THE

FERN BULLETIN

A Quarterly Devoted to Ferns

EDITED BY WILLARD N. CLUTE

VOLUME XVI

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The Fern Bulletin

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Joliet, Ill.
Willard N. Clute & Company
1908

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

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ASPLENIUM FERRISSI.

THREE-FOURTHS NATURAL SIZE.

THE FERN BULLETIN

Vol. XVI JANUARY, 1908 No. 1

A NEW FERN FROM THE UNITED STATES.

By Willard N. Clute.

Collectors of the ferns have so carefully explored every easily accessible part of the United States, that a new fern is a rarity, indeed, and only to be found by penetrating beyond the bounds of even frontier civilization. The opinion has often been expressed in these pages, however, that the southern parts of our territory would still yield several more ferns that were either new to science or new to the United States, and this opinion has recently been substantiated by the finding in southern Florida of various species new to our flora. It is probable that other species will eventually come to light in that state, as the exploration of unsettled parts continues.

A second region from which we may expect additional species from time to time is that part of the United States which borders Mexico. In the past several unique species have been reported from the canyons of New Mexico and Arizona and the recent trip to that region made by Mr. James H. Ferriss, has resulted in the discovery of various new forms. One of these is so unlike anything I have been able to find described, that I venture to name it a new species as follows:

Asplenium Ferrissi sp. nov.

Rootstock small, erect; fronds oblong-lanceolate, short-stalked, spreading, 8 to 15 cm. in length; 2 to

4 cm. in width, tapering from above the middle to the base, thickish, dull green in color, nearly pinnate below, pinnatifid in the upper portion; divisions of the blade alternate, spreading or ascending, rounded in small fronds, longer and obtuse in larger ones, the margins entire or wavy; sori, heavy, elongated, 5 to 10 on a segment, the basal ones nearly parallel to the midrib: Indusium thin, nearly disappearing in old fronds, veins free, one to three times forked.

Habitat: Under dryish shelving rocks between Brown and Tanner's Canyons, Huachuca mountains, Cochise County, Arizona. Collected October, 1907 by James H. Ferriss, for whom I take pleasure in naming the species. Type in my own herbarium.

The locality in which the plant was found is about five miles from Conservatory (Ramsey) Canyon in the direction of Fort Huachuca and six miles or more from the Mexican boundary. It was growing in locations similar to those selected by *Aspidum juglandifolium* and *Polystichum aculeatum lobatum*.

The plants have a passing resemblance to *Asplenium ebeneum* but could not be mistaken for it even by a novice. The stipes and midrib are greenish, the pinnules broad and in the upper part of the frond the sinuses between them are from 3 to 5 millimeters from the midrib. The long and heavy sori and the spreading habit of even the fertile fronds are especially characteristic. Young forms of this species have undivided elliptical fronds. About 75 specimens of this plant are at present growing in cultivation in Joliet, Illinois.

A NEW VARIETY OF THE OSTRICH FERN.

By William A. Terry.

Somewhere about twenty years ago, I commenced growing a complete collection of the native ferns of this section in my home grounds. I wished to become familiar with all their peculiarities through the entire season and decide from their variations which were really the typical forms of the species. I also hoped to give protection to rare species that were threatened with extinction. As there were some six or eight species that I did not find in Bristol I applied to several botanical friends for information as to localities where they might be found. The late James N. Bishop of Plainville gave me two stations for the ostrich fern, Goldie's fern and the purple cliff-brake in Plainville. I had previously known of abundant colonies of climbing fern near the same place. Mr. James Shepard showed me several small colonies of the walking fern and gave me a new station for the climbing fern in Plainville. Mr. Lumen Andrews of Southington gave me a station for the oak fern, Goldie's fern and the chain fern (*Woodwardia virginica*) in Southington. Some years later, Bishop told me of a new find, a remarkable colony of *Woodwardia angustifolia* in the town of Orange. I afterwards found this abundant in South Haven.

Bishop's colony of the ostrich fern was quite large. Some hundreds of the plants were growing in the open in direct sunlight. These were all large clumps. In the woods many of them were smaller and on the border were many quite small and detached, evidently grown from spores. To make sure of success, I took plants, both large and small as I had known of several instances in which plants moved failed to grow. All

my plants lived and grew although it took several years for them to become used to the change and show their natural vigorous growth. One small plant had both stipe and rachis densely covered with a downy white pubescence and in after explorations I saw others with the same peculiarity. In exploring the neighborhood of Bishop's find of *Asplenium* I found other colonies and one of the ostrich fern with many plants, all of which appeared to me to be the pubescent variety, but as at the time I took no particular interest in this variety I did not give them the close examination that I should have done.

In my principal fern bed this pubescent form has increased in numbers to some eight strong plants. The pubescence is so strongly marked as to be visible at several rods distance and persists throughout the season. The common variety grows here about six feet high, many of the fronds measuring six feet four inches long, while the pubescent form growing among them is scarcely four feet high and the fronds are drooping like those of Clayton's fern (*Osmunda Claytoniana*) instead of upright and the stipe is slenderer. The common form fruits abundantly, each plant having from three to eight fertile fronds, while the pubescent form has never fruited at all. I hope that in the coming season I shall be able to give the wild plants of this variety a more careful examination.

Bristol, Conn.

[The editor of this magazine has known of Mr. Terry's plants for some time and can add that they seem very distinct from the others so far as outward appearances go. Neither of us have any idea that the pubescent plants comprise a new spe-

cies, but since it is desirable that these variations from the normal have a name to distinguish them, we may adopt for this one the name of *pubescens* which Mr. Terry has suggested in correspondence regarding it. —Ed.]

BUT HALF A FERN.

By Willard N. Clute.

Twice in the life-cycle of the ferns, each plant is reduced to a single cell. The best-known of these reductions is that in which the spores are produced on the backs of the fronds, the other occurs on the prothallium at the time when the new fern plant arises. It is this second cell that really produces the fern plant, although it is commonly believed that the spores found on the backs of the fronds are the ones that do so. These latter spores, called *asexual* spores because they are not connected in any way with sexual processes, are formed by the interior division of a cell and merely produce the prothallium. It is only in exceptional cases, to be mentioned later, that a new fern-plant originates without the prothallium first forming a special *sexual* cell or spore. In fact, the two kinds of spores divide the life of the fern into two distinct generations which alternate with each other, a prothallium being first formed by the asexual spore and this being followed by the production of a new fern plant by a sexual cell in the prothallium. The sexual cell is formed by the union of two other cells, usually called *gametes* and the prothallium is therefore often known as the *gametophyte,* while the fern plant producing the asexual spores is called the *sporophyte.* The fact that all the fernworts consist of two distinct gen-

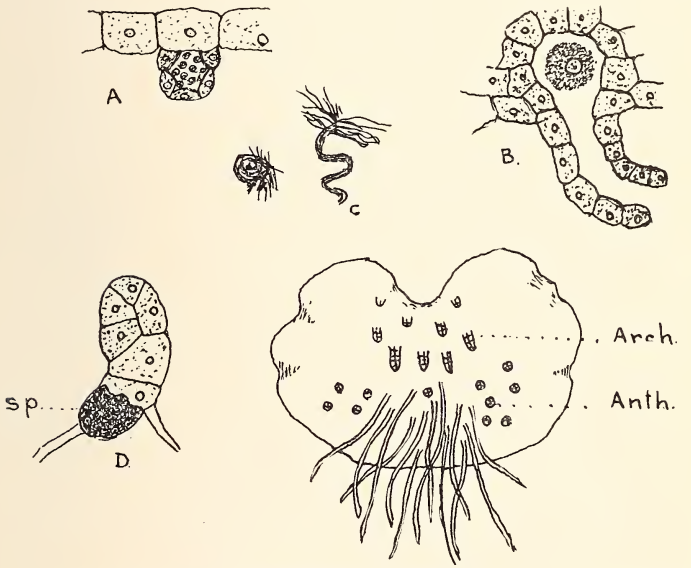
erations that alternate with each other cannot be too strongly emphasized. The fern-plant as commonly recognized, therefore, is but half a fern. It is the other and less familiar half that we purpose considering in this article.

When an asexual spore from one of the sporangia on the back of a fern frond falls in a place suitable for germination, it begins to grow, forming new cells by the repeated division of the original one. Soon, there is formed a flat, green, scale-like object, usually heart-shaped and approximately a quarter of an inch in diameter. This is the prothallium of gametophyte. It is attached to the soil by slender, hair-like structures, called *rhizoids* by means of which it absorbs the moisture that, together with the carbon-dioxide of the air, forms its food materials. The building of the food is carried on by certain small bodies in the cells, called *chloroplasts,* which derive their energy from sunlight by means of the green coloring matter of plants or *chlorophyll.* The gametophyte of the grape-ferns (*Botrychium*), the adder'stongues (*Ophioglossum*) and various club-mosses (*Lycopodium*), lack this green color, and cannot alone form their own food. They have therefore gone into partnership with various minute fungi in order to secure a living.

As the development of the gametophyte proceeds, there begin to appear upon the older parts certain small structures called *antheridia.* These are borne on the under side of the plant and, at maturity, consist of three or more cells enclosing a number of male gametes called *sperms.* The sperms are slender, ribbon-like objects, coiled cork-screw fashion and furnished near one end with numerous hair-like *cilia.*

If the gametophyte happens to have difficulty in se-

curing a plentiful supply of food, it may develop only antheridia, but if well nourished, *archegonia* may begin to appear a short time after the antheridia, and upon the same side of the prothallium. The two kinds of organs are rarely, if ever, intermingled, the archegonia always appearing on the younger parts, near



GAMETOPHITE OF THE FERN.

A—The antheridium containing sperms. B—The archegonium. C—The sperms. D—A very young prothallium. sp.—The spore. All much enlarged.

the notch which gives the heart-shaped outline to the gametophyte.

The archegonia, like the antheridia consist of several cells and in the base of each is developed a single cell called the *egg*. When the egg is mature, the central cells in the neck of the archegonium break down and disappear, leaving a channel from the outside

down to the egg. About this time the antheridia burst, liberating the sperms which by rapid motions of their cilia swim through the dew-like moisture on the gametophyte until they reach the archegonium, being attracted in that direction by malic and other acids which it secretes. Arived at the archegonium the sperms swim down through the neck and one at last fuses with the egg thus forming the sexual spore from which the new plant is to come.

Although numerous archegonia are usually formed on each gametophyte various conditions combine to prevent the fertilization of more than one egg and in consequence the gametophyte rarely produces more than a single fern-plant. It is interesting to note that while the sex-organs are normally borne on the underside of the gametophyte, this appears to be due largely to the light for if the gametophyte be brightly illuminated from below, it will produce the sex-organs on the darker upper surface.

A thorough understanding of the processes that lead up to the formation of the sexual spore is necessary for the intelligent hybridizing of ferns. The only way that two different species can be crossed is by causing the sperm of one to unite with the eggs of another. A chance cross may result when the spores of two different kinds are sown thickly together but the crossing may be brought about more certainly by sectioning the prothallia with a sharp knife in such a way that each piece shall have but a single kind of sex-organ upon it. Then, by planting a section of one with archegonia close to another with antheridia, a cross is practically certain. The only difficulty in the way is the small size of the prothallia which makes proper sectioning a delicate matter. All natural hy-

brids, of course, have originated in the first way and it is a matter of wonder that a greater number of natural hybrids have not been recorded since the possibilities are in favor of it. In species like *Equisetum,* in which the gametophytes are dioecious, that is, each produces but one kind of sex-organ, fertilization of the egg by sperms from another gametophyte is the natural course.

In rare cases the gametophyte may omit the formation of a fern-plant by means of a sexual spore and produce a new fern-plant directly from a bud. This is known as *apogamy.* In some species the gametophyte thus give rise to several branches, each of which may produce a new plant or penetrating the soil, form tuber-like growths from which new plants subsequently spring.

When the sexual cell or spore begins to grow, it increases in size by the repeated division of the original cell just as the asexual spore does, but unlike that spore , it does not fall from the plant. From one section arises the first leaf, from another the stem, from another the first root and from the last an organ called the *foot* by means of which the young sporophyte absorbs food from the gametophyte until it is able to get food for itself. Some of the structures developed by the new sporophyte mark a long step in the evolution of the fern and serve to sharply disguish them from plants lower in the scale of life. For instance, the ferns are the first plants to have true roots. The mosses, to which the ferns are near allied produce rhizoids as the fern gametophyte does. but never roots. Again, the moss gametophyte may be leafy while the sporophyte never is; in the ferns this is exactly turned around for here it is the sporophyte that is leafy and the gametophyte not.

