not escaped the general mutation. *Scolopendrium* has long been known as *S. officinarum* or *S. vulgare* and was but recently changed to *S. Scolopendrium* because of the discovery of an older name. Now the generic name is to have its turn. Prof. Edw. L. Greene finds that it is antedated by *Phyllitis* of Hill, and our plant accordingly becomes *Phyllitis Scolopendrium*.

* *

THE communication in this issue from Mr. Geo. E. Davenport regarding the varieties of *Botrychium ternatum* emphasizes the fact that the rank to be given these peculiar forms is still a matter of considerable doubt, and the decidedly different views upon the subject held by two of our foremost fern-students serve to indicate how far the question is from a satisfactory settlement. When such botanists as Lamarck and Michaux have considered the so-called variety, *lunarioides*, distinct enough to be entitled to specific rank, we should not be too hasty in accepting Milde's dictum regarding its varietal nature, especially since he certainly had very little material from which to judge of its merits. The only satisfactory way in which the whole question can be disposed of is by the examination of a large amount of material from a wide range of territory. In this work every reader of the BULLETIN can assist by keeping a sharp lookout for all varying forms of *Botrychium*. A large number have responded to Dr. Underwood's request for specimens in the April BULLETIN, and it is hoped that others may do so. All forms of *dissectum* and *lunarioides* are especially desired, and may be addressed to the editor of this journal. Rare and peculiar forms will be returned after study, if desired.

—The October BULLETIN will contain a list of those nominated for office in the Chapter for 1898. The nominating committee, which consists of the present officers of the Chapter, will be glad to hear from any member who desires to suggest candidates for office.

NOTES.

—An article on The Bracken appears in *Popular Science News* for April.

—The March number of *Meehan's Monthly* contains a page article on the Harts-tongue fern, by Willard N. Clute.

—Mr. Geo. E. Davenport devotes several pages of the *Botanical Gazette* for April to the discussion of the rank to be assigned the so-called variety *lunarioides* of *Botrychium ternatum*. His conclusions are summed up in the suggestion that the plant had best remain where Milde placed it—as a good variety of *B. ternatum*.

—Another interesting volume* designed to assist the beginner in fern study has recently appeared from the press of Henry Holt & Co. The book is mainly a series of octavo plates, 72 in number, from drawings by the author, illustrating all the species of ferns to be found in the United States east of the Mississippi river and north of North Carolina and Tennessee. By its use one who knows nothing of botany, may identify any fern in the region mentioned, by simply turning over the pages until he comes to the illustration that matches his specimen. The pages are also interleaved with stubs to enable the collector to preserve specimens of each fern by fastening them to the blank pages. Students of botany in general will find this work of much value in identifying ferns.

—A second volume of "An Illustrated Flora of the Northern United States and Canada," by Dr. N. L. Britton and Hon. Addison Brown, has just appeared. In all respects it is the equal of the preceding one, and carries the subject from *Portulacaceæ* to *Menyanthaceæ*. Besides many smaller families this volume treats of the Crowfoots, Cresses, Saxifrages, Roses, Legumes, Spurges, Sumacs, Mallows, Violets, Heaths, Umbelworts and Gentians. There are 640 pages and 1453 illustrations. The third and last volume will probably appear before the end of the year. We can supply either of the first two volumes bound in cloth for \$3.25, post-paid. A year's subscription to the FERN BULLETIN given with each volume ordered. Two volumes and a subscription this journal will be sent post-paid for \$6.25. Address all orders to the editor.

*The Fern Collectors' Hand-book and Herbarium, by Sadie F. Price, Henry Holt & Co., New York. Price \$2.25.

—Part X of Bulletin 9 of "Minnesota Botanical Studies" contains a paper by A. A. Heller entitled, "Observations on the Ferns and Flowering Plants of the Hawaiian Islands." Ninety-six ferns and nine fern allies are mentioned, seven of which are described as new. The author notes that outside of the lower cryptogams one-sixth of the native vegetation consists of ferns. *Gymnogramme Sadlerioides* and *Acrostichium Helleri* are figured in the report.

—Among the ever increasing number of books concerning the out-door world, a prominent place must be given to a charming little volume by Thomas Wentworth Higginson, entitled *The Procession of the Flowers and Kindred Papers*.* In this book of 170 pages, the author has brought together six very felicitous sketches of nature in New England, entitled "The Procession of the Flowers," "April Days," "Water Lilies," "My Out-Door Study," "The Life of Birds," and "A Moonglade." Those who see the book will wish to read it, and those who read it will want to own it. It is worthy a place in the library of every one who loves nature.

—Students of lichens in America have always been greatly handicapped in their work for want of a proper treatise on the subject. With the exception of Tuckerman's publication, now considerably out of date, almost nothing has been written upon this class of plants. Lichenologists will be inclined to give a cordial reception to the recently issued *Text-book of Lichenology*† by Dr. Schneider, in which the subject has been very thoroughly treated. The work is divided into two parts, the first dealing with the history, general morphology and physiology of Lichens, and the second with the classification and special morphology of the plants. In the first part, symbiosis, reproduction growth, mechanics, chemistry, etc., of lichens is fully discussed, while the second contains excellent keys to the families and genera. Those who are studying the lichens will find this book invaluable. In addition to 230 royal octavo pages of text, there are 76 full-page plates illustrating all the genera.

**The Procession of the Flowers and Kindred Papers*, by Thomas Wentworth Higginson. Longmans, Green & Co., New York, price \$1.25.

†*A Text Book of General Lichenology with descriptions and figures of the Genera occurring in the Northeastern United States*, by Albert Schneider. Willard N. Clute & Co., Binghamton, N. Y., price (cloth) \$4.25; paper, \$3.80.

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EDITED BY WILLARD N. CLUTE.

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THE FERN BULLETIN.

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OCTOBER, 1897.

NO. 4.

THE FERNS OF SCOLOPENDRIUM LAKE.

BY LUCIEN M. UNDERWOOD.

I HAVE often been asked to indicate the species of ferns that grow in the immediate vicinity of Green Lake, near Jamesville, Onondaga county, New York, which has posed as the locality furnishing the largest number of species. I refer to that particular "Green Lake" which is located about a mile east of the D., L. & W. station at Jamesville, as the one a similar distance to the west, although better known, is far less interesting. I think all the species will be found within a radius of fifty rods from the margin of the lake or pond, as it is a mere pool in the depression left, doubtless, after the caving in of the roof of a cavern.

The list is as follows: *Polypodium vulgare*, *Adiantum pedatum*, *Pteris aquilina*, *Pellæa atropurpurea*,* *Asplenium Trichomanes*, *A. angustifolium*, *A. thelypteroides*, *A. filix-fœmina*, *Phyllitis Scolopendrium*, *Camptosorus rhizophyllus*, *Phegopteris hexagonoptera*, *P. Dryopteris*, *Dryopteris Thelypteris*, *D. spinulosa intermedia*, *D. cristata*, *D. Goldieana*, *D. marginalis*, *D. acrostichoides*, *D. Boottii*,* *Cystopteris bulbifera*, *C. fragilis*, *Onoclea sensibilis*, *Dicksonia punctilobula*, *Osmunda regalis*, *O. cinnamomea*, *Botrychium ternatum*,* *B. Virginianum*. All the species are comparatively common at this station except the three which I have marked with a*; these three I have found only once.

At "White Lake," an interesting locality about half a mile north of Green Lake, I found a single specimen of *Ophioglossum vulgatum*; less than half way to the city of Syracuse and within three miles of this Green Lake, on the "Jamesville road," is the original Central New York station for the curious plant that has been referred to *Botrychium Lunaria*, and on the cliffs near by,

Asplenium Ruta-muraria can be found by careful searching, and *A. platyneuron* is not uncommon; on the opposite (south) cliffs Mr. Hulst, of Brooklyn, found *Pellæa Stelleri* a few years ago, but several weary searches have failed to reveal the station.

To the above species we must add *Osmunda Claytoniana* and *Onoclea Struthiopteris* (which, by the way, forms a good genus by itself) as occasional species of this region, and thus within the circle whose diameter is not over three miles we have thirty-four species of ferns, twenty-seven of which grow in the immediate vicinity of what some of my Syracuse friends have very appropriately called "Scolopendrium Lake." If there is a locality in the United States that will present so large a list within such narrow limits, I should be pleased to know of it.

IN THE HAUNTS OF THE HART'S TONGUE.

THE Hart's Tongue (*Phyllitis Scolopendrium*) was first discovered in America near Syracuse, N. Y., in 1807, by Frederick Pursh. These first specimens are often referred to Chittenango Falls, but we have it in Pursh's own words that he first detected it "in shady woods among loose rocks in the western part of New York, near Onondaga, on the plantations of J. Geddes, Esq." The two localities are not far apart, and at Chittenango Falls the plant still flourishes. With a fern-loving friend I visited the latter station last September. It is a wild and beautiful locality—just the spot to serve as a hiding place for botanical rarities. A large stream, the Chittenango, hurrying northward to Oneida Lake, here makes a plunge of many feet over a double series of falls, and winds away through a narrow wooded glen, hemmed in by great precipices of corniferous limestone which echo the roar of the waters and are always damp with their spray. The shadier parts of these cliffs shelter the Walking-fern and Slender Cliff-brake, while from every dripping ledge the long, tapering fronds of the bulbous Bladder-fern hang like a curtain. On the sunnier walls the Purple Cliff-brake and Rue Spleenwort find a home. Ever since the Chittenango cut its channel through these rocks, wind and weather have been steadily at work tearing them to pieces. Huge banks of rock fragments slope from the bases of the cliffs to the water. Over them the falling leaves of centuries have spread a soft and yielding carpet of mould that affords a congenial soil for such trees as the Basswood, Hemlock, Striped Maple, Cedar and others. In the



THE HART'S-TONGUE.

shade of these, where there is always semi-twilight, the Hars't-tongue elects to grow.

The fronds have been likened to plantain leaves, but no one should mistake these thick, glossy, green things for anything so common. Here and there along the cliffs they appear, a dozen or more leaves, half erect in a circular clump. So lightly are the plants anchored in the yielding soil, that they may be easily lifted out roots and all, without digging. We find ourselves wondering how they manage to exist with such a precarious foothold ; but the number of young plants to be seen testifies to their vigor. In September the spores are ripe and then nearly every frond is loaded on the under side with velvety-brown lines that look like embroidery. So profusely do they fruit, that a [spore-bearing frond is noticeably heavier than a sterile one.

Taken separately, the fronds can hardly be said to have much beauty; but their odd shape will not fail to attract attention. The short, chaffy stipe with its entire blade a foot or more long and scarcely an inch and a half broad, seems an anomaly among our common ferns. The frond is usually broadest towards the apex, and the base is heart-shaped. In growing plants the edges are crisped and wavy, as if with a superabundance of tissue, giving the plant a very pretty effect.—*Willard N. Clute, in Meehan's Monthly.*

THE ASH OF PHEGOPTERIS HEXAGONOPTERIS.

THE following is taken from an old number of the *Bulletin of the Torrey Botanical Club*, and may interest some of those who have fronds of this fern to burn. We shall be glad if those who try the experiment will report results.

Some years since I found in Cayuga county a number of exceedingly large specimens of *Phegopteris hexagonoptera*. On burning some broken pieces after I had dried them, I noticed that instead of leaving an ordinary ash, each piece left a white globule of nearly pure carbonate of potash. I then took a whole frond and set one end on fire, holding the other, when a little white globule followed up the burning end, hissing and boiling and increasing as it went on, and attaining the size of a very large pin-head by the time the frond had burned up to my fingers; but no other ash appeared. I repeated the experiment several times with the same result, and have since tried specimens from other localities and have often found that the fern would burn entirely up, with nothing solid left but a white globule of carbonate of potash. How pure the salt was I cannot say, as I only satisfied myself of its main character. I ought to mention that the soil in which the specimens first mentioned grew was mainly formed of decayed wood.

AOSPORY AND FERN VARIATION IN GREAT BRITAIN.

THE Spring number of the FERN BULLETIN which has reached me interests me greatly as an evidence of more extended love of ferns in the United States than appears to obtain in this country, since we have no periodical devoted to this special cult. My object in writing is to inform your readers, should you think fit to insert my letter in your next issue, that I take a particular interest in those abnormal forms of reproduction which ferns in recent years have been demonstrated to produce, and in this particular connection I may point to apospory or the production of prothalli without the intervention of the spore, a phenomenon of which I was fortunate enough to discover the first instance, as you may confirm by reference to the Linnæan Society's papers. Examples of this I subsequently found in *Lastrea* (*Nephrodium*) *pseudo-mas*, *Polystichium angulare*, *Scolopendrium vulgare*, and a second form of *Athyrium filix-fœmina*, upon which species the first case was discovered and its true nature

established. These phenomena are all associated with varietal forms of which my little book, ("Choice British Ferns," Upcott Gill, publisher,) gives an extensive list of British finds, and it is also in this direction that I think your readers should turn their attention since, while many hundreds of truly remarkable varieties have been found wild in Great Britain, I have failed to find any record of similar sportiveness in the States, though most of our species are indigenous there also. A study of this phase of fern-life is so replete with interest that a Bulletin without an allusion to it is curiously incomplete. The variations incidentally mentioned in the number before me do not belong to the class I have in view, viz., plumose, cristate, and others of like marked character, and would rank here as sub-varieties only. I should be delighted to correspond with any of your readers who may possess or discover varietal finds of American origin, and to exchange spores or specimens (living) with them. My theory has always been that the same careful and assiduous search among ferns which has yielded so rich a harvest in Britain, will reward the hunter equally anywhere where they are abundant.—*Charles T. Drury, F. L. S., Acton, W. London, England.*

THE BRACKEN IN BRITISH COLUMBIA.

IN certain parts of the world people have been obliged to turn fern students to some extent, in order to protect their fields and pastures from being overgrown with these usually retiring plants. The following, abridged from Dr. Fletcher's reply to a farmer in British Columbia, is taken from a Canadian paper. To many it will place our familiar bracken in a new light.

"Although the brake fern is, as this correspondent describes it, a terrible pest in newly broken land in British Columbia, this is not the case in many parts of Canada. The fern referred to is a variety of the common brake—*Pteris aquilina*, var. *lanuginosa*. The Brake in Canada, east of the Rocky Mountains, is supposed to be identical with the European form, but I do not think that this is correct, as our Canadian plant is very much smaller and of a slightly different habit. But while our Eastern Canadian form is smaller than the European, the British Columbia variety is a giant, sometimes growing tall enough—as I have myself seen near New Westminster—for a man on horseback to take two fronds, one on either side of him, and touch them, over his head. Botanically, the chief difference between the eastern

and western forms is that the western one is clothed thickly with woolly down beneath the leaves, for which reason it has been named 'lanuginosa,' or 'woolly.' ”

The settlers in many parts of British Columbia experience difficulty in fighting ferns when they clear land. It is almost impossible to clear the roots out of the land with an ordinary plow. A heavy scrub plow has to be used first of all, and then every effort must be made to destroy the fronds as they spring up, and, indeed, this is the only hope for the farmer. These ferns have an extensive underground system of roots and branches which throw up many fronds, but, as in the case of all other plants, the foliage is the stomach of the plant, and if the fronds are kept from forming by constant hoeing or other methods of cultivation, the roots must in time die out.”

THE GEMMÆ OF LYCOPODIUM.

SOME time ago a query as to the nature of the small gemmæ that form in the axils of the upper leaves of some species of *Lycopodium* was published in the FERN BULLETIN. A friend of the journal has kindly sent us the quotation on the subject from Sach's Lehrbuch, to which the 6th edition of Gray's Manual refers. It is published herewith.

“The gemmæ or bulbils of *L. Selago*, which subsequently fall off, are probably products of the leaves, not of the stem; they are apparently axillary. It appears, however, to result, from Cramer's description and drawings, that they spring from the basal part of the leaf itself, at least this is indicated by the circumstance that the vascular bundle does not spring from the cauline but from the foliar bundle. The additional circumstance that sporangia are developed on the earlier leaves of a year's growth, bulbils on the later ones (the branch continuing to grow for years without dichotomising), appears further to justify the supposition that the bulbils occupy morphologically the same position as the sporangia, which in *Lycopodium* unquestionably originate from the leaves and are not axillary.”

DIFFERENCES IN FERN STEMS.

THE stems of ferns are a never-failing source of pleasure and profit to me. If rightly studied they may often aid us in deciding knotty questions. At the *extreme* base of the stipe of *Asplenium acrostichoides*, where it is black and flattened

somewhat, are one or more slight tooth-like knobs on each edge. As far as I know there is but one other species among our ferns that has these peculiar outgrowths. The stem of this other species, *A. filix foemina*, might easily be mistaken for that of *Dryopteris simulata* were it not for this peculiarity. It is interesting to notice that although in general appearance *Asplenium angustifolium* and *A. acrostichoides* are so much alike, yet the former has not the faintest trace, as far as I could see when making a special examination with reference to this, of the little knobs. In Gray's Manual, *A. filix-foemina* and *A. acrostichoides* are put under separate sections of the genus, the latter being placed next to *A. angustifolium*. On the other hand, Prof. Underwood has recognized the obvious relationship between the first two by placing them together. As every detail of structure counts, why should not the peculiarities of the stems above mentioned be cited as arguments in favor of the latter's arrangement? It would seem strange if such a deviation from the ordinary type of stem should be found in but two of our ferns, and these two should be only distantly connected. What is the purpose of these teeth?—*C. E. Waters, Johns Hopkins University, Baltimore, Md.*

THE SENSITIVE FERN.

JUST why that one of our common ferns which bears the coarsest foliage should be called the sensitive fern (*Onoclea sensibilis*), has never been quite apparent. One suggestion is that it was because it withers so soon after being cut. Another and more reasonable explanation assigns the name to the plant because it withers at the first hint of frost; but with even better reason this name could be given to *Pellaea Stelleri*, whose fronds are often gone by August. In an old book entitled "Conversations on Botany," another suggestion for the origin of the name is given. It is to the effect that the fern will wither immediately on being touched by the human hand, but withstands the touch of other bodies. The German botanist, Sprengel, is quoted as having proved the truth of this statement by numerous experiments. In Rees' Cyclopaedia it is stated that "the barren fronds are smooth and of a thin texture, so delicate that, as we have heard, the frond soon fades after being drawn through the hand when growing." Doubtless these stories were made to fit the name, rather than the name to fit the facts. One thing should be remembered in reference to *Onoclea sensibilis*—it is a water-

loving fern, and while it will stand more sun than many of its relatives if supplied with water, like most other water plants it withers much sooner than do allied species growing in drier ground, when taken from its natural surroundings.

THE CREEPING SELAGINELLA.

IN eastern North America there are three species of Selaginella.

One of these (*S. selaginoides*) is found far northward and barely reaches the United States. Another (*S. rupestris*) is common on dry and exposed rocks throughout the continent; and the third (*S. apus*), the subject of this sketch, grows "in low, shaded places from Maine and Ontario to the Northwest Territory, south to Florida, Louisiana and Texas." Apparently, it is somewhat common throughout its range, but its size, appearance and manner of growth all conspire to shield it from discovery. Many who are familiar with the majority of the higher cryptogams find themselves baffled in their search for this diminutive member of the group. It is likely that the plant is often set down as missing, when the fact is that it has only eluded the eye.

The creeping Selaginella is a plant that one must get down on his knees to find during most of the year. Its slender, prostrate stems, scarcely four inches long, with leaves half as large as a flax-seed, need a sharp eye to detect them. In the spring, before the grass has started, the task is easiest, the delicate yellow-green of the foliage making it quite noticeable amid the gray of the stubble and the dark greens and bronzes of neighboring mosses. In the vicinity of New York City this is one of the commonest of the fern allies, growing in thickets, fields, pastures and country door-yards; but even here in August, when it fruits, to find it in the profusion of other vegetation requires a diligent search. If found at all it is usually on the border of some wet meadow, just where the grasses begin to give way to sedges, trumpet weed, turtle-head and other marsh plants. On the black mud, well shaded by tufts of sedge, it grows in little colonies, like a moss, with branches thickly intertwined.

There is a genus of mosses (*Mnium*) growing in the same places and having leaves like those of Selaginella, that might be mistaken for it; but if we examine the latter closely we find that it has *two kinds* of leaves while the moss has but one. The members of the larger leaf series are barely one-twelfth of an inch in length and are arranged on opposite sides of the stem, their blades

turned parallel to the earth ; between them, on the upper side of the stem, are the two rows of smaller, differently shaped leaves (fig. 2). The stems of the creeping *Selaginella* seldom get more than half an inch from the soil, and at every point where they branch, there also goes down a system of roots, something after the manner of the club mosses. These roots are apparently excellent examples of dichotomous branching, but according to Campbell's "*Mosses and Ferns*" they are really monopodial. The fruiting spikes are generally rather erect and obscurely four angled. In the axils of the upper leaves are borne round spore-cases containing numerous microspores, while the lower produces larger spore-cases containing three or more macrospores.



SELAGINELLA APUS.

Fig. 1—Part of plant, natural size. Fig. 2—Section of stem, enlarged. Fig. 3—Fruiting spike. Fig. 4—Leaf from spike with macrosporangium containing macrospores.

The books unite in saying that *Selaginella apus* is an annual, but from the fact that strong, thrifty plants are found as soon as the snow disappears, this seems to be an error. The genus *Selaginella* contains upwards of three hundred species, mostly in the warmer parts of the globe. Of the present species, Baker's "*Fern Allies*" says "it is a representative in the temperate zone of a characteristically tropical group."—*Willard N. Clute*.

Mr. F. Peyton Rous adds to the list of common names for *Scolopendrium*, that of "caterpillar fern," which he finds in a Botany by Mrs. Lincoln Phelps, published in 1854.

CHELIANTHES LANOSA.

MY bed of lanosa is on the south side of a gray sandstone cliff which rises from the river's edge. Here the sunlight filters through, and lightly strikes the large shallow pockets of loam, watered from the rocks above and held in place by a network of roots and creeping root-stocks. These pockets are covered with dead and growing fronds and are well protected against drought; but should the summer heat become too great, Cheilanthes tucks her curly head away and sleeps until another shower. On the north side of this cliff are *Asplenium trichomanes*, *A. parvulum* and *Pellæa atropurpurea*, but no lanosa. She is contented with the complete possession of the south side. The velvet knobs on the root-stock, by means of which she extends her dominion, suggest to me the budding horns of our Virginia deer.—*Prof. W. Alphonso Murrill, Staunton, Va.*

SOME CALIFORNIAN FERNS.

SEVERAL times during winter and early spring, while living in Pasadena, I drove up to the mountains about three miles north of town, in search of such flowers and ferns as I could find by driving, as I had no strength for walking or mountain-climbing. My favorite haunt was Eaton's cañon, as that one is most pleasant for those who must keep close to the carriage. Entering the cañon, the sandy wagon-road winds about among the boulders, many of which are glaring in the strong sunshine, while others are wholly or partially shaded by live oaks or such shrubs as the Bay tree (*Laurus nobilis*), the Californian holly (*Heteromelis arbutifolia*), the mountain sage (*Artemisia tridentata*), and that enemy which it is often quite serious to encounter—*Rhus toxicodendron*. The ascent is quite gradual until about two miles from the mouth of the cañon the Toll-gate is reached, where begins the trail to Mt. Wilson. This being as far as I could drive into the cañon, I always tied my horse, and, with the friend or my little child who accompanied me, looked about, where within a few feet of the carriage we generally found numerous flowers as well as a few ferns. The ferns were always *Gymnogramme triangularis*, *Pellæa andromedæfolia* and *P. ornithopus*.

Here in the strong sunlight and amid the boulders, with yucca and cactus plants as their nearest neighbors, these ferns

thrive—the fronds of *Pellaea andromedæfolia* sometimes measuring sixteen inches in length. After being obliged for two years to limit my fern collections to these species, at last increasing strength allowed me to walk up the cañon one June morning, as far as the Falls. After resting there in the most beautiful spot I have seen in Southern California, I continued my hunt for ferns. One nice plant of *Cheilanthes Californica* rewarded me. It was growing in a tiny crevice of a rock, where it was shaded half the day, and where the water was always within at least ten feet of it. I saw the season was too far advanced, for all the other ferns found were crisp and brown. Last winter, not finding opportunity to collect there myself, I asked a friend to go for me. March 13th was the day selected, the result being the specimens of *Cheilanthes Californica* which it has given me pleasure to offer to our Chapter.—*Mrs. Julia E. Campbell, Long Beach, Calif.*

THE COMMON POLYPODY.

ONE of the commonest ferns about Philadelphia is the rock polypody. Its favorite haunt seems to be on ledges of rock and the flat tops of shaded boulders, though sometimes we find it growing about the roots of trees and mildly essaying to climb their trunks. Its vitality is something remarkable. In very dry times in summer and fall the fronds dry up and look as though it was all over with them, but a little wet weather freshens them up directly, and they look as stout as ever. These withered fronds, gathered and brought home, will lose all their dryness over night, if steeped in cold water, and be bright and stiff in the morning. So, too, in winter, the fronds curl up and look decidedly dejected, but come around all right again with the spring. It is a very cheerful little fern to me, and I think an intimate acquaintance with it might be something of a tonic to all of us in times of adversity.—*C. F. Saunders.*

TRICHOMANES PETERSII.

THE rarest fern to find, however, even when you are near its station, is the elegant *Trichomanes Petersii*. Within the section that contains the type locality it took two days of very earnest search to find it. From the description of the original station, I had expected to find it on rocks wet with the spray of waterfalls, but all such over-moist localities yielded no re-

turns. When I had almost given up the search, I found it at last, creeping under the roof of shelving rocks, sending up at intervals of one or two centimeters its tiny fronds that look more like the leaves of a large *Mnium* than a fern; it occasionally forms matted masses of fronds like those distributed by Judge Peters years ago, but it is distinctively a creeping plant. I learn from Dr. Mohr that the plant is found at one or two other stations, but so far it is not known outside of Alabama. Its minute size, however, and its unusual habitat, would evade one not familiar with its habits, and it may have a wider distribution than I now suspect for it. But before these things will be known we need any number of people, call them botanists or what you may, who know plants, their haunts and habits, who love the fields and woods and search them with the zeal that prompted Peters and Beaumont and the other earlier botanists of Alabama to make known their native flora.—*Dr. L. M. Underwood, in Botanical Gazette.*

POLYPODIUM POLYPODIOIDES.

“Two years ago I collected this fern in southern Virginia. It is a most curious and interesting little plant. The little pits in which the sporangia grow are very noticeable. I know of no other fern which possesses anything like them. The sporangia mature in the pits under cover of the peltate scales with which the under surface of the frond is liberally supplied, and when fully grown the spore cases push the scales aside and appear at the surface. These scales are very interesting. The fronds of the year have scales of a light brown or reddish color; the fronds which have survived more than one season have rusty-gray scales, and in the oldest stages the fronds have very few scales at all, most of them having been weathered off.”—*F. Peyton Rous.*

OUR MISCELLANY.

Mr. Alvah A. Eaton adds to the list of forking fronds *Vittaria lineata* and *Nephrolepis exaltata*.

On a recent trip to the vicinity of Little Ferry, N. J., Mr. W. H. McDonald reports finding twelve species of ferns in a spot 100 feet square. Among them were *Woodwardia areolata* and *Dryopteris simulata*.

Miss Nellie Mirick places on record a new station for *Dryopteris simulata* in New York. Specimens which Mr. Davenport pronounces good *simulata* were collected by her at Oneida several years ago.

Regarding *Scolopendrium*, Mrs. Thomas Baxter Gresham of Baltimore writes that she has a plant of this species, brought from the old world, that has grown vigorously and fruited freely for several years. She has been able to raise a number of plants from the sporelings that have self sown on an adjacent wall.

Does the texture of *Asplenium ebenoides* vary with the locality? In the January BULLETIN, Prof. Murrill says the texture of this is similar to *A. pinnatifidum*. Miss Sadie F. Price writes that in her locality *pinnatifidum* is one of the heaviest in texture, while all the specimens of *ebenoides* she has seen are very thin.

In favorable situations all of our ferns occasionally produce fronds of unusual size. At Swarthmore, Pa., Mr. H. P. Wells found fronds of *Onoclea sensibilis* nearly five feet high. The editor of this journal has seen in Southern New York, fronds of the Bracken, each of which formed a green triangle with sides more than a yard long. In the same locality, the Ostrich fern commonly attains a height of six feet or more.

On June 12th, '96, I found about thirty fronds of *Osmunda cinnamomea frondosa* by the side of the road, where the bushes had been cut away and burned last fall. They were the finest I ever saw. Every root where a fire had been showed from three to six, and on one even the sterile fronds had scattered sporangia on the edges of their pinnules. I examined a great many neighboring plants, with the result that I found but one *frondosa*, and that not very good.—A. A. Eaton.

In the exhilaration incident to the collection and study of rarities, some of us are apt to underestimate the importance of the common species. The very abundance of what we may term our "every day" plants seems to argue their importance in the divine economy and to give them a dignity that should make them subjects of especial study. Those who may think their neighborhoods poor in good varieties of ferns, should devote time to those that occur, even though they be the commonest. We may be sure that they have secrets which they will unfold to the eye of love, and which it will be a delight to know.—C. F. Saunders.

Miss Catharine M. Bates, of Bedford, N. Y., reports finding the walking fern growing in great abundance on decomposing gneiss and not on limestone. In other sections this fern has been found on sandstone, shale and conglomerate.

Mr. R. Kent Beattie notes that in the summer of 1896, *Osmunda regalis* was collected in the Republican river valley near Franklin, Neb. The genus *Osmunda* is not mentioned in Coulter's Manual, and Mr. Beattie adds that this is apparently the first recorded instance of the occurrence of this fern west of the Mississippi river.

One of the most difficult things to preserve is an equisetum of the sub-order containing *arvense*, *limosum* and *littorale*. Unless extreme care be taken they discolor. I find they bear no pressure at all. My way is to put them between papers, when they are easily slipped between the driers. I then get on top of the pile to press it down to give the plants shape, then take off all pressure. This gives a fine result, if the pile be not too large.
—A. A. Eaton.

Eaton's "Ferns of North America" mentions *Botrychium ternatum* as rarely bearing two fertile fronds. I have found about twenty so, variously doubled, and this year found a *B. ternatum obliquum* with three fine fertile fronds, the main one forking near the sterile leaf, and the sterile one sending up a fertile branch. They are all well developed.—*Alvah A. Eaton*. [Dr. L. M. Underwood has a specimen of this variety in his collection which bears a sterile leaf and three equally well developed fertile fronds which fork just above the juncture of the sterile frond and stem.—*Ed.*]

Even so staid a species as we are accustomed to consider the common polypody is not without its changes in other climes, as will be seen from the following note from Sowerby's "Ferns and Fern Allies of Great Britain:" "The size of the fronds varies from six to eighteen inches. When much exposed or at a distance from the ground they have a drooping habit. The fronds of this fern are in perfection from August to November, but are, in exposed situations, disfigured by the first frost. Under shelter it becomes evergreen, retaining the old fronds until the appearance of new ones." We who have seen the fronds of this species weathering all temperatures, find it hard to imagine their being hurt by a frost.

Although *Asplenium pinnatifidum* has been reported as rooting at the apex, it seems that it very rarely does so. Miss Sadie F. Price remarks that this fern is plentiful, but local in Warren county, Ky., and while she has seen hundreds of plants, she has detected none so rooted.

I have had considerable difficulty in getting good mature specimens of *Phegopteris Dryopteris*, and have sometimes wondered whether it is because I have always found it in localities where the conditions did not just suit it, or whether other collectors have met with the same imperfections. Have others had a similar experience? What I allude to, is a blanched or blotched condition of the mature fronds, which seems like a disfigurement. The young plants growing among them I generally find of a beautiful clear green, or sometimes toned off to a lighter shade around the margins. This fern is a great favorite of mine when perfect, its stipe being an especial delight, in looks like a highly tempered steel rod.—*C. F. Saunders, Philadelphia.*

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Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Several members who find it impossible to meet the other members of the Chapter, have signified a desire for their photographs; and offer in return cabinet-size photographs of themselves. Those who care for an exchange of this kind are requested to communicate with the editor of this journal.—*C.*

—The pleasure to be obtained from a wider acquaintance among fern students is beginning to be appreciated, and reports of several interesting meetings are the result. In 1896 the President, Vice-President and Treasurer of the Chapter for that year, and the editor of the *FERN BULLETIN* spent two very pleasant days together near Scranton, Pa. and in July, 1897, four members met at Binghamton, N. Y. This feature of fern study is capable of

much further development. It is likely that summer meetings will come to be a regular part of the Fern Chapter's program.—C.

Chapter Ferns.

It is not a fern but a fern ally that is offered this quarter. Members who care for specimens of *Selaginella apus* may have them by sending a request with stamped self-addressed envelope to the editor of this journal. Those who wish to aid less fortunate members by distributing the more desirable ferns are requested to communicate with the President.—C.

New Members.

In the five years that the FERN BULLETIN has been published not a single issue has appeared without adding new names to the Chapter. During the last quarter we have gained the following: *Active*—Miss Margaret Slosson, Pittsford, Vt.; A. O. Hastings, 253 Nineteenth street, Milwaukee, Wis.; Mrs. H. T. Brown, Hillcrest, Winchester, Mass. *Associate*—John A. Wheeler, Milford, N. H.; Lloyd T. Stephenson, Chat, Lassen County, Calif. At the end of the present year a new list of members will be published. All who intend to join the Chapter should do so at once, that their names may appear on this list.—C.

Election Notice.

The fifth annual election of the Chapter will be held in October. As required by the Constitution, the Executive Council have nominated two candidates for each office, as follows:

For President, Will R. Maxon, Oneida, N. Y.; C. E. Waters, Baltimore, Md. *For Vice-President*, Prof. W. Alphonso Murrill, Staunton, Va.; Mrs. A. D. Dean, Scranton, Pa. *For Secretary*, C. K. Dodge, Port Huron, Mich.; Alvah A. Eaton, Seabrook, N. H. *For Treasurer*, Mrs. M. L. Stevens, Cambridge, Mass.; Jas. A. Graves, Susquehanna, Pa.

These nominations will not prevent members from voting for any person not nominated, if so inclined; in fact, such expression of opinion is desired and will be of assistance in making up the next list of candidates, if the persons so voted for are not elected. The President has appointed Miss Elmira E. Noyes, 430 High Street, Portsmouth, Va., as Judge of Elections, to whom all votes should be sent. Balloting ends October 31st. Votes should be sent by postal card, and all are urged to vote.—C.

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THE present number of the FERN BULLETIN brings us to the end of another volume, and with it the journal is permanently increased in size by the addition of four pages to each issue. We feel safe in saying that the volume just finished is much superior to any that have gone before it, and we are confident that the one for 1898 will show still further improvements. In order to make this volume of the greatest usefulness to fern lovers, it is necessary to know what our readers need, and we therefore ask for suggestions. What part of the journal do you like best? Whose articles? Upon what subjects? What changes would you like to see made? Now is the time to shape the FERN BULLETIN to your liking, and we shall welcome all suggestions.

* *

TWO features of the forth-coming volume will be of special value to younger students. The first is a series of illustrated articles on how to find, identify and study the ferns. These will be written expressly for beginners and those who desire to know the ferns of their own region, but who find the study of the ferns by the books now in use a difficult matter. At the same time in the Moss Department, conducted by Dr. A. J. Grout, of Plymouth, N. H., there will be presented several articles designed to assist students to an understanding of this class of plants. In the majority of cases specimens of the mosses described will be mailed to subscribers of this journal who ask for them, giving all an opportunity to see and study the plants for themselves. There will also be articles on the mosses for older students, and helpful notes for everybody. Interesting items regarding the mosses are solicited from all.

It is not easy to make good photographs of the ferns, but that this may be done is attested by the pictures that are received at this office from time to time. We are desirous of obtaining photographs of fern localities, fern gardens, clumps of ferns, large, curiously shaped or specimen plants, or anything of this nature of interest to fern students. When possible we will reproduce them in the FERN BULLETIN.

* * *

It is a curious fact that the discovery of *Phyllitis Scolopendrium* in America by Frederick Pursh, was indirectly the means of preserving from destruction that botanist's journal of his trip through New York and Pennsylvania. At the death of Dr B. S. Barton in 1817, this journal came into the possession of the American Philosophical Society, along with other papers, where it lay for a long time unrecognized. Finally the attention of Mr. Thos. P. James, then Librarian of the Society, was called to an entry under July 20th, in which the writer says, after enumerating numerous plants found in a deep ravine on the grounds of a Mr. Geddes: "And what I thought the most of, *Asplenium Scolopendrium*—this fern which I don't find mentioned by any one to grow in America I always had a notion to be here: & indeed I was quit enjoyed to find my prejudice so well founded in truth. It appears to be the same as the europæan, only smaler: query? is the europæan auriculated at the base like this species?" This entry was compared with Paine's notes on the discovery of the fern by Pursh in the *American Journal of Science and Arts* for September, 1866, and the ownership of the journal discovered. In 1869 it was published by the American Philosophical Society, with all its mis-spelled words and quaint phrasing unchanged.

Regarding the habitat of *Asplenium Bradleyi* in Kentucky' Miss Sadie F. Price writes as follows: "I found it in this (Warren) county about 13 miles from Bowling Green, near Green river, in September, 1892. A chain of hills crowned with sandstone cliffs extend along this river. The walls are worn into picturesque grottos and clothed with a wealth of ferns—*Polypodium vulgare*, *Camptosorus rhizophyllus*, *Asplenium pinnatifidum*, *Cheilanthes lanosa* and others. In this company is found the interesting *Asplenium Bradleyi*. Prof. Hussey found this in a similar place in an adjoining county."

NOTES.

—The Philadelphia *Public Ledger* of Aug. 16th contains a note and illustration of a new species of *Ophioglossum*, found at Wildwood, New Jersey, by members of the Torrey Botanical Club upon a recent excursion. It will soon be described and named by Mrs. E. G. Britton. It resembles *O. vulgatum*, but is quite distinct.

—At the Winter meeting of the Vermont Botanical Club, Mr. C. G. Pringle delivered an address, entitled, "Reminiscences of Botanical Ramblers in Vermont." It is published in the July number of the *Bulletin of the Torrey Botanical Club*. There is much in it to interest fern lovers, since the greater part details the speaker's rambles in search of the rarer woodsias, aspleniums and dryopterids of Vermont.

—The name of the fern known to a great many botanists as *Cheilanthes lanuginosa*, has had its full share of changes. It was called *Myriopteris gracilis* by Fee. Then it was called *Cheilanthes lanuginosa*, and subsequently *C. gracilis*. But there is a still older name, which is pointed out by Dr. John Hendley Barnhart in the *Bulletin of the Torrey Botanical Club* for August, and the fern now stands as *Cheilanthes Feei* of Moore.

—In the year, 1819 John Goldie, for whom *Dryopteris Goldiana* was named, made an expedition on foot through Upper Canada. The strictly botanical journal which he kept upon this trip was lost by fire, but his diary of the journey was preserved. It has recently been published in a neat little brochure by his son, Mr. James Goldie, of Guelph, Ontario, Canada, to whom our thanks are due for a copy. The book is prefaced with a portrait of John Goldie, and also contains a plate of the fern named after him, together with his original description of it. The writer's observations upon the features of the country he passed through make very entertaining reading.

—We desire to call attention to the fact that with the exception of the current volume we have no complete volumes of the FERN BULLETIN on hand. The only back numbers we have are as follows: Volumes I-III (Nos. 1, 4, 6, 7, 8, 9, 10, including the "Fern List"), nine sets at 35 cts. a set. Vol. IV (minus No. 1), eleven sets at 35 cts. a set. Vol. V (the current volume), fifteen volumes at 50 cts. a volume. When these are gone no more can be offered. The missing numbers are now at a premium. Those

who would have their file of this journal as nearly complete as possible should order at once. While the supply lasts we will send a set of all the above for one dollar. Money returned if the order comes too late. Volume IV has pages slightly smaller than Vol. V. The numbers previous to Vol IV have pages the size of a postal card.

—Those who were charmed by the little volume entitled "Among Rhode Island Wild-Flowers," by William Whitman Bailey, will be glad to hear of a new book by the same author. In "New England Wild-Flowers and Their Seasons,"* the author takes his readers afield through every month in the year from March to December, and with true poetic instinct points out the beauty and interest of the flowers. Each month has a chapter devoted to its own blossoms, and is usually prefaced by a poem by the author. It is a book worth reading.

—In America the study of Mushrooms is increasing each year and in consequence a larger number of books and pamphlets treating of the subject is being issued. Among those that are especially useful to all classes is a handbook of edible and poisonous Mushrooms,† by Dr. Thomas Taylor. The substance of the five numbers that are comprised in this "handbook" was formerly published by the Department of Agriculture, under the title "Food Products." Of this, thirty six thousand copies were sent out in the years 1894-5. The present work contains much additional matter as regards both text and plates. Each part consists of twenty-four pages, exclusive of the plates, and in addition to classification and description, treats of the structure, food-value and methods of cooking mushrooms. A glossary of terms used in describing the plants is included. There are three excellent colored plates in each number, and several more in black and white.

*"New England Wild-Flowers and Their Seasons," by William Whitman Bailey. Preston & Rounds, Providence, R. I.

†"Students' Handbook of Mushrooms of America, Edible and Poisonous," by Thomas Taylor, M. D. A. R. Taylor, Publisher, 238 Mass. Ave., N. E., Washington, D. C. In five parts; 50c. each.

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CONTENTS.

	PAGE.
Anacamptodon Splachnoides	41
A New Isoetes— <i>A. A. Eaton</i>	5
A New Plan of Study	32
A New Station for the Hart's-tongue Fern— <i>Frances Theodora Parsons</i>	74
A Rich Fern Locality— <i>Margaret Slosson</i>	51
Asplenium Fontanum in the West— <i>B. D. Gilbert</i>	4
Botrychiums in an Odd Place— <i>Frances Zirngiebel</i>	9
Brachythecium cyrtophyllum	66
Bulblets of Lycopodium lucidulum— <i>C. E. Waters</i>	24
Camptosorus Sibiricus— <i>Willard N. Clute</i>	75
Cheilanthes lanosa— <i>H. A. Green</i>	27
Development of Ferns from Spores	8
Dorset Ferns— <i>Mrs. Emily Hitchcock Terry</i>	7
Editorial	13, 33, 57, 81
Election of Officers	78
Ferns in the New Jersey Pine Barrens— <i>C. F. Saunders</i>	21
Fern Study in Great Britain— <i>Chas. T. Druery</i>	26
Four New Species of Ophioglossum— <i>Mrs. E. G. Britton</i>	1
How to Collect Mosses— <i>A. J. Grout</i>	62
Isoetes minima— <i>A. A. Eaton</i>	30
Linnæan Fern Chapter	11, 32, 55, 77
Microscopic Preparation of Mosses	89
Moss Department	17
Mosses for Distribution	67, 91
Naturalization of Exotic Ferns— <i>Willard N. Clute</i>	10
Nebraska Ferns and Fern Allies— <i>R. Kent Beattie</i>	72
New American Mosses	43, 67, 91
New or Rare Mosses	41, 66
Notes	15, 34, 83
Notes for the Beginner— <i>Willard N. Clute</i>	28, 52, 76
Notes on Equisetum Scirpoides— <i>A. J. Grout</i>	24
Notes on the Life History of the Mosses— <i>A. J. Grout</i>	40
Our Miscellany	12, 30, 54
Outfit for the Study of Mosses— <i>A. J. Grout</i>	17
Pellæa atropurpurea in Cultivation— <i>F. W. Barclay</i>	25
The Bryologist	37, 61, 85
The Catherinas— <i>A. J. Grout</i>	63

	PAGE.
The Dicranums— <i>A. J. Grout</i>	86
The Genus Equisetum with Reference to the North American Species— <i>A. A. Eaton</i>	45, 69
The First Meeting of the Chapter— <i>Willard N. Clute</i>	79
The Hair-cap Mosses— <i>A. J. Grout</i>	18
The Pogonatum or Bearded Mosses— <i>A. J. Grout</i>	38
The New Moss Chapter.....	85
The Santa Marta Expedition.	59
<i>Woodsia ilvensis</i> — <i>C. F. Saunders</i>	3
World Distribution of Some Eastern American Ferns— <i>C. F. Saunders</i>	49

INDEX TO CONTRIBUTORS.




Barclay, F. W.....	25
Bastedo, W. A.....	54
Bates, Miss Edith.....	12
Bates, James A.....	31
Beattie, R. Kent.....	72
Britton, Mrs. E. G.....	I, 42, 90
Burnett, D. A.....	43, 66
Classon, E.....	43
Clute, Willard N.....	10, 28, 52, 75, 76, 79
Collins, J. Franklin.....	90
Dodge, Raynal.....	31
Druery, Chas. T.....	26
Eaton, Alvah A.....	5, 30, 45, 69
Gilbert, B. D.....	4
Green, H. A.....	27
Grout, A. J.....	17, 18, 24, 38, 40, 62, 63, 66, 86, 90
Holzinger, J. M.....	67
Kennedy, Geo. G.....	43
Parsons, Frances Theodora.....	74
Price, Miss Sadie F.....	30, 31
Saunders, C. F.....	3, 21, 49
Schneck, J.....	84
Slosson, Miss Margaret.....	36, 51
Terry, Mrs. Emily Hitchcock.....	7
Vail, Miss Anna Murray.....	42
Waters, C. E.....	24, 55
Zirngiebel, Miss Frances.....	9

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The 
Fern 
 Bulletin.

A Quarterly Devoted to Ferns.

EDITED BY WILLARD N. CLUTE.

JANUARY.

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1898.

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THE FERN BULLETIN

VOL. VI.

JANUARY, 1898.

No. 1.

FOUR NEW SPECIES OF OPHIOGLOSSUM.

By E. G. BRITTON.

ON the Fourth of July excursion of the Torrey Botanical Club in company with the Philadelphia and Washington botanists, a patch of *Ophioglossum* was found by Mr. Joseph Crawford and Mr. Charles Louis Pollard near Wildwood, New Jersey, which was so different from the common forms of *O. vulgatum*, that we at once concluded it was a new species. It grew in open wood, under oaks, cedars and holly trees, not far from the beach, in soil so sandy that grass grew but sparingly, and bay-berry bushes were common. The stalks were only slightly above the ground, but those of the fertile spikes were longer, and the spikes mostly twisted. None of the plants were more than 6-7 inches in height, and mostly two grew from the same rootstock. They had an erect, rigid habit, and at maturity were yellow in color, making the patch quite conspicuous, not only for the number of the plants, several hundreds grew together, but for their crowded position. A tuft five inches across would contain 20-30 plants. The leaf-blades were thick, and rather fleshy, lanceolate or ovate-lanceolate in the larger ones, (1-2 inches) narrower and longer in the basal, sterile leaves. The venation was rather hard to see, even after they were pressed, and there were fewer basal veins, and less reticulate areolation than in *O. vulgatum*. After considerable correspondence and comparison of specimens, it has been discovered that *O. vulgatum* does vary greatly in the size and shape of its fronds, but none have been seen which agreed exactly in habit and constancy with the specimens from Wildwood, which have been described as *Ophioglossum arenarium*, n. sp.

Prof. Underwood called my attention to Prantl's revision of the genus ["*Jahrb. d. K. Bot. Gart.*" Berlin, 3: 297-350, 1884], where are described two new North American species, thus far not included in any of our text-books, and seemingly unrecognized by

all our students of ferns. *Ophioglossum Engelmanni*, Prantl, was described from Texas and Arizona, and it has been found by various collectors in Missouri, Louisiana, Arkansas, Kentucky and Tennessee, Indiana and Virginia, as well as lower California. *Ophioglossum Californicum*, Prantl, has thus far been collected from only two localities in Mexico and Lower California besides the type locality at San Diego, California, where it was originally discovered by Dr. C. C. Parry.

Some specimens collected by L. M. Turner on Unalaska Id. Alaska, have also proved to be different from *O. vulgatum*, by which name they were distributed, and have been called *O. Alaskanum*, n. sp.

There has been much confusion as to the name which should be used for the smallest species of the genus which we have been calling *O. nudicaule*, L. This name belongs to an African species and Prantl enumerates five authors who have applied the name to seven different species, ours being *O. nudicaule* of Sturm in part. Prantl concluded to call it by a manuscript name of Mettenius, *O. tenerum*, but from notes by J. H. Redfield in the Eaton Herbarium, and the text as given in Nuttall's genera, it seems plain enough that *O. pusillum*, Nutt. 1818, is the name which belongs to the species of our Southern States.

A revision of the genus with descriptions, plates and full citations of localities appears in the December number of the *Bulletin of the Torrey Botanical Club*. I wish here to thank Mr. Alvah A. Eaton, Mr. Stewart H. Burnham and Miss Sadie F. Price, whose interesting notes in the FERN BULLETIN for October, 1896, led me to write to them for further information, and who have generously contributed specimens and notes which have been very useful. It is most important to note the habit and peculiarity of place of growth in collecting specimens, as they exert a great influence on the character of the variations. Mr. Burnham, particularly, has sent me a most interesting chronological series, beginning in May and extending through August, all from the same locality at different stations. His specimens show a great variation, and it would be very interesting to know if other collectors and readers of the BULLETIN have found similar varieties. The specimens which Miss Price described from dry, open woods and cedar groves at Bowling Green, Kentucky, have proved to be *O. Engelmanni*, though she has also found *O. vulgatum* at the same locality. We shall await with interest further notes and observations from the readers of this journal.

WOODSIA ILVENSIS.

BY C. F. SAUNDERS.

WOODSIA ILVENSIS, that is, the *Elba Woodsia*, is a native of Arctic regions and mountainous parts of the temperate zone in Asia, Europe and America. In the United States its most southern recorded limit is North Carolina. The present writer's acquaintance with it is confined to the mountains of eastern Pennsylvania, where, without being rare, it is nevertheless among the less common plants. It is one of the few ferns that lend the grace of their presence to exposed rocks, and so do what they can to make pleasant the waste places of the earth. At Lehigh Gap, Penna, where the Lehigh river cuts its way through the wall of the Blue Mountains, this *Woodsia* grows in the open sunlight on rocks high up on the side of an almost perpendicular ascent facing the river. Twenty miles away it may again be found, in the rocky clefts of a shaded hillside along McMichael's Creek. In the latter locality, perhaps because protected from the direct rays of the sun, it grows more luxuriantly, and in point of graceful beauty challenges comparison with any member of its lovely order.

In Pennsylvania our fern is usually from four to six inches in height, and grows in tufts either on the face or top or in the crevices of the rocks. The dead fronds break off at a joint in the stipe a half an inch or so above the ground, leaving the lower portion of the stalks stiffly standing, and the living fronds are very frequently found surrounded by small plantations of such stubble. This joint (which is plainly discernible under a pocket lens) is a characteristic of several species of this genus and serves as a ready and sure means of distinguishing our plant from *Cheilanthes lanosa*, which bears a considerable resemblance to it and grows in similar situations.

The fronds of *W. Ilvensis* are thickly clothed on the back with hairs and bristly chaff. These in the young plants are whitish, and give to the whole back of the frond a silvery or frosted appearance, which, however, changes upon maturity to a brownish-red—a color possessed also by the chaffy stipe and rachis. Although it may seem on first acquaintance somewhat stiff and even coarse of habit, *W. Ilvensis* is one of the most interesting of our native ferns, and the unpretentious but sturdy, unwavering fight of the furry little plant with sun and frost will speedily win for it, I think, a place in the heart of any who will give it due attention.

ASPLENIUM FONTANUM IN THE WEST.

BY B. D. GILBERT.

HOW would you like a bit of gossip to supplement your delightfully interesting article on *Asplenium fontanum* in the July number of the *FERN BULLETIN*? You imply in that article that this species has not been found "in this country," except in the two localities mentioned, although you say "it is not preposterous to suppose that the fern may occur in other parts of America." Now, in my herbarium there is a beautiful little plant, underneath which is the following original label:

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U. S. PACIFIC COAST FLORA.
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Now if this label were correct, you see there would be another and probably a better vouched-for station, because no doubt more specimens were collected. The date is August 8, 1882. I have a letter from Prof. Lemmon, written at Fort Huachua, Oct. 5, 1882, during the same expedition in which our fern was gathered. In it he describes how he broke one of the metacarpal bones of his hand in sliding down the steep walls of a cañon; "but," he says, with a fine disregard of the accident, "I found three more interesting ferns for my reward. Sent specimens of all to Prof. Eaton, but get no returns as yet. I think one or two of the ferns are new, at least they are not described in Eaton's great work.

So they were discovered too late to get into Eaton's "Ferns of North America," and, of course, too late to be in the first edition of Prof. Underwood's "Our Native Ferns," which was published in 1881. Now comes the question: Was Prof. Lemmon's label correct? The fern was sent to me with others in the following November, when, I take it for granted, Prof. Eaton had sent to Prof. Lemmon a provisional list of what thought the species might prove to be, after more careful examination and study. Prof. Lemmon had made up his sets and was anxious to distribute them, as his patrons were waiting to receive them; so he sent them out with the names originally furnished by Prof. Eaton. I

imagine, however, that there were very few specimens of this fern, as it was priced very high, and Eaton says it was "scantly collected." The final result of Eaton's examination will be found in his series of "New and Little-Known Ferns of the United States, No 13," published in *The Bulletin of the Torrey Botanical Club* of March, 1883. It appears under the head of *Asplenium Glenniei* Baker. Prof. Eaton says: "It is a small fern growing in little tufts like *A. montanum*, but the fronds are lanceolate, etc., etc. The fern *comes near* the Old World *A. fontanum*, but is not closely allied to any of our common species. I am obliged to Mr. Baker for the identification."

So near and yet so far! On the whole, it was better to have *Asplenium Glenniei* added to the United States flora than *A. fontanum*, as the former is, so far as known, a much rarer species in the world at large. Besides, as you have shown, *A. fontanum* does occur in the eastern states, while Arizona is the only region "in this country" where *A. Glenniei* has been found.

A NEW ISOETES.

By A. A. EATON.

DURING the spring of 1896, while examining specimens of the plant subsequently published as *Isoetes Eatoni*, I came across one of very peculiar aspect. The leaves were tortuous and interlaced or "snarled," the macro-spores large and crested, the microspores present in about equal quantity, the sporangia spotted. A minute search among hundreds of specimens failed to discover another, and the only specimens in my herbarium of similar aspect were some collected by Macoun on Vancouver Island in '90 and sent under name of *Nuttalli* (the real *Nuttalli* was, however, sent from the same section). Wishing to determine whether this was a freak or a new species, I made extended search in 1896 at the type locality of *Eatoni*. The pond is formed by damming Powow River in East Kingston, N. H., so it floods a space $\frac{1}{4}$ - $\frac{1}{2}$ mile wide and $1\frac{1}{2}$ miles long, extending back well into Kingston.

In the lower part of this pond—the type locality for *Eatoni*—the search was futile; but in the upper part, in Kingston, I found it in the greatest abundance, in places lining the banks in a strip a rod wide and 4 or 5 rods long, to the utter exclusion of everything else, the leaves, about 18 inches long, being so close set that they

might have passed as a grass patch. When growing so thickly the trunks were small, but when more scattered they sometimes attain a size of $1\frac{1}{4}$ inches, with 75 leaves, 18 inches long. These leaves under water ascend spirally, fall flat and decay on subsidence of water, and a new growth appears, shorter, tortuous and often intricately interlaced in a manner not heretofore noticed in any Isoetes.