The name frond was early given to the leaves of ferns and will probably always be used in designating these structures, but strictly scientific botanists are inclined to divide them into two groups according to the work they perform. Thus the ordinary leaves are called such while those which bear the asexual spores are known as *sporphylls.* In the ferns the sporophylls are usually very much like the leaves in appearance, but among the fern allies may be seen a gradual differentiation between them until in such plants as the *Lycopodium*s and *Selaginellas* the sporophylls are set apart for the work of spore-production while the leaves are devoted to purely vegetative functions. In *Lycopodium* the sporophylls are borne at the tip of a branch, forming the familiar spike, and each sporophyll produces the same kind of spores. In *Selaginella,* however, there are two sizes of spores, the smaller being borne in the axils of sporophylls near the tip of the spikes, while the larger are borne on the sporophylls below them. The sporophylls bearing the large spores are the *megasporophylls* and the other are *microsporophylls,* the sporangia that enclose the spores being known as *megasporangia* and *microsporangia,* respectively. This condition also exists in *Isoetes,* but in *Marsilia,* where there are two sizes of spores, both are borne on the same sporophyll which is folded up, somewhat like the pinnules of *Onoclea,* forming a *sporocarp.*

It is often asserted that the sex-organs of the prothallium are homologous with the stamens and carpels of flowering plants, but from the foregoing it may be seen that this it not correct for the pollen grain is really a spore. The stamens and carpels have their counterparts among the ferns it is true, but it is among

the parts of the sporophyte and not the gametophyte that we shall find them. The fact is, the microsporophylls of *Selaginella* are practically identical with the stamens of flowering plants while the megasporophylls with their megaspores correspond closely with the carpels and their embryo sacs. If, as we are warranted in doing, we define a flower as a cluster of megasporophylls and microsporophylls, then we can say with truth that some of the fernworts actually bear flowers.

The microspores of *Selaginella* always produce small prothallia that bear only antheridia while the megraspores give rise to prothallia that bear only archegonia. These latter, which we may call female gametophytes are not green like the gametophytes of the ferns but are colorless and therefore dependent as regards their food. The food they use is stored in the megaspore by the sporophyte. The gametophytes of this kind never get entirely out of the spore-coats, but by the splitting of these coats at maturity the archegonia are exposed for the fertilization of the egg. The new sporophyte begins to grow while yet the gametophyte is attached to the old sporophyte and thus very much resembles a seed, pointing clearly to the fact that while on the one hand the fernworts are the nearest relatives of the mosses, on the other they approach very close to flowering plants.

In a few instances, the fern sporophyte has been found to produce new gametophytes without the intervention of an asexual spore, just as the gametophyte may produce a new sporophyte without the intervention of a sexual spore. This process is known as *apospory* and was first noted by Chas. T. Druery. There are two types of apospory: in one the prothallia spring from what would ordinarily be a sporangium and are,

after all, rather spore-like in origin; in the other they grow from some marginal cell of the frond. Apospory must not, however, be confused with ordinary reproduction by adventitious buds, such as may be seen on the walking fern and many others. Of the same general nature are the bulblets of *Cystopteris bulbifera* and *Lycopodium lucidulum*. The stolons of the ostrich fern, the bracken and the sword ferns are mere branches that rooting at their tips, form new plants.

RARE FORMS OF FERNS.—VI.

A Cut-Leaved Crest Fern.

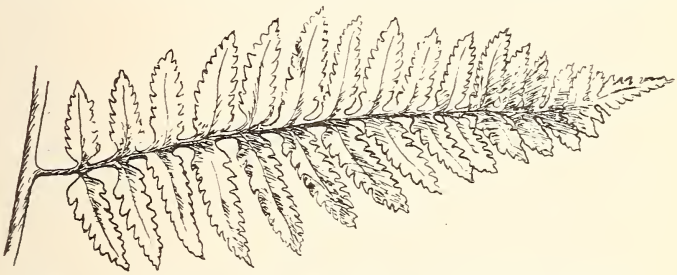
The description which D. C. Eaton drew up for the form of *Nephrodium cristatum* which he named *Clintonianum* neither fits his illustration of that form nor agrees with the specimens that have subsequently been referred to it. He describes the pinnules as "linear-oblong, obtuse, serrate or cut-toothed, the basal ones sometimes pinnately lobed." It is rare, indeed, to find specimens with the cutting of the pinnules extending beyond what would be pronounced serrate while in many specimens the outline can hardly be characterized by any word that suggests a tooth-like edge. In some handsome specimens which Mr. W. A. Poyser recently sent me for examination, however, the description is fully met for in these the pinnules certainly are well described as cut-toothed. As will be seen from our illustration of a single middle pinna the cutting follows the general rule for such features and consists in a deepening into lobes of the serratures that are found on normal pinnae. The effect upon the appearance of the whole frond is to give it a very striking and beautiful outline.

Since it is desirable to have a name to characterize

this extreme form, which stands in much the same relation to *N. cristatum* that *Asplenium ebenium serratum* does to the type, Mr. Poyser sends the following description:

NEPHRODIUM CRISTATUM CLINTONIANUM F. SILVATICUM f. nov.

Rootstock as in the type: fronds averaging as large as the sub-species; pinnae long-stalked, broader than in the normal form, as wide at base as in the middle:



PINNA OF NEPHRODIUM CRISTATUM CLINTONIANUM SILVATICUM POYSER.

pinnules distant, linear-oblong, sharp-pointed, deeply serrate or toothed, the teeth often serrulate.

Found in Delaware County, Pennsylvania. Type No. 534 in the herbarium of W. A. Poyser.

In the original description Prof. Eaton says that the fertile and sterile fronds of *Clintonianum* differ in habit, but in the present form they apparently do not. The fern was found in a deep and shaded ravine and has maintained its form unchanged for at least three years. Recently there has been shown a disposition to consider *Clintonianum* a species distinct from *N. cristatum*. In that case the species would be *Nephrodium Clintonianum* and the form *N. Clintonianum sylvaticum*. Those who prefer *Dryopteris* will of course call the form *Dryopteris Clintoniana sylvatica*.

POLYSTICHUM ACROSTICHOIDES X ANGULARE.

By Amedee Hans.

Hybridizing plays a greater part in ferns than is generally believed and many forms that are still named species are only hybrids. This conclusion comes to one when he sees how easily some species cross when the spores are sown together. If *Camptosorus* and *Asplenium ebeneum,* though found in nature often in different localities, can produce *Asplenium ebenoides* by hybridization, there is no reason why others could not do the same, especially in the tropics where so many kinds grow together.

The different forms of *Polystichum angulare* found and raised in the British Islands, are among the finest hardy ferns on account of the finely divided fronds of some of them, but being entirely British forms, they stand the climate of our Northern States only with good protection. It occurred to me that by crossing some of them with *Polystichum acrostichoides* something could be obtained that would combine the hardiness of *acrostichoides* with the delicate cutting of some of the forms of *angulare.* Accordingly I made sowings of *Polystichum angulare venustum, P. a. divisilobatum, P. a. grandidens, P. a. perserratum* and P. *aculeatum Braunii.* No crossing resulted from the last sowing, but for the others the results were beyond expectation.

Of these sporelings, more than 1500 in number, more than 10% are distinct and all have passed the past two winters without protection and without loss, though during the first, they were only small sporelings. Different forms of *P. a. incisum* are the most conspicuous. They are of different shapes, more or less incised, undulate, recurved, crisped etc. The

others are more or less deeply cut to bipinnate and these last are easily distinguished from *P. angulare* by their glossy appearance and stronger substance. Among the rest of the sporelings, *angulare* forms are more numerous than those of *acrostichoides* but among the forms resembling the first there are many that are easily distinguished from the original plant. They are just as finely cut, but there is something different in their appearance. It would be hazardous to call them hybrids, however, until another year's trial.

Some good spores have been collected from the best of these hybrids and no doubt after a few more trials a new set of perfectly hardy plants will be obtained that will have the delicate structure of the plumose, crested and other forms of *angulare*.
Stamford, Conn.

Polystichum Acrostichoides Recurvatum.—It is a well-known fact that most of the abnormal forms of ferns found in nature reproduce themselves in a great percentage of cases from spores, the abnormality more or less accented with always some normal plants among them. An abnormal plant means a plant that has all its fronds affected in the same way; if only a few fronds are affected, it is usually accidental and cannot be reproduced by spores. Through the courtesy of our editor who sent me spores of *Polystichum acrostichoides recurvatum,* I was able to raise about one hundred sporelings of this form. They are not big enough yet to form a definite conclusion, nevertheless nearly all show signs of *recurvatum.*—*Amedee Hans, Stamford, Conn.*

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued.)

SALVINIACEAE.

Azolla Lam.

212. **Azolla Caroliniana** Willd. Azolla; Water Fern. Not common: on the surface of still water. New York, Iowa and Washington to the Gulf of Mexico; also in the tropics and southward to Patagonia.

213. **Azolla filiculoides** Lam. Not uncommon; on the surface of ditches and pools. California; also along the western slopes of the Andes.

Salvinia Adans.

214. **Salvinia Natans** (L.) Very rare; on the surface of ponds. Perry County, Missouri. Also in the temperate parts of Europe and Asia.

MARSILIACEAE.

Marsilia L.

215. **Marsilia quadrifolia** (L) Marsilia; Water Clover. Very rare; in ponds and slow-moving streams. Bantam Lake, Conn., and naturalized elsewhere; also in Central Europe, and Asia to Japan and Northern India.

216. **Marsilia macropoda** Engelm. Not common; in water or in moist places. Texas and New Mexico.

217. **Marsilia uncinata** A. Br. Abundant on the banks of streams, in swamps and shallow ponds. Louisiana and Texas.

218. **Marsilia vestita** Hook and Grev. Horse Clover. Common; in moist places. Dakota, and Washington to Texas and California; also in Mexico.

219. **Marsilia vestita tenuifolia** (Engelm.) Very rare; in moist places. Texas. Only twice collected.—*M. tenuifolia* Engelm.

Pilularia L.

220. **Pilularia Americana** A. Br. Pillwort; Water Pepper. Rare; in moist places. Oregon, California and Arkansas; also reported from Chili.

EQUISETACEAE.

Equisetum L.

221. **Equisetum arvense** L. Field Horsetail. Very abundant; in swamps, woodlands, fields and roadsides. Throughout North America, also in the north temperate and Arctic zones of the Old World.

This is a most variable species with many named forms of no stability. The following are most important: **alpestre, arcticum, boreale, campestre, decumbens, diffusum, irriguum, nanum nemorosum, polystachyon,** and **pseudosylvaticum.** All are described in Fern Bulletin, vols. VII and VIII.

222. **Equisetum Ferrissi** Clute. Rare; in moist shades. Northeastern Illinois.

223. **Equisetum fluviatile** L. Water Horsetail. Common; in shallow ponds and ditches. Virginia, Kansas and Washington to the far

north; also in central and northern Europe and Asia—*E. limosum* L.

The form **intermedium** A. A. Eaton, resembles forms of *E. litorale*. **f. linosum** L. is a nearly unbranched form found with the type.

224. **Equisetum Funstoni** A. A. Eaton. Not uncommon; in moist places Southern California, probably in Mexico. The plants to which this name has been given were referred in older floras to *E. Mexicanum* and *E. ramosissimum*, two species not now considered members of our flora.

225. **Equisetum hiemale** L. Scouring Rush; Winter Rush. Common; in moist places. Nearly throughout North America and extending across Northern Europe and Asia.

The forms **affine, Californicum, Doelli, Drummondii, herbaceum, pumilum, Suksdorfii, ramosum** and **Texanum** are ecological forms likely to be found with the type. All are described in Fern Bulletin Vol. XI.

226. **Equisetum hiemale intermedium** A. A. Eaton. Common or abundant; in moist meadows. Mississippi Valley and westward to the Rocky Mountains. Resembles *E. laevigatum*.

227. **Equisetum hiemale robustum,** (A. Br.) Great Scouring Rush. Very common; in the Southern States. Often regarded as a mere robust form of the type. It may be noted that the correct name for this plant is *E. hiemale prealtum* (Raf.).—*Equisetum robustum A. Br.*

228. **Equisetum laevigatum** A. Br. Smooth Scouring Rush. Common; in moist meadows. New Jersey, Wisconsin and Louisiana to the Pacific coast. The ecological forms **Caespitosum, elatum, polystachyon, scabrellum, ramosum,** and **variegatoides** have been described in Fern Bulletin, Vol. XI.

229. **Equisetum litorale** Kuhl. Shore Horsetail. Rare; in moist places. New Jersey, Pennsylvania and Wisconsin northward; also in the Old World from France and Austria northward.. Variable, and often regarded as a hybrid.

The following forms have been described in Fern Bulletin, Vol. X.: **arvensiforme elatius, gracile, humile, prolifera,** and **vulgare.**

230. **Equisetum palustre** L. Marsh Horsetail. Rare; in wet grounds. New England, Illinois and Washington to the far north; also in the northern parts of Europe and Asia.

231. **Equisetum pratense** Ehr. Shade Horsetail. Rare; in cultivated fields and waste places. New Jersey, Minnesota and Colorado northward; also in the colder parts of the old world.

232. **Equisetum scirpoides** Mich. Dwarf Scouring Rush. Somewhat rare; on moist banks. Connecticut, Pennsylvania, Illinois, Nebraska and British Columbia northward to Greenland and Alaska; also in Northern Europe and Asia.

233. **Equisetum silvaticum** L. Wood Horsetail. Common; in moist shades. Virginia to Nebraska and northward to the Arctic Circle; also in the colder parts of the old world. In Vol. IX of the Fern Bulletin the following

American forms are described: **Capillare, pauciramosum praecox, pyramidale, robustum, serotinum,** and **squarrosum.** All are mere ecological phases of the plant.

234. **Equisetum telmateia** Ehrh. Ivory Horsetail. Common; in moist places. California to Alaska mostly near the coast; also from Ireland and Scotland to Siberia, Persia and North Africa.

235. **Equisetum variegatum** Schleich. Variegated Scouring Rush. Not uncommon; in moist places. From beyond the Arctic Circle southward to the northern tier of States and Illinois and Indiana; also in the old world north of the forty-second degree of latitude. The form **Alaskanum** A. A. Eaton has been reported from Alaska.

LYCOPODIACEAE.

236. **Lycopodium alopecuroides** L. Fox Tail Club-Moss. Not uncommon; in wet grounds. Long Island to Texas, mostly near the coast; also southward to Monte Video.

237. **Lycopodium alopecuroides adpressum** Chapm. Common; in sandy swamps. Massachusetts to Texas—the common form. The variety **polyclavatum** McDonald with several heads on a stem is reported from Staten Island, New York. —*Lycopodium alopecuroides Chapmani* (*Underw.*) *Lycopodium adpressum* (*Capm.*)

238. **Lycopodium alopecuroides pinnatum** Chapm. Not uncommon; in wet grounds. Georgia and

Florida to Mississippi—*Lycopodium pinnatum* (Chapm.)

239. **Lycopodium alpinum** L. Ground Fir. Common; on grassy moors. British Columbia to Alaska and Greenland; also in the Old World from Spain and Switzerland northward.

240. **Lycopodium annotinum** L. Stiff Club-Moss. Not uncommon; in moist shades. New Jersey, Minnesota, Colorado and Washington to Alaska and Greenland; also in the colder parts of the Old World.

241. **Lycopodium annotinum pungens** Spring. Somewhat rare; found with the type in the far north and on mountain tops; also in the Old World.

242. **Lycopodium Carolinianum** L. Carolina Club-Moss. Common; in sandy swamps. Central New Jersey to Florida and Louisiana near the coast; also reported from Ceylon, Hong Kong, New Guinea, Tasmania and the Cape of Good Hope.

243. **Lycopodium cernuum** L. Rare; on moist banks. Southern Mississippi, Alabama and Georgia to Florida; also around the world in the Tropics and southward to Cape Colony and New Zealand.

244. **Lycopodium clavatum** L. Ground Pine. Abundant; in woods and pastures. Mountains of North Carolina, New Jersey, Pennsylvania, Iowa and Oregon to the far north; also nearly throughout the world. Confined to the mountain tops in the tropics. A form with a single

spike to each branch is **monostachyon** Hook.

245. **Lycopodium complanatum** L. Ground Pine; Christmas Green. Abundant; in woods and thickets. Georgia, Iowa and Washington to Labrador and Alaska; also nearly throughout the old world. The form **wibbei** Haberer has a single spike of fruit on each branch.

246. **Lycopodium complanatum flabelliforme** Fernald. The common form in the United States distinguished by its strongly dorsiventral leaves.

247. **Lycopodium complanatum chaemacyparissus** (A. Br.) A slenderer, more upright form found with the type and frequently regarded as a distinct species.—*Lycopodium chamaecyparissus* A. Br. *L. tristachyon* Pursh.

248. **Lycopodium lucidulum** Mich. Shining Club-Moss. Common; in moist shades. South Carolina, Alabama, Iowa and Minnesota to Labrador; also in Japan, China and the Himalayas. The form **occidentale** Clute is reported from Washington and the form **porophilum** (Lloyd and Underw.) (*Lycopodium porophilum* Lloyd and Underw.) is a dwarf form reported from Wisconsin, Indiana, Kentucky and Alabama on dry rocks.

249. **Lycopodium inundatum** L. Bog Club-Moss. Not uncommon; in bogs. New Jersey, Pennsylvania, Illinois and Washington to the far north; also in Northern Europe. The form **Biglovii** Tuckerm. is a luxuriant form that may occur with the type.

250. **Lycopodium obscurum** L. Tree Club-Moss. Common; in dryish shades. North Carolina, Tennessee and Montana to Newfoundland, and Alaska; also in Siberia and Japan.—*L. dendroideum* Michx.

251. **Lycopodium sabinaefolium** Willd. Not uncommon; in open grassy places. Northern New England and Ontario northward.

252. **Lycopodium Selago** L. Fir Club-Moss. Rare; in exposed elevated regions. North Carolina, Michigan and Washington to Alaska and Greenland; also in Northern Europe and Asia and in Australia and New Zealand.

253. **Lycopodium Sitchense** Rupr. Rare; in exposed places. Elevated regions of Maine, New York, Idaho and Washington to Labrador and Alaska.

PSILOTACEAE.

254. **Psilotum triqeutrum** Sw. Rare; on the trunks of trees. Florida; also widely spread in the tropics and reaching Japan and New Zealand.—*P. nudum* (L.)

Light and Germination of Spores.—The prothallia of most ferns are found in moist shady places and the ferns themselves are unusually adapted to a shady habitat, but notwithstanding this the spores refuse to germinate in darkness. A. C. Life who has been carrying on some experiments along this line at the Missouri Botanical Garden, writes in the 18th Annual Report that the spores of the species he used would not grow in darkness, but that germination proceded best in light of medium intensity. In very weak light the prothallia tend to take on a ribbon shape, while stronger light gave the usual heart-shaped form. Strong light seems to favor the production of archegonia and weak light produces antheridia, only. The spores of all the species experimented upon contain chlorophyll which very readily accounts for the stimulus that light gives to germination. A point which none who have investigated the germination of fern spores seem to have kept in mind is that all ferns do not have the same habitat. It may be assumed that with ferns which normally grow in the open, a higher light intensity for germination would be required than with ferns that naturally grow in the shaded ravines. A higher temperature, also, will probably be found more congenial to the spores of tropical ferns than to those of colder regions.

Development of Ophioglossum.—In ordinary ferns a new plant is produced by a fertilized egg which divides into four regions that produce the stem, leaf, root and foot respectively, but in some cases some of these organs are omitted. According to Campbell, who has been studying the Ophioglossaceae, there are

three types of embryo in this group. In one, represented by *Ophioglossum mollucanum,* the plant is an annual and develops only a root and leaf and has no stem; in another, represented by our own *O. Vulgatum,* a root and stem are produced, followed much later by a leaf; and in the third represented by the well-known *O. pendulum* of the tropics a root, only, is produced, the stem and leaf which the plant bears appearing ultimately from a bud on this root at some distance from the prothallium. It may be added that the prothallia of all these species lack the leaf-green of ordinary fern prothallia and must set up a partnership with a fungus in order to produce a new plant.

Generic Relationships.—It is a comparatively easy matter to distinguish one species from another when one is dealing only with a few specimens of each, but as the amount of material increases trouble develops, due to the variations that are absolutely certain to occur. It then becomes a very nice matter of judgement to draw the line between closely allied species, if, indeed, any hard and fast line can be drawn. Nor is this difficulty absent from the consideration of genera though from the nature of the case, it is only the student of the larger aspects of the science, working with an immense amount of material, that ever experiences any trouble. Ordinarily we have no difficulty in distinguishing an *Asplenium* from a *Nephrodium,* for instance, but if all the plants referred to these two genera were brought together, no novice could place many of the species correctly. It has long been known that *Acrostichum* and the old *Aspidium* are closely related, and in a recent publication Dr. Christ reverting to the idea, says: "The con-

tention that "Acrostichchum" is only "Aspidium" with reduced fertile pinnae appears to me to be better established than ever. Is this a step in advance in the development or a degeneration? The example of *Dryopteris canescens* where the incontestable deformation of the pinnae both fertile and sterile, is accompanied by the acrostichoid formation as to the sorriferous parts, appears to me to point strongly to the latter; that is to say, an aberration and weakening of the type, which one can scarcely call only teratological, because the infiuences that have caused the changes are unknown." An excellent example of this may be seen in our common Christmas fern, whose specific name, *Acrostichoides,* was derived from the fact that it closely resembles an *Acrostichum.* While such ferns point unmistakably to an alliance of *Nephrodium* with *Acrostichum,* other forms as clearly connect it through *Phegopteris* with *Polypodium.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from, this list.

Binford, R. *The Development of the Sporangia in Lygodium,* illust. Botanical Gazette, S. 1907.

Clute, W. N.. *Naming the Ferns without a Book,* illust. American Botanist, Je. 1906.

Dobbin, F. *A Fern Community.* American Botanist, Ap 1906.

Life, H. C. *Effect of Light upon the Germination of Spores and the Gametophyte of Ferns,* illust. 18th Report of Missouri Botanical Garden, 1907.—

Under ordinary conditions fern spores of the species experimented with will not germinate in darkness. Germination was best in light of medium intensity. Weak light produces filamentous prothallia and stronger light the usual heart shaped forms.

PFEIFER, W. M. *Differentiation of Sporocarps in Azolla* illust. Botanical Gazette, D. 1907—Megasporocarps and microsporocarps develop alike for some time. The microsporocarp results from the abortion of the megaspores.

PIERCE, W. C. *Ferns,* illust. Floral Life, D. 1907—The forms of *Nephrolepis exaltata* discussed from the cultural viewpoint.

UNDERWOOD, L. M. *The Names of Some of our Native Ferns.* Torreya, O. 1907.—Calls attention to several new combinations that the publication of Christiansen's "Index" makes possible.

UNDERWOOD, L. M. *American Ferns.—VII. The American species of Stenochlaena.* Illust. Torrey Bulletin 1907.—An account of the American species which are regarded as 12 in number. Includes a description of three new species, *S. angustata* from Columbia *S. Jamaicensis* from Jamaica and *S. Maxoni* from Costa Rica. *S. Kunzeana* is reported from southern Florida.

WOODBURN, W. L. *A Remarkable case of Polyspermy in Ferns,* illust. Botanical Gazette, S. 1907.

YAMANANOUCH, S. *Sporogenesis in Nephrodium,* illust. Botanical Gazette, Ja. 1908.—A preliminary paper to one on apogamy. The conclusion is drawn that there is a uniform number of chromosomes and in the normal life-history a reduction of chromosomes in sporogenesis.

EDITORIAL.

Some days ago, a subscriber to this magazine wrote to condole with the editor upon the demise of the FERN BULETIN. It may be needless to add that he was a comparatively new subscriber. This magazine is not dead now moribund, nor is it, to continue our pathological anology further, even in a comatose condition. The magazine is still supposed to be printed at Binghamton, but when our business was moved to Joliet and nobody left to stir up the printers, matters began to drag. Readers will recall that the January issue, though late, had to be reprinted, that the April issue was more than four months in getting through the press, and we may add for their further information, that the printers have had the copy for the next issue for nearly three months without finding time to set it up. The present number beginning a new volume is printed at Joliet with a reliable printing establishment, and no more delays of this kind need be feared. We shall continue right along with volume 16 and send the two missing numbers as soon as we can get them.