I made several trips to the locality in '96 and observed it in all its phases. In '97 the water was not drawn off till the middle of September, so the immersed form was rarely observed, but it was characteristic so far as noticed. Inasmuch as the terms vernal and æstival as applied to the leaves imply a dependence on the season, while the forms depend entirely on the water, long when submersed, short when growing on the bank after the water has been drawn off, I abandon them and use the terms "submersed" and "emersed" leaves respectively, which terms are sufficiently self-explanatory.

ISOETES DODGEI, n. sp. *Trunk*, bilobed, .4-3^{cm} ($\frac{1}{8}$ -1 $\frac{1}{4}$ in.) in diameter; *leaves*, 10-75, submersed 20-45^{cm}. (8-18 in.) long, erect when plants are close set, spirally ascending when scattered, mostly female; emersed, stouter, 2-3^{mm}. (1-1 $\frac{1}{2}$ in.) in diameter, 10-15^{cm}. (4-6 in.) long, tortuous and intricately interlaced, mostly male, both with many stomata and usually 4 bast-bundles. *Ligula* 2^{mm}. (1" in.) long, sharply lance-triangular; *velum*, $\frac{1}{5}$ - $\frac{1}{4}$ indusiate; *sporangia*, thickly sprinkled with light-brown cells. *Macrospores*, globular, 500-675 μ , averaging 560 μ in diameter, sparsely covered with irregular crests, set on a reticulate pattern, especially on young spores. As the spores develop, the crests separate into irregular or isolated groups, with large bare spaces between, or rarely they extend across one face of the spore. They are always serrate or spinulose-rosulate at the top. *Microspores*, ashy, 22-40 μ , average 32 μ , papillose.

This belongs next *I. riparia*, from which it differs in its larger size, longer leaves, narrower vellum, more isolated and jagged sculpture of the macrospores, larger microspores, narrower dissepiments to the leaves, as, indeed, the whole interior structure is different; and especially in the bast bundles, which are nearly always present. At one time I thought it might be *I. riparia* var. *Canadensis* Eng., and had it compared with specimens at the Missouri Botanical Gardens, through the courtesy of Dr. Trelease. As they differ in so many points no doubt of their being distinct can be entertained.

It is very desirable to get specimens of the plants referred to riparia by Dr Engelmann, from Uxbridge, Mass., and Brattleboro, Vt., for comparison. The locality of Mt. Desert for *I. riparia*, given by Redfield & Rand is invalid, the plant being a large form of Tuckermanni, which I call var. boreale. It seems strange this plant is so abundant at one end of the pond and not found at the other; also that it should be found at two localities so far apart as New Hampshire and Vancouver Island and not in the intervening space. As soon as competent collectors begin to hunt for Isoetes, however, it will doubtless be found common.

I take pleasure in dedicating this species to Mr. Raynal Dodge.

DORSET FERNS.

I WAS greatly interested in Dr. Underwood's article in the October BULLETIN, in regard to the Ferns of Scolopendrium Lake. It has stimulated me to write an account of a place in Vermont, which I believe to be equally remarkable. I believe this state is generally conceded to be one of the most profitable for students of Ferns. Certainly Dorset is both profitable and interesting. To be brief, let me say that at my boarding place I was known as the woman who found ferns, and requests were made to me to bring them in for general inspection. In response, one day, I said I would go for a walk, and in two hours I would bring home more than thirty varieties. Accordingly I started out to fulfill my promise, and at the time specified, I was on hand with thirty-seven varieties. I will name them in the order in which they occur in *Gray's Manual*, using also his nomenclature, as I am most familiar with that.

Polypodium vulgare, *Adiantum pedatum*, *Pteris aquilina*, *Asplenium Trichomanes*, *A. ebeneum*, *A. angustifolium*, *A. thelypteroides*, *A. filix-fœmina*, *Camptosorus rhizophyllus*, *Phegopteris polypodioides*, *P. Dryopteris*, *Aspidium Thelypteris*, *A. Noveboracense*, *A. spinulosum intermedium*, *A. s.*, var. *dilatatum*, *A. cristatum*, *A. c.*, var. *Clintonianum*, *A. Goldianum*, *A. marginale*, *A. acrostichoides*, *A. aculeatum*, var. *Braunii*, *Cystopteris bulbifera*, *C. fragilis*, *Onoclea sensibilis*, *O. Struthiopteris*, *Woodsia Ilvensis*, *Dicksonia pilosiuscula*, *Osmunda regalis*, *O. Claytoniana*, *O. cinnamomea*, *Botrychium lanceolatum*, *B. matri-cariæfolium*, *B. ternatum*, var. *obliquum*, *B. t.*, var. *dissectum*, *B. Virginianum*, *B. V.*, var. *gracile*, *Ophioglossum vulgatum*.

Most of these were in great abundance—the rarest one being *Asplenium angustifolium*. As the woods are being cut down where it grew, it will doubtless soon disappear, if it has not done so already. But in another part of the town it grows in great profusion, in company with *Aspidium Goldianum*. Indeed, the luxuriance of these two ferns in this second locality, exceeds anything I have ever seen elsewhere.

A walk in another direction was made memorable by finding *Asplenium Ruta-muraria* and *Pellæa gracilis*, each of them in great abundance.

Now in view of this long list of ferns, may not Dorset claim the first rank in point of variety?—*Emily Hitchcock Terry, Smith College, Northampton, Mass.*

DEVELOPMENT OF FERNS FROM SPORES.

A field in which very little has been done, but one which has much of interest in it for the student, is found in watching a young fern as it develops from the spore. Miss H. D. Hutchinson who has been experimenting in this way with *Pteris serrulata*, sends a drawing showing the development of the first five fronds which is herewith reproduced. She writes that observation of numerous plants has shown



that the first three or four fronds are always produced after the same pattern. The seventh frond often fruits. We are also indebted to Miss Hutchinson for a series of plants showing these various stages of development.

BOTRYCHIUMS IN AN ODD PLACE.

BEFORE making a systematic study of ferns the Botrychiums were entirely unknown to me, I never having gathered them with other strange plants or even noticed their peculiar growth. Since making their acquaintance, however, they have always shown themselves whenever present and I have been able to distinguish them at a distance even when among other thickly growing plants. About Boston the typical *Botrychium ternatum* is quite rare, only a few specimens having been found in rich woods. The variety *obliquum* is, however, very plentiful in moist sunny pastures where it is associated with *var. intermedium* and *var. dissectum*. In each of two such places I have, in early September, collected over fifty specimens, their golden fruit being conspicuous among the grass and the purple gerardia, polygala, and running blackberry vines which frequented the same spots. *Botrychium ternatum*, varieties *obliquum* and *dissectum*, we often find near the paths under bushes in dark woods. In such places only a few specimens are found and these are seldom fruited.

During the first week of last August while in the Yellowstone National Park, I was astonished at finding two plants of *Botrychium* in a surprising location. At an altitude of about 7,500 feet is the mud geyser region. Here the mud-volcano belches forth, with disagreeable sounds, hot mud and steam, which having reached the plants in the vicinity has deposited upon their foliage a thin coating of the ejected matter. Within thirty feet of this crater are several boiling springs and it was on the edge of one of these, on a soil consisting in a great part of geyser formation and almost devoid of vegetation that I found in company with some little sedges, and, if I remember rightly, pipewort, that I found these *Botrychiums*. A few feet away a few large plants of a rugged species of the orchid *spiranthes* lent their erect white forms to the weird scene. There was considerable heat in this place as it was exposed to the sun and the ground was hot, too, from the internal heat which here and there manifests itself by cracking the surface and sending out steam and bubbles of hot water. Although growing in a situation unlike that in which we find this genus, these two plants flourished and seemed to be "to the manor born." The specimen which I have preserved grew to the height of seven inches. The fertile segment

has a long, coarse, hairy, ridged stalk. It has six pairs of pinnæ, the lowest pair being twice and the others once pinnate. It forms a heavy panicle of good sized pods and clearly shows its foliate origin. The sterile segment has a short thick petiole the divisions of which are large, hairy and somewhat contorted. The divisions and sub-divisions of this sterile segment follow close upon one another. They are somewhat ovate in form and denticulate. It most nearly resembles variety *intermedium*. On the whole it was a luxuriant plant. In another geyser basin more removed from any active spring and in a spot where a few trees were growing I found another plant of this moonwort.—*Frances Zirngiebel, Roxbury, Mass.*

NATURALIZATION OF EXOTIC FERNS.

RECENTLY three cases of exotic ferns becoming naturalized about New York have been reported. At a meeting of the Torrey Botanical Club, Dr. N. L. Britton reported the naturalization on Staten Island of a fern whose native home appears to be Japan. The other cases were reported by Mr. F. S. Curtis, who brought us plants of *Pteris tremula*, and what is doubtless *Dryopteris patens*, which he had collected on a stone wall at the entrance to the tunnel under Park Avenue in New York City. This tunnel is used by the New York Central Railway, and trains are passing constantly, yet in all the smoke and dust, exposed to the sun and with scarcely any moisture, these denizens of a warmer climate have persisted for years. One plant of the *Pteris* had nearly twenty fronds, living and dead, the tallest being seventeen inches high and well fruited. It is supposed that these plants originated from spores blown from some nearby florists. Walls in the city, facing the north, frequently bear young ferns in spring, but these do not exist through the summer. The others, however, have not only lasted through the summer, but what is the greater wonder, endured the rigors of a northern winter.—*Willard N. Clute.*

Mr. W. H. McDonald inquires where he can find *Onoclea Struthiopteris* growing near New York City. It seems to be the general opinion that this fern is not common along the seaboard, and we believe it is not known within one hundred miles of New York.

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

President, C. E. WATERS, Baltimore, Md.

Vice-President, MRS. A. D. DEAN, Scranton, Pa.

Secretary, ALVAH A. EATON, Seabrook, N. H.

Treasurer, JAS. A. GRAVES, Susquehanna, Pa.

Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—The report of the officers for 1897 will be issued some time in January and will be mailed to all members of the Chapter. It will contain a revised list of the members, and all who wish to make any change in their address should notify the Secretary at once.—C.

—The following new members have been admitted to the Chapter since October 1st: Miss Elizabeth Billings, Woodstock, Vt., C. H. Holcomb, Brookline, N. H., active, and Miss Mina K. Goddard, Lexington, Mass., associate. Miss Lura L. Perrine, an associate member, has changed to the active list.—C.

—The October election has given us the following officers for 1898: President, C. E. Waters; Vice-President, Mrs. A. D. Dean; Secretary, Alvah A. Eaton; Treasurer, Jas. A. Graves. The vote for President resulted in a tie between Messrs. C. E. Waters and Will R. Maxon, which the Executive Council decided in favor of President Waters. The full report of votes cast will appear in the annual report.—C.

—The plan for giving a fern book to members of the Chapter worked so advantageously last year that preparations for repeating the experiment are already being made. It is the intention of the Executive Council to place as much fern literature in the hands of our members as possible. A new fern book is nearly ready and will shortly be mailed to all active members whose dues are paid for 1898. The Treasurer, whose address appears at the head of this department, will promptly acknowledge all dues sent him. Associate members who wish to change to the active list may do so by sending the proper amount for dues with notice that they desire to change.—C.

—Mr. C. F. Saunders, 305 Walnut st., Philadelphia, Pa., whose excellent article on *Woodsia Ilvensis* appears in this issue, will send a specimen of this fern to any member of the Chapter who encloses five cents in stamps for postage and packing. Mr. Charles Louis Pollard, who with Dr. Joseph Crawford, has the honor of discovering *Ophioglossum arenarium*, described by Mrs. Britton in this number, generously offers single specimens of it for five cents in stamps. His address is U. S. National Museum, Washington, D. C.

OUR MISCELLANY.

Mr. W. H. McDonald an indefatigable fern collector, writes that in a single walk in the vicinity of Bronxville, Westchester county, N. Y., he found no less than twenty-two species of ferns. Taking into consideration the nearness of this locality to New York City, the record is surprising.

Miss Edith Bates writes that on October 9th she found a quantity of *Asplenium pinnatifidum* within the city limits of Philadelphia, growing on gneiss rock. She discovered the locality about eight years ago, but thought it had been since exterminated at this point. The fronds were large and thrifty, one measuring seven inches long, and three of them were forking.

Mr. Samuel Henshaw, of the New York Botanical Garden, tells us of a new and unique way of procuring ferns from spores. It is merely to take a common flower-pot, stop up the hole in the bottom, fill it with water and set it in the greenhouse or conservatory near the ferns, of which young plants are desired. The water percolates through the pot just fast enough to keep the outer surface properly moist and the spores floating about in the air come in contact with this surface and at once germinate. Until they get their third frond they seem not to require more sustenance than they are able to procure in this situation.

The first number of the *Plant World* (Oct. 1897) contains a very interesting article on the Sword Moss (*Bryoziphium Norvegicum* (Brid.) Mitt.) by Mrs. E. G. Britton. Mrs. Britton tells in a delightful narrative way of her experience in collecting the fruit of this moss, which was before unknown. There is also a good plate and a complete description of the moss with the following list of N. American localities: Columbus and Lancaster, Ohio; lower Ohio and southern Kentucky; Dells of Wisconsin River; Ferns, Indiana; Lamoille Cave, Minnesota. Mrs. Britton offers to send a specimen (sterile) of the moss to all BULLETIN subscribers who send her a self-addressed stamped envelope.

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

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IN a recent issue we mentioned some of the good things in store for readers of this magazine during 1898. In order to present these in acceptable form, we have now improved the mechanical side of the journal by new type and a better grade of paper. We hope this will have due weight with those who are trying to decide whether or not a journal which gives all the news regarding ferns is worth fifty cents a year. Many have expressed a wish that the FERN BULLETIN be issued oftener. This can be done, either by increasing the subscription price or the subscription list; in other words, we must have larger revenues to do it. We do not intend to again raise the price of this journal, but, if we can add five hundred more subscribers to our list, we will issue it bi-monthly. If each of our present subscribers will get us the subscription of a friend, we shall be ready for a more frequent issue at once.

* *
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WITH this number we begin the publication of four pages extra, devoted to the mosses. So many of our fern students are students of the mosses also, that this department will properly fall in with their line of work. To those who are not acquainted with this fascinating group of plants, it may be said that here is a chance to know them. The clear and concise accounts of our common species which Dr. Grout and others are preparing for our columns, will enable all who wish for a better knowledge of them to obtain it, while the shorter notes will give the learner helps and "short-cuts" that are not found in the books. There is one thing

yet lacking among students of the mosses and that is an organization for mutual help, similar in scope to the Fern Chapter. Here is a chance for some energetic Bryologist to bring all these interests together into one strong society that will help the individual more than he can help himself. This journal will gladly do all it can to assist such a movement.

* *

ALTHOUGH the Fern Chapter has a page of its own, some mention of this active society, just finishing its fifth year of work, may be made here. In 1893 there were four persons who suggested a society for giving particular attention to the study of ferns. Before this had been organized the number of persons interested had increased to a dozen, and from that time to the present the Chapter has steadily increased in strength and influence. It has nearly reached, if not passed, the hundred mark in membership and the increase continues. The society has been of immense benefit to beginners in giving helps over hard places, and to older students in placing them in communication with others, leading to an exchange of specimens, the interchange of thought and the formation of lasting friendships. What was begun tentatively has proven by flourishing vigorously that there is a broad field for it in the realms of science.

* *

THE time at which the American Association for the Advancement of Science meets in Boston next summer, has been fixed upon as the date for a meeting of fern lovers. There are upwards of a hundred persons interested in ferns in that city and the knowledge that we are to have a meeting there, will, it is expected, bring as many more. Several instructive and valuable papers will be presented and other topics for discussion announced. Mr. George E. Davenport assures us that the Bostonians will take pleasure in welcoming students from other sections and an enjoyable time is anticipated. Committees and program will be published in our April issue.

* *

THE thanks of the Editor are due to some unknown friend in England for copies of the British Pteridological Society's reports for the years 1894-7. This society was founded in 1891 and has a membership of about fifty. One meeting is held each year for the discussion of matters pertaining to ferns and the reading of papers upon various subjects of interest to fern students. The titles of some of the papers that have thus far been presented are:

“Some Results of Fern-hunting in Ireland,” “Fern Reproduction,” “The Marvelous Side of Fern Life,” “Ferns of the Diamond Jubilee,” “Weissmann’s Theory of Heredity and its Relation to Fern Life,” “Selective Culture,” etc. These titles will give some idea of the scope of the society, but one must read the papers themselves to understand how widely the aims of fern students in Europe differ from those in America. Here, the lovers of ferns, led by our own Fern Chapter, are giving attention to the life histories of the ferns, comparing forms as nature made them, discovering new stations in which they grow, and constantly increasing our knowledge by contributing the facts brought out by close and careful observation. In England, however, the interest in ferns has developed along very different lines. Starting with practically the same species that we have, their attention has been given almost wholly to the development of varieties, or monstrosities, as we would be inclined to call them. This is carried so far that an American student, although knowing the parent species well, might be much perplexed to name its wonderful offspring, so changed is it in appearance. In justice to our British cousins it must be said that the development of these varieties is not allowed to proceed hap-hazard, but all plants that do not come up to the proper standard of excellence are ruthlessly weeded out. Many of the forms are curious, some are beautiful and all are interesting, but we are inclined to think that in the study of our native ferns in their haunts the American student has the best of it.

NOTES.

—The latest aspirant for favor among lovers of botany, *The Plant World*, contains in its initial number an entertaining article on “Ferns of the Yosemite and Neighboring Sierras,” by S. H. Burnham. The habitat and manner of growth of numerous western ferns are given.

—We have received from the author, Dr. A. J. Grout, a copy of his “Revision of the North American Isotheciaceæ and Brachythecia.” In this revision Dr. Grout has correlated and brought up to date the recent work on the American species of this group of mosses which before was scattered in various publications. The habitat and distribution of each species receives considerable attention and a number of excellent keys reduces to a minimum the work of determining genera and species.

—*Popular Science News* for November contains an article on "Superstitions Concerning Ferns."

—The author of "How to Know the Wild-flowers" will soon issue another volume on the same lines for lovers of ferns. Those who have read her other volumes will await the new book with interest.

—The third number of the "Student's Handbook of the Mushroomrooms of America" has recently appeared from the press of A. R. Taylor, Washington, D. C., and is fully up to previous issues. It contains three colored and two uncolored plates, and the text includes an analytical table showing prominent characteristics of the genera of Agarics, with a list of the genera of Hymenomycetes.

—The following list of Monographs of North American mosses may be useful to those who wish more complete descriptions than those given in the Manual. The genera "Physcomitrium, Bruchia and Scouleria," Mrs. E. G. Britton; the genera "Thuidium and Claopodium", Dr. G. N. Best; "Brachythecia and Isotheciaceæ," A. J. Grout. These are all printed in the publications of the Torrey Club. The genus "Fissidens" has been revised by Prof. C. R. Barnes, and "Amblystegium," by Prof. L. S. Cheney. These last have been published in the *Botanical Gazette*. The following additional Monographs are being prepared: A completion of the "Leskeaceæ," Dr. G. N. Best; "Dicranum," Prof. R. H. True; "Eurhynchium," A. J. Grout.

—Mr. William Tricker has performed an acceptable service to flower lovers in the publication of his book, "The Water Garden,"* recently issued. The increasing interest in the cultivation of aquatics makes the present volume both timely and valuable. Apparently every point upon which the amateur may desire information is treated. The making of ponds, planting, hybridizing, propagating seed saving, etc., all have their place in the volume. Not only does the author write of how and where to grow aquatics, but the margins of the aquatic garden receive attention as well. Several chapters are devoted to the hardy herbs, shrubs and trees that assist in making the shores attractive. The value of the book is further enhanced by nine plates, eighteen full page views and numerous illustrations in the text.

*"The Water Garden," by William Tricker. The A. T. De La Mare Printing and Publishing Co., New York. Small quarto. Price \$2.00.

MOSS DEPARTMENT.

EDITED BY DR. A. J. GROUT.

Items for this department should be addressed to Dr. A. J. Grout, Plymouth, N. H.

THIS department is opened with the purpose of enabling any one at all interested in mosses to get some knowledge of these plants without excessive labor or expense. The articles in this first number will be followed by articles on collecting, mounting, methods of study and other topics of general interest. In the following numbers, as in this, we propose to describe and illustrate one or more of our common mosses and to continue this so long as it seems helpful or advisable.

The editor will also try to identify for subscribers difficult specimens accompanied by notes and return postage, but will not agree to do so if either of the above conditions is not complied with. All letters requiring a reply must also contain return postage. The specimens will be kept unless something to the contrary is requested.

* * *

It is also hoped that the BULLETIN may become a medium for the communication of bryological notes of interest in the same way that has been so admirably done in the case of ferns and fern-allies. Notes are earnestly solicited from all our moss students. The editor also plans to have ready for distribution specimens of as many of the species taken up as is possible. A nominal charge for each specimen will be made to pay for postage, labels, assistance in making up packets, etc. The same arrangements for distribution to subscribers will be made in this department that is made in the case of ferns, i. e., members having mosses to distribute will announce the fact in the BULLETIN and send out their material at their own terms.

OUTFIT FOR THE STUDY OF MOSSES.

FOR the study of mosses we should have a good hand-lens, a compound microscope with a magnifying power of 100 to 200 diameters (a two inch eye-piece and a one-half and one-fifth lens make a good combination), a pair of dissecting needles, a pair of small sharp scissors, a pair of fine pointed forceps and a

pair of sharp eyes; also the following books: Lesquereux and James' "Manual of the Mosses of North America," price \$4.00; and "Analytic Keys to the Genera and Species of North American Mosses," by Prof. C. R. Barnes and Fred D. Heald, price \$1.00. Jameson and Dixon's "Handbook of British Mosses," costing about \$5.75, will be very useful.

Do not be appalled by the above list as it will be possible to learn many of the common mosses with the BULLETIN, hand-lens and the sharp eyes, and if driven to it one can do very well with the eyes and the BULLETIN alone. The editor knows twenty-five or more species of New England mosses that he can recognize without the aid of any lens, and nearly all of these possess characters sufficient to enable others to recognize them from a careful description accompanied by a simple illustration.

THE HAIR-CAP MOSSES.

THE Common Hair-cap moss (*Polytrichum Commune* L), is the most common and easily recognized of the group. The Latin and English names of this moss are both unusually appropriate. So common is it that scarcely any roadside or meadow is free from it. In many portions of New England it is a great nuisance in old meadows, entirely killing out the grass and covering the ground with a dark green mat of its closely growing upright stems.

From the figure of the fruiting plant it will be seen that it belongs to the acrocarpus division of the mosses, which have their fruit borne on the ends of the main stem. The plant with fruit grows from two to six inches in height. The base of the stem is fixed in the earth by a tangle of thread-like rhizoids which answer the purpose of roots and root hairs. Above are the leaves arranged in ranks, and from the top of the stem springs the long slender seta, bearing at the summit the square capsule or spore case. In the freshly matured plant the capsule is covered with a hairy cap (*calyptra*), whence the name Hair-cap Moss.

The seta and capsule of the moss correspond to what is commonly called a fern, while the rest of the plant corresponds to the prothallium, and if the base of the seta be carefully examined it will be found to be swollen and covered with little flask-shaped bodies, the archegonia.

The fruit of the moss has developed from just such a body which was fertilized by an antherozoid, produced in the anthe-



POLYTRICHUM COMMUNE L.

1.—Male and female plants, about one-half natural size. 2 and 3.—Capsules with and without calyptra 4.—Mouth of capsule, enlarged. 5.—Teeth of peristome, greatly enlarged. 6.—Antheridium and paraphyses, greatly enlarged. 7.—Leaf, enlarged. 8.—Margin of leaf enlarged to show tooth and cells. 10.—Cross-section of leaf to show lamellæ on upper surface. 9.—Lamellæ, greatly enlarged.

Taken by permission from Mrs E. G Britton's "Mosses of the Eastern United States." (in preparation).

ridium (fig 6). The antheridia are borne on separate plants in terminal rosettes (fig 1). Both antheridia and archegonia grow intermingled with slender hairs called paraphyses (fig 6).

Returning to the capsule we shall find, if our plant is mature, that at the top of the capsule there is a lid or operculum (fig 3), which can be pulled off and which lets the spores escape. A strong dissecting microscope will be needed to see the antheridia and

archegonia and a compound microscope will be necessary to make out most of the following points:

If after removing the operculum we examine the mouth of the capsule under a low power we shall find it to be surrounded by a row of 64 teeth; this row of teeth is called the peristome. The points of the teeth are lightly attached to a membrane stretched across the mouth of the spore case. Under the compound microscope the leaves appear lanceolate and sharply serrate with a clasping base made up of large, nearly colorless cells, while the upper part of the leaf is much more dense, and is deep green. The midrib or costa is very broad and consists of several layers of cells while the margin consists of a single layer. In order to increase the light-receiving area this plant has adopted the curious contrivance of sending out from the upper surface of the costa radiating layers, lamellæ, a single cell thick. These are shown in a cross section of the leaf at fig. 10. The upper cell in this species is concave on its upper edge, as is shown in the greatly magnified lamellæ at fig. 9.

There are six species of *Polytrichum* which occur in New England. The most common species next to *P. commune* is *P. piliferum* Schreb., Awned Hair-cap Moss, which grows in dry situations around ledges and gravelly places. It is much smaller and is readily determined by the long slender awns at the apex of the leaves. I have collected this on the very brow of The Profile, Franconia Mountains. *P. juniperinum* Willd, Juniper-like Hair-cap Moss, is also common in woods or peat bogs and is easily distinguished by its lighter color and the incurved margins of the leaves. If you climb any of the higher mountains you are sure in moist places to find *P. strictum* Banks, the Erect Hair-cap Moss. This is distinguished from all our other species by the dense felt of radicles which sometimes covers nearly the entire plant, and from *P. juniperinum* of which it was formerly reckoned a variety, by the erect appressed leaves and cubical capsules. The three species last named have entire leaves. The only other species likely to be met with is *P. Ohiense*, Ren. and Card., Ohio Hair-cap Moss. This has serrate leaves and is not always readily distinguished from *P. commune* by an inexperienced observer. *P. commune* has the capsule cubical and entirely covered by the calyptra, while in *P. Ohiense* the capsule tapers into the seta and is not quite covered by the calyptra.

While the limited supply lasts specimens of *P. commune*, *P. strictum*, *P. juniperinum* and *P. piliferum* will be sent to any subscriber upon receipt of ten cents in stamps.

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THE FERN BULLETIN

VOL. VI.

APRIL, 1898.

No. 2.

FERNS IN THE NEW JERSEY PINE BARRENS.

By C. F. SAUNDERS.

RICH in flowering plants as is the flora of the New Jersey Pine Barrens, the species of ferns found there are rather few, although these few include at least two species, to do homage to which in their native haunts, the plant-lover thinks it no hardship to make long pilgrimages. These are *Schizæa pusilla* and *Lygodium palmatum*. The latter is one of the loveliest of American plants, with twining stem adorned with palmate leaflets, bearing small resemblance to the popular idea of a fern. It loves the shaded, mossy banks of the quiet streams whose cool, clear, amber waters, murmuring over beds of pure white sand, are so characteristic of the pine country. There the graceful fronds are to be found, sometimes clambering a yard high over the bushes and cat-briars; sometimes trailing down the bank until their tips touch the surface of the water.

The *Lygodium* is reckoned among the rare plants of the region—though often growing in good-sized patches when found at all—and is getting rarer. Many of the localities which knew it once now know it no more, both because of the depredations of ruthless collectors, and to some extent, probably, the ravages of fire. The plant is in its prime in early fall, but may be looked for up to the time of killing frosts.