* * *

A second reason for the delay in issuing the magazine is that the editor finds himself in much the position as regards fern study that Napoleon considered himself in regard to France when he observed "The State? I am the State!" The editor is far too modest to claim that he is all there is of fern-study, but to judge from the amount of writing he is obliged to do in order to keep this magazine filled he is pretty near all of it. It is the editor's misfortune rather than his ambition that obliges him to thus appear in the role

of a monopolist. If he had the time, he feels quite sure that he could write thirty-two pages four times a year, but any reader who has a mental picture of the editor in a palatial office with nothing to do but concoct fern literature has another guess coming. A long time ago, when this magazine was started, the editor might have entertained the hope that the magazine would some day earn him a living and allow him to give his whole time to advancing the study of ferns but that was fifteen years ago. The hope he now entertains is that the magazine will continue to bring in enough revenues to pay the printer, while the editor earns his daily bread as a teacher of biology in a great city school. Business before pleasure is an old and well tried motto, and when school affairs demand attention this magazine, which is at best, a mere recreation of the editor's, must wait. The only question with each subscriber must be, is a magazine issued as irregularly as this one and containing the matter it does, worth seventy-five cents a year? Some there are that for fifteen years have given a strong affirmative to this question and have answered it for the future by paying several years in advance. Others, whether they are satisfied or not, continue to renew, as one recently expressed it, "because they have formed the habit." We are sure such good habits should not be lightly broken. We cannot, however, neglect this opportunity to express our appreciation of the indulgent attitude of our readers in regard to the delay. Those who have written about it at all, have mildly said that their two numbers were missing and if issued must have been lost in the mails.

* * *

For the year 1908 we have planned to continue our series of illustrations and notes on rare forms of ferns,

and also our illustrations of curious or interesting exotic species. These two features, alone, we feel sure will be of the greatest usefulness to fern students and worth the cost of the magazine. The check-list of North American Fernworts will be completed in this volume; additional fern-floras of the States published and various new species and forms which we have in hand will be described and illustrated. Notwithstanding this, we wish to impress it upon our readers that we are very desirous that they shall take part in the making of the magazine and earnestly invite notes and articles in our line. The department of Pteridodographica should be especially remembered when you have a note that will not do for a long article. The magazine will be issued on time if copy accumulates fast enough; otherwise it will be issued when the editor accumulates time enough.

* * *

In this issue, bills to the end of 1908 are sent out to all subscribers. They will be found facing the frontispiece. Those who have any doubts as to our ability to deliver the two missing numbers, need not pay their subscriptions until these are received. If any there be whose subscriptions expired at the end of 1907 and who do not wish to continue, they may elect to receive the first two numbers of 1908 in lieu of the missing numbers or they will be sent these numbers when printed, just as they choose. Unless notified we shall suit ourselves in the matter.

* * *

There is just as much of an evolution in fern study as there is in any other department of human endeavor. The first plant gatherer's interest in ferns

centered in their curious forms and medicinal properties. It was not until long afterward that the early botanists busied themselves with naming and studying the ferns scientifically and still later that the ferns began to be cultivated or collected for their beauty and decorative qualities. From this it was but a step to the recognition of the minute differences that characterize forms and the study of the haunts, habits, and curious traits of these magnificent plants. This sequence of interest, the first phase alone excepted, has been repeated again, and again as new countries have been discovered. To the first phase belong the books on simpling, charms and divination, to the second belong the manuals and text-books, and to the third belong the popular hand-books. In the United States and Canada we have reached the third stage, but Mexico is still in the second and many of the islands of the sea are in the first. With us, the wave of popular hand-books has pased but it is an error to think that in consequence everything interesting about ferns has been found out and published. There is still enough to be discovered to keep any who read these lines busy until all fern study for them has ceased in this world. Let no one, therefore, think he has exhausted the subject; rather let him study through his books and collections anew and prepare for the new season while yet he may.

BOOK NEWS.

The Plant World, formerly of Binghamton, and more recently of Washington, New York and Denver, has moved to Tucson, Arizona.

According to a prospectus received, Dr. Edward F. Bigelow, well known to readers of out-door literature

as the editor of the old *Observer,* will soon issue a monthly magazine of similar scope to be known as the "Guide to Nature." The publication is to be the official organ of the Agassic Association of which Dr. Bigelow was recently elected president.

At Chicago, during the Christmas holidays the American Nature Study Society was organized. All who are interested in advancing the study of nature in the schools are invited to become members. Full information may be obtained by addressing the Secretary of the Nature-Study Society, Teachers' College, New York City. Membership in the Society entitles one to the *Nature-Study Review,* the official organ of the society, now in its fourth volume.

"Walking a fine Art" is the title of an attractive little volume compiled by Edward F. Bigelow from the writings of poets and naturalists in all lands, and from original contributions by present-day walkers. Together they form a most readable book which all who love to walk in field and wood will be glad to possess. The book is published by S. E. Casino & Son, Salem, Mass.

AMERICAN FERN SOCIETY.

The annual election of the Society last November gave us the following officers for the present year: President, James H. Ferriss, Joliet, Ill.; Vice-President, Dr. D. W. Fellows, Portland, Maine; Secretary, W. A. Poyser, 6028 Delancy Street, Philadelphia, Pa.; Treasurer, Miss Nellie Mirick, 28 East Walnut St., Oneida, N. Y. At this election a larger number of votes were cast than in any previous election indicating a very gratifying interest in our work.

Standard Books on Ferns

"How Ferns Grow," by **Margaret Slosson.** With 46 plates by the author. Large 8vo. $3.00 net, by mail $3.34.

A valuable contribution to fern literature in that it not only enables fern students to distinguish different species of mature ferns, but points out characteristics of the different kinds at all stages of development, and shows the genetic relations of ferns to each other and to the rest of plant life. The plates, nearly all reproducing ferns at their natural size, are particularly excellent. Published 1906.

"No one has hitherto devoted, as the present author does, a whole book to a readable account of the youth of ferns. . . . With great pains she has studied the various metamorphoses and has recorded in good photographs her interesting results. The transformations are all well shown by the engravings, but she has supplemented these engravings by clear text."—The Nation.

"Botanical books especially, of late years, have been remarkable for wealth and beauty of illustration, but even among these "How Ferns Grow" is notable. The pictures are purely scientific, nearly all are the size of nature, and they are so numerous and so carefully arranged as to make the text almost superfluous. . . . A beautiful book that every fern lover will want."—N. Y. Sun.

"Ferns," by **Campbell E. Waters,** of John Hopkins University. 362 pp., square 8vo. Over 200 illustrations from original drawings and photographs. $3.00 net, by mail, $3.34.

A manual for the Northeastern States, thoroughly authoritative and written in a popular style. It covers all the ferns in the region embraced either in Britton's or in Gray's Manuals. A key based on the stalks, as well as one based on frutification, differentiates if from other analtical keys now existing.

"The ideal fern-book. . . . The best fern-book that has appeared. The illustrations are superb."—Dr. F. H. Knowlton, U. S. National Museum.

"The best fern-book—beautiful and scientific."—Critic.

"Likely to prove the leading popular work on ferns. . . . It can confidently be asserted that no finer examples of fern photography have ever been produced."—Plant World.

"Our Native Ferns and Their Allies." With Synoptical Description of the American Pteridophta North of Mexico. By **Lucien M. Underwood,** Professor in Columbia University. Revised. xii + 156 pp. $1.00 net, by mail, $1.10.

"The elementary part is clear and well calculated to introduce beginners to the study of the plants treated of. The excellent key makes the analysis of ferns comparatively easy. The writer cordially commends the book. It should be in the hands of all who are especially interested in the vascular cryptograms of the United States."—Bulletin of the Torrey Botanical Club, N. Y.

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A Quarterly Devoted to Ferns

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Secretary, W. A. POYSER, 6028 Delancy St., Philadelphia, Pa.

Fern students are cordially invited to join the Society. Members receive the Fern Bulletin free. Address either the President or Secretary for further information. The annual dues are $1.00 and should be sent direct to MISS NELLIE MIRICK, Treasurer, 28 East Walnut St., Oneida, N. Y.

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THE PEDATE BRACKEN — *Doryopteris pedata.*

THE FERN BULLETIN

Vol. XVI APRIL, 1908 No. 2

A PEDATE BRACKEN.
Doryopteris pedata.

BY WILLARD N. CLUTE.

In the tribe Pterideae to which our common brake or bracken (*Pteris aquilina*) belongs, there are at least a dozen genera, among which may be mentioned as typical *Pellaea, Chilanthes* and *Lonchitis.* The characteristic recognition marks of the tribe are found in the sori which are placed at the ends of the veins near the margin of the frond, or upon a vein-like receptacle connecting the tips of the veins, and covered with some sort of an indusium formed by the reflexed margin of the frond. With genera as with species, however, it is easy enough to recognize typical and well-marked examples; the trouble arises in trying to draw the line between those which shade off into other groups with characters that make them as well placed in one as in the other. In consequence of this, the limits of the tribe are, in a measure, matters of opinion and botanists are not entirely agreed as to just what genera should be included in it. In the same way, the genus *Pteris* for which the tribe is named, consists of a hundred or more species differing so greatly among themselves that the different groups into which they naturally separate are often considered to be distinct genera as is often the case with similar groups in *Polypodium* and *Nephrodium.*

It thus happens that the subject of this sketch sometimes finds itself in the genus *Pteris* and again in the

genus *Dorypteris*. Linnaeus knew the plant as *Pteris pedata* but John Smith, a former curator of the Royal Botanical Gardens at Kew, concluded that the reticulated venation of this species, so unlike that of the true brackens, entitled it to be placed in a distinct genus and therefore called it *Doryopteris pedata*.

If generic relationships depended alone upon the superficial appearance of plants, our species would still have much to warrant its being placed in a separate genus, for its fronds, not unlike certain geranium leaves in appearance, have little of the conventional fern frond about them. It is to be noted, however, that even these fronds have a hint of the triangular in them such as many species in the genus *Pteris* exhibit and which is well shown in the common brake. But it is the venation and arrangement of the sori that must furnish the decisive features, and in these it differs so much from the true brackens that it seems well placed as *Doryopteris*. In the present instance the great value of veining and disposition of the sori in determining genera is shown by another species *Pellaea geraniifolia* that at first glance is almost exactly like our plant. This, too, was once considered a member of the *Pteris* genus, but is now regarded as a *Pellaea* because the sori are on the tips of free veins not connected by a transverse vein. Its veins being free and not reticulated very clearly distinguishes it from *Doryopteris*.

The pedate bracken is found from the West Indies to Southern Brazil, being not uncommon in half shaded situations. Its fronds spring in tufts from a short rootstock and are a foot or more in length, with rather thick blades and dark and polished stipes and rachises. The spore-cases are usually abundant

and at maturity form a heavy brown margin to the pinnae.

The specimen figured as our frontispiece is from the ferns of Southern Brazil named by Dr. Rosenstock. Certain small differences in the stipe and blade led him to describe it as a new species, *Doryopteris stierii,* in *Hedwigia,* but he has later regarded it as a variety. In the same journal two additional forms of this species are described.

REDISCOVERY OF CHEILANTHES PARISHII.

BY C. F. SAUNDERS.

On a visit to Palm Springs, in the Colorado Desert, Southeastern California, in March of the present year, I had the good fortune to collect a single plant of *Cheilanthes Parishii*—one of the rarest of North American ferns. It was originally discovered by Mr. S. B. Parish (for whom it was named) in the same locality 27 years ago and has never been reported since. My specimen grew in a crevice of rock on the side of Andreas Canon, where the first collection was made, and though I searched carefully for more plants of it, could find none.

Pasadena, California.

[To Mr. Saunders' interesting and valuable note, we take the liberty of adding the following observations by Mr. S. B. Parish, originally published in Vol. IX, No. 4, of *The Fern Bulletin.*—Ed.]