Very different in aspect, though closely related in certain essential structural features, is *Lygodium's* cousin *Schizæa*, represented in the New Jersey Barrens by the species *pusilla*, whose fertile fronds (much taller than the sterile) rarely exceed four inches in height. It delights in the damp sand and sphagnum of those abrupt depressions which one often comes upon in the pines, suggestive of amphitheatres in which elves might gather to hold plays. Here the vines of the wild cranberry creep; *Lycopodiums*, mosses and sundews luxuriate; and that odd little member of the

Gentian family, *Bartonea tenella*, displays its tiny blossoms side by side with the gorgeous orange spikes of *Polygala lutea* and the purple ones of *P. cruciata*. Though choosing such sunny spots for its residence, our shy little friend nevertheless shows a decided preference for a bit of shade, and most likely will be found in modest retirement beneath the shadow of a huckleberry bush or under the protecting shelter of a clump of grass. In some localities its boon companion is *Lycopodium Carolinianum*, the most delicate of our club-mosses and a plant which, whenever seen, may encourage the hope of finding *Schizæa* nearby. It is not, however, a sure "call-plant," as in one spot at Forked River last fall, the fern was found with no *Lycopodium* discernible in the neighborhood except an occasional plant of *L. inundatum Bigelovii*.

The fertile fronds of *Schizæa* mature early in autumn, and have browned, shed their spores, and usually fallen before winter sets in; but the sterile fronds are evergreen and their green spirals may be collected in mid-winter by the sharp-eyed. Though so inconspicuous in the tangle where they grow as to test the keenest eyesight, these sterile fronds possess such distinctive characteristics in their cell structure that the late Dr. J. Gibbons Hunt is quoted as saying of them that with a microscope "the botanist need find no difficulty in identifying the smallest fragment of the plant." As sometimes occurs in human nature, so here in vegetable nature, we have a case of a powerful individuality resident in an insignificant frame.

The two species by which the genus *Woodwardia* is represented in the Eastern United States, are both frequent in these New Jersey barrens. Of the two, *W. Virginica* seems rather the commoner, and is one of the handsomest plants of the swamps which form its home. In favorable situations its noble fronds are often two feet or more in length, poised upon smooth, dark stipes of much beauty. This fern spreads by means of long, black rootstocks, creeping close under the surface of the ground, and will usually be found at its best in July. The spore cases then form a genuine linked chain of brown on the backs of the fronds—an arrangement characteristic of the genus, and earning for both our species the common name of "Chain Fern."

In September, in similar situations, we shall likely notice the curious, fertile fronds of *Woodwardia areolata*, their long, narrow pinnæ loaded with heavy chains of sporangia. Tall and gaunt they stand, on polished stipes of purplish brown or

black, amid green patches of what at first glance appear to be the broad leaves of the sensitive fern (*Onoclea sensibilis*), but which somehow do not look quite like it, either. If we dig up a few plants, however, both sorts will be found springing from one root-stock and we are enabled to recognize then, the two forms of the same fern. Sometimes fronds are found intermediate between these two forms—analogueous to the so-called variety *obtusilobata* of *O. sensibilis*.

In such swamps in spring, *Osmunda cinnamomea* and *O. regalis* unfold their stately leaves of almost tropical magnificence, and disposed in large crowns. *Pteris aquilina*—the “brake” or “bracken” of Old World song and story—grows to the very edge of the swamps, but is most abundant in the dry sand of the Pine Barrens, luxuriating in sunny openings.

Among the most characteristic plants of the Pine Barrens are several *Lycopodiums*, which creep and flourish in evergreen vigor in sandy bogs, in wet savannas and on the damp sand in low places and by streams. *L. Carolinianum* has already been alluded to. It is a beautiful little plant, peculiar to the Pine Barren regions of the Atlantic coast, and in New Jersey, the most northern limit, it is quite abundant. *L. inundatum* is of much wider range. In the New Jersey bogs it is often found with fertile stems five or six inches high (the variety *Bigelovii*), and requiring care to distinguish it from *L. alopecuroides*, which grows in similar situations. This latter is also found at its northernmost limit in New Jersey, and is a striking plant, with stout, bushy spikes which so well resemble little fox-tails as to make the specific name quite appropriate. In damp ground under the pines, *L. obscurum* spreads its pretty fans. This is the Ground Pine, which is so unceremoniously pulled up at Christmas time, tied into ropes and sent to town for purposes of decoration.

[NOTE :—Besides the ferns mentioned above, Britton's Catalogue of the New Jersey Flora gives *Asplenium platyneuron*, *Dryopteris acrostichoides* and *Botrychium ternatum* as found throughout the State. This would of course include the region of the Pines, but I do not seem to have noticed them in my excursions.—C. F. S.]

It is said that *Blechnum spicant* grows nearer to the north pole than any other known fern. It gets its common name of deer fern from the fact that reindeer eat it. This species is also called jointed-pod fern, from the shape of the fertile fronds.

BULBLETS OF LYCOPODIUM LUCIDULUM.

MENTION has already been made in the BULLETIN of the bulblets found on many plants of this interesting species which is not uncommon in moist places in rich woods. It is a very hardy plant and when placed in water in a vase will keep fresh and green for weeks or even months. While gathering some recently (Jan. 29) for this purpose, I accidentally came across the little plant which is shown in the accompanying drawing. The three scales of the bulb were yellowish-green and the rest of the plant, except the single root-fibre, was a glossy green, in spite of the previous cold weather, the ground even then being frozen.



At this place the plants are on a very steep bank where they are continually being beaten down and covered by sliding earth and leaves so that in their efforts to reach the air very large stems result; one specimen was twenty-two (22) inches long. It represented a growth of fifteen years, as was determined by counting its rings of larger leaves which are produced at the end of each season's growth.—*C. E. Waters, Baltimore, Md.*

NOTES ON EQUISETUM SCIRPOIDES.

MY experience with this plant leads me to believe that like many other small plants it is considered rare because it is overlooked. When growing in grassy or sedgy places it would be well nigh impossible to find it in mid-summer. I made my first field acquaintance with it on an April walk while the snow still lingered on the shady banks. It grew in a cold, boggy meadow and showed plainly above the dead leaves of last year's sedge and grass. I gathered a few plants and looked at my books to find out where to go for fruit. Gray's Manual said, "Fruiting in summer," so I waited until after the field had been mown and went back. Only after a long search was I able to find the plant,

although I remembered the exact locality. So closely did it resemble the grass stubble that one who was not looking for it would never have seen it, and there were no signs of fruit except some problematical, dead, black bunches on the ends of the stems, but these had been present in the spring also.

The next year I resolved to keep a close watch on it until I caught the fruit. I began searching almost as soon as the snow was off and was rewarded by an abundance of perfect fruit, which was at its prime during the last week of April, contemporary with the anemone and dog-tooth violet. The fruiting buds are formed the season before and remain at the apex of the stems as a dense, black knob which stretches up and expands into spore-bearing spikes late in April. Some of these buds abort and have been mistaken for fruit. Good fruit appears to have been very rare. I have never seen any except that collected by myself.

I am aware that none of the books give date of fruiting as earlier than the second week in May. My plants were collected in northern Vermont, where the season is from one to two weeks later than in Boston. It has also been collected in fruit as early as April 28, at Rochester, N. Y., by M. S. Baxter. In my opinion the best time of all the year for searching for this plant is as soon as the snow is off the ground in spring. It will be found in fruit a week or two later.—*A. J. Grout, Plymouth, N. H.*

PELLÆA ATROPURPUREA IN CULTIVATION.

IN the Dolobran Wild Garden, on the estate of C. A. Griscom, Esq., at Haverford, Pa., the most important feature is the presence of two old building-stone quarries transformed into model gardens for native plants. Crevices in the rock walls were plentiful, as were also the spaces between the rough stone used for steps at various points. For planting in these fissures numerous species of plants were used, but it is my purpose to speak here only of the use of *Pellæa atropurpurea* in the work.

This fern was found growing between the heavy stone used for abutments to a railway bridge over a road. No plants were found in the immediate vicinity of this place; in fact the fern has not been noticed in any other spot in this locality, which has been fairly well searched for other species of plants. Moreover, not a single specimen could be found on the opposing wall of the bridge, but little over a rod distant. How the fern ever became estab-

lished in this strange place is something of a puzzle. Where found the ferns were growing only a few inches in height, yet were so plentiful that they filled nearly every crack in the wall and were wedged so firmly between the rocks that an iron, made for the purpose, was needed to remove them. About two hundred were collected and planted in the garden, in both shade and direct sunlight. The fern is doing well between stone steps in an exceedingly dry and sunny position, and it is also thriving as well in quite dense shade.

Gray's Manual gives the habitat of this fern as "calcareous rocks;" but I find that with this fern, as also with many others that are generally found on limestone cliffs, no addition of calcium to ordinary soil is necessary for their culture. The rock in the garden here is in general a mica schist and should contain no calcium, and the soil in which the ferns were planted is a mixture of decomposed mica schist and wood-soil lying above the same rock. There would seem to be a sufficient lack of calcium here to prove that its over-abundance is not necessary for the growth of the plant. It would be of interest, however, to know the reason for the seeming preference of the fern for calcareous rock when it can grow to perfection in size at least under other conditions. Where the fern has been planted in very narrow seams in rock of micaceous sandstone, it has grown only a few inches in height and has peculiar rudimentary-like fronds, many of which are simply round-reniform in shape. Here the lack of root-room is the main cause, at least of their dwarf state, as where the seams are wider the fern has attained its normal size and appearance.

When introduced into the garden in 1895 and '96, the ferns were only two or three inches in height, but now where root-room has been sufficient the plants have fronds eight to ten inches long and with two or more years' growth should form plants of the size of which the fern is capable.—*F. W. Barclay, Haverford, Pa.*

FERN STUDY IN GREAT BRITAIN.

IN your remarks in connection with the different lines along which the interest in ferns has developed in the United States and here I cannot altogether coincide. Here, as with you, the first step was the giving of "attention to the life histories and comparing forms as nature made them;" the next was the discov-

ery of very wonderful varieties, also "as nature made them"—since they are found wild—and the next step usually, since these varieties (which no one acquainted with them accounts as "monstrosities") are much more beautiful in most cases than the normal, was their cultivation and propagation. This has since resulted in more advanced types, but indubitably the very finest, with few exceptions, are nature's handiwork and just as unsophisticated as the commonest. Here we have had sixty years, at least, of development of fern taste and I should be very much surprised if you do not find that sooner or later the varietal branch will grow on your side as it has on ours. Wait until one of your members lights upon a parallel to *Asplenium Felix-fœmina* *Victoriæ* on one of your lakesides and see then whether his interest in ferns "as nature makes them," will not be immensely enhanced; dub his find a "monstrosity" and see what he will say to you, and then calling your members together and "comparing forms as nature made them" see what their verdict will be as regards comparative beauty. Did we owe our collections to long continued breeding from slight natural variations, then indeed our taste might be challenged, but when the best of our types, plumose, crested or merely curious, are of nature's own fashioning, cropping up in some inscrutable way, usually as solitary specimens, among their common fellows, surely the student "has not the best of it" who shuts out the possibility of their discovery from the scope of his hobby. Out of the latest published list of over 1,800 distinct forms, no less than 1,100 were found in a perfectly wild state and in such localities as to remove the slightest suspicion of their being strays from collections apart from the evidence afforded by their distinctness.—*Chas. T. Druery, F. L. S., V. M. H., 11 Shaw Road, Acton, London, W., Eng.*

Cheilanthes lanosa.

I have not found this fern except in one place—Torbits, Chester county, S. C. It is not an easy place to reach, as it is back from the county roads on what is here called a "neighborhood" road. It is about seven miles east of Chester, on Rocky Creek. Where the road crosses the creek there used to be a grist-mill, the remains of which are still to be seen. Going down the stream a few rods from here, and on the left bank, the *Cheilanthes* is found in abundance. It grows mostly on rocks where there is but little earth, and that seems to be held in place largely by the roots of this fern. It is on a steep hillside and but a few feet above the water.—*H. A. Green, Chester, S. C.*

NOTES FOR THE BEGINNER.

I.—WHAT A FERN IS.

WHEN one comes to inquire of his plant-loving friends, he is surprised to find how very few of them know anything about ferns. The great majority of those who are well acquainted with the flowering plants give up at once when they come to these. The fact that ferns can reproduce their kind, without the aid of anything in the visible semblance of a flower, is almost as much of a mystery to the present generation as it was to the ancients, and the study of this most beautiful group of plants is neglected because of the difficulties supposed to be connected with it. But the difficulties are more apparent than real. The writer knows of one young man who identified sixteen species of his vicinity the first season, with but one book to assist him, and without previous botanical knowledge.

In these papers I shall try to clear up some of the obstacles that present themselves to the beginner in the study of ferns. And first let us define what a fern is. So many things that are not ferns are often believed to be—such as the finely divided foliage of the yarrow and various other plants—and so many true ferns are in appearance so little like the popular conception of a fern, that such a definition at once becomes necessary.

One of the cardinal points that distinguishes a fern from the higher plants is what is called the alternation of generations; that is, it takes two generations to round out the life of a fern, and only one generation for higher forms. The latter are reproduced by seeds, and when these are germinated, we expect from them plants like those from which the seeds came. But ferns have no seeds, and what might be taken for such are the *spores*. If the spore comes into a favorable situation for growth, usually the moist surface of earth or rock, it does not at once give rise to a new fern, but instead develops a flat heart-shaped body no larger than one's little finger nail, called the *prothallium*. Upon this are borne what correspond to the pistils and stamens of higher plants, and when fertilization has taken place, the form commonly known as a fern grows from it.

If one examines the back of a fern-leaf, about mid-summer, he will be likely to find it covered with brownish dots or lines which may be mistaken for minute insects or some fungus which has



attacked the plant. (Fig. 1.) Under a magnifier these dots and lines are resolved into heaps of tiny globes (Fig. 2), which are usually attached to the leaves by a short stalk (Fig. 3.) In these globes the spores are de-

veloped, and from them comes the first generation of the fern. The heaps of globes are called *sori* (singular, *sorus*), and the globes themselves are called *sporangia*. Sometimes the young sori are covered with a thin membrane called the *indusium* and this should be remembered, as it plays an important part in the identification of the species.

The leaves of ferns are called *fronds*, the part corresponding to the stem being called the *stipe* and the rest the *lamina* or blade. It will be noticed that they differ from other leaves in two important particulars. First, they are not folded or plaited when young, but are rolled up like a watch-spring (Fig. 5), and develop by unrolling and expanding. Second, the veins fork. In the higher plants, a few strong veins give off smaller ones at irregular intervals, but in the ferns the first veins divide into two equal branches, and when these divide again it is always into two equal divisions. (Fig. 4).

There are other additional characters that serve to distinguish the ferns from other nearly related groups, or from one another, but the above are all that need be taken into consideration now. When one finds a plant whose leaves have forked veins, bear spores, and are rolled up in the bud, he may be sure he has a fern. With the exception of the cinnamon ferns (*Osmunda*) and the Christmas fern (*Dryopteris acrostichoides*), the ferns of the Northern States do not fruit before midsummer. In the next paper something will be said about where to find and how to identify our common species.—*W. N. C.*

ISOETES MINIMA n. sp.

PLANT amphibious; *trunk*, trilobed, 3-4^{mm.} wide by 2-3^{mm.} high; *sporangium*, unspotted, 4^{mm.} long 1.5 wide; *velum*, $\frac{2}{3}$ - $\frac{3}{4}$ indusiate; *leaves*, 6-12, 2-4^{cm.} long, round, slender, .67-.74^{mm.} in diameter, with four variable, peripheral bast-bundles. Dissepiments of leaves very thick, the lateral of width of 2-6, and median and dorsal of 6-9 very large cells. *Macrospores*, globose, 290-350 μ , covered with short, slender, blunt, distinct spinules. *Equatorial commissure* pectinate or beset with polished spinules. *Microspores*, papillose or sparingly spinulose, white, 26-31 μ , average 27 μ in length. *Stomata* many, as in all *amphibiæ*. Damp places in prairie near Waverly, Spokane county, Wash. W. N. Suksdorf, No. 2365.

This is a very peculiar species in many ways. Among United States species it is the only trilobed one with partial velum. It is one of three now known to be trilobed habitually, Nuttalli and an undescribed species from California (*Orcuttii*) being the others. It is the smallest American species. An entirely peculiar character is shown by the equator, which resembles a ship's wheel with the spinules for handspikes.—A. A. Eaton.

OUR MISCELLANY.

It is a difficult matter to induce our ferns to put forth new fronds upon being brought into the house in autumn, but when they have had a proper rest they are more easily influenced. Some roots of *Polypodium vulgare* and *Dryopteris acrostichoides* brought into the house in February, and placed in a flower-pot, began unrolling their fronds within a week.

Having *Phegopteris hexagonoptera* "to burn," I amused myself with the experiment you suggested in your last issue. I have no "globules of carbonate of potash" to show, and am only minus a fine lot of *Phegopteris*, as each burned to very black ashes. The specimen had been gathered in different localities at different times.—Miss Sadie F. Price, Bowling Green, Ky. [The editor has recently tried this experiment, and while he got no globules of potash, the ashes were pure white, and probably had much potash in them. Under the most favorable circumstances, it may be possible to get globules of potash.—ED.]

We have to thank several readers for calling our attention to an error in the January number, which stated that *Onoclea Struthiopteris* does not grow within one hundred miles of New York city. It has been reported at Easton and Narrowsville, Pa., and along the Housatonic river at Gaylordsville, Conn. These localities are all at a considerable distance from the city. If there are nearer localities we shall be glad to hear of them.

A writer in an old *Garden and Forest* says: "I have found beautiful crested forms of two species. * * * One plant, *Aspidium marginale*, was surrounded with numerous smaller ones, all of which were crested at the end of each division of the frond." I am not certain that I know this form. Is it anything unusual?—*Miss S. F. Price*. [This is doubtless one of the natural variations which Mr. Druery writes of in the October BULLETIN. They may be found occasionally in nearly all our ferns if one is on the watch for them.—ED.]

Referring to the contribution of Mr. Charles T. Druery, of London, in a recent issue regarding fern variation in Great Britain, I would say that perhaps not all the readers of the BULLETIN are aware of the great interest in fern variation taken in England. As an example in "Fern Growing" by E. J. Lowe, there are given names to 123 varieties of the lady fern and to 140 varieties of the hart's-tongue. Among these are *Scolopendrium vulgare obtusidentatum costale* and *Asplenium Filix-fœmina congestum laciniato-cristatum*. These forms are mainly produced by cultivation, a branch of pteridology which as yet has been given but little attention in the United States.—*Raynal Dodge*.

I have had another trip to the homes of some of our rare little ferns on Mt. Mansfield and its vicinity, and for most of them it has been, I think, a very good year. I have never seen such long fronds of the *Asplenium viride*, or of the *Pellæa atropurpurea* (nearly 15 inches), or the *Asplenium ruta-muraria*. I found magnificent "walking ferns" which had already taken two steps and were starting out for the third. But some vandals have been up to our mountain ravines this summer and have been trying to exterminate some of our rarest little species. If I ever find out who rooted out every frond from our *Aspidium fragrans* cliff, that fellow had better not try to join our Chapter. If he does, I promise him I will find some one to cast the needed two adverse ballots.—*James A. Bates, Randolph, Vt.*

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

President, C. E. WATERS, Baltimore, Md.

Vice-President, MRS. A. D. DEAN, Scranton, Pa.

Secretary, ALVAH A. EATON, Seabrook, N. H.

Treasurer, JAS. A. GRAVES, Susquehanna, Pa.

Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md

—The fern to be distributed this quarter is offered by Mr. L. T. Stevenson, Chat, Lassen county, Calif. Members of the Chapter will receive specimens of the beautiful little *Cheilanthes Clevelandii* upon sending five cents in stamps to Mr. Stevenson.—*W.*

—The fifth annual report of the Chapter was issued in March. Besides the reports of the officers, it contains a list of the Chapter's members and the dates when they were admitted. This list includes one hundred and four names, ten of which were added since January, 1898. We now add that of Mrs. Josephine D. Lowe, 178 Carlton avenue, Brooklyn, N. Y., as an Active Member.

A New Plan of Study.

It has been suggested that the Chapter select a particular fern for thorough study each year. It is hoped that by thus bending our energies to the study of a single species, many new facts will result. The fern selected for this year is *Adiantum pedatum*. Notes of any kind relating to this fern are earnestly desired. The plan provides for an editor, to whom all notes and reports should be sent. These will be carefully arranged and published in a pamphlet by the Chapter. Mr. Alvah A. Eaton, Seabrook, N. H., has been appointed editor for this year by the president. The fern chosen is common and every one has a chance to add something to the report. Study the plant in its native haunts with reference to the soil, shade, moisture, etc. Note its companion plants and everything interesting or peculiar in its life-history. Further information may be obtained from the editor.—*W.*

A correspondent asks: Are there two species going under the name of *Cystopteris bulbifera*? What is the colored dust on the *Gymnogrammes*? Who will enlighten him?

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

THE FERN BULLETIN CO., PUBLISHERS, BINGHAMTON, N. Y.

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AGAIN it is our pleasure to call attention to the fact that the FERN BULLETIN has added four more pages to each issue. The cordial support given to our Moss Department has warranted us in making this enlargement. While primarily intended to aid the moss students, all our readers will receive the benefit, as no increase in price is contemplated. Beginning with this issue, the Moss Department will also be issued separately at twenty-five cents a year. This is to enable students of the mosses to keep the moss literature separate if so desired. Only a limited number of copies will be thus issued, and those who wish a complete set should subscribe at once. The rapidity with which the early numbers of the BULLETIN disappeared is likely to be repeated in the case of the *Bryologist*. Dr. Grout will continue to have editorial supervision of the journal.

* *

THE Fern Chapter has adopted a plan of study which can but result in the discovery of many new facts regarding our ferns. Supplementing this we wish to offer a modest prize for original work among these plants, and for the best article or series of notes upon any one of our ferns or fern allies received before October 1, 1898, we will give a copy of a fern book by Underwood, Robinson, Cooke or Dodge, as the writer may select. To win this prize it is only necessary to study carefully the fern nearest at hand, and send us the result of your observations. Papers in response to this offer should be marked, "Submitted for the Prize."

THE Fern Chapter has cause for congratulation. In January it passed the hundred mark in membership, and is fast making progress toward a second hundred. So far as the editor is aware, there is only one other strictly botanical society in America that exceeds it in numbers.

* *

WE are indebted to the courtesy of the *Bulletin of the Torrey Botanical Club* for the illustration which appears as the frontispiece of this number. It presents a view of the newly discovered *Ophioglossum arenarium*, which was described in that journal by Mrs. Britton last December.

* *

OUR thanks are due Dr. P. Magnus of the University of Berlin, Berlin, Germany, for several interesting publications received, Dr. Magnus is especially interested in rusts, and has published a paper on a new genus of rusts discovered by himself on *Phegopteris*. He is at present giving much attention to fern rusts, and if any of our readers chance to find fronds attacked by rust, it will please Dr. Magnus very much to receive specimens.

* *

IF one is studying ferns for the mere beauty of form which they present, he may take the view of the case adopted by Mr. Druery in this number. The contention of the person who is studying ferns scientifically is apt to be, that, at their best, the majority of British forms are mere varieties of species. We can well see how one might admire them in the conservatory or fern garden, and yet pass them by when studying ferns a-field. The study of varieties may teach us something of the way in which forms originate, but there are a hundred and one questions in fern study which can only be answered by close observation of the species themselves.

NOTES.

—The *Asa Gray Bulletin* which is advertised in combination with the FERN BULLETIN in this issue, is doing for flowering plants what this journal is trying to do for ferns, and should be in the library of all who are interested in general botany. No subscription at the combination rate will be received unless the sender is a new subscriber to one or both journals.

—*The Plant World* for March, contains an article on "The Adder's-Tongue Ferns," by Mrs. E. G. Britton, in which the genus is treated at some length. Illustrations of the outline and venation of the fronds of our North American species are given.

—We have received from the author, Prof. T. J. Fitzpatrick, Lamoni, Iowa, a copy of "Ferns of Iowa and their Allies." Forty-one species embraced in nineteen genera are mentioned. Enough keys and descriptive matter is included to enable the student to identify any of the ferns he may find within the state.

—The annual meeting of the Vermont Botanical Club was held at Burlington, Vt., Feb. 4th and 5th, 1898. Upwards of a dozen papers were presented; among them was one by Rev. J. M. Bates entitled "Among the Ferns." This consisted of an exhibition of some eighty species of ferns from various parts of the world, with remarks upon them. A note from Mrs. A. J. Grout recorded a "New Fern From Vermont" which was believed to be a remarkable variation of one of the *Osmundas*.

—The two numbers of the "Student's Hand-book of Mushrooms of America" that remained to be published have recently appeared and are of the same excellent character as the others. Number four deals with the well-known puff-balls and their allies, and the following number treats of the poisonous *Amanitas*, with observations on the poisons found in other groups. It is probable that another series like the present will ultimately be issued to include the species not mentioned in this.

—A most interesting and valuable contribution to fern literature has just appeared from the pen of Dr. H. Christ, entitled "Die Farnkrauter der Erde"*. It is a well printed volume of four hundred pages and treats of some eleven hundred representative species of ferns from all parts of the world. The species mentioned are described at considerable length, and two hundred and ninety-one good illustrations add to the value of the text. The author takes the middle ground in the matter of genera and recognizes ninety-eight. We note the separation of the genus *Struthiopteris* from *Onoclea*, and the retention of *Aspidium* for *Dryopteris*. Those who read German will find this book one worthy of a place in their library.

*Die Farnkrauter der Erde, von H. Christ. Gustav Fischer, Jena. Price 12 marks.

—Beginners in the study of mosses will find the Analytical Keys in Dr. Grout's "List of Mosses," described on another page, one of the best aids they can procure. We can supply it for fifteen cents in stamps. It will be given with a year's subscription to the FERN BULLETIN for sixty cents.

—Those interested in the flora of Texas, will find "Botanical Explorations in Southern Texas" by Mr. A. A. Heller, especially helpful. In 1894 Mr. Heller spent several months collecting in the vicinity of Corpus Christi, and San Antonio, which resulted in the above mentioned volume. It is an octavo of a hundred pages, containing a list of the plants collected, with numerous notes concerning them.

—Directions for performing thirty-five experiments connected with the growth, movements, respiration and composition of plants are given in "Laboratory Exercises in Vegetable Physiology"* by Prof. J. C. Arthur, of Perdue University. These directions are explicit enough to guide the student in manipulation, but he is left to make his own deductions from what he sees. The pamphlet is neatly printed, has several illustrations, and will be of interest to all students of this branch of botany.

—It has now been about eight years since a complete catalogue of the plants of North America north of Mexico was published. In that time the amount of new material which has accumulated has rendered a new list very desirable. This has been given us by Mr. A. A. Heller, whose "Catalogue of the North American Plants North of Mexico" is now ready. There are nearly fifteen thousand numbers given. The arrangement of the families and the nomenclature of the species is in accord with the most recent ideas on the subject. In typography and make-up the book is excellent. Copies may be had for sixty cents by addressing the author at the University of Minnesota, Minneapolis, Minn.

*"Laboratory Exercises in Vegetable Physiology" by J. C. Arthur. Kimmel & Herbert, Lafayette, Ind. Price 35 cents.

Mr. Charles J. A. Knowles records a forking frond of *Polypodium pectinatum*, and Miss Margaret Slosson adds four other species that have this peculiarity, namely: *Woodsia obtusa*, *Asplenium ruta-muraria*, *Phegopteris Dryopteris* and *Osmunda Claytoniana*.

THE BRYOLOGIST,

A DEPARTMENT OF THE FERN BULLETIN,

DEVOTED TO THE STUDY OF NORTH AMERICAN MOSSES.

EDITED BY DR. A. J. GROUT, PLYMOUTH, N. H.,

To whom all correspondence regarding the mosses should be addressed.

This department is issued separately at twenty-five cents a year. Subscriptions should be addressed to the Fern Bulletin, Binghamton, N. Y.

AMONG some of the good things in store for the beginners is an illustrated glossary of the terms in common use in bryological literature.

* *

IF you find the BRYOLOGIST interesting and helpful, mention it to your neighbors and friends. If it has induced you to subscribe to the FERN BULLETIN, this department will be materially aided by your informing the publishers of the fact.

* *

THE response to the first issue of this department has been very gratifying; many sets of the mosses offered have been sent out and the Editor has had his hands full of work identifying the mosses sent him. As will be seen by reading this issue, the Editor has at once obtained valuable assistance.

* *

IN addition to the articles designed to interest the beginners in the study of mosses, we shall in future publish in each issue a series of notes on new and rare mosses, and a resumé of all the recent publications on American mosses, including a list of all new species and those newly discovered in America, with a brief diagnosis of each. So many new mosses are being published in foreign periodicals difficult of access to the majority, that something of this sort has become almost a necessity. The BRYOLOGIST will endeavor to take up this work where the new edition of Barnes' Keys stopped.

* *

THE Editor has just issued a "List of Mosses Growing in Vermont, with Analytical Keys to the Genera and Species." This list contains about 240 species included in 72 genera. While primarily intended for the use of Vermont students, it will be almost equally useful to students in other northeastern states. Its

advantages over any other American work of a similar character are these: Great attention is given to the habitat of each species, that is, it tells one in what sort of place to look for each. While the keys and text include most of the common mosses of the northeastern states they are much simplified by the omission of many species which never occur in our limits and serve only to confuse the beginner in other keys in which they are included. It is the only American book on mosses, excepting monographs, with a nomenclature conforming to the Rochester Code. It is a very great inconvenience to unlearn names and learn new ones in their places. This inconvenience is best avoided by learning in the beginning the names which are to be used in the literature of the future. With the exception of the genus *Hypnum* and a few other doubtful cases, the names here used are the names to be adopted in subsequent American works. A complete index, and the synonymy of Lesquereux and James' Manual make the list easy to use with existing literature. The price is fifteen cents, postpaid. A copy of the list and a year's subscription to the *BRYOLOGIST* will be sent for thirty cents.

THE POGONATUMS OR BEARDED MOSSES.

THE generic name of the hair-cap mosses comes from two Greek words meaning many hairs, in reference to the hairy calyptra. The Pogonatum, which are very closely related to the hair-cap mosses, take their name from a word meaning a beard. Indeed, when you first discover one of the Pogonatum you will wonder what new hair-cap you have found. Dr. Robert Braithwaite, in his superb *British Moss-Flora*, has included the Pogonatum in the hair-cap mosses, but to most American students it has seemed better and much more convenient to keep them separate. So nearly alike are the two that we shall need no figure of the Pogonatum. They have the hairy calyptra, the lamellate costa, and the general habit of the hair-caps. They are, however, readily distinguished by the fact that the capsules are round instead of square and there are 32 teeth instead of 64. As in *Polytrichum*, the species are dioicous, that is, the male and female reproductive organs, antheridia and archegonia, are borne on separate plants.

There are four species of *Pogonatum* found in New England and the North Central States. The one most likely to be met

with is the slender Pogonatum (*P. tenue*—*P. brevicaulis* of many authors). It grows on bare clayey soil of banks, roadsides, and ditches. The plants do not grow close together but scattered, so that they look like small green dots against the lighter color of the soil. The stems are very short and simple, without branches; the leaves are few, 5–10, radical and very close to the ground, serrate, with few, 8–12, lamellæ. If the ground around the plants be examined, it will be found to be covered with a green felt, the protonema (fig. 1), which is composed of slender, green, alga-like threads that spring from the germinating spore and later give rise to the mature moss plant. In this species, contrary to the general rule, the protonema lasts throughout the life of the plant. The abundance and persistence of the protonema may account for the small number of leaves and the reduced size of the plant, as it doubtless does as much starch-making as many leaves could do. The capsules are cylindric, nearly or quite erect, and are covered with very minute wart-like projections called papillæ. The short-leaved Pogonatum of the New Jersey pine barrens and southward is much like this species, but is easily distinguished by its shorter entire leaves. The urn-like Pogonatum (*P. urnigerum*), is fully as common as the slender Pogonatum in the hilly districts of New England. The stems are much longer, usually branched, naked below and densely leafy above, without persistent protonema. The leaves are serrate, but larger, with very many, 40–50, lamellæ. The capsules are very much like those of the slender Pogonatum. The alpine Pogonatum (*P. alpinum*), is almost sure to be at first mistaken for a hair-cap because of its large size, 2–6 inches in height. It is more likely to be met with than its name indicates, as it is not uncommon in New England on exposed places at an altitude of 1,000 feet or even less. It is readily distinguished by its size, its smooth and inclined or slightly curved capsule. Only those who are privileged to visit our higher mountains need expect to find the hair-like Pogonatum (*P. capillare*). It is most likely to be mistaken for the urn-like Pogonatum, from which it differs in its shorter capsule, nearly simple stem, and in the terminal cell of the lamellæ which is flat-topped; in the urn-like Pogonatum it is sharply rounded. The leaves are also much more curled when dry.

The common hair-cap moss is one of the few plants that have an almost world-wide distribution. It is found in all parts of North America, in Europe, and in Asia.

NOTES ON THE LIFE HISTORY OF THE MOSSES.

THE great majority of mosses mature their fruit in autumn or winter so that the spores are ready for germination in the spring as soon as the proper conditions of moisture and temperature arrive. When this time comes, the spores, which have been scattered by the wind and the jostling of small animals, burst their brown coats and send out delicate threads (fig. 2). These threads are of two kinds, those that are at the surface of the substratum such as those of the slender *Pogonatum* (fig. 1); these form the protonema, a tangle of green threads that might easily be mistaken for *Algæ*. Those which grow down beneath the surface are called rhizoids and serve the purpose of roots. This distinction between protonema and rhizoid is more apparent than real as each may develop the other and very often does so.

The protonema goes on growing like an *Alga* for a considerable time until it has reached the proper stage of development, when the first moss bud is formed (fig. 3), on some favorable portion of the protonema by the repeated division of a single unfertilized cell. Thus it will be seen that the whole moss plant thus far and including the protonema corresponds to the prothallium of the fern.

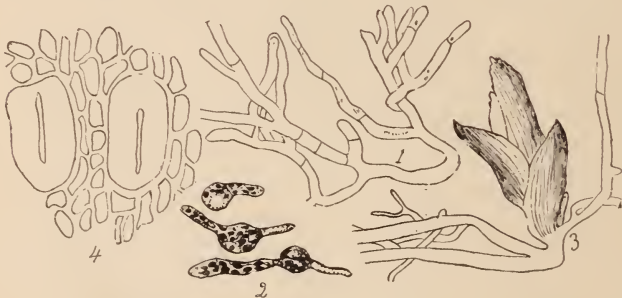


Fig. 1—Protonema of *Pogonatum tenue*. Fig. 2—Germinating moss spore (After Goebel). Fig. 3—Young moss plant starting from protonema. Fig. 4—Stomata and cells of base of outer (exothecial) wall of capsule of *Polytrichum commune*. Figs. 2 and 4 are magnified about twice as much as 1 and 3.

As no doubt our readers all know, the ferns have what is called an alternation of generations, the prothallium represent-

ing one generation, the sexual, so-called because of the fertilization of the archegonia by the antherozoids. The spore bearing fern is called the asexual generation because the spores are formed by simple cell division without fertilization. The capsule and seta of the moss correspond to this asexual generation of the fern.

The great difference between the moss and the fern lies in the fact that in the fern the asexual generation (gametophyte), merely serves as a starting point for the young fern, while in the case of the moss it persists and nourishes the asexual generation (sporophyte), throughout its life and in many cases persists for years, sending up a new sporophyte each year.

In most of the mosses, however, the sporophyte has begun to take care of itself. Referring to fig. 3 of our last issue, a small knob, the apophysis or better the hypophysis, will be seen at the base of the capsule. If we divide the capsule longitudinally we shall find that the spore case does not extend to the hypophysis, but the base of the capsule just above it consists of a loose mass of cellular tissue. The walls of this part of the capsule are pierced by numerous stomata (fig. 4), much like those of the epidermis of the under side of plant leaves and serving the same purposes.

NEW OR RARE MOSSES.

I.—ANACAMPTODON SPLACHNOIDES (Frölich) Brid.

THIS moss, though rare, has an extensive range, being known from Central and Southern Europe, and the Caucasian mountains, as well as from the mountainous regions of the Eastern United States. Although small, and rarely found except in small quantities, it is easily recognized by its dark green velvety appearance and usually abundant fruit, which is so distinctive a character that it has given both the generic and specific names to this species. The generic name refers to the teeth which are bent backward, and the specific name indicates its resemblance to the Splachnums, on account of the contraction below the mouth, which is so noticeable in the older capsules. Besides its unmistakable appearance, this moss has also a peculiar habit, by which it may be looked for and always recognized when found. It always grows around the edges of cavities in trees, where water stands, such as old knot-holes, in the forks of branches, and even on blazed surfaces and scars, usually on fallen trees. It also

loves deep, shady, damp woods at rather high elevations, and wild places, and is more or less abundant in such localities. I have found it completely surrounding a large hole in the trunk of a buttonball tree (*Platanus*) on the bank of the Holston River in Virginia, also on Buckeye, forming dense, velvety green cushions all around the rim of the hole, which was filled with water. In the Adirondack Mountains it grows on fallen beech trees around the base of Mt. Marcy, and I once found it in a blaze on a standing tree on the Boreas range. It is represented in the Herbarium of Columbia University from the following stations: Maine, Massachusetts, New York and New Jersey, Pennsylvania, Ohio, Illinois, Louisiana, and Texas. It fruits from April to November, according to locality, the Texas station being the earliest, as might have been expected. The following notes from other collectors are interesting, and we believe that Mr. Burnett has duplicates for those who wish to exchange with him.—*Elizabeth G. Britton, Torrey Botanical Club, New York.*

Mrs. Britton and myself collected *Anacamptodon* two or three times during a memorable trip to the mountains of southwestern Virginia in 1892. The last time we found it we went through a particularly beautiful valley in the neighborhood of the small hamlet, Troutdale, on the borders of North Carolina. A legendary high cliff where "many mosses grow" was the goal of our journey. We walked several miles, almost losing ourselves in one of the most magnificent of forests. Magnolias, tulips, cherry and walnut trees, oaks and maples were there in profusion, with many others too numerous to mention. Our feet sank deep in the dense mossy carpet and at every turn there was something new and interesting to see and gather. The little scrap of *Anacamptodon* was found growing on a small dry twig, and much to our regret it was all that we found. Needless to say we did not reach the cliffs which to this day seem an El Dorado for future moss-collectors in that locality.—*Anna Murray Vail, New York City.*

Twice only during my four years collecting have I found specimens of *Anacamptodon splachnoides*; in both instances in open woods on the hills nearly 2,000 feet above sea level. Sunday, July 25, while strolling along the banks of a creek about two miles from this city, I found in swampy ground at the base of a maple a mass of this moss over fifteen inches in length and from two to five inches in breadth. Owing to irregularities in the surface I could not remove it entire, but the fragments secured aggregated

over thirty-six square inches and bore nearly 1,000 capsules. The cavity seems to have been lined with a tough elastic fungoid growth, on the moist surface of which the moss grew.—*D. A. Burnett, Bradford, Pa.*

During the past four years, when collecting in Northern Ohio, the writer happened to find several small patches of the above rare moss. On one occasion the tree on which it grew was alive and overhanging the bottom of a creek at about a height of four feet. On another occasion it grew on a dead upright birch. There was in this tree at a height of about four feet above the ground a small cavity, but large enough to furnish room for a specimen of *Viola rotundifolia*, which nearly filled it and was in a thriving condition. It was on the border of this hollow knot that a small patch of *Anacamptodon* was seen growing.—*E. Clason, Cleveland, Ohio.*

I found the *Anacamptodon* twice this past summer—at Franconia Notch, near Profile Lake, N. H., August 19, and in Smuggler's Notch, Mt. Mansfield, Vt., July 5th; both were on old yellow birches and both were in good fruit. The Franconia Notch specimen was lining the lower part of a decaying hole in the birch, and its dark green foliage and curious fruit caught the eye at once.—*Dr. George G. Kennedy, Readville, Mass.*

A few years ago, on a rainy March day, as I was making my rounds, I chanced to see a moss about a rotten knot hole on a sour gum (*Nyssa*), and I scraped a liberal quantity from the bark, for it was something "new." Its color was what attracted my attention, a peculiar shade of bluish-green very different from that of most mosses. It proved to be *Anacamptodon splachnoides*, the first I had seen.—*George N. Best, M. D., Rosemont, N. J.*

NEW AMERICAN MOSSES.

From a Revision of the Claopodiums by Dr. G. N. Best. Bull. Torr. Bot. Club, **24**: 427. 1897.

CLAOPODIUM BOLANDERI Best. A less developed form of *C. crispifolium* (Hook.) R. & C., distinguished by its smaller size, pluripapillate leaf-cells, shorter ($1\frac{1}{2}$ -2cm.) seta, short broadly oval capsule and imperfect cilia. The leaves are broadly ovate-lanceolate with the margins not rugose. From Alaska to California, eastward to Idaho.

From a Preliminary Revision of the N. Am. Isotheciaceæ by A. J. Grout. Bull. Torr. Bot. Club, **23**: 223. 1896.

ENTODON SEDUCTRIX LANCEOLATUS Grout. Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering grad-

ually to the serrate acute apex. On rotten wood, Hanging Rock, Wabash county, Ill., April 3, 1890, J. Schneck.

E. SEDUCTRIX MINUS Aust. Mss. in herb. Entire plant much reduced, dirty green; leaves, seta and capsule shorter than in type. Capsule 1.5–2mm. long, its length about three times its diameter. Ohio. Sullivant. Sand hill near Augusta, Ga., J. D. Smith, Feb. 2, 1877. A portion of No. 388 of Sull. and Lesq. Musc. Bor. Am., in Columbia Herb., issued as *Cylindrothecium compressum* Br. and Sch. is this variety.

E. SEDUCTRIX DEMETRII (Ren. & Card.) Grout. (*Entodon Demetrii* Ren. & Card. Rev. Bry. 20: 14. 1893.) Stems irregularly divided and branched, strongly complanate-foliate, slender, having almost exactly the facies of *E. compressus*; leaves ovate, gradually acute, very entire. Peristomal teeth often irregularly perforate. On stones at top of well, Emma, Saline county, Mo., Rev. C. H. Demetrio.

From "Fontinales Nouvelle," by J. Cardot, Rev. Bryol. 23: 67. 1896.

F. PATULA Card. Distinguished from *F. antipyretica* L. by the leaves straight or little curved upon the keel and very open, by the narrower subcylindric capsule and by the more elongated peristomal teeth with more numerous lamellæ. The form of the capsule approaches that of *F. Kindbergii* Ren. and Card., from which it is distinguished at first sight by the non-cuspidate leaves, shortly and broadly acuminate and not presenting so clearly marked dimorphism. Vaucouver, Macoun.

F. MISSOURICA Card. This species reminds one strongly of *F. biformis* Sulliv., but it is easily distinguished by its more persistent and longly acuminate cauline leaves with more compact tissue and by its less folded branch leaves, which are a little concave at the base, by the infolding of the borders, but not caniliculate. On rocks floating in the creeks, Benton county, Mo., Rev. C. H. Demetrio.

F. WAGHORNEI Card. Belonging to the group of *F. Novæ-Angliæ* Sulliv., but clearly distinguished from other described species by having the leaves nearly entire at the summit, the capsule half emergent, its peristome higher and strongly papillose, with its lattice nearly or quite perfect. *F. involuta* of Louisiana and Florida approaches it most closely, but is more slender, with narrower leaves ordinarily denticulate at summit, and capsule immersed. Trinity Bay and Witters Bay, Newfoundland, Rev. A. C. Waghorne.

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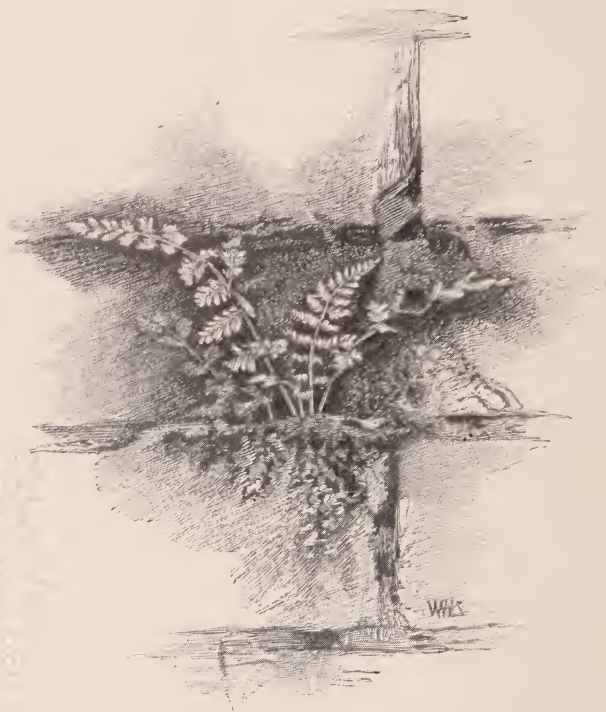
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No. 3.

THE GENUS *EQUISETUM*, WITH REFERENCE TO THE NORTH AMERICAN SPECIES.

BY ALVAH A. EATON.

FIRST PAPER.

WHILE classed among the fern allies, the genus *Equisetum* is essentially an isolated group, resembling the other orders only in reproduction from spores, which produce prothallia, with antheridia and archegonia. In company with other Pteridophytes, it has a vascular system (*i. e.*, the cells are of various forms and arranged in vessels, bast, epidermis, etc.), through which they obtain the name Vascular Cryptogams, to distinguish them from mosses, etc. (the Cellular Cryptogams), whose cells are not so differentiated.

Aside from these similarities, few affinities can be found, and the place of the genus has long been a matter of opinion. It seems to be related to the pines as well as to the ferns; and the calamites, so numerous in the Coal Measures of the Carboniferous age, may be regarded as the common ancestor of *Equisetaceæ* and *Gymnospermæ*.

DISTRIBUTION IN TIME.

Few orders can boast of being older than *Equisetum*, though *Lycopodium* was declining when the scouring-rushes were young. It made its advent in the Triassic; and some of the fossil forms closely resemble some existing species.

NUMBER OF SPECIES.

Milde, in his Monograph, describes twenty-five species. These Baker ("Fern Allies") cuts down to twenty. Whether this be on account of superficial work, apparent in the volume in general, or whether the species done away with are really not valid, can only be determined by access to European herbaria. Several species

are not clearly distinct, as *hyemale* and *robustum*, for instance; no description of one can be given which is not true of some form of the other.

DISTRIBUTION IN SPACE.

It is remarkable that a genus of so few species should have so general a distribution; but more remarkable that the individual species should have so wide a range. America seems to be the home of *Equisetum*. Of twenty-five species given by Milde, twenty-one are found in our hemisphere, and of these, nine are peculiar to it, the remaining twelve having a cosmopolitan range in the northern hemisphere, mostly north of 40° N. Lat.; and two, *arvense* and *variegatum*, were found by Greeley in Northern Greenland. *Arvense* appears again in South Africa; only two other species, *ramosissimum* and *Telmateia*, are found on that continent, the latter but rarely. Europe has twelve species, Asia thirteen, the United States fourteen, Mexico and South America ten, and Australia one.

GENERAL CHARACTERISTICS.

The structure of *Equisetum* is on a single plan, the internode. From the tip of the rhizome to the top of the stem there is no variation, save in degree. So similar are many species that it is only by resort to the microscope that we are enabled, through examination of the interior structure, to recognize them. They are leafless, jointed, perennial plants, often branchless and never forked. The joints are regularly grooved and surmounted by a sheath, bearing on its upper border as many teeth (or a few, more or less,) as there are grooves and ridges on the internode. These teeth are analogous to leaves, and are often spoken of as such.

The epidermis of the stem is covered with a silicious coat, which gives the plants characteristic harshness to the touch, and wins for them the name of "scouring-rushes." This silex is variously set in granules, rosettes, rings, ridges, teeth, and several other ways in the different species, being of considerable diagnostic value, especially in the *Hippochætæ*, where most prominent. The tissue of the stem may be destroyed by burning or by acids, leaving the glass skeleton behind, which is then a beautiful microscopical object.

The number and size of the ridges and grooves also enter into the diagnosis, the former being angled, rounded or again grooved, the latter bearing the stomata, the arrangement and structure of which is a very important factor.

Some species, as *silvaticum*, bear verticils of branches just below the sheaths of the upper internodes. When present the branches are simple, save in a few species, as *silvaticum*, *pratense* and occasionally *arvense*. They are of essentially the same structure as the stem, except that in some species they want the central cavity. In no species of *Equisteum* proper do they habitually bear spikes, but may do so in all, giving rise to the *polystachyum* (many spikes) varieties. The branches of the larger *Hippochætæ* often bear spikes with us, and regularly do so in Mexican and South American species.

At a depth of one to three feet in the soil there is a horizontal, wide-spreading, repeatedly-forked rhizome, composed of internodes with their sheaths much like the aerial stems. Back of these sheaths there are verticils of roots, corresponding to the branches above. Besides this, the rhizome is usually clothed with a cinnamon-colored felt of root-hairs. In some species, as *arvense* and *silvaticum*, some internodes are shortened and thickened, forming tubercles, which are often in series like a string of beads. Their office is unknown, and it is doubtful if they are of any economic use.

The rhizome is the essentially perennial part of the plant. Any fragment will develop into a new plant, if properly situated. At intervals they give rise to secondary rhizomes, which ascend to the surface of the earth, where they produce buds which develop into aerial shoots. These buds, before growth commences in spring, are simply a collection of sheaths and teeth. Growth consists of the lengthening of the internodes, which shoot out like the joints of a telescope. They do not increase in diameter at all as they develop.

The secondary rhizomes are usually from six inches to two feet in length, but it seems impossible to bury the plants so deeply that they will not find their way out. I have seen *arvense* and *silvaticum* flourishing and fruiting from the top of a sawdust pile seven feet deep the second year after being covered.

The spikes are normally terminal on the main stem, raised on a short, flesh-colored peduncle. Usually there is a ring just beneath it, which is easily shown to be a modified sheath, sometimes with normal teeth, and even with a verticil of branches below, as occasionally in *silvaticum*.

The spikes are composed of whorls of little buckler-shaped objects (clypeoles), consisting of a short pedicel and a five or six-

lobed cap, beneath which are borne the sporangia, which, when ripe, rupture and disseminate the spores.

A little observation among growing plants will convince one that the spike is a stem arrested in development. Sometimes an internode in the spike will become lengthened, bearing a normal sheath, thus forming two spikes in series, and I have even found them with branches below the upper spike. In several of the true *Equiseta* the spike may end in a proliferous point, like the end of a sterile stem; and I have seen *arvense* with about half a normal spike, bearing on its top three inches of normal-branched stem.

That the clypeoles are modified teeth may be seen by hunting among *arvense* and *silvaticum* for transitional forms of the ring beneath the spike, when they may often be found with clypeoles and teeth intermixed.

The spores are green, globular bodies, very similar in all species. They bear two bands, fastened together in the middle at right angles. The free ends, ending in a broad expansion, are spirally wound round the spore. These are very hygrometric, unwinding when dry, but coiling tightly round the spore when moistened, as by the breath. These undoubtedly assist the spores in escaping from the sporangia, and possibly in inserting them in places suitable for germinating. The vitality of the spore lasts only a short time, usually less than three days. If sown on water or damp earth they readily germinate, though those on water usually fail to become established as plants. The development of the prothallus by division of cells, the formation of archegonia, ultimately fertilized by the little wriggling antherozoids, are much as in the ferns proper. The prothallia are several-lobed, and usually unisexual, so it is necessary, in order to secure fertilization, for prothallia of both sexes to be contiguous.

The inner structure of the stem is peculiar. In all there is a hollow in the center, extending the length of the internode; in some species very large, in others very small or obsolescent. In cross section this is surrounded first by loose parenchyma cells, then directly under each ridge there is a small opening (carinal), surrounded by bast-fibers, which layer extends from these to the epidermis. Between these carinal openings, but usually a little nearer the exterior, there are larger openings (vallecular), situated directly under the grooves. The outer part of these has a coat of chlorophyl, usually showing as two distinct areas, between which the stomata open into the cavity. Thus the vallecular

openings are directly connected with transpiration. The relative size and position of these parts vary in different species, and are in some the only sure means of determination.

VARIETIES.

As might be expected of plants of so wide a range, there are many varieties, but rarely so well-marked that they might be called sub-species, and many being simply forms or monstrosities. *Arvense* has a dozen or more named varieties, *Telmateia* about as many, as has *hyemale* and several others; while *ramosissimum* has fifteen from Africa, and is accredited with a total of thirty-four.

WHAT IS MEANT BY "VARIETY."

These notes, being intended to engender a systematic study into this much neglected genus, rather than to set forth any peculiar ideas held by the author, will adopt Milde's method and give the name of every form.

As the genus is small, this will not be cumbersome, and it may incite investigation which will shed some light on the causes of variation. The common idea of a "variety" is a well-characterized, more or less constant race of a given species. The term "sub-species" could best be used in that sense. As applied herein, however, the term "variety" includes all forms and monstrosities of a species, without any claim that they are constant.

WORLD DISTRIBUTION OF SOME EASTERN AMERICAN FERNS.

LOOKING through Hooker's "Synopsis Filicum" recently, I was interested in noting where our native ferns of the eastern United States are found outside of our own country. *Cheilanthes lanosa*; *Woodwardia areolata*; *Asplenium pinnatifidum*, *ebenoides*, *angustifolium*, *montanum*, and *Bradleyi*; *Camposorus rhizophyllus*; *Phegopteris hexagonoptera*; *Dryopteris acrostichoides*, *Noveboracensis*, *Goldieana*, and *marginalis*; *Cystopteris bulbifera*; *Dicksonia punctilobula*; *Trichomanes Petersii*; *Lygodium palmatum*; *Schizæa pusilla*, seem to be confined to our own continent. *Adiantum Capillus-Veneris*, rare here, is well distributed through Europe, Africa, Asia, Japan, Polynesia and parts of South America; while *A. pedatum* is credited only to North Hindostan, Japan, Manchuria and Alaska. *Polypodium vulgare* is found throughout Europe to the Azores, Maderia, North Africa,

Asia, Japan, Cape Colony; *P. polypodiodes*, only in South America and South Africa. *Pteris aquilina* is found all round the world, both in the tropics and the temperate zones. It has been reported from the Andes 14 feet high. *Pellæa gracilis* is given from Central Asia; *Pellæa atropurpurea* from Mexico and the Andes; *Woodwardia Virginica*, from Bermuda. *Asplenium platyneuron* is reported from West Indies, Ecuador, Cape Colony; *A. fontanum* from Europe (pretty generally), Lycia and the Himalayas; *A. Trichomanes*, temperate regions of the old world from Britain and the Azores to Himalayas and Japan, South Africa, Australasia, Sandwich Islands and Andes south to Peru; *A. viride*, Arctic Europe to Pyrenees, and Himalayas (at 12,000 ft.); *A. Ruta-muraria*, Arctic Europe to Spain, Algiers, Central Asia; *A. Filix-fœmina*, Europe (generally), Africa, Himalayas (10,000 to 12,000 ft.), Kamtchatka, Japan, Cuba, Venezuela; *A. acrostichoides*, Northeast Asia, Himalayas, Penang. *Scolopendrium* is frequent in Britain and Europe, Azores, Madeira, the Caucasus, Persia and Japan. *Phegopteris Phegopteris*, Europe, Greenland, Iceland and Alaska; *P. Dryopteris*, Europe, Manchuria, Japan, Greenland, Alaska. *Dryopteris aculeata*, though rare in the United States, is found with its varieties throughout the world; *D. Thelpteris*, Europe, Cashmere and Northeast Asia, South Africa, New Zealand; *D. fragrans*, Caucasus to Kamtchatka; *D. cristata*, Europe; *D. filix-mas*, throughout Europe and Asia, Madeira, Sandwich Islands; *D. spinulosa*, Europe, Himalayas. *Cystopteris fragilis*, everywhere in Europe and Asia, also Africa, Australasia, Sandwich Islands, South America. *Onoclea sensibilis*, North Asia and Japan; *O. Struthiopteris*, Europe, North Asia. *Woodsia Ilvensis* and *alpina*, Arctic regions and high mountains, temperate Europe and Asia; *W. glabella*, Norway, Tyrol, Carinthia, Behring's Straits; *W. obtusa*, Andes. *Trichomanes radicans*, Ireland, Wales, Spain, Canaries, Madeira, Fernando Po, Angola, Japan, North Hindostan, Polynesia, West Indies south to Rio Janeiro. *Osmunda regalis*, Europe, Asia, Africa, Brazil; *O. Claytoniana*, Himalayas; *O. cinnamomea*, Mexico, West Indies, Central and South America, Japan, East Asia.—*C. F. Saunders, Philadelphia.*

—Mr. Alvah A. Eaton, Seabrook, N. H., desires specimens of *Botrychium simplex* from all localities to compare with a supposed new species.