It is now some twenty years since the type specimens of these two species [*Cheilanthes fibrillosa* and *C. Parishii*] were gathered; their validity has not been doubted by any subsequent student of ferns, but they remain known only from the original collections. To

facilitate their rediscovery it appears desirable to place on record the exact places at which the types were found. Both were discovered at the base of San Jacinto Mountain but on opposite sides of it, in what was formerly San Diego, but is now Riverside county. *Cheilanthes Parishii* came from the eastern or desert base of that mountain. Here, under its shelter an arm of the desert pushes in and is watered by three streams which drain its acclivities. A hot sulphur spring rises in the plain which gave the place its Spanish name of Agua Caliente. Twenty years ago it was occupied only by Indians who soaked away their physical ills in the hot pool and supplied their primitive wants from the fruits of their gardens aided by the fruits of the palm, the mesquite and other native vegetation. Perhaps it is best barely to refer to the snakes, caterpillars and other animal food which gave relish to this vegetarian diet. But this is all changed, now, even the name. A little hamlet called Palmdale—or sometimes Palm Springs—clusters around the sulphur spring, the few Indians who remain are crowded to the outskirts and the valley is occupied by vineyards and apricot orchards which ripen their fruit long before any other in Southern California. The inhabitants are almost exclusively sufferers from lung troubles who find life in this warm and dry atmosphere. The altitude is but 500 feet above sea level and the climate is charming in winter but in summer the place in an oven. The natural vegetation is abundant a botanist could not spend a fortnight of his winter vacation in California amidst a more novel and interesting flora.

Some three miles up the valley from the springs a cluster of a few houses and orchards bear the enticing

name of "The Garden of Eden." Opposite comes down a canyon from which the garden is watered. An Indian named Andreas used to live at its mouth and from him it was named Andreas' canyon. Up it ran a difficult trail leading to nowhere. Perhaps three miles, or it may be more or less, for the distance is a guess at this length of time, this trail crossed over a low ridge of the mountain to avoid the narrow gorge through which the stream at that point flows and just above, it came to an end under a cliff on the left bank. Here we sat down by the cool stream and ate our lunch and then turning to an examination of the cliff, collected among other things the type of the fern of which I am writing. This was in March, 1881 and I was just beginning my acquaintance with the desert flora. Almost every plant was unknown to me so that my overloaded press could contain but a scanty gathering of any one species. I saw that the fern was new to me but had no thought that it would prove to be so to better informed students and so made no exception in its favor. The few specimens gathered were sent to Mr. Davenport who described and figured them in the *Bulletin of the Torrey Botanical Club,* 8:61. In April of the next year I revisited the place confidently expecting to secure a good supply of the new fern but without succeeding in finding a single specimen. I have never been there since, nor, I am confident, has any other botanist. I hope others may not be deterred by my disappointment and may be more fortunate. As as aid to such an one, I will remind him that the fern has a considerable general resemblance to *Notholaena Parryi,* which is very abundant in that region, but it is readily distinguished on close examination.

NEW STATION FOR A RARE FLORIDA FERN.

BY WILLARD N. CLUTE.

Until recently the claim of *Hypolepis repens* to a place in the fern flora of the United States rested upon a single specimen from Oakland, Florida, reported some years since by L. M. Underwood. Many parts of this state are still so little known, botanically, that further reports of the occurrence of this fern, instead of occasioning surprise are rather in the line of the expected.

The good fortune of discovering a second locality for this species belongs to Rev. and Mrs. J. C. Armstrong of Chicago, who first found it a year or more ago while wintering in Florida. The new locality is near Lake Charm, in Orange County, Florida, about 18 miles north-east of Sanford. Mrs. Armstrong writes me that the colony consists of at least a hundred plants growing thriftily in the rich black soil and deep shade of hammock land in company with *Blechnum serrulatum*. Some of the fronds were more than three feet high.

The typical *Hypolepis repens* has a prickly stipe and rachis but the Armstrong plants, though somewhat rough are not at all prickly and apparently belong to Hookers variety *inermis* which differs very little from the type in other respects.

At first glance the plant has the appearance of a *Dicksonia* since it bears its sporangia on a reflexed tooth of the pinnule, but a closer look shows instead of the inferior, bowl-shaped indusium of *Dicksonia,* the sori gathered at the tips of the veins and covered by an indusium formed by the reflexed margin of the lesser divisions of the frond. Its affinities will thus be seen to be with *Pteris, Pellaea* and *Chilanthes* and not so very far removed from *Adiantum.* Plants sent to the north a year ago have taken kindly to pot culture and are reported as excellent for this purpose.

SOLAR PRINTS OF PLANTS.

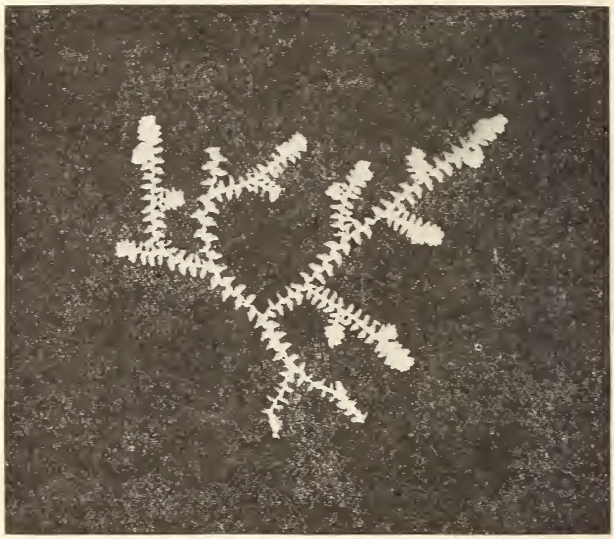
BY JAMES SHEPARD, NEW BRITAIN, CONN.

It is nothing new to make solar prints direct from plants, but the result is unsatisfactory as it gives a white image on a dark ground. This produces a negative from a positive and is not pleasing because it is the reverse of nature. But if we go one step further and use the direct print as a negative to make other prints from, the result will be a print in harmony with nature and an exact print of the plant itself. The most simple and convenient of all solar printing papers is the ordinary blue print paper. This however cannot be used for making a negative, as a blue ground will not cut off the rays of light sufficiently to give any substantial contrast in a print made from such a negative.

The best cheap negative paper is that known as "Vandyke Solar Paper." I have used this paper for many years obtaining the same from Messrs. Eugene Dietzgen Co., 124 W. 23rd, St., New York City. It is sold in rolls of ten yards in three different widths, of either thick or thin paper. A ten yard roll, thirty-six inches wide, costs only $2.10 and the roll may be cut into as many lengths as desired without extra cost. I use the thin paper in rolls 36 inches wide cut into four lengths each 9 inches wide. It is easy to cut from the end of a nine inch roll any size desired, not exceeding nine inches in its lesser dimensions. Fixing salts to be disolved in water for a fixing solution come with the paper. This paper gives white transparent lines on an *opaque* dark brown background. It is as simple to use as the ordinary blue print paper, is permanent, and unlike the blue print paper will keep indefinitely without imparing its printing qualities, so that old paper is as good as new.

To make negative of plant, or any portion thereof, place it on the glass of an ordinary printing frame and then place the Vandyke paper on the top of the

plant and the glass with the face side of the paper towards the glass. Then put in and fasten the back of the printing frame to secure the plant and paper in close contact with each other. Care should be taken to properly arrange the plant in the frame after which place the frame where the sun will shine directly upon the glass. As soon as the ground of the paper darkens to a deep yellowish brown remove the paper and place it face side up under a stream of running water for five



minutes to wash it. Then pour a little of the fixing solution on the paper wetting all parts thoroughly, then wash the print again and hang it up to dry. The brown of the wet negative turns darker in drying. From three to five minutes exposure in bright sunshine is ample, but this can be varied somewhat according to the nature of the plant. If the plant is thick and opaque a longer exposure is desirable, but if the plant is quite thin and translucent, care must be taken not to over print it. Fig. 1 illustrates a negative printed

direct from a spray of *Selaginella* and Fig. 2 illustrates the second printing operation, that is, a print from the negative Fig. 1, instead of a direct print from the plant. The original print thus produced in Fig. 2 was a white and brown-black print on ordinary solio paper. The negative can be used repeatedly for making any number of prints on any kind of solar printing paper. The ordinary blue print paper and the Vandyke paper are the more simple and convenient to use, as no baths for

toning etc. are required. The blue printing paper has an advantage over the brown printing Vandyke paper for the final print, in that a little tinge of blue in the high lights makes them look clearer, whereas a little tinge of brown in the high lights makes them look dingy. A plant with thin leaves may be exposed long enough in making the negative to print through the leaves and show the veins a little instead of producing a mere silhouette. Observe that this result is shown by the half tone lights in Fig. 2. The Vandyke paper

can be used for making a solar negative direct from writing, printing, or drawing, as well as from a plant, so that the image of anything in black or brown that is on one side only of translucent paper, can be reproduced correctly in the form of a positive from a positive without the use of a camera

ON SOME NEW ZEALAND FERNS.

BY WILLARD N. CLUTE.

Through the kindness of Mr. George E. Smith, Esq., of Aratapu, New Zealand, the only representative of the American Fern Society in that far-away land I received, recently, a parcel of New Zealand ferns with the request that I keep a set for myself and give the rest to fellow members of the Society. In accordance with these directions, I have presented sets of the ferns to the President and Secretary of the Society and the remainder will be sent to members for the cost of postage as noted at the end of this article.

As collections of this kind have considerable interest for comparison with our own ferns, a list of all the species sent is here given with various notes.

1. *Lomaria Vulcanica.* On hillsides and banks of streams, Kakahi, N. Z. The sterile frond of this species has considerable resemblance to those of *Blechnum occidentale* to which the *Lomarias* in general are nearly related.

2. *Lomaria Pattersoni.* This species forms large clumps on the surface of the earth in dense forest. Kakahi, N. Z. The fertile frond of this is pinnate while the sterile is deeply cut into a few broad, acuminate pinnules. According to "Synopsis Filicum" the true *Pattersoni* was supposed to always be simple fronded, while a second species named *L. elongata* was always pinnate. They have, however been found to completely intergrade.

3. *Lomaria fluviatilis.* On the edge of bush clearings at Owhango, N. Z. This species is readily separated from its allies by the shape of its pinnae, those of the sterile frond being orbicular, while those of the fertile frond are narrow and pod like. At first glance it suggests *Notholaena trichomanoides* of our own Tropics, but it lacks the colored farina on the under surface.

4. *Lomaria alpina.* In open country on the banks of streams. This is a pretty little species closely related to *Lomaria spicant* whose place it takes in the Southern Hemisphere. Like *L. spicant* the fertile fronds are erect and the sterile more or less spreading.

5. *Polystichum aculeatum.* Banks of the Wanganni River, N. Z. Mr. Smith reports that the caudex of this species attains the thickness of a man's thigh and that the fern is fond of growing on the edge of bush clearings. The fern is unmistakably our well known plant and is found in one form or another in nearly every part of the world.

6. *Davallia Novae Zelandiae.* On the banks of streams and in dense bush, Kahahi, N. Z. A very finely cut and feathery species reminding one of certain decompound *Aspleniums.*

7. *Polypodium australe.* On trunks of trees in dense forest Owhango, N. Z. A small species with entire linear fronds which might be mistaken for an *Asplenium* by reason of the elongated sori. Many botanists place this and several others with similar sori in a separate genus *Grammitis* on acount of the elongated fruit-dots. Our plant encircles the earth in the far south.

8. *Polypodium grammitidis.* On trunks of trees in dense forest, Makatoti, N. Z. A handsome species

with narrow segments closely allied to *P. cultratum* of the West Indies.

9. *Lindsaya trichomanoides.* The *Lindsayas* are the nearest relative of the maidenhair ferns (*Adiantum*) and the pinnules have much the same general shape in many species. The indusium is formed, as in *Adiantum* by a reflexed portion of the pinnule, but there is a second indusium springing from the surface of the frond, which *Adiatnm* does not have.

10. *Dicksonia antarctica?* The customs officials were not particularly careful of the labels in the packet and this one was lost. The frond appears to be from the species mentioned which is not uncommon in New Zealand.

11. *Hymenophyllum flabellatum.* On the trunks of trees ferns in dense shade, Kakahi, N. Z.

12. *Hymenophyllum Javanicum.* In marshy places and on the banks of streams in dense shade, Kakahi, N. Z. This was sent for the widely distributed *H. polyanthos* but unlike the latter species has winged stipes.

13. *Hymenophyllum scabrum.* On trunks of trees and rocks in low lying places in dense shade, Kakahi, N. Z. This species seems confined to New Zealand.

14. *Hymenophyllum pulcherrimum.* On trunks of trees in dense forests, Raurium, N. Z. Has a general resemblance to *H. flabellatum* but easily distinguished from it.

15. *Hymenophyllum Franklinianum.* In dense forest on the trunks of trees, Owhango, N. Z. A delicate species related to *H. sericeum* of tropical America. It is so heavily clothed with tawny hairs as to quite obscure the green of the frond. This is frequently named *H. Acruginosum.*

16. *Trichomanes reniforme.* On trunks of trees in dense forests, Kakahi, N. Z. A curious round-

leaved fern with the margin thickly set with the curious funnel shaped involucres. The fronds of most of the "filmy ferns" are but one cell thick. The present species is much thicker, one of the thickest of the genus, in fact.

17. *Todea superba.* Forming large clumps in dense shade. Found only at the southern end of Island at an altitude of 2,000 feet. This handsome specimen is remarkable for belonging to the only other genus in the Osmundaceae. In *Osmunda* the sporangia are borne in much transformed fronds or parts of fronds, but in the *Todeas* the spore-cases though like those of *Osmunda* are on the backs of ordinary fronds and the ferns might easily be mistaken for members of the Polypodiaceae. The whole genus is confined to Australia and New Zealand with the exception of one species that extends to South Africa.

18. *Gleichenia Cunninghami.* On banks of streams. Owhango, N. Z. Confined to New Zealand.

19. *Gleichenia dicarpa.* On open pumice flats and marshy places, Owhango, N. Z. A diminutive species with very narrow pinnae and forking branches. Received under the name *G. alpina* by which name the plant is frequently called.

20. *Lycopodium vulcanicum.* The label of this species was lost in transit. It is much like our common *Lycopodium obscurum* in appearance,being the counterpart of that species in the Southern Hemisphere.

There still remain a few specimens each of Nos. 1, 7, 8, 11, 15 and 16. These will be sent to the first member of the Society who apply enclosing three cents in stamps for postage. A full set cannot be promised to any member, but one or more specimens can probably be sent. Applications should be made at once.

Joliet, Ill.

RARE FORMS OF FERNS—VII.

Although the opportunities for hybridizing among ferns are much rarer than they are among flowering plants, hybrid ferns undoubtedly occur. In a few cases, such as that of *Camptosorus rhizophyllus X Asplenium ebeneum* (*Asplenium ebenoides*) the hybrid nature of the plant has been proved experimentally but in most, the hybridity has been inferred from the resemblance of the new form to its supposed

ASPLENIUM TRICHOMANES X RUTA-MURARIA.

parents. The latter seems to be the case with the specimen here illustrated, the dark stipe and lower rachis and the shape of the upper pinnae being taken to indicate *trichomanes* characters while the distant, three-parted lower pinnae, the green upper rachis and the long stipes are held to be characteristic of *ruta-muraria*.

Until about three years ago, this plant was not known to be a member of our fern flora. In 1905 Mr. G. A. Woolson found it near Proctor, Vt., growing within three feet of *Asplenium ruta-muraria* and not very far removed from *A. Trichomanes*. The plant had previously been known from Europe and was given the name it bears by Ascherson and Graebner in 1896. Dr. Christ figured it in "Die Farnkrauter der Schweiz," but since hybrids are likely to vary considerably it is desirable that an illustration of the American form be

given. The figure here shown was drawn from a blue print of one of the fronds collected by Mr. Woolson which was made by Mr. Geo. E. Davenport at the time the discovery was announced. It is quite likely that the plant will be found in other regions where both the parents species occur, and other collectors should be on the watch for it.—*W. N. C.*

"OSTRICH FERN VAR. PUBESCENS."

It was certainly through inadvertence that the editor made the above unfortunate mongrel combination in the January *Bulletin.* It is well known, if iteration can make a thing well known, that he does not care for the honor of new combinations; but he must bear in mind the fact that all new names must be kept track of, and a cataloger is caused no end of trouble by such looseness. What is the editor's name for the ostrich fern? If it had but one it would be a simple matter to decide. Unfortunately it has had nine, as follows:

Osmunda Struthiopteris L. (1753).
Struthiopteris filicastrum All. (1785).
Onoclea struthiopteris Hoffm. (1795).
Onoclea nodosum Schkuhr (1809).
Struthiopteris Germanica Willd. (1809).
S. Pensylvanica Willd. (1810).
S. europea Hornem. (1813).
Matteuccia Struthiopteris Todaro (1866).
Pterinodes Struthiopteris Kuntze (1891).

Adherents to the Vienna Code would call this *Struthiopteris Germanica* var. *pubescens;* but as the generic name was first used for *Blechnum,* then for *Osmunda,* and finally for this plant, adherents to the principle that if a name is once a synonym it is always

a synonym would call it a variety of *Matteuccia Struthiopteris.* What the name will be under Mr. Clute's code can only be conjectured till he enlightens us.—*A. A. Eaton, Ames Botanical Laboratory, N. Easton Mass..*

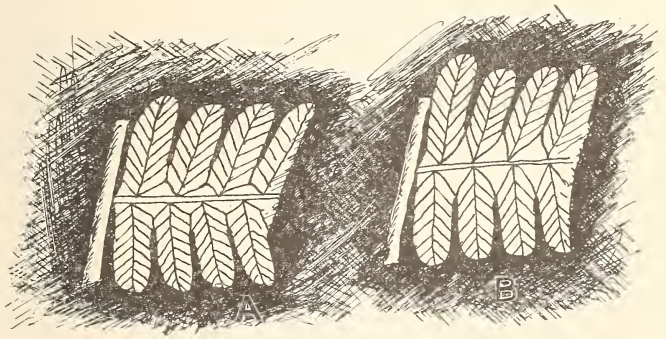
[It never occurred to the author of the name that has given Mr. Eaton so much trouble that a mere pubescent form of the ostrich fern was of enough significance to merit an extended description in Latin and the citation of synonomy from the dawn of creation to the present. Mr. Terry did not think it important enough for a name, and the editor merely suggested that it be called the form *pubescens* in order to have a handle for it. He will continue to use this name writing the name of Mr. Terry, and not his own, after it as sponsor. We note, however, that a prominent New England botanist has recently made a new species of fern that differs from one previously known only in *the form of pubescence;* so it is possible that one cannot be too careful in making species now that nomenclature has got down to parting hairs if not splitting them. We would therefore first describe the fern as *Struthiopteris pubescens* with all the hard things Mr. Eaton has said about it in synonmy added. Then we should label it again *S. Germanica* forma *pubescens,* and yet again as *S. Pennsylvanica f. pubescens.* Next paying our respects to the memory of Todaro we would call it *Matteuccia pubescens,* also *M. Struthiopteris* f. *pubescens* and still also *M. Struthiopteris* var. *pubescens,* in this separate citation of form and variety following the illustrious example set in a recent Boston publication. Of course all this makes trouble for the cataloguer, but what is a cataloguer for? Serves him right for wasting time on the names of plants when

he might be studying the plants themselves. But now, in all seriousness, to answer Mr. Eaton's question as to our name for this fern under discussion we would say we would prefer to call it *Struthiopteris Germanica* f. *pubescens* Terry.—*Ed.*]

NEPHRODIUM PATENS AND NEPHRODIUM MOLLE.

By Willard N. Clute.

There has always been some question as to the range of *Nephrodium molle* in the United States, owing to its close resemblance to *N. patens*. Many good collectors contend that it does not belong naturally to our



A—*N. Molle.* B—*N. Patens.*

PINNAE OF NEPHRODIUM.

flora and if found at all is merely an escape. The corectness of this contention can not be questioned until the collector in the field can recognize the two species at sight and give us more abundant data than we have at present. While the two are superficially very much alike, especially in the herbarium, the re-

semblances are only superficial and a few minutes given to learning their differences will make any collector able to recognize either species at a glance.

In the field *N. patens* is absolutely distinguished from the plants that resemble it by its creeping rootstock with the fronds arranged along it in two rows. *N. molle* has an erect rootstock and the fronds in a crown. In the herbarium, where often one has no rootstock to aid in the identification, dependence must be placed upon the venation. In *N. patens* the veins are simple and the lowest pair meet at, or just below, the sinus. In *N. molle* the lowest pair of veins meet at some distance from the sinus, forming narrow areolae and sending a single vein to the sinus. The two types are well shown in our illustration.

There has recently been reported from Florida a third species belonging to this group named *N. stipulare* This differs from *N. molle* in having the lowest pair of veins free or running *together* to the sinus and from *N. patens* by its more or less erect rootstock. This latter characteristic does not seem to be constant for there is one variety named *pseudopatens* indicating how closely the two are connected. A variant form of *N. patens* can thus be more easily mistaken for *N. molle* and all reported occurrences of *N. stipulare* should be investigated with more than usual care.

Fern students are in need of a careful mapping of the range of *N. patens* and *N. molle* and we suggest that all who have collected either of these species, reexamine them and send us any new data thus obtained.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

SELAGINELLACEAE.

SELAGINELLA, Beauv.

255. **Selaginella apus** (L.) CREEPING SELAGINELLA. Not uncommon; on moist banks and in wet meadows. Maine and Ontario to Florida, Texas and British Columbia. Represented in the Tropics by many closely allied species.

256. **Selaginella arenicola** Underw. SAND BARREN SELAGINELLA. Not uncommon; in sandy soil. Florida to Louisiana and Texas.—*Selaginella arenaria* Underw.

257. **Selaginella Bigelovii** Underw. Tolerably common; in exposed places and the chinks of rocks. Southern California.

258. **Selaginella cinerascens** A. A. Eaton. Somewhat rare; on dry bare hills. Southern California.—*Selaginella bryoides* Nutt.

259. **Selaginella Douglasii** (H. and G.) Rare; in damp shades. Northern California to British Columbia and Idaho.

260. **Selaginella lepidophylla** Spring. RESURRECTION MOSS. Common; in dry and open places. Texas, Arizona, and New Mexico; also southward to Peru.

261. **Selaginella Ludoviciana** A. Br. Rare; in moist shades. Florida, Alabama and Louisiana.

262. **Selaginella Oregana** D. C. Eaton. OREGON SELAGINELLA. Not uncommon; in dense shade,

on soil or the branches of trees. Oregon and Washington near the coast.—*Selaginella struthioloides* (Presl.)

263. **Selaginella Parishii** Underwood. Rare. Southern California.

264. **Selaginella Pringlei** Baker. Very rare; Chenate Mountains, Texas, also in Mexico.

265. **Selaginella rhodospora** Baker. Rare. Southern Florida; also in Eastern Cuba.

266. **Selaginella rupestris** (L.) Rock Selaginella. Not uncommon, especially on granite rocks. New England and Ontario to Alabama, California and British Columbia. Reported also from South America, India and Ceylon. Many forms have been described as species. A key to these will be found in *Fern Bulletin*, Vol. X. Many of these are separated by minute distinctions and may be disposed of as follows:

The form **Bolanderi** (Hieron) is from California.—*S. Bolanderi* Hieron; f. **Bourgeaui** (Hieron.) is from Oregon.—*S. Bourgeaui* Hieron.; f. **Engelmanni** (Hieron.) is from Colorado.—*S. Engelmanni* Hieron.; f. **Hanseni** (Hieron.) is from California.—*S. Hanseni* Hieron.; f. **Haydeni** (Hieron.) is from Oregon and Nebraska.—*S. Haydeni* Hieron.; f. **Montaniensis** (Hieron.) is from Montana.—*S. Montaniensis* Hieron.; f. **Schmidtii** (Hieron.) is from Alaska.—*S. Schmidtii* Hieron.; f. **Wallacei** (Hieron.) is from Orogon.—*S. Wallacei* Hieron.; f. **Wrightii** (Hieron.) is from New Mexico.—*S. Wrightii* Hieron.

267. **Selaginella rupestris acanthanota** (Underw.) Rare; Costal plain of the Carolinas and Georgia. This and the five following are forms of *S. rupestris* that are somewhat more distinct than other forms.—*Selaginella acanthanota* Underw.

268. **Selaginella rupestris densa** (Rydb.) Rare. Western Nebraska and Montana.—*Selaginella densa* Rydberg.

269. **Selaginella rupestris Fendleri** (Underw.) Not uncommon. Colorado and New Mexico.—*Selaginella Underwoodii* Hieronymus.

270. **Selaginella rupestris rupincola** (Underw.) Rare. New Mexico and Arizona.—*Selaginella rupincola* Underw.