A RICH FERN LOCALITY.

IN the October BULLETIN Dr. Underwood reports the finding, near Jamesville, Onondaga county, New York, of thirty-four species of ferns within a circle whose diameter was not over three miles; twenty-seven of which species grew in the immediate vicinity of Scolopendrium Lake, and asks if there is any other locality in the United States where so many species of ferns have been found within such narrow limits.

Near Pittsford, Rutland county, Vermont—the end of a tamarack swamp, a field less than a mile away, and some limestone cliffs three miles from both the field and the end of the swamp, form the corners of a triangle. Within this triangle I have found thirty-nine species and eight varieties (or so-called varieties), although not quite so many species at any one point as Dr. Underwood found at Scolopendrium Lake.

My list is as follows: Species—Polypodium vulgare, Adiantum pedatum, Pteris aquilina, Pellæa atropurpurea, P. Stelleri, Asplenium platyneuron, A. Tricomanes, A. angustifolium, A. acrostichoides, A. ruta-muraria, A. Filix-femina, Camptosorus rhizophyllus, Phegopteris Phegopteris, P. Dryopteris, Cystopteris bulbifera, C. fragilis, Dryopteris Noveboracensis, D. thelypteris, D. spinulosa, D. cristata, D. Boottii, D. Goldiana, D. marginalis, D. acrostichoides, D. cristata \times marginalis, Onoclea sensibilis, O. Struthiopteris, Woodsia Ilvensis, W. obtusa, Dicksonia punctilobula, Osmunda regalis, O. Claytoniana, O. Cinnamomea, Botrychium matricariæfolium, B. simplex, B. lanceolatum, B. ternatum, B. Virginianum and Ophioglossum vulgatum; varieties—Dryopteris spinulosa intermedia, D. spinulosa dilatata, D. cristata Clintoniana, D. acrostichoides incisa, Onoclea sensibilis obtusilobata, Osmunda cinnamomea frondosa, Botrychium ternatum obliquum, B. ternatum dissectum.—*Margaret Slosson, Summit, N. J.*

—Mention has several times been made in this journal of the revision, which is being made by Dr. L. M. Underwood, of the ferns of the Botrychium ternatum group. In a paper recently presented before the Torrey Botanical Club, four new species have been segregated. When the work is completed a synopsis of it will be published in these pages.

NOTES FOR THE BEGINNER.

II.—WHERE TO FIND AND HOW TO IDENTIFY THE FERNS.

IN studying the higher plants we find that they are grouped into families and genera according to the flowers they bear. However different other parts of the plants may be, the flowers of each genus do not differ in any essential particular. In ferns the sori serve instead of flowers for the determination of the genera. Each genus affects a certain type of sorus and, while there are endless variations in the size and arrangement of this, the *shape* and *structure* remain as constant as the flowers of a genus.

In the northeastern states, two families, the spleenworts and the shield ferns, divide the honors in regard to numbers, each containing more than twice as many species as any of the other genera. Their numbers make an early knowledge of how to distinguish them very desirable. Fortunately this is very easy, for the spleenworts (*Asplenium*) bear their spores in short linear sori on the backs of the fronds (Fig. 3), while the shield ferns (*Dryopteris*) bear theirs in round or kidney-shaped sori (Figs. 1 and 2). In both genera the sori are covered with an indusium. The shield ferns are also called wood ferns, because they are mostly lovers of deep shade, though some do not fear the sun if growing in wet places. Seek for them on the borders of swamps, in wet woodlands, ravines and dry, rich woods. So nearly do some species resemble others that the student frequently passes them by, but, after having the differences pointed out, wonders how he ever could have missed them.

Many of the larger spleenworts are also lovers of the woodlands, but the smaller and weaker members seem to crave the protection of the rocks, and will be found on the ledges, especially of limestone, often in full sunlight. At a glance the sori will tell the genus to which they belong. The only apparent exception is the lady fern (*A. Filix-femina*), which delights to grow along old roadsides. When young the sori are curved in horseshoe shape, and the novice might take the plant for a *Dryopteris*, but as it grows older, the sori straighten out into the conventional spleenwort shape.

The polypody (*Polypodium*) must not be taken for a *Dryopteris* because of its round sori, for if we look closely we shall find that its sori are not covered with an indusium as those of *Dryop-*

teris are. (Page 29, Figs. 1 and 2.) It will be found on the top and higher ledges of almost any cliff, the sole representative in our region of a large family of tropical ferns. At the base of cliffs and in damp woodlands will be found the three members of the genus *Phegopteris*, with tiny round sori without indusium. They are often classed with the polypodies, and only differ from them in small particulars. They, too, might be taken for *Dryopteris*. The maidenhair fern (*Adiantum*), so common in rich woodlands, is the only member of its genus within our limits. Its peculiar crescent-shaped sori under a reflexed portion of the pinnule (Fig. 4 and page 29, Fig. 4), serve to distinguish it at once.



The bracken (*Pteris*), a coarse inhabitant of woods, thickets and barren fields, is well known, being readily distinguished by the line of spore cases that border nearly every pinnule (Fig. 5). It is also our single representative of a large tropical family. On limestone cliffs may be found two smaller species (*Pellaea*) fruiting nearly like bracken, but easily distinguished from it by their aspect, smaller size, and place of growth. They are often placed in the same genus with the bracken. The Woodsias are lovers of rocks, and the peculiar star-shaped indusium which is placed *under* the sori, settles the question of their identity at once (Fig. 6). The genus *Cystopteris*, which frequents the same places, might be confused with the Woodsias, judging from the shape of the fronds, but the indusium fixed at one side and half covering the

spore cases (Fig. 7) distinguishes it. In much the same form, but never to be confused with *Cystopteris*, is the sori of *Dicksonia* (Fig. 8), which, under the lens, appear as tiny green cups filled with spore cases, held by reflexed teeth of the frond.

We have still to consider the tall ferns of the marshes and wet woodlands. No one can mistake the cinnamon fern (*Osmunda*) with its tall spike of cinnamon-colored fruit in early spring. Equally noticeable are the two other species, one with fruiting pinnules of brown midway in the green frond, and the other with elegant smooth pinnæ like acacia leaves and a panicle of brown fruit at the summit. All these are very common and grow in clumps. The sensitive fern (*Onoclea*), which is abundant in all wet places, with broad, coarse foliage and fruit in erect, berry-like spikes that are held up above the snow all winter, needs no further description. The Woodwardias have elliptical sori arranged on the back of the fronds like links in a chain. The frond of the common species is closely like that of the cinnamon fern in aspect, but unlike it in coming up singly instead of in clumps. It is found in bogs and easily escapes notice.

The beginner will doubtless find other ferns that are not mentioned in this paper, but familiarity with those of which we have spoken will enable him to refer the others to their proper genera. But the study of ferns does not stop with the identification of them; it rather begins there. In our next paper the matter of collecting, pressing and arranging ferns in the Herbarium will be considered.—*W. N. C.*

OUR MISCELLANY.

Specimens of *Asplenium Trichomanes incisum*, which are said to be even more incised than the average San Diego (Cal.) specimen, are reported from Eastern Tennessee by Mr. Jas. H. Ferriss of Joliet, Ill.

A peculiar instance of the little gray polypody (*P. podioides*) occurring much beyond its usual range is reported by Dr. W. A. Bastedo, who found a single living plant on the dead branch of a tree on the south shore of Staten Island in May, 1896. The plant was some thirty feet or more from the water, and the story of how it got there would no doubt be a curious one. We shall be glad to hear from our readers in reference to this fern's northern range in other parts of the country.

The *Joliet* (Ill.) *News* of May 17, 1898, contains a list of the ferns of Wills county, Ill., with notes by Mr. J. H. Ferriss. We note some common names that appear to have been unrecorded before, as follows: *Onoclea sensibilis*, oak-leaved fern; *Pteris aquilina*, umbrella fern; *Pellaea atropurpurea*, blue fern.

While on a recent trip to Blue Ridge Summit, Md., a great abundance of *Osmunda Claytoniana* was met with. The plants were very large and the clumps made a beautiful appearance scattered through the woods. They were quite as luxuriant on a dry slope, or a sunny spot, as in a moist, shady spot. All were very fertile, fronds with five or six pairs of fertile pinnæ being easily found. The variety of conditions under which they were growing suggests that possibly the fern would be an easy one to cultivate.—*C. E. Waters.*

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

President, C. E. WATERS, Baltimore, Md.

Vice-President, MRS. A. D. DEAN, Scranton, Pa.

Secretary, ALVAH A. EATON, Seabrook, N. H.

Treasurer, JAS. A. GRAVES, Susquehanna, Pa.

Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—A small pamphlet on the Ferns of the Upper Susquehanna is in press, and a copy will soon be mailed to all members of the Chapter whose dues are paid for 1898. Members admitted since January may also have a copy of the pamphlet by dating their membership with the beginning of the year.—*C.*

—For the third time in its history our Chapter has lost a member through death. Mrs. S. H. McAlpine passed from this life on December 30, 1897, aged 55. Her death was very sudden and due to apoplexy. Mrs. McAlpine was born in New Marlboro, Mass., and lived there until her marriage in 1865, when she removed to Portland, Maine, where she resided until her death. She was an ardent botanist, but without aspiring to be more than an amateur. Her loss is mourned by a large circle of friends.—*C.*

—The Chapter ends the second quarter of 1898 with one hundred and ten members. The following have been gained since the last report: Active—Anthony Baumann, Scranton, Pa.; Mrs. C. S. Marshall, Canandaigua, N. Y.; A. D. Choate, 5739 Clemens ave., St. Louis, Mo. Associate—Mrs. Reuben W. Seymour, Chatham, Columbia Co., N. Y.; Mrs. Henry B. Twombly, Summit, N. J.; J. Warren Huntington, Amesbury, Mass. The address of Miss Margaret Slosson has been changed to Summit, N. J. W. A. Bastedo and Miss A. O. Hastings have changed to the associate list. Members may make these corrections on their lists of members. Additional lists may be had from the treasurer for five cents each.—C.

—The spirit of the Fern Chapter and its work is well shown in a recent communication from one of our busiest members, who says, among other things: "It is a matter of pride to me when I get a package of most common things from some novice for identification. I like to tell him some things of interest about them and suggest that he look for certain forms in certain localities and see if he can tell what makes them grow so." And in the hope that we shall ultimately teach all who will be taught to know and love the ferns, he adds, and we add with him—"This appears to be our mission."—C.

—Arrangements for the meeting of fern-lovers in Boston at the time of the meeting of the American Association for the Advancement of Science, is progressing rapidly. It is believed that more than a hundred students of ferns will be present. Several prominent fern-lovers have already signified their intention of presenting papers. The meeting will be under the auspices of the Fern Chapter, but anyone, whether a member of the Chapter or not, is cordially invited to be present and take part in the discussions. Those who wish to present notes or papers are requested to communicate as soon as convenient with Mr. Alvah A. Eaton, Seabrook, N. H. A printed program will be issued as soon as completed, and those who wish a copy should inform Mr. Eaton. The meeting will afford fern students an excellent chance to become acquainted, and all who can attend should not fail to do so.

OUR readers are reminded that there are wonderful possibilities in a postal card for adding to the value of the FERN BULLETIN. Send us your short notes in this way. It only takes a moment to set down the thought which may interest hundreds and be the means of drawing forth a reply of as great interest to yourself.

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

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Articles upon any subject in fern study solicited.

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THE artistic little illustration which forms the frontispiece of this number is reproduced from a pencil sketch by Mr. W. W. Stilson, whose work as a delineator of the beautiful in nature is fast winning a deserved recognition. Aside from its value as a picture, our illustration is of interest from the fact that it shows a fern growing in the crevice of a brick wall, a rather unusual place for a fern in this latitude.

* *

DR. GROUT informs us that nearly fifty sets of some of the mosses offered in April have been sent out. This indicates a greater interest in the subject than was anticipated, and the outcome would seem to be a strong and flourishing Chapter for the exchange of specimens and ideas. If this should start with half of fifty members, there would be good prospects for its soon rivaling the Fern Chapter in size. It is hoped that all who wish to join such a Chapter will notify Dr. Grout at once.

* *

THE first of Mr. Eaton's long-expected papers on the genus *Equisetum* appears in this number and others will follow in each issue until the series is finished. It is Mr. Eaton's intention to illustrate with actual specimens each species and variety treated. These specimens will be sent only to subscribers of the FERN BULLETIN or members of the Fern Chapter. Since all the North

American species will be treated, those who follow the series will have a very interesting set of specimens at the end. All who wish specimens and are not subscribers should subscribe now.

* *

A FRIEND of the FERN BULLETIN has taken the editor to task for some statements on page 28 of the current volume, in which the reproduction of the fern is described. It is also charged that the position taken in comparing ferns and the higher plants upon the basis of the alternation of generations is untenable. In reference to the latter, it may be said that although both ferns and the higher plants go through a prothallium stage in the processes of reproduction, it is only in the ferns and the lower orders that the prothallium is at all conspicuous, forming two *generations* or forms of the same plant, and it was in this sense only that the term "alternation of generations" was used. The seed is the resting stage of the plant and really contains a plant in embryo; the spore is usually the resting stage of the fern, but is not of a similar nature and neither contains a plant embryo nor has the power to directly reproduce one. Between the spore and the "fern," so-called, there exists the prothallium bearing the sex organs and often quite conspicuous. As to the likening of these sex organs to the stamens and pistils of higher plants, to which objection is made, the editor emphatically disclaims any idea of intimating that they are homologous. Our discussion did not include a close study of the method of reproduction, and it was wished merely to indicate in a general way the relationship of the sex organs of the ferns to those of higher plants. It may be well, however, to give a short account of the exact method of reproduction in each, in order to correct any misunderstanding that may have arisen, and incidentally to throw more light on the subject of the alternation of generations. If, then, we take some such fernwort as *Selaginella*, we shall find that it produces spores of two sizes, the smaller, called *micro-spores*, producing prothallia bearing the male sex organs; and the larger, called *macro-spores*, producing prothallia bearing the female sex organs. In the higher plants, the anther contains the micro-spores (or pollen grains), and these, falling on the pistil, germinate, forming male prothallia. The pistil contains the macrosporangia (ovules), and each ovule or macrosporangium normally contains one macrospore, which by cell division forms the female prothallium. The prothallium of a fern, then, might be compared to a flower, inasmuch

as it produces both male and female sex organs. The spermatozoids (produced by the antheridium) correspond to the terminal cell of the pollen tube, and the "egg cell" of the archegonium is the homologue of the "egg cell" in the ovule.

—American fern-lovers have scarcely a conception of the extent to which the business of growing ferns is carried on in the Old World. A valuable little aid to a better knowledge of the subject, a pamphlet entitled "Ferns and Selaginellas," may be had free by addressing Messrs. W. & J. Birkenhead, Fern Nursery, Sale, Manchester, England. In this are catalogued and described nearly fifteen hundred kinds. The same house also publishes a larger catalogue of a hundred pages (mailed for fifty cents), which is profusely illustrated, and, in addition to the species listed, gives much information on the cultivation of ferns. The experience of the Messrs. Birkenhead, however, is summed up in their handy little volume on "Ferns and Fern Culture".* There is seemingly not a point in the growing of ferns upon which this book does not touch. Some of the topics treated are geographical distribution, modes of growth, composts, rockwork, habits of ferns, modes of cultivation, potting, out-door ferneries, rock ferneries, light and shading, temperature, moisture, ventilation, propagation, lists of ferns for cultivation in special ways, insect pests and how to eradicate them, common names of ferns, etc. The book contains upward of a hundred pages, is well illustrated, neatly printed and is bound in cloth.

*Ferns and Fern Culture by J. Birkenhead, F. R. H. S., W. & J. Birkenhead, publishers, Sale, Manchester, England. Price, postpaid, 30 cents.

THE SANTA MARTA EXPEDITION.

IN April a notable expedition sailed from New York for South America, where nearly two years will be spent collecting in the mountainous districts of Santa Marta in the State of Magdalena, Colombia. The region is one of peculiar interest to the scientist from the fact that it is set off from the continent by a broad stretch of flat country, rendering its mountains like an island in many respects. The little that is known of the region indicates that it is rich in species, and it is expected that a thorough exploration will yield many species new to science.

The expedition is under the direction of Mr. Herbert H. Smith, recently curator of the Carnegie Museum, Pittsburg. Mr. Smith is well and favorably known as a collector in tropical lands, having begun collecting in 1870 as an assistant to Prof. C. T. Hartt on the "Morgan Expedition," and later collected for the Brazilian Geological Survey. In 1878-9 he made two trips to Brazil for Scribner & Co., writing a series of articles for their magazine. Beginning in 1882, five years were spent in the central region of South America. Two more were spent in Mexico exploring and collecting for the "Biologia Centrali-Americana." The three years following were devoted to the Caribbean Islands in the interests of the West India Joint Committee of the Royal Society and the British Association. A collection of plants were also made in the West Indies for the Royal Gardens at Kew. With all these duties he has found time to write several volumes of travel.

Mr. Smith will be accompanied by several capable assistants, who will take charge of various parts of the work. The botanical collecting will be under the supervision of Prof. Carl F. Baker, of Auburn, Ala. In distributing the collections, the flowering plants and the ferns will be made up into separate sets and sold separately if desired. The ferns will be named by Prof. L. M. Underwood, and it is expected that the first hundred specimens will be ready early in 1899. Each specimen will be accompanied by label and full data, and in all cases will contain enough material to properly represent all parts of the plant. They will be sold at the uniform rate of ten cents a specimen, delivered in New York or Pittsburg. Orders for the ferns should be addressed to Willard N. Clute, 63 East 49th street, New York City. The ferns will be distributed in lots of a hundred each as fast as they can be named. Orders for the complete sets will be booked in the order they are received, and the early ones will get the more complete sets in case there are not enough of any one species for all. Orders for less than complete sets will be received, but in such cases the selection of the specimens will be made by the collectors. Subscribers pay no money until the first hundred plants are ready, and then only pay for the plants as delivered. The interest and value that will attach to these first collections will render complete sets very desirable, and no delay should be made by any who wish them. Further information regarding sets of either the ferns or flowering plants will be furnished to those interested upon application.

THE BRYOLOGIST,

A DEPARTMENT OF THE FERN BULLETIN,

DEVOTED TO THE STUDY OF NORTH AMERICAN MOSSES.

EDITED BY DR. A. J. GROUT, PLYMOUTH, N. H.,

To whom all correspondence regarding the mosses should be addressed.

This department is issued separately at twenty-five cents a year. Subscriptions should be addressed to the Fern Bulletin, Binghamton, N. Y.

THE Editor has received many gratifying comments from subscribers and also many helpful suggestions. He takes this means of thanking his numerous correspondents for their expressions of friendly interest.

* *

QUITE a number have expressed a wish that the BRYOLOGIST might appear oftener. We shall be only too glad to issue it oftener as soon as our subscription list will warrant it. Therefore if you would like the BRYOLOGIST oftener, get some new subscribers.

* *

THERE seems to be a general desire for a Chapter for the study of mosses organized on somewhat the same lines as the Fern Chapter. The Editor has in mind a person who is exactly fitted for the work of organizing such a Chapter, but he will not consent to take up the work unless a sufficient number express themselves interested. The Chapter will aim to aid students of mosses as much as possible and the dues will be nominal. It is desired that all who wish to join such a Chapter communicate with the Editor at once in order that the Chapter may be on a working basis before autumn.

* *

HERE are some of the comments on the keys in the Editor's List of Vermont Mosses:

"I have given the keys a good trial with my botany class today. They are going to be a fine thing, and I congratulate you upon them."—*Prof. L. R. Jones, University of Vermont.*

"I find it (the List) excellent for acquainting our students with our mosses of New York."—*Prof. Carlton C. Curtis, Instructor in Botany, Columbia University.*

"They work out very nicely and will be useful to students of the local flora as well as to others of the neighboring states, who should be tempted to emulate Dr. Grout's good example."—*Mrs. E. G. Britton in the Plant World for May, 1898.*

HOW TO COLLECT MOSSES.

THE classification of mosses is so largely based on the characters of the capsule and seta that the beginner would best collect only fruiting specimens, unless he may chance to find something particularly striking. If one is to study the mosses at all carefully he must preserve his collections in a systematic way for future reference. The larger the number of correctly named specimens in a collection the more valuable and useful it is. Additional specimens can usually be obtained by exchange or by purchase. It has been the purpose of the Editor to place a series of correctly named specimens within the reach of all our readers because such specimens are almost indispensable for satisfactory work in the study of mosses. If one is to make exchanges, extra specimens must be collected and prepared. One should usually collect enough for six or more good specimens and if the moss seems rare, collect a larger quantity.

Most species of mosses, by reason of their growing on the surface of trees, stones or earth, are subjected to great extremes of drouth and moisture so that they readily soak out in good condition for study, no matter how dried, provided only that they be dry enough to prevent moulding. Much more satisfactory specimens are made by drying under a light pressure. If the moss grows in thin mats it can be transferred bodily to the pressing sheets. If time is abundant, it will be well to separate the mats into sections such as will be distributed for herbarium specimens, wrapping each in a newspaper packet. If, as is often the case, two or more species are growing interwoven, it will be well to separate them. If the mats are thick and consist mostly of erect stems, it is better to break them up into vertical sections or slices. The substance upon which the plant is growing, the date, and the locality should be plainly noted in every case. The Editor always carries some old envelopes in his pocket and finds them very handy for collecting chance specimens.

An unnecessary and troublesome amount of earth or rotten wood often adheres to the plants; as much of this should be removed as can be done without injury to the specimens. After drying it can often be removed more easily. The best season for collecting varies with the plants. The Mniums, the Bryums, the hair-caps and their allies will mostly be in prime condition by July first. Most of the Pleurocarpus mosses are in the best condition

in late autumn to early spring. The beginner would best not try to identify sterile specimens unless they have some striking character. If a perfect specimen cannot be identified, make careful notes and send the specimen and notes to some one who has a better knowledge of mosses.

THE CATHARINEAS.

THE hair-cap mosses and the Pogonatumms belong to the family Polytrichaceæ, which in some respects is the most highly developed of all the mosses. The stem has a central axis of specialized tissue that in structure and function shows a near approach to the central fibro-vascular bundle of the ferns and their allies. The most notable member of the family in point of size is the magnificent Dawsonia of Australia, which reaches a height of 14 inches and has leaves an inch or more in length. There are several other genera belonging to this family, some of which are represented in North America, but the only other genus which our readers are likely to meet with is Catharinea, which, in 1780, was named by Erhart for the Empress Catharine II. of Russia, but sixty-four years later Bruch and Schimper changed its name to Atrichum*. If our readers are troubled by the recent changes of plant names, this instance will show them the justice of restoring names long in use but arbitrarily rejected by the caprice of a prominent botanical writer.

The Catharineas will be easily recognized by reference to Figs. 1-3. They have the lamellate costa of the hair-caps and a peristome of 32 teeth, similar in all respects. The calyptra, however, has become almost bald and shows mere traces of hairs in the spine-like projections near its apex (Fig. 3). The wavy Catharinea (*C. undulata*) is one of our most common and conspicuous mosses, being abundant everywhere on moist, shady banks. The novice will find it not always easy to distinguish the narrow-leaved Catharinea (which is less frequent and the only other species likely to be met with) from the wavy Catharinea. The wavy Catharinea has the leaves rather acute, serrate to the base; upper leaf cells irregular and rounded; capsule more or less curved, frequently several together. The narrow-leaved Catharinea is more slender; leaves more obtuse, less undulate, serrate in the upper

*See Mrs. Britton's article in the *Observer* for May, 1894.

half only; upper leaf cells regularly six-angled, much smaller; capsule less curved, single.

Mr. Dixon says that these two species are separated by a combination of characters, most of which may, at one time or another, be found to some extent in both species. But he adds that they can usually be readily distinguished by the lamellæ, which,



in the wavy *Catharinea*, are few, short and, when flattened out beneath a cover glass, occupy (in the upper part of the leaf) $\frac{1}{8}$ - $\frac{1}{10}$ the entire width of the leaf, while in the narrow-leaved *Catharinea* they will cover $\frac{1}{3}$ - $\frac{1}{4}$ the width of the leaf.

EXPLANATION OF PLATE.

Figs. 1-3—*Catharinea angustata*; 1, plant, natural size; 2, leaf, greatly enlarged; 3, capsule, operculum, and calyptra, enlarged. Figs. 4-7—*Georgia pellucida*; 4, plant, natural size, showing the basal branching; 5, Gemmiferous plant; 6, capsule, enlarged; 7, Gemmæ. Figs. 8-11—*Webera sessilis*; 8, plant, natural size; 9, capsule, greatly enlarged; 10, half of mouth of capsule, enlarged, showing plicate cone; 11, Perichætial leaf. [Taken by permission from Mrs. Britton's plates in the *Observer*.]

GEORGIA.

This genus was named after George III., but its name was soon after changed to *Tetraphis* by another botanist. The latter name refers to the four large strong teeth of the peristome, by which character alone the genus is readily recognized. The pellucid Georgia (*G. pellucida*, Figs. 4-7) is very abundant on moist decaying wood, but seems to flourish best on the vertical sides of old stumps. Some of the plants bear peculiar looking tufts of leaves at the summit that might easily be mistaken for the antheridial heads. The species, however, is monoicous and these heads consist of large numbers of minute bright-green bodies, called gemmæ, surrounded by modified leaves. These bodies much magnified are shown in Fig. 7. These fall off and develop into new plants. This method of reproduction is rather rare in mosses and reminds one strongly of the gemmæ of *Lycopodium* or the bulblets of *Cystopteris*.

There is another species of this genus and another genus of this family which are found in North America, but they are so rare that none of our readers are likely to meet with them.

While Georgia belongs to a different family from the hair-caps, there are certain resemblances that have led botanists to put them into one group, the *Nematodontæ* or thread-toothed mosses in contrast to the *Arthrodontæ* or jointed-toothed mosses. The jointed-toothed mosses have the teeth of the peristome crossed by very conspicuous bars or joints which are formed by the thickening of the cell walls of a single layer of cells. The mosses we have thus far taken up belong to the thread-toothed mosses, in which the teeth are not jointed and are derived from several concentric layers of cells. In Georgia the teeth are formed from the division of the whole cellular tissue of the interior of the lid, but in the *Polytrichaceæ* the teeth are formed from more clearly differentiated tissue. Each tooth consists of several layers of fine threads (hence the name, thread-toothed), held together by cellular material. In *Dawsonia* the threads are set free and form brush-like tufts of cilia. These structures are so fundamentally different from those in the jointed-toothed mosses that *Arthrodontæ* and *Nematodontæ* ought to stand as the great divisions instead of *Acrocarpus* and *Pleurocarpus*.

The *Buxbaumias* and their allies, the oddest and most curious of all our mosses, belongs with the thread-toothed mosses, according to most recent writers, but they are not very common and w

will refer our readers to Mrs. Britton's article in the March, '96, *Observer* for a full description accompanied by an excellent plate. Figs. 8-11 represent the most abundant member of this family, the sessile *Webera* (*Webera sessilis* (Schmid.) Lindb. *Diphyscium foliosum* Mohr.), which is easily recognized by the odd shaped capsules and is easily distinguished from *Buxbaumia* by its much greater number of leaves.

NEW OR RARE MOSSES.

II.—BRACHYTHECIUM CYRTOPHYLLUM Kindb.

BRACHYTHECIUM *cyrtophyllum* Kindb. is a very interesting moss closely allied to *B. acuminatum*, but much more slender, with much smaller leaves and broader, shorter leaf cells. Besides the type collection at Brighton, Ontario, by Prof. Macoun, it had previously been collected by Austin at Waterloo, N. Y., and the specimen in his herbarium was labeled *Hypnum* (*Brachythecium*) *julaceum* sp. nov. It was distributed in Austin's *Musci Appalachiani* No. 311, as *B. acuminatum*, var. *setosum*.

Since this it has been collected by Prof. Holzinger and probably by others, but never in fruit until Mr. Burnett collected it as recorded below. The capsules, however, do not differ materially from those of *B. acuminatum*, except that they are more slender. Besides this collection of the fertile plant, Mr. Burnett has several times collected it in a sterile condition.—*A. J. G.*

Riverside Park, on the Alleghany River ten miles north of Bradford, near the mouth of Tuna Creek, is an interesting locality for the botanist. The rich, deep alluvium of the broad valley is greatly broken by numerous creeks or bayous, which, in seasons of protracted drouth, leave many stagnant pools. In August, 1896, I found some beautiful specimens of *Dichelyma pallescens* in one of these pools. In October, 1897, we had a season of low water, and in seeking to locate my *Dichelyma* I came upon an uprooted tree, reclining upon another tree at an angle of about thirty degrees. The tree was large, partially denuded of bark, and decidedly slippery, but the sight of the dainty little *Brachythecium* with its glossy red-brown cylindrical capsules was too tempting to resist. Selecting the fertile and leaving most of the sterile I filled my pockets with what proved to be *Brachythecium cyrtophyllum fertile*.—*D. A. Burnett, Bradford, McKean Co., Pa.*

Brachythecium cyrtophyllum was collected by me at the base of some willow trees in the creek bottom of Rout "river," running through the village of Lanesboro, Fillmore Co., Minn. in August, 1894.—*J. M. Holzinger, Winona, Minn.*

MOSES FOR DISTRIBUTION.

Mrs. Britton reports that she has still a large number of specimens of the Sword Moss (*Bryoziphium Norvegicum*), described in the *Plant World* for October, 1897, which she will be glad to distribute to all the readers of the *BRYOLOGIST* who will send her a self-addressed and stamped envelope to New Dorp, Richmond, N. Y. City, N. Y. On the same terms Miss Harriet Wheeler of Chatham, N. Y., will send specimens of *Pogonatum urnigerum*.

Specimens of *Catharinaea undulata*, *C. angustata*, *Georgia pelucida*, and *Webera sessilis* will be sent to anyone sending ten cents to the editor of the *BRYOLOGIST*. The rarer mosses of the last two offerings are all exhausted, but *Polytrichum commune*, *P. juniperinum*, *P. piliferum*, *Pogonatum tenue*, and *P. alpinum* will be kept on hand and will be sent at any time for ten cents.

NEW AMERICAN MOSSES.

From "Fontinales Nouvelle," by J. Cardot.

F. MACMILLANI Card. This is a relative of *F. Lescurii*, from which it is distinguished by its more folded and slightly concave leaves, which are narrower and more longly acuminate with narrower and more elongated median cells, and alar-cells less differentiated. Northern Minnesota, near the international boundary. Prof. Conway MacMillan.

F. DELECARICA MACOUNI Card. Differs from the typical form in the softer leaves and in the perichæatial leaves, which are round-obtuse, not apiculate. It is distinguished from *F. Delamarei* R. & C. by its more slender habit and much smaller, narrowly lanceolate leaves, which are about 2.25×0.5 mm. Lake Athabasca, Macoun.

From N. Am. species of *Amblystegium* by L. S. Cheney, *Bot. Gaz.*, 24: 236-291. 1897.

A. RIPARIUM LONGIFOLIUM (Schultz) Sch. & Buys. Large, yellowish green to bright yellow or bronze; stems moderately elongate, 3-8 cm. long; leaves large, 0.6-0.7 by 0.32-0.42 mm., slenderly acuminate. Vancouver and Washington.

From *Erythea*, 5: 91. 1897.

HEDWIGIA ALBICANS (Web.) Lindb. (*H. ciliata* Ehrh.), var. *detonsa* M. A. Howe. Perichæatial leaves entire or slightly den-

ticulate; stem leaves diaphanous at apex for $\frac{1}{3}$ – $\frac{1}{5}$ the length, margins plane or very slightly reflexed at base; calyptra usually glabrous. On rocks. From four stations in California.

From Memoirs of the Torrey Botanical Club, 6: No. 2.

BRACHYTHECIUM SALEBROSUM FLACCIDUM Br. & Sch. *Gametophyte* in wide loose dark-green mats; stem and branches slender; branch leaves distant, spreading, more or less complanate, strongly serrate, apex often twisted; stem leaves very broadly triangular-ovate approaching in outline those of *B. Starkei*, about 2×1.2 mm., very slenderly acuminate, slightly serrulate. *Sporophyte* with cilia often 3. Capsule much like that of *B. oxycladon*. New Brunswick; Weehawken, N. J.; Oneida, N. Y. *B. salebrosum flaccidum* is the extreme broad-leaved form of the species and may be distinct, but at present our knowledge is insufficient to define it.

BRACHYTHECIUM FLEXICAULE R. & C. Stems creeping, densely radiculose, closely applied to the substratum, 5–12cm. long, pinnately branching; branch leaves narrowly lanceolate, $2-2.5 \times 0.5-0.65$ mm., gradually narrowed to a very long slender apex, serrate; median cells linear-vermicular, 12–14:1; basal cells broader and shorter; extreme alar cells subquadrate; monoicous. *Sporophyte* usually not to be distinguished from that of *B. salebrosum*. Type locality, John's Beach, Newfoundland (Waghorne); on earth, Revelstoke, B. C. (Macoun, sent out as *B. glareosum*); on schistose rocks, Manchester, Vt.; New Jersey; on decaying wood, Bradford, Pa.; Adirondack Mountains, N. Y. This species seems to me to be almost identical with *B. salebrosum densum* Br. & Sch. Bryol. Eur. pl. 550, but M. Cardot thinks otherwise. It is easily distinguished from all its near allies by the extremely narrow stem leaves, gradually narrowed from just above the base to the apex.

BRACHYTHECIUM ROTEANUM DeNot. *Gametophyte* in glossy yellow-green mats; branches subjulaceous; branch leaves more closely imbricated and appressed than in *B. salebrosum*, ovate-lanceolate, long acuminate, $1.5-2 \times 0.45-0.55$ mm., serrate above, concave; median cells linear-fusiform, 10–12:1; several rows of basal cells much enlarged, quadrate to oblong-hexagonal; lower stem leaves ovate, abruptly narrowed to a long slender acumination, nearly entire, $2-2.4 \times 0.9$ mm.; areolation much looser; monoicous. *Sporophyte* 2.5cm. high; seta red-brown, smooth; capsule red-brown, cylindric, nearly erect, slightly arcuate, about 3mm. long, 4:1; operculum conic rostrate; annulus (?), cilia 2 or 3, well developed, nodulose; spores granulose roughened, 13μ . Louisiana and Texas. Distinguished from *B. oxycladon* (*B. laetum* Br. & Sch.) by being monoicous and by the conspicuously enlarged basal cells of the leaves; from *B. salebrosum* by the longer suberect capsule and leaves scarcely or not at all plicate; from both by its much shorter-acuminate perichætal leaves.

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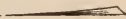
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THE FERN BULLETIN

VOL. VI.

OCTOBER, 1898

No. 4.

THE GENUS *EQUISETUM*, WITH REFERENCE TO THE NORTH AMERICAN SPECIES.

BY ALVAH A. EATON.

SECOND PAPER.

USES.

THE ferns and allies of the past are of great economical importance, furnishing practically the whole flora of the Carboniferous forests, whence come our most extensive coal deposits. It is a strange fact that orders of plants and animals have always made their appearance in a burst of splendor, because the climatic conditions at their inception were favorable for their best development; but as earth changed in successive eons, it became necessary for her denizens to change location or habits, or to die. The more staid did the latter, while the more adaptive suited themselves to circumstances and broke up into species.

Thus we find that the present population of the earth is supported on the skeletons of ancestors. This is notably so with the fernworts. *Sigillarias* and *Lepidodendrons*, rising to the rank of forest trees, were the progenitors of our lycopods and selaginellas—now among our most humble plants—and the swamps of giant *Calamites* of the past are at present represented by their puny offspring, the marestails—of little value, either for use or beauty.

The *hyemalia* are oddly interesting plants, and a clump with dark green stems encircled with ashy sheaths is not wanting in attractiveness, especially in winter. *Silvaticum* is very beautiful when grown in shade. Very few, however, use the *Equiseta* in their ferneries. *Hyemale* is used by cabinetmakers in Germany, even to-day, to polish wood and horn, while *arvense* is in constant use to polish wood and tin in the kitchen, as it formerly was in this country. The buds of *arvense* are eaten by swine, and have been used by the poor in various parts of Europe for food, from remote ages. This species is diuretic, and was formerly used in chest and dropsical complaints; while the Chinese use

debile as an astringent. Some species are used at times as fodder for stock, mostly from lack of better material. Cows do not reject *arvense*, but do not appear to relish it. *Silvaticum* is the principal fodder of horses in some parts of Sweden, but is not relished by cows. *Fluviatile* has been used as food for cows and is reputed to induce an abundant flow of milk. *Lævigatum* is used as hay in parts of Nebraska, according to Rydberg, and *litorale* and *fluviatile* are cut along the borders of the Merrimac at Amesbury, Mass., but evidently are not valued highly.

Though of little use, the marestails of America are also free from the charge of being pernicious. *Fluviatile* and *litorale* border the shores of streams and slow brooks, the latter occasionally appearing in damp pastures; *pratense*, very pernicious in fields of central Europe, is rarely collected here, as is *palustre*. *Silvaticum* keeps to the shade of the woods or to field borders. Only twice have I seen *hyemale* growing in cultivated fields, and although it has grown among hoed crops in one locality for years, it never appears to do any harm. The only species having a tendency to become weeds are *arvense* and perhaps *telmateia*. The former grows extensively in the gravel of railroad grades and in damp fields among hoed crops, often covering the ground.

CLASSIFICATION.

There are two well-marked groups of *Equiseta* sufficiently well characterized to be classed as genera, though they have always been treated as sub-genera. The first, *Equisetum*, has fruit stems mostly different from the sterile, has stomata scattered in the grooves, and habitually regular verticils of branches. The stems are annual, usually perishing early in the season. The second, *Hippochæte*, has the stems all alike, evergreen, persistent for three to four years, usually very rough with silex, branched (in ours) only in case of injury to the main stock, or where it has previously fruited. The branches are formed the second or third year. The stomata are in regular lines, usually one row on each side of a ridge. *Arvense* may be taken as a type of the first, and *hyemale* of the second.

The species of *Equisetum* are well characterized, while those of *Hippochæte* appear in a measure to be geographical forms, the little *scirpoides* of the north being connected with the great *giganteum* of Mexico by a more or less continuous chain of intermediate species. It is often extremely difficult to determine

a species of this sub-genus, and it can only be done by a microscopical examination of the epidermis and interior. The following characterization has been adapted from Milde's "Monographia Equisetorum:"

EQUISETUM L.

Stomata forming a single broad line, composed of several rows, or with two irregular lines, often scattered, set obliquely, without regularly formed cells between them; the surface of the stomata overlaid with a plate of silex, which is free at the edges, and which shows a small vertical slit in the middle—corresponding to the opening of the stomata. Plants with usually two kinds of stems, spike blunt, rhizome without silicious dots, species easily separated by prominent characteristics.

A. EQUISETA HETEROPHYADICA A. Br.

Stomata always forming two separate rows; stems dimorphous; fertile at first branchless, pale, smooth, without stomata or bast, evanescent, or developing branches, chlorophyl, stomata and bast; sterile with dense verticils of branches, which are without central cavity; inner cylinder (*i. e.*, the parenchyma cells surrounding the central cavity) composed of thickened cells.

a. *Equiseta anomopora* Milde.

Stomata wanting or forming two contiguous rows, made up of 2-6 lines each, in the middle of the grooves.

(1.) *E. arvense* L. (2.) *E. telmateia* Ehrh.

b. *Equiseta stichopora* Milde.

Stomata widely separated, forming 1-2 lines, high up on the ridges; fertile stems at first pale, branchless, smooth, without stomata or bast, very soon developing branches, chlorophyl, stomata and bast, and becoming rough.

(3.) *E. pratense* Ehrh. (4.) *E. silvaticum* L.

B. EQUISETA HOMOPHYADICA A. Br.

Stomata forming a single, very wide row in the grooves, consisting of many lines; branches wanting, scattered or in verticils, with central cavity.

a. Inner cylinder composed of thickened cells. (5.) *E. palustre* L.

b. Cells of inner cylinder not thickened. (6.) *E. fluviatile* L. (7.) *E. litorale* Kuhlw.

NEBRASKA FERNS AND FERN ALLIES.

THE student of ferns finds that Nebraska does not offer a very wide or a very fertile field for his researches. Although our flora as a whole is rich and varied, it is greatly lacking in these interesting and beautiful plants. This fact is easily understood when we remember that ferns love the shady ravines of the wooded parts of the Eastern States or the dense thickets of the tropical jungles. Here on the great plains the sunlight is too powerful and the air is too dry to present favorable conditions for them.

There are, however, a few ferns which have thickened their epidermis, have accustomed themselves to life under difficulties, and are found in dry soil or on almost barren rocks in the bright sunlight. And it is true there are a few localities in the State where conditions favorable for fern growth are approached. In the bluffs along the Missouri river there is now and then a delightful ravine, shaded by overhanging trees, carpeted with mosses and liverworts, and kept always moist by a small stream flowing down its midst from the limestone springs above. In this soft, velvety moss-carpet, ferns are abundant in number of individuals, if not of species. In the hills in the northwestern part of the State moist cañons are numerous and in them ferns abound. Franklin and Kearney counties, in the southern part, also possess a number of localities favorable for fern growth. These facts have made it possible for a few ferns and fern allies to become a part of the flora of our State.

Out of the about 4,000 known ferns and fern allies, only twenty-six are reported for Nebraska. Five of these occur generally throughout the State. *Cystopteris fragilis*, the bladder fern, with its tufts of leaves, bearing on their backs roundish fruit dots, is probably the most abundant. *Botrychium Virginianum* is found near the heads of ravines among the fallen leaves. It is one of the more primitive ferns and bears its spores in a grape-like cluster of spore cases branching off from the vegetative part of the leaf near the base of the blade, which is broad, delicate and much divided. Three scouring rushes or horsetails are found generally over the State, *Equisetum arvense*, *E. robustum*, and *E. lævigatum*, the latter being more abundant in the eastern part.

The rest of our ferns are more local in their distribution. In the Missouri bluff region we find *Adiantum pedatum*, the maiden-hair, with its delicate, spreading leaves, bearing lunate fruit dots

just under their reflexed edges. *Pellæa atropurpurea* clings closely in the crevices in the sandstone cliffs along the Missouri river, and is only to be obtained after a careful search and a hard climb. This fern has fruit dots similar to those of *Adiantum*, but the lines of fruit are continuous and the leaves are much coarser in texture. On the top of the hills at Weeping Water grows a small fern, the back of whose leaves is covered with a starch-like powder. This is *Notholæna dealbata*.

Three more ferns and fern allies are reported from Franklin county. *Botrychium ternatum*, another moon-wort; *Equisetum variegatum*, a scouring rush, and *Osmunda regalis*, the so-called "flowering fern," are here found. Franklin, Nebraska, is the only locality west of the Mississippi river from which this fern has been reported.

Over half of our twenty-six ferns are found in the north-western part of the State, where some of the Rocky mountain conditions prevail. *Onoclea sensibilis*, the sensitive fern, and *O. Struthiopeteris*, the ostrich fern, creep across the Dakota line. *Aspidium spinulosum*, *A. thelypteris* and *A. cristatum*, three shield-ferns, are found here. *Cheilanthes lanuginosa* here, as elsewhere, protects its spores from the winds and weather by covering them with a layer of fine brown hairs. *Woodsia oregana* and *W. obtusâ*, two delicate little ferns, are found in the cañons in the foothill region. *Asplenium Filix-foemina*, the so-called "female fern" of the ancients, shows its large and graceful leaves in the same localities. *Equisetum limosum* is found in the northern part of the State.

Marsilia vestita, a small aquatic fern, is also found in these parts. Each of its leaves is divided into four leaflets and presents almost the appearance of a "four-leaved clover." The spores are borne inside of pods formed by modified leaves.

Probably the most interesting of all the fern allies which we have in the State has been reported but once. *Isoetes melanopoda* has been collected near Exeter. As this genus, *Isoetes*, is probably that which, of all existing genera, comes nearest the flowering plants, a great deal of interest is attached to it. The plant grows in the edge of shallow water. It is very similar in appearance to grass and is therefore hard to find. It may be distinguished from a clump of grass by the swollen bases of its leaves, and in the leaf bases the spore cases filled with many small spores. To discover this form elsewhere should be the aim of every collector of ferns and their allies in the State.

There are probably a few other ferns than those mentioned here which grow as yet undiscovered within our borders. The above mentioned ones have been collected by the Botanical Survey of the state, conducted under the management of the Botanical Seminar of the University of Nebraska, and have been deposited in its herbarium at the University.—*R. Kent Beattie, A. M., The University of Nebraska, Lincoln, Nebraska.*

A NEW STATION FOR THE HART'S-TONGUE FERN.

LAST July on an expedition to Perryville Falls, Madison county, N. Y., planned for the purpose of finding the rue spleenwort and the purple cliff-brake, a new station was discovered for the hart's-tongue.

To Miss Murray Ledyard, of Cazenovia, belongs the honor of finding the first plants in this locality. We had been successful in the original object of our journey and had crossed to the west bank of the stream to examine the cliffs on that side. J. and I, curious to study the wet wall of rock close to the sheer white veil of water which fell more than 100 feet, finally secured an unsubstantial foothold among graceful tufts of the greenish, lily-like flowers which ought to receive a more appropriate title than *Lygadenus elegans*.

Having satisfied ourselves that the mossy crevices harbored no plants of the slender cliff-brake, now the immediate object of our search, we followed the natural path beneath the overhanging rock and above the sheer descent to the ravine, examining the cliffs as we cautiously picked our way. Miss Ledyard had remained below and suddenly we heard her give a triumphant shout, followed by the joyful announcement that she had found the hart's-tongue. On entering the ravine we had discussed the possibility of such a discovery, but I had fancied that any hope of it was unfounded, as I supposed the ground had been thoroughly canvassed by the many botanists who had visited the neighborhood.

The plants were still young, but large and vigorous, growing in a partial opening among the basswoods, maples and beeches on a steep slope covered with fragments of limestone, some thirty or forty feet from the base of the cliffs. We must have found anywhere from twenty to thirty plants within a radius of as many feet.—*Frances Theodora Parsons, Cazenovia, N. Y.*



CAMPTOSORUS SIBIRICUS.

WE present herewith an illustration of our walking fern's only near relative, *Camptosorus Sibiricus*. It is a native of the far east, and it is rare that a specimen finds its way into an American collection. The plant figured here came from Japan.

It will be seen that while there is a general resemblance between the two species, there are many points of difference. In *Sibiricus* the base of the frond is not heart-shaped, and the auricles, if any, are smaller. In the American species the frond is broadest at base; in *Sibiricus* it is narrow at base and usually much broader at about the middle. *Sibiricus* is also usually smaller and has thinner foliage than *rhizophyllum*. The species are alike in fruiting at the apex of the fronds, and in producing sterile fronds that differ somewhat from the fertile. In *Sibiricus* these are ovate or lanceolate, and in *rhizophyllum*, nearly triangular or with a rounded apex.—*W. N. C.*

NOTES FOR THE BEGINNER.

III.—COLLECTING AND PRESERVING.

THE object of an herbarium is to preserve our plants in proper shape for study until we may need them. It follows, then, that in collecting specimens we should get everything that will aid us in such study. Of primary value is the fruiting frond, but it is not well to content ourselves with this alone. When the plants are small the whole plant may be taken, especially if there is a difference between fertile and sterile fronds, but for large ferns, single fronds will do, and these may be bent or doubled to allow them to fit the dimensions of the herbarium sheet. Sections of rootstocks, young fronds and all variations from the normal should be collected, as they often throw much light on the species.

Get the plants from the field to your home as quickly as possible and by any method you prefer—between the leaves of a book, in a tin box of proper size, or even by carrying in the hand if it can be done before they wilt. At home, procure driers of blotting paper or other bibulous stuff—about 12 by 18 inches is a convenient size—and place the ferns between them with date and place of collection marked. Upon the top of this pile of ferns and driers, place a weight heavy enough to prevent the plants from shriveling while drying. To make the best specimens, fresh driers should be substituted for those in use at the end of the first twenty four hours, and the ones in use dried; but the writer has seen good specimens that were simply placed between newspapers without further attention until dry—say at the end of two weeks.

When dry the plants are mounted on heavy ledger paper or light cardboard, which *must* be of the standard size, 11½ by 16½ inches. This is the only *must* in herbarium-making, but it cannot be disregarded. Mounted on sheets of the standard size, plants will always be worth preserving; on other sizes and their value is lessened to all but the collector. One can always sell or exchange properly mounted specimens; it is often difficult to give the others away.

For fastening the plants to the sheets, liquid glue is recommended. It should be spread thinly on a smooth surface, the plants dipped into it and laid on the mounting sheet in the positions in which they are to remain. Place the mounted specimens between driers and under a weight until the glue has dried. The label should always be pasted on the lower right hand corner of

the mounted sheet. It should contain the name of the locality where the specimen was collected in any event. The name of the collector, name of plant and date of collection may also appear upon it, but locality is of first importance. "Where is it from?" is the first question asked by the botanist.

There are other ways of mounting plants—by sewing to the sheet, fastening with gummed paper or linen, etc., but these are not good for ordinary work. Heavy parts are sometimes sewed to the sheet, and it is customary to strengthen stems and other stiff parts by placing narrow strips of gummed linen across them, but plants keep best if they are glued to the sheet first — *W. N. C.*

THE LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

President. C. E. WATERS, Baltimore, Md.

Vice-President. MRS. A. D. DEAN, Scranton, Pa.

Secretary. ALVAH A. EATON, Seabrook, N. H.

Treasurer. JAS. A. GRAVES, Susquehanna, Pa.

Fern lovers are cordially invited to join the Chapter. Active membership costs \$1.00 annually; Associate, 50c. This journal is sent to both classes free. Application for membership should be made to either President or Secretary.

Items for this department should be sent to Mr. C. E. Waters, Johns Hopkins University, Baltimore, Md.

—Miss E. Cannon, 431 Bartlett St., San Francisco, Calif., offers free to members of the Chapter, specimens of *Polypodium Scouleri* from the vicinity of San Francisco. Those desiring specimens should send Miss Cannon five cents in stamps for return postage. — *W.*

—The twenty members who were at the Boston meeting comprise nearly one-fifth of the entire Chapter. When it is remembered that a large number of our members are in the Central and Western States, or in other localities far from Boston, the number attending is worthy of note. Two members traveled more than four hundred miles each to attend this single meeting. — *C.*

—Those who were fortunate enough to attend the Boston meeting saw at once that the papers presented were of unusual interest, and in order that they might not be dispersed in various scientific journals it was decided to bring them together into one volume, to be published by a committee named at the meeting. The volume will be published by subscription, and only enough

copies will be issued to supply orders. The cost will be less than twenty-five cents a copy. One person may subscribe for several copies if he chooses. No cash is to be paid until the volume is ready, but all who wish a copy should notify the editor of the *FERN BULLETIN* at once, by postal, stating number of copies desired, as no extra copies will be issued. All members of the Chapter will want a copy of this report; no one who loves ferns can afford to be without it. The volume will appear as soon as it can be learned how many copies need be issued.—C.

—The dues of about a dozen members of the Fern Chapter remain unpaid for 1898. Our invariable rule is not to send copies of the *BULLETIN* to those in arrears for dues, but as soon as these are paid, the back numbers for the year will be sent. Members who pay up now, will not only receive the volume for 1898, but will be entitled to vote at this election, and be sent a copy of the pamphlet "Ferns of the Upper Susquehanna," which has recently been mailed to members.—C.

—It is certainly remarkable that during the six years that the Fern Chapter has been in existence, every quarter has been marked by an increase in membership. A roll of a hundred members was once considered to be unattainable; now, five hundred would not be thought too large. The following members have been admitted since July, bringing our list up to one hundred and nineteen: Active—Miss Mary Andrews, 283 Elizabeth St., New York City; Miss Agnes W. Lincoln, 10 Island Ave., Medford, Mass.; Mrs. Addie Howarth, Amesbury, Mass.; Mr. Walter R. Davis, 139 Park St., Newton, Mass.; Mrs. W. R. Davis, 139 Park St., Newton, Mass. Associate—Mrs. Willis Baldwin, Hunter, Greene Co., N. Y.; Miss Ella A. Noyes, 12 Essex St., Newburyport, Mass.; G. A. Woolson, Pittsford Mills, Vt.; Mr. Phillips Barry, 33 Ball St., Roxbury, Mass. The names of all members admitted during the year will be added to the list of members in the annual report issued in January.—C.

Election of Officers.

The sixth annual election of officers for the Chapter will be held in October. As required by the Constitution, the Executive Council have nominated two candidates for each office as follows:

For President—Alvah A. Eaton, Seabrook, N. H.; H. A. Green, Chester, S. C. *For Vice-President*—W. A. Murrill, Ithaca,

N. Y. ; C. K. Dodge, Port Huron, Mich. *For Secretary*—Will R. Maxon, New York City; George L. Parmele, Hartford, Conn. *For Treasurer*—James A. Graves, Susquehanna, Pa. ; Miss E. H. Thompson, Litchfield, Conn.

Balloting begins October 1st, and ends November 1st. Only active members may vote. President Waters has appointed Miss Margaret Slosson, Pittsford, Vt., as judge of elections, and to her all votes should be sent, preferably by postal card. The naming of the candidates above will not prevent members from voting for other active members if desired.

THE FIRST MEETING OF THE CHAPTER.