271. **Selaginella rupestris Sherwoodii** (Underw.) Not uncommon; North Carolina.—*Selaginella Sherwoodii* Underw.

272. **Selaginella rupestris tortipila** (A. Br.) Rare. Mountains of the Carolinas.—*S. tortipila* A. Br.

273. **Selaginella spinosa** Beauv. Mountain Moss. Rare, or common northward; in moist places. Elevated parts of Maine, New Hampshire, New York, Michigan and Colorado, northward; also in Greenland, the British Isles and Northern Europe.—*Selaginella selaginoides* (L.)

274. **Selaginella Watsoni** Underw. Rare. Mountains of Utah, Nevada and California.

275. **Selaginella Watsoni mutica** (D. C. Eaton.) Rare. Mountains of Colorado, Arizona and New Mexico.—*Selaginella mutica.* D. C. Eaton.

ISOETACEAE.

Isoetes L.

276. **Isoetes Bolanderi** Engelm. Not uncommon; in mountain lakes. Colorado, Utah and California.

The form **pygmaea** (Engelm.) is a small form collected but once.—*Isoetes pygmaea* Engelm. Form **Sonnei** is reported from Donner Lake, California.

277. **Isoetes Butleri** Engelm. Rare: in wet weather lakes. Prairies of Tennessee, Missouri and Oklahoma. The form **immaculata** occurs with the type.

278. **Isoetes Canadensis** (Engelm.) Rare; in rivers and streams. Maine to Ontario and Pennsylvania; also in British Columbia.—*Isoetes Dodgei* A. A. Eaton.

The form **Robinsii** A. A. Eaton is reported from Massachusetts and the form **Amesii** (A. A. Eaton) apparently belongs here.—*Isoetes saccharata Amesii* A. A. Eaton.

279. **Isoetes Echinospora Braunii** (Dur.) Common; in lakes and ponds. Pennsylvania, Utah and Washington to Alaska and Greenland. The typical species is also found in Europe.—*Isoetes Echinospora Brittoni* Cockerell.

The following forms have been reported

from America f. **Boottii** (A. Br.) is from Massachusetts.—*Isoetes Boottii* A. Br.; f. **Flettii** (A. A. Eaton) is from Washington and British Columbia.—*Isoetes Flettii* A. A. Eaton; f. **maritima** (Underw.) is from Vancouver Island.—*Isoetes Maritima* Underw.; f. **muricata** (Dur.) ranges from Nova Scotia to New Jersey.—*Isoetes muricata* Dur.; f. **robusta** Engelm. is from New Hampshire and Vermont.

280. **Isoetes Engelmanni** A. Br. Common; in shallow water or on moist banks of streams. Maine to Delaware and Missouri.

The forms **Caroliniana** A. A. Eaton from Carolina, f. **fontana** A. A. Eaton from Pennsylvania and f. **Georgiana** Engelm. from Georgia have been reported; f. **gracilis** Engelm. is found with the type.

281. **Isoetes flaccida** Shuttlew. Not uncommon; in ponds and streams, Florida.

The forms **Chapmani** Engelm. and **rigida** Engelm. have been reported with the type.

282. **Isoetes foveolata** A. A. Eaton. Rare. New Hampshire and Massachusetts. The form **plenospora** A. A. Eaton is reported with the type.

283. **Isoetes Gravesii** A. A. Eaton. Rare. Connecticut.—*Isoetes valida Gravesii* (A. A. Eaton.) *Isoetes Eatoni Gravesii* (A. A. Eaton.)

284. **Isoetes hieroglyphica** A. A. Eaton. Rare; in lakes. Maine. Possibly a form of *Isoetes Tuckermani.*

285. **Isoetes Howellii** Engelm. Not uncommon. California to Idaho and Washington.—*Isoetes nuda* Engelm.; *Isoetes Underwoodii* Henders.

The form **Piperi** (A. A. Eaton) is reported with the type.—*Isoetes Piperi* A. A. Eaton.

286. **Isoetes Macounii** A. A. Eaton. Very rare. Atka Island off the coast of Alaska.

287. **Isoetes macrospora** Dur. Somewhat rare. New Jersey, Lake Superior, Colorado and California northward. The closely allied *Isoetes lacustris* is common in Northern Europe.

The form **heterospora** (A. A. Eaton).—*I. heterospora* A. A. Eaton is reported from Maine; f. **paupercula** Engelm. is reported from Colorado and California.—*Isoetes occidentalis* Henders.

288. **Isoetes melanopoda,** J. Gay. Common; in wet weather lakes. Illinois, Iowa and Nebraska to Texas and California. The form **pallida** Engelm. is reported from Texas and f. **Californica** A. A. Eaton, from California.

289. **Isoetes melanospora** Engelm. Very rare. Stone Mountain and vicinity, Georgia.

290. **Isoetes minima** A. A. Eaton. Very rare. Damp prairie near Waverly, Washington. Collected but once.

291. **Isoetes Nuttallii** A. Br. Rare; on the banks of rivers and streams. California to British Columbia and Idaho.

292. **Isoetes Orcutti** A. A. Eaton. Rare; in wet weather pools. San Diego, California; also in Lower California.

293. **Isoetes riparia** Engelm. Rare. Along the Delaware River. It is probable that this and the following are two forms of the same species in which case the following might be named *Isoetes riparia saccharta* (Engelm.)

294. **Isoetes saccharata** Engelm. Not uncommon: on tidal flats about Chesapeake Bay and in the rivers that empty into it.

The forms **Palmeri** A. A. Eaton and **reticulata** A. A. Eaton are seasonal forms found with the type.

295. **Isoetes Tuckermani** A. Br. Not uncommon: in rather deep water. New England.

The forms **borealis** A. A. Eaton and **Harveyi** (A. A. Eaton) are reported from the northern parts of the species' range.

296. **Isoetes truncata** (A. A. Eaton.) Not common: Vancouver Island to Alaska.—*Isoetes echinospora truncata* A. A. Eaton

297. **Isoetes valida** (Engelm.) Rare. New Hampshire to Delaware and Virginia.—*Isoetes* Eatoni Dodge: *Isoetes Engelmanni valida* Engelm.

Death of Mrs. Horton.—We note with deep regret the death of Mrs. Frances B. Horton at Brattleboro, Vt., Aug. 18, 1907. Mrs. Horton was the discoverer of a cut-leaved form of *Asplenium ebeneum* in Vermont which Mr. Davenport named *Hortonae* in her honor.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from, this list.

Benedict, R. C. *Studies in the Ophioglossaceae.—I.* Torreya, Ap., 1908.—Notes on terminology and a key to the American species of *Ophioglossum.*

Clute, W. N. *A check-list of the North-American Fern-worts.* Fern Bulletin Ja. 1908.—A continuation embodying the Salviniaceae, Marsiliaceae, Equisetaceae and Lycopodiaceae.

Clute, W. N. *A New Fern.* Illust. American Botanist F. 1908.

Clute, W. N. *A New Fern from the United States.* Illust. Fern Bulletin, Ja. 1908.—Description of *Asplenium Ferrissi.*

Clute, W. N. *But Half a Fern.* Illust. Fern Bulletin, Ja. 1908.—An account of the structure and functions of the gametophyte.

Clute, W. N. *Generic Relationships.* Fern Bulletin, Ja. 1908.

Clute, W. N. *Rare Forms of Ferns.—VI.* Illust. Fern Bulletin, Ja. 1908.—Description of *Nephrodium cristatum clintonianum silvaticum.*

Clute, W. N. *The Genus Acrostichum.* Illust. American Botanist Ja. 1908.

Eaton, A. A. *Normenclatorial Changes in Isoetes.* Rhodora, Mr. 1908.—*Isoetes Macrospora hetrospora* and *I. Dodgei Robinsii* made as new combinations.

Foster, A. S. *Polypodium Scouleri.* Muhlenbergia, Ap. 1908.—Several stations for this fern in Washington and Oregon reported.

HANS, A. *Polystichum acrostichoides X Angulare.* Fern Bulletin, Ja. 1908.—An account of hybridizing the species mentioned.

HANS, A. *Polystichum acrostichoides recurvatum.* Fern Bulletin Ja. 1908.

KAUFMAN, P. *Rue Spleenwort and Cliff Brake.* American Botanist, F. 1908.

MAXON, W. R. *Studies of Tropical American Ferns No. 1,* illust. Contributions from the U. S. National Herbarium, Mr. 30, 1908.—Description of various new species mostly from tropical America.

ROBINSON, C. B. *Botrychiums in Sand.* Torreya, N. 1907.—*B. lanceolatum, B. matricariaefolium* and a form of *B. ternatum* on sand dunes near the Gulf of St. Lawrence.

TERRY, W. A. *A New Variety of the Ostrich Fern.* Fern Bulletin, Ja. 1908.—The variety *pubescens* described.

YAMANOUCHI, S. *Spermatogenesis, oogenesis and fertilization in Nephrodium.* Illust. Botanical Gazette Mr. 1908.—Reports the number of chromosomes in the gametophyte to be constant (64 in number).

EDITORIAL.

During the past few months, an unusual number of letters containing money addressed to us, have failed to arrive and the fact that so many letters have gone astray in so short an interval appears to us to be something more than a co-incidence. We suggest to our subscribers, therefore, that in sending us money, it should be sent in a form that can be easily traced. Money-orders, registered letters and bank drafts are absolutely safe, for if lost or stolen a re-issue or refund will be made. Those who have an account at the bank can usually obtain bank drafts on New York or Chicago without extra charge, and many banks are now issuing money orders on the same plan. Personal checks are safe, but unless drawn on a bank in some large city of the eastern or central States must include enough extra for collection. While we are quite willing to accept currency or stamps in payment, we do not advise remitting by these methods at present, for fear that such letters will also become "lost" in the mails.

* * *

For some time Dr. Rosenstock has been working up an extensive collection of ferns from southern Brazil, and the first installment is now offered for sale by the Thienemanns Buchhandlung of Gotha Germany. Through the kindness of Dr. Rosenstock we have been forwarded a parcel of these ferns and take pleasure in testifying to the fullness and excellence of the specimens. In the collection are included a considerable number of new species and varieties, making the collection an unusually valuable one. A second installment from the same collection is expected to be ready some time during the summer. Considering the quality

of the specimens, the prices are very moderate. Full information as to the make-up of the sets, prices, etc, may be had by addressing Thienemann's.

* * *

As usual, during part of the summer, the editor expects to speak on various out-door topics at several eastern Chautauquas. From July 7 to 11 he will be at the Connecticut Valley Chautauqua, Laurel Park, Mass; from July 13 to 18 at Round Lake, N. Y., from July 20 to 28 at the Connecticut Chautauqua, Plainville, Conn., and from July 28 to Aug. 5 at Pine Grove Chautauqua, Canaan, Conn. At most of these he will have charge of the nature-study work and will be glad to meet any who are interested in ferns. A special feature of the work are the daily excursions for specimens upon which many rare plants are usually discovered. At Plainville, Conn., within a radius of three miles nearly forty of the fern-worts have been found including the walking fern, the climbing fern, the cliff-brake, the adder'stongue, and two *Selaginellas*. Our readers will find that anyone of these chautauquas will afford a week's delightful outing in the company of congenial people at a very moderate cost. Information regarding rates and program may be obtained by writing Rev. G. M. Brown, Bridgeport, Conn., (for Round Lake.) Rev. E. P. Butler Sunderland, Mass. (for Laurel Park) and Rev. B. F. Gilman, Torrington, Conn.

* * *

It is difficult for those who live in the midst of ferns to imagine a region in which ferns are among the rarities, but the vast extent diversified surface and varied climate of our country make possible several

different regions that are practically fern-less. The prairie region of the Middle West, on the edge of which this magazine is now located is one of these. One might travel about Joliet all day and never find a fern. A few species may be found, however, if search is made in the right places. An outcropping ledge of limestone may yield the walking fern and the purple stemmed cliff-brake, a shaded swamp or swale may harbor the sensitive fern, and in the woods *Cytopteris fragilis* is usually present. The common and familiar ferns of the East—the cinnamon fern, Christmas fern, lady fern, and bracken—are entirely missing. Within a year or two a single small colony of *Pteris aquilina* has made its appearance along a railway and its whereabouts will not be indicated for fear somebody will dig it up. Just imagine guarding the bracken in this way in the East! By going twenty or thirty miles from the city we can find a fair number of ferns, but the conditions mentioned prevail for lesser distances. Notwithstanding this it must be said that about six miles away may be found a colony of *Pellaea gracilis* which has rarely been found so far south in any part of the world. That ferns are able to grow here is attested by the fact that in one of our public parks there is one of the best collections of ferns to be found in any city of its size. Another region that is entirely fernless is Southern Louisiana. In a flora of that part of the state recently issued by Prof. R. S. Cocks, not a single fern is catalogued. The conditions here are so different from those in Southern Florida that we wonder at the cause until we consider the physiography of the two regions. Southern Florida is built of calcareous rocks; Southern Louisiana resembles nothing so much as a vast and bottomless mud pie. Without

doubt this explains why one has an abundant fern flora and the other none at all. Large areas of the desert are also without ferns, but as a general thing ferns are not entirely missing from American deserts. Here and there a species, adapted to the rigorous conditions, finds safety and a home.