THAT a body of students interested in a single branch of science could continue to exist for six years without a meeting, speaks well for the enthusiasm of its members. This same enthusiasm took twenty members of the Linnæan Fern Chapter to Boston on Wednesday, August 24th, to the first meeting the Chapter has ever held. The meeting was successful beyond the most sanguine hopes of its promoters. The papers were listened to by an audience of nearly a hundred fern students, many of whom had come long distances especially for this meeting. So far as could be learned, the members of the Chapter attending were: Messrs. Bates, Davenport, Eaton, Gilbert, Davis, Grout, Fletcher, Kingman, Floyd, Barry and Clute, Mrs. Stevens, Mrs. Rich, Mrs. Davis, Mrs. Coffin, and Misses Hutchinson, Lincoln, Howarth, E. A. Noyes, and Zirngiebel.

The meeting was announced to be held in Horticultural Hall from 9:00 A. M. to 2:00 P. M., but some time before the hour set students began to arrive. People who had corresponded for years here met for the first time, and so busy were all in getting acquainted that it was with some difficulty that the program for the day was begun.

At about 10:30 A. M. Secretary Eaton called the meeting to order and in the absence of the president, Willard N. Clute was elected chairman. To the cordial address of welcome from Mr. Geo. E. Davenport, Rev. James A. Bates made a happy reply in behalf of the Chapter, and the papers for the day were then taken up. The first, on "Hybridity in Ferns," was presented by Mr. Geo. E. Davenport, who discussed the possibility of fern hybrids. His paper was prefaced by some remarks on the variation in the

fronds of dimorphic ferns and was discussed by Messrs. Grout, Eaton, Pollard, Gilbert, Clute, and Mrs. Britton.

Dr. Grout illustrated his paper on "An Interesting Variety of *Osmunda Claytoniana*" by herbarium specimens of the plant in question. The paper was commented upon by Messrs. Davenport, Grout and Clute. In the absence of Miss Mary A. Fleming, her paper on the "Ferns of the Urals and Caucasus," detailing a trip through those regions, was read by the secretary. The paper by Willard N. Clute, on "The Distribution of Some Eastern American Ferns," discussed the distribution of some eastern ferns with restricted ranges. The paper was commented upon by Messrs. Eaton and Gilbert.

Mr. B. D. Gilbert's paper, on "The Genera of Ferns; a Study in the Tribe *Aspidieæ*," in which he proposed several important changes in the disposition of the genus *Aspidium* and allied groups, was well received and discussed at some length by Mr. Davenport. Three hundred specimens were used by Mr. Alvah A. Eaton to illustrate his "Notes on a Peculiar *Botrychium*," which he held to be a new species or a remarkable variation of an old one. This was also discussed by Mr. Davenport.

Mrs. E. G. Britton ended the program with an interesting "Study of *Ophioglossum vulgatum*," in which she spoke of the recent changes in the way in which the so-called forms of this species have been regarded. Before adjournment a vote of thanks was given the Massachusetts Horticultural Society for the use of the hall, and to those who had been instrumental in making a Chapter meeting possible.

A field meeting had been planned for the afternoon, but those attending the morning session found so many things to discuss that it was decided to return to the hall after lunch and spend the rest of the day in conversation. This session proved fully as enjoyable as the other, many finding it difficult to decide whether hearing the papers read or meeting fellow members was the more pleasing. The hall was decorated with many varieties of our native ferns in vases and several members exhibited herbarium specimens, notably Mr. Davenport and Miss Zirngiebel. Upon invitation of Mr. W. R. Davis, a visit was made to the rooms of the Apalachin Club, where a collection of exotic ferns was seen. Gradually the party broke up as various members hurried away to catch their trains, and thus ended the first and long to be remembered meeting of the Fern Chapter.—*W. N. C.*

—THE—
FERN BULLETIN.

A QUARTERLY DEVOTED TO FERNS.

Official Organ of the Linnaean Fern Chapter.

WILLARD N. CLUTE, Editor.

THE FERN BULLETIN CO., PUBLISHERS, BINGHAMTON, N. Y.

Subscriptions, fifty cents per annum.

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Articles upon any subject in fern study solicited.

Communications intended for the editor should be addressed to Willard N. Clute, 63 E. 49th St., New York City.

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ANOTHER volume of the FERN BULLETIN is completed with this number. As it has progressed we have not failed to note several features which we believe can be improved upon in the new volume. In doing this we shall attempt to meet the expectations of those readers who take it for granted that every volume shall be an improvement upon the one that preceded it. It is almost needless to add that a prompt renewal of subscriptions will have an immediate effect upon these improvements. We would also urge that our readers speak of the journal to their friends. With a larger circle of readers, we shall be able to make a journal that approaches much nearer to our ideas of what such a publication should be.

* *

BEGINNING with the next number we shall publish an exchange column, in response to a considerable demand for one. Members of the Fern and Moss Chapters and subscribers to this journal will receive coupons entitling them to notices in this column at nominal rates; to others the price will be twenty-five cents for twenty-five words. Members' coupons will be sent by the treasurers of the Chapters upon payment of dues. Subscribers' coupons will be mailed from this office.

* *

THE success of the Boston meeting has emboldened us to try it again, and it is likely that an annual meeting will be a regular feature of the Chapter in future. Although this was the first

meeting of such scope as to include all students of ferns, the editor has pleasantly in mind two smaller meetings in which he was one of a party of Chapter members to meet for discussion of our favorite plants. The practice is to be commended to those who live in sections where there are several fern students, and we hope to have many reports of such meetings.

* *

In this number we publish an account of a new locality for the hart's-tongue fern by the author of "How to Know the Wild-flowers." Although the station has been known for less than three months, the finders already have cause to regret that a knowledge of the location was made public. The vandal who delights to uproot and carry away specimens because they are rare has begun work in the new station, where, unfortunately, the ferns are not protected as they are at Chittenango Falls. Destructiveness seems to be one of the characteristics of uncivilized man that is most difficult to eradicate. Until the race reaches a point where it can enjoy and not destroy, plant lovers must use every precaution to prevent the extermination of our rarer species.

* *

ONE of our most pleasant experiences this season was the finding of *Schizæa pusilla* in its New Jersey haunts. After one has spent some time in the "pine barrens" in which it grows, he is likely to become impressed with the idea that the fern is commoner than the books would have it. Apparently it requires no unusual conditions for growth—we found it about the knolls in a half-dry swamp—but its size renders it very easy to overlook. When one knows just where to search and what to search for, the finding is much easier. It may take some time to find the first specimen, even in places where it is known to grow, but after that the eye becomes marvelously quickened, and the fruiting spikes like tiny fists appear in many places in the shade of other vegetation. We could have collected a hundred plants in half an hour, but forbore to contribute to its destruction.

* *

A NEW station for *Dryopteris simulata* was discovered by the editor at Babylon, N. Y., in September. This seems to be the first recorded station for the fern on Long Island. It grew in great quantities in a shaded, swampy piece of ground. Our quest was for fertile fronds of *Woodwardia areolata*, whose sterile fronds abound in the locality, but the new fern attracted attention at

once. It could be distinguished at a glance from *Dryopteris thelypteris*, which grew with it, by the habit its fertile fronds have of drooping somewhat, making a more graceful plant. Although the fern was fruiting abundantly, it was exceedingly difficult to find good specimens because of the ravages of a small worm that eats the spores and spins a web over the pinnæ as he goes.

NOTES.

—Under the title of "A Plea for Preservation," Miss Harriet Wheeler contributes to the July *Plant World* a timely article upon the carelessness of collectors in rooting out rare plants in order to make a show with their collections. Mention is made of a locality for the climbing fern, near Hunter, N. Y., which was entirely destroyed to gratify the desires of the "summer boarder."

—The formation of a Moss Chapter will add another to the list of Correspondence Chapters so popular in the Agassiz Association. There is scarcely a natural science that has not a Chapter of this kind for its study. Botany, Geology, Entomology, Ornithology and others are represented, and if the student finds none of these to his liking, he can still join the association as a corresponding member, where he will be put in communication with many students with similar tastes, or, better, he may form a local Chapter in his own town. The Corresponding Chapters have official organs of their own. The official organ for the Association at large is *Popular Science News*, and short articles for this are desired. All communications regarding the Association should be addressed to Mr. H. H. Ballard, President of the Agassiz Association, Pittsfield, Mass. Membership in any one of the Corresponding Chapters makes one a member of the main Association.

—In the *Journal of Botany* for August, 1898, figures of *Botrychium matricaræfolium* and *B. lanceolatum* are given, and the accompanying text claims for them a place in the British Flora. The chief claim for *matricaræfolium* rests on a somewhat doubtful species collected "on the sandy sea-shore of Stevenston, Ayrshire, in July, 1897." The plant was subsequently mislaid and afterwards brought to light from its resting place inside of an old catalogue. *B. matricaræfolium* has long had a half-recognized right to a place among British plants, having several times been figured or described as a variety of *B. lunaria*. It is also reported to have been frequently confused with the continental *B. rutaceum*.

While the author is satisfied that his plants are true *matricaræfolium*, it would seem to us from their habitat ("sands of Barry" and "sandy seashore"), that they might be referred with more propriety to some other species, since our plants do not affect such places.

—In the preface to "A Guide to the Study of Lichens,"* Dr. Schneider tells us that the volume is an attempt at popularizing our present knowledge of the lichens. After carefully examining the book, we are willing to agree that he has succeeded very well in the attempt. The majority of people are prone to consider lichenology as a very dry subject, but Dr. Schneider's presentation of it is anything but dry. Part 1 of the volume deals with the history of lichenology, the uses of lichens and a rather extended discussion of their structure and life histories. All of this is made very readable by numerous interesting facts about lichens which might not be necessary to a scientific presentation of the subject, but which the general reader will be very glad to have. The collection, study and preservation of lichens also receive considerable attention. In part 2 the systematic study of the plants is taken up. An artificial key to the genera occurring in the United States is given and also a key to the families. All the species which the average collector is likely to find in his rambles are described, and here again the author has added many entertaining notes. The work ends with a list of the lichens occurring in the United States. The author's ability to treat of the scientific side of the subject is vouched for by his recently issued "Text-Book of General Lichenology," and we doubt if any other writer could present the popular side more acceptably. Dr. Schneider may be open to criticism for the use of too many scientific terms in a work of this nature, or at least to their use without sufficient explanation, especially as no glossary is given, but this is not sufficient to detract from the merits of the work. The book contains 234 pages, with twelve full-page plates illustrating generic spore-types, drawn by the author.

*A Guide to the Study of Lichens, by Albert Schneider, M. D., Ph. D. Bradlee Whidden, publisher, Boston. 8 vo. Price \$2.50 net.

I see on page 26 of the April BULLETIN that the impression appears to prevail that *Pellœa atropurpurea* shows great preference for calcareous rock. It is frequently found here on perpendicular bluffs of sandstone, belonging to the Carboniferous and Quarternary periods.—*J. Schneck, Mt. Carmel, Ill.*

THE BRYOLOGIST,

A DEPARTMENT OF THE FERN BULLETIN,
DEVOTED TO THE STUDY OF NORTH AMERICAN MOSSES.

EDITED BY DR. A. J. GROUT, PLYMOUTH, N. H.,
To whom all correspondence regarding the mosses should be addressed.

This department is issued separately at twenty-five cents a year. Subscriptions should be addressed to the Fern Bulletin, Binghamton, N. Y.

THE NEW MOSS CHAPTER.

THE proposed Moss Chapter has received support beyond the expectations of the Editor and his friends. Not only beginners, but several of the more prominent moss students, have volunteered their support. It is therefore proposed to form a correspondence Chapter of the Agassiz Association for the study of mosses, with a constitution similar to that of the Linnæan Fern Chapter. It seems appropriate that this Chapter should be called The Sullivant Moss Chapter, after that "Prince of American bryologists," William Starling Sullivant.

Mrs. Britton, the Editor of the FERN BULLETIN, and the Editor of the BRYOLOGIST, will act as a committee to name officers for the first year, and their appointments will be published in the January BRYOLOGIST. After this officers will be elected according to the Constitution. The Editor will act as secretary and treasurer *pro tem.* until that time, and all dues and correspondence should be directed to him until the appointments of officers are announced.

The officers appointed will constitute a committee to draft a constitution to be acted upon by the Chapter as soon as convenient.

The Chapter will be entitled to a page in each issue of the BRYOLOGIST for Chapter notes and news. All who join as active members before January 1st, 1900, will be entitled to a free copy of the Editor's "List of Vermont Mosses, with Keys." They shall also be entitled to exchange notices at the same terms as members of the Fern Chapter. The annual dues will be 25 cents for associate members and 50 cents for active. Both classes will receive the BRYOLOGIST free, but only the active members shall vote or hold office. Members of the Fern Chapter can become active

members of the Moss Chapter by paying 25 cents annually, but such members shall not be entitled to a separate copy of the *BRYOLOGIST*. All revenue for dues, etc., will go directly into the treasury of the Chapter, to be expended for the Chapter by the officers elected for that purpose.

The charter membership roll will remain open until Dec. 10th, 1898, and it is expected that there will be a large number of charter members, since the present month is the beginning of a season when the mosses are at their best.

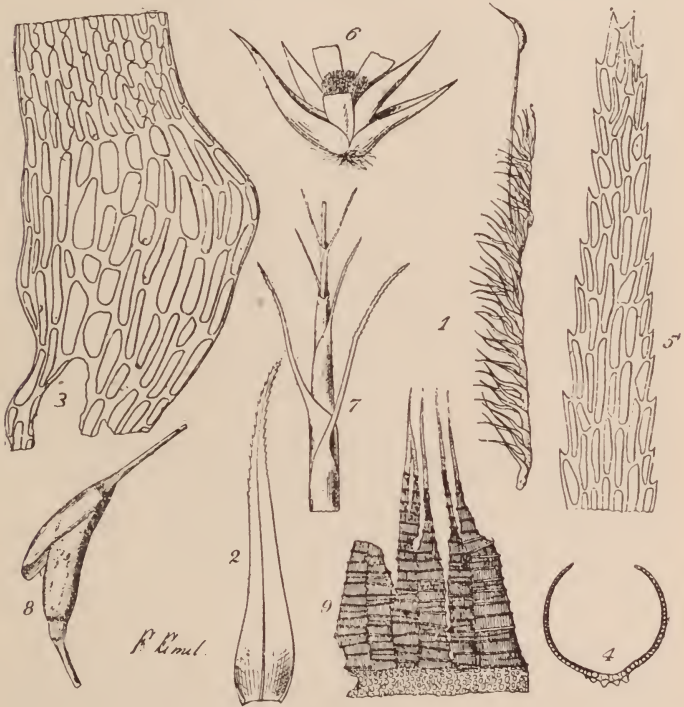
Only members of the Chapter will be entitled to the mosses offered in the *BRYOLOGIST* at the rates mentioned therein.

THE DICRANUMS.

THE Dicranums include some of our most common and easily recognized mosses, and they will be found in perfect fruit at the time this issue of the *BRYOLOGIST* reaches our readers. When one knows a single species of this genus, he will have little difficulty in recognizing the others, although it is not so easy to say just what characters give them their distinctive habit. The Dicranums usually grow in dense tufts or cushions which soak up water like a sponge and retain it for a long time. The leaves are usually bent to one side (secund), as if the wind had blown them strongly in one direction (Fig. 1). They are also usually curved like a scythe or a sickle (falcate).

The Dicranums are acrocarpous, but the stem grows on after the capsule has begun to develop, thus leaving the seta apparently starting from the side of the stem (Fig. 1). This often happens with acrocarpous mosses, but their erect habit and stems little divided or branched enable the acrocarpous mosses to be distinguished from the pleurocarpous even when sterile. The capsules are on long setæ and are either curved (arcuate, Fig. 8) or drooping (cernous), or straight. The operculum is long-beaked (rostrate), and the calyptra smooth and split down one side (cucullate, Fig. 8). The base of the seta is surrounded by a cluster of specialized leaves (the perichætil leaves, Fig. 7). There are perichætil leaves in the hair-caps, but they are much less strongly differentiated. The peristome is single—that is, it consists of one row of 16 jointed teeth, which are split half way down into two or three prongs (Fig. 9). It is strongly colored and makes a most beautiful microscopic object. Most of the species have at least the lower part of the stem covered with a

thick felt of radicles. The leaves are usually lanceolate to lance-subulate, with a concave base and a very strong costa extending nearly or quite to the apex of the leaf, or even beyond. Fig. 4 shows the leaf in cross section and also shows the narrow lamellæ, which are found on the *lower side* of the costa instead of the upper, as in the hair-caps. These lamellæ are often very strongly toothed. A section of the leaf is not necessary in order to see the lamellæ



DICRANUM SCOPARIUM.

Fig. 1, Plant natural size, the fruit terminal, becoming lateral by the growth of the stem; 2, single leaf enlarged; 3, part of base of leaf, showing the enlarged cells at basal angles, and the porose cells above; 4, cross-section of leaf showing the ridges on the back of the vein; 5, apex of leaf enlarged; 6, antheridial bud; 7, perichaetial leaves, sheathing the base of the seta; 8, capsule with the calyptra and lid on; 9, peristome showing two teeth divided more or less irregularly to the middle. [From Mrs. Britton's article in the February, 1895, *Observer*. By permission].

clearly. If several leaves be mounted in water, some will nearly always be turned so as to show them in profile. This is rendered easier by the fact that in many species the edges of the leaves are rolled in (involute) in the upper part so that the leaves are tubulose. The upper leaf cells are elongated-rectangular, oblong-linear, quadrate or elliptical, according to the species; toward the base they are elongated-rectangular. Those at the basal angles are much enlarged and inflated, and are often of a different color from the others (Fig. 3, lower portion). This last character distinguishes the *Dicranums* from the allied genera and species except *Campylopus*, in which the seta is curved and the capsule pendent. Many of the species have the cells communicating by pores, as shown in the upper part of Fig. 3. Such cells are called porose or pitted. The protoplasm of the adjoining cells communicates through these pores. These pores are very helpful in determining the species.

While there are 20 species of *Dicranum* found in the United States north of Virginia and east of the Mississippi, there are only five that are likely to be found by the great majority of our readers. One of the most common and conspicuous is the broom moss (*D. scoparium*), so called because its leaves all point one way in a manner that reminds one of a hair-broom or counter-brush.* This is often used by florists and other merchants to form banks of dark green in their windows. It can be found almost anywhere in the woods, on the ground, roots of trees, and rocks. It is much the coarsest-appearing of the common species that have curved capsules. A reference to the figures will give all further details necessary for the identification of this species.

The wavy *Dicranum* (*D. undulatum*) also grows on the ground and rocks, but is the largest of the five species, and is at once distinguished in the field by its beautiful silky, strongly undulate leaves and clustered capsules. That is, it has several capsules with setæ inclosed in one cluster of perichætil leaves (perichætium). The leaf cells are elongated and porose, like those of the broom moss.

The fuscous *Dicranum* (*D. fuscescens*) grows on rotten wood, and is the only other common *Dicranum* with a curved capsule. It is easily distinguished from the preceding species by its smaller size, more delicate appearance, and leaves not undulate but

*Fide Mrs. E. G. Britton in the New York Teachers' Monograph, Vol. 1, No. 2.

crisped after the manner of curled hair. Its capsules are single, and much shorter and more strongly arcuate than in the above species. Under the microscope it is at once distinguished by the short upper leaf cells nearly or quite as broad as long and often quadrate. None of the leaf cells are porose (rarely a very few near the base).

Another species with curved capsules is the pale Dicranum (*D. pallidum*, *D. spurium condensatum* of L. & J. Manual). This is found on sandy plains in New Jersey and the neighboring territory, but is probably not found elsewhere within the range mentioned above. It is distinguished from all the above mentioned species by its small size (less than one inch in height); from the broom moss by its short irregular upper leaf cells with cell walls without pores, excepting a very few in the lower part; from the fuscous Dicranum by the more compact tufts, and leaves equally spreading, not secund, and little crisped.

There are two common species with erect straight capsules. Of these two, the flagellate Dicranum (*D. flagellare*) is much the more common. It is found in moist woods nearly everywhere. It grows on *decayed logs and stumps*, and often produces abundant flagellæ from the upper part of the plant. These flagellæ bear minute ecostate leaves very different from those on the main plant. In this species the costa does not extend to the apex of the leaf.

The other erect capsuled Dicranum, the fulvous Dicranum (*D. fulvum*) grows on *rocks* and has the costa excurrent—that is, extending beyond the lamina of the leaf into a thick point. In our next number we plan to publish an entirely new key to the whole twenty species. This key will be especially adapted to the use of beginners. We also hope to have some of the rarer species to distribute.

MICROSCOPIC PREPARATIONS OF MOSSES.

PORTIONS of the types of Hedwig's species, many of which are North American, and all of which date back to the beginning of this century, are preserved at the Boissier Herbarium in Geneva, mounted on small mica slides. The medium is a very durable one, for all the slides which I have examined have kept perfectly, and it seems to have been easily handled, for the specimens are not shrivelled or broken. I have since adopted this method for keeping all dissections that I make of the mosses,

and have also learned that others have done the same. I quote from the *Revue Bryologique* for 1893, M. Amann's remarks on this subject :

“The employment of mica slides for the preserving in the herbarium microscopic preparations of the organs of the mosses was recommended in 1853 by Carl Mueller in his ‘Deutschlands Moose.’ This eminent bryologist says in one of the numbers of *Natur* that thanks to this method, which permits the comparison under the microscope in a few minutes of the organs of a great number of species, it has been possible for him to devote himself to the systematic study of the mosses of the entire world.

“In fact, these microscopic preparations accompanying every specimen in the herbarium and enclosed in the same envelope with the specimen from which they were taken, permits a great economy of time and are for that reason exceedingly convenient.”

M. Amann objects to them, however, as dry mounts, because of the imperfection of the image and because all our modern objectives are corrected for a standard thickness of cover-glass. He therefore prefers to use a small slide, only 25mm. long and $\frac{3}{4}$ mm. thick, which is specially made for anatomical preparations. As a mounting medium he uses gum arabic dissolved in glycerine jelly, thinned with distilled water, to the thickness of honey. Specimens transferred from either cold or hot water to this medium harden in a few hours and preserve indefinitely, being less bulky than ordinary slides for microscopic preparations.—*E. G. Britton.*

My method of making microscopic slides is as follows: Dissections are made in water on the stage of a simple microscope. This stage is removable so that it can be placed under a compound microscope and the smaller parts examined without disturbing their position. Such parts as I wish to retain are transferred to a few drops of dilute glycerine (10 to 20 per cent.) on a glass slide, on the end of which a number is marked with pen and ink for means of identification. This is set aside without cover glass until the water has entirely evaporated, leaving only clear glycerine. It usually requires at least an hour, generally more, unless the slide is placed where it will be warm (but not *hot*).

I usually leave it over night when convenient. After this it only remains to again transfer to hard glycerine jelly by almost any of the methods in general use. For the “permanent” slide and cover I now invariably use mica. The slides are fairly stiff and from $1\frac{3}{4}$ to 2 inches long by $\frac{3}{4}$ or $\frac{7}{8}$ wide, while the covers are thinner and $\frac{5}{8}$ by $\frac{1}{2}$ inch or larger, as the particular case demands. These slides are placed in small envelopes glued

to the herbarium sheets on which the plants, from which the dissections were made, are fastened. The necessary legend for identification is easily scratched on the mica with a metal point.—*J. Franklin Collins.*

As some of our readers may not be familiar with glycerine jelly, it may be useful to state that it can be bought of any dealer in microscopical supplies. It can be softened for use by heating a bit on a slide, or by immersing the bottle in cold water and then raising the water to the boiling point, when the jelly will be liquefied. If a slide bearing a water or glycerine mount be slightly warmed, the jelly can be easily run under the cover glass by putting a drop on one side and drawing out the other medium at the other side with a piece of blotting paper. An ordinary kerosene lamp can be used to warm slides if nothing better is at hand.

Mr. Collins' method will do away with the shrinkage which is so troublesome when water mounts are transferred directly to the jelly. I once obtained a large quantity of excellent mica from a wall-paper factory where it was ground up to make the glittering specks in the wall-paper. This was much cheaper than the article ordinarily sold at hardware stores because of the small size of the pieces. I do not think that the ordinary moss mount requires a power high enough to render the variations in thickness of covers of very great importance and always use mica covers for my small slides.—*A. J. G.*

MOSSES FOR DISTRIBUTION.

Specimens of *Dicranum scoparium*, *D. fuscescens*, *D. fulvum*, *D. flagellare*, and *D. pallidum* (this last by courtesy of Mr. C. F. Saunders) will be sent to any subscriber for 12 cents. A sterile specimen of *D. undulatum* will be added for an extra two cents if any failed to take advantage of Mr. Stultz's offer.

NEW AMERICAN MOSSES.

From Notes on California Bryophytes, by M. A. Howe in *Erythea*. 5: 92. 1897.

STABLERIA GRACILIS (Wils.) Lindb. "On charred stumps and logs, mainly of *Sequoia sempervirens*. First collected in Turner's Cañon between Cazadero and Fort Ross, Sonoma county, March 15, 1896; later at various stations in Mendocino county, and near Eureka, Humboldt county. Most of these specimens, in our judgment, cannot be distinguished even varietally from the European plants. The processes of the endostome are often as long

as the teeth, but they are so described by Boulay and by Husnot, and are sometimes equally long in Wilson's Musc. Brit. No. 220. *Stableria gracilis* was discovered by Wilson in Cheshire, England, in 1833. Since then, three or four English stations and two in Finistère, France, have been added. It is another interesting link in the chain of relationship between the bryophyte flora of California and that of Europe."

STABLERIA GRACILIS (Wils.) Lindb., var. *CALIFORNICA* M. A. Howe. "Leaves linear-lanceolate, acuminate, broader than in the typical form and without subulate points; antheridia surrounded by a few small bracts, on a short gemmiform branch. Near Eureka. The leaves of this variety are often strikingly different from those of the type, but it grows mingled with the ordinary form and plants bearing leaves of a transitional character are found. The specimens which we have identified with the type, so far as observed, are paroicous, but var. *Californica* appears always to be autoicous. Braithwaite describes *Stableria gracilis* as exhibiting both these methods of bearing the antheridia."

Stableria is a genus closely related to *Leptobryum pyriforme* (L.) Wils., and for the benefit of our readers we insert Mr. Dixon's description of the species: "Stems densely tufted, slender, hardly branched, about $\frac{1}{4}$ - $\frac{1}{2}$ in. high, rarely taller, bright green, silky. Leaves flexuose, when dry somewhat curled, very narrow, linear-setaceous, the upper longest ($1-1\frac{1}{2}$ lines); margin plane, entire or obsoletely denticulate above, nerve vanishing at apex, narrow, rather indistinct above, areolation narrowly linear-rhomboid, at base wider, hexagonal-rectangular, hyaline. Seta short, less than $\frac{1}{2}$ in. high, pale, very slender; capsule suberect, narrowly clavate, with a slender tapering neck, thin-walled; lid acutely pointed. Peristome teeth incurved when dry, inserted below the mouth of the capsule; outer teeth narrow, distant; inner peristome a very short basal membrane with sixteen slender processes without intermediate cilia. Paroicous; antheridia in the axils of the comal leaves."

From Memoirs of the Torrey Botanical Club, 6: No. 2.

BRACHYTHECIUM LAMPROCHRYSEUM GIGANTEUM n. var. Stems much stouter, secondary stems with fewer branches; stem leaves distant, longer, 3-3.5 mm. long, very strongly plicate; extreme alar cells inflated. Capsule ovoid; operculum conic-rostrate; annulus large, persistent; segments as long as teeth, from a very broad basal membrane; cilia 2 or 3, well developed, nodose; spores maturing in winter. Atku Id., Behring Sea. (U. S. S. Albatross, No. 44. June 10, 1894.)

BRACHYTHECIUM RIVULARE CATARACTARUM Sauter. Fl. Herzogth. Salzburg. 3: 60. 1870. Floating, dark green to golden green, brown underneath; secondary stems much elongated, simple or sparingly branched; branches short, directed forward at an acute angle; leaves much more closely imbricated, especially at the tips of the branches. On timbers of old dam, Staley's Creek, Virginia.

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