AMERICAN FERN SOCIETY.

The Society continues to increase in membership. Since the last report the following have joined us: Miss Alice M. Paine, Sebago Lake, Maine, Mrs. Edward C. Chatfield, 613 Fulton St., Minneapolis, Minn., Mrs. Thomas G. Lee, 509 River Road S. E., Minneapolis, Minn., Mr. H. Harwood Tracy, Claremont, Calif., Mr. C. Edward Jones, State Education Dept. Albany, N. Y., Mr. Charles W. Jenks, Stonecroft Farm, Bedford, Mass., Mr. Henry C. Bigelow, New Britain, Conn., Mrs. W. F. Brooks, New Britain, Conn., Mrs. Agnes M. Paxson, 64 Oak Street, Lowell., Mass.

The following changes of address should be noted in the list of members. The address of Henry P. Walker should be 1208 Union Street, Schenectady, N. Y., that of Dr. C. E. Waters to Bureau of Soils, Washington, D. C., A. Hans, to Locust Valley, Long Island, N. Y., Miss A. D. Choate to 523 Pendleton Ave., St. Louis. Miss Mary A. Andrews, 283 Elizabeth Street, New York. Rev. S. M. Newman to Front Royal, Va.

It has been some time since the constitution of the American Fern Society was printed and it is suggested that new members would be glad to see it published in the forthcoming annual report. If there is room for it this will probably be done.

Rev. S. M. Newman who for many years has resided in Washington, D. C., has gone to Front Royal, Va., as President of Eastern College. Our Society counts among its members men of eminence in nearly all walks of life, including one who has several times been mentioned for President of this Nation but this is our first member from the list of College Presidents. The best wishes of all fern students will go with Mr. Newman in his new position.

Members who do not receive acknowledgment of dues within a reasonable time after sending will confer a favor on the Treasurer by notifying her at once, stating whether the dues were sent in cash or otherwise. Instances have come to her notice where the dues have not reached her.

The grim Reaper has been unusually busy among the members of the Society during the past year and we record with much regret the loss of Edward R. Heacock, Wyncote, Pa., Mrs. W. H. Woolworth, Youngstown, N. Y., Mrs. C. A. Pearson, Holyoke, Mass., Mr. Geo. E. Davenport, Medford, Mass., Mr. B. D. Gilbert, Clayville, N. Y. and Dr. L. M. Underwood, New York City. Biographical sketches of all will appear in the next annual Report of the Society.

Standard Books on Ferns

"How Ferns Grow," by **Margaret Slosson.** With 46 plates by the author. Large 8vo. $3.00 net, by mail $3.34.

A valuable contribution to fern literature in that it not only enables fern students to distinguish different species of mature ferns, but points out characteristics of the different kinds at all stages of development, and shows the genetic relations of ferns to each other and to the rest of plant life. The plates, nearly all reproducing ferns at their natural size, are particularly excellent. Published 1906.

"No one has hitherto devoted, as the present author does, a whole book to a readable account of the youth of ferns. . . . With great pains she has studied the various metamorphoses and has recorded in good photographs her interesting results. The transformations are all well shown by the engravings, but she has supplemented these engravings by clear text."—The Nation.

"Botanical books especially, of late years, have been remarkable for wealth and beauty of illustration, but even among these "How Ferns Grow" is notable. The pictures are purely scientific, nearly all are the size of nature, and they are so numerous and so carefully arranged as to make the text almost superfluous. . . . A beautiful book that every fern lover will want."—N. Y. Sun.

"Ferns," by **Campbell E. Waters,** of John Hopkins University. 362 pp., square 8vo. Over 200 illustrations from original drawings and photographs. $3.00 net, by mail, $3.34.

A manual for the Northeastern States, thoroughly authoritative and written in a popular style. It covers all the ferns in the region embraced either in Britton's or in Gray's Manuals. A key based on the stalks, as well as one based on frutification, differentiates if from other analtical keys now existing.

"The ideal fern-book. . . . The best fern-book that has appeared. The illustrations are superb."—Dr. F. H. Knowlton, U. S. National Museum.

"The best fern-book—beautiful and scientific."—Critic.

"Likely to prove the leading popular work on ferns. . . . It can confidently be asserted that no finer examples of fern photography have ever been produced."—Plant World.

"Our Native Ferns and Their Allies." With Synoptical Description of the American Pteridophta North of Mexico. By **Lucien M. Underwood,** Professor in Columbia University. Revised. xii + 156 pp. $1.00 net, by mail, $1.10.

"The elementary part is clear and well calculated to introduce beginners to the study of the plants treated of. The excellent key makes the analysis of ferns comparatively easy. The writer cordially commends the book. It should be in the hands of all who are especially interested in the vascular cryptograms of the United States."—Bulletin of the Torrey Botanical Club, N. Y.

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A Quarterly Devoted to Ferns

Joliet, Ill.
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Secretary, W. A. POYSER, 6028 Delancy St., Philadelphia, Pa.

Fern students are cordially invited to join the Society. Members receive the **Fern Bulletin** free. Address either the President or Secretary for further information. The annual dues are $1.00 and should be sent direct to MISS NELLIE MIRICK, Treasurer, 28 East Walnut St., Oneida, N. Y.

WANTS AND EXCHANGES

TROPICAL FERNS—If you want dried ferns from the tropics, apply for catalogue of good scientific specimens to THIENEMANNS BUCHHANDLUNG, Gotha, Germany.

BOTRYCHIUM VIRGINIANUM
WITH LEAFY FRUITING PARTS.

THE FERN BULLETIN

Vol. XVI JULY, 1908 No. 3

ON CHANGES IN FUNCTION IN DIMORPHIC FRONDS.

By Willard N. Clute.

By far the greater number of ferns throughout the world produce their asexual spores on the backs of fronds that do not differ materially from other fronds devoted to purely vegetative functions. A few species, however, such as the cinnamon, sensitive and ostrich ferns have sharply separated the work of reproduction from that of food making, at least so far as this relates to the chief or sporophyte generation, and as the spore-bearing fronds have no longer use for a large expanse of chlorophyll tissue, we find them variously reduced and quite unlike the sterile fronds, or as we say, they have become dimorphic. Occasionally, too, we find this tendency to separate the two functions displayed in the same frond, as in the royal, the interrupted and the grape ferns. Usually the plants which show this latter tendency are those which commonly produce a single frond each year, as *Ophioglossum*, *Anemia* and *Botrychium*, but the phenomenon is not restricted to them as is illustrated by the *Osmundas* cited as well as by the Christmas fern and others.

That the law which determines whether a frond shall be fertile or sterile is not irrevocably fixed is seen in the instances which are steadily accumulating of fertile parts made sterile or partly sterile and what would normally be sterile parts turning fertile. We see this in that striking form *obtusilobata* of the sensitive fern, which

is so unlike the typical plant that for a long time it was thought to be a separate species. Similar forms are found in the sensitive fern's ally, the ostrich fern, and that form of the cinnamon fern named *frondosa* is manifestly akin to them in origin. The common rattle-snake fern (*Botrychium Virginianum*) frequently exhibits such forms, though since it has but a single frond, it must perforce change only a part of the pinnae. Through the kindness of Messrs. James Shepard and H. C. Bigelow, I am able to illustrate in the frontispiece a specimen collected near New Britain,

STERILE PINNA OF BOTRYCHIUM VIRGINIANUM BEARING SPORANGIA

Conn. in which some of the normally fertile pinnae have reverted to leafy parts, while an accompanying drawing from a plant colected in Indiana by Mr. F. C. Greene, shows the reverse of this in which some of the leafy parts have become spore-bearing.. So well are the principles underlying the production of these reversions now known that several of them can be made at will by the experimentor.

In connection with this may be found the answer to the question: which was first, the spore-bearing or leafy parts of the fern? Botanists are pretty well agreed that ferns have arisen from some moss-like ancestor. All the evidence points toward this conclusion.

In the mosses, however, the gametophyte—that part which corresponds to the prothallium of ferns—does practically all the work of food-getting and supports the spore-bearing generation—which is equivalent to the ordinary fern-plant—throughout its existence.

Our ferns, of course, are self-supporting except for a brief period in infancy when they are dependent upon the gametophyte exactly as the spore-bearing parts of the moss are for life. It will thus be seen that the office of bearing spores was selected for the fern plant long before it needed to secure its own living and the first step toward an independent existence was undoubtedly made by turning part of the spore-bearing tissue into a green blade for vegetative functions. Some of our simplest fern-worts still point to the way in which fern fronds were evolved by being little more than a cluster of spore-capsules with some rudimentary green leaf-like parts.

Thus it may be seen that when a fern frond that is normally fertile becomes sterile, it has but followed a precedent set for it since time began for the ferns, while a sterile part that becomes fertile is the only one that may be said to *revert* to a former condition, though curiously enough, we customarily refer to fertile parts becoming sterile as true cases of reversion.

Just how late in the history of any given frond it is able to change from fertile to sterile or *vice versa* does not seem to be very definitely known. Probably the power to make the change exists until the cells have nearly ceased to multiply. Ferns belong to a class which the old botanists knew as Acrogens, or tip-growers from the fact that the region where new cells are produced is at the apex. As a consequence of this method of growth, the basal parts of fern fronds are

formed first and therefore should lose their plasticity long before the tip does so. As a matter of fact, this is shown in practically all these curious changes, for when a fertile frond becomes partly sterile, it is the newer tip that makes the change. If any part is fertile it is likely to be the lower parts as shown in our illustration. It is well known that fern fronds are completed, so far as the making of additional cells is concerned, for some time before they appear above the earth, their subsequent development being largely an increase in the size rather than in the number of the cells, so that when the frond is fully formed it is doubtless incapable of change though it may not be destined to be unfurled for months to come. In many ferns the sporangia are developed from single cells on the surface of the frond and it may be possible that in such species the power to produce spores exists even after the frond is formed, but nothing very definite seems to be known on this point.

FERNS OF BLOOMINGTON, INDIANA.

By F. C. Greene.

Bloomington, the seat of Indiana University, is situated in the great Mississippian limestone belt of southern Indiana. However, the Knobstone, with its deep, shaded ravines and dry points, is found less than a mile to the east, while large cliffs of sandstone occur a few miles to the west. Each locality adds variety to the fern flora, although many species are common to all three.

A short walk in any direction will be almost sure to disclose *Cystopteris fragilis, Phegopteris hexagonoptera, Adiantum pedatum, Polystichum acrostichoides* and *Botrychum Virginianum.* The deep Knobstone ravines contain luxurious plants of *Asplenium angusti-*

folium, Athyrium thelypteroides and *Nephrodium goldieanum.* Higher up on the knobs, particularly on shaded northern slopes, *Nephrodium marginale, N. Noveboracense* and *Athyrium filix-foemina* are found.

Blatchley has recorded *Ophioglossum vulgatum* from Huckleberry Hill, a dry Knobstone point to the northeast, and there is no doubt as to the authenticity of the record although several searches have failed to reveal it to the writer. The knobs yield, in favored places, three more species which appear to be rather rare namely *Pteris aquilina, Asplenium ebeneum,* and *Osmunda regalis.* In the limestone region, the edge of a cliff sometimes reveals *Woodsia obtusa,* while *Camptosorus rhizophyllus* commonly covers detached boulders at the foot of the cliff. One locality known as Cedar Cliff affords specimens of *Pellaea atropurpurea.* Near the head of a ravine, in the refreshing spray of a small waterfall, is the most luxurious colony of *Cystopteris bulbifera* it has ever been my pleasure to see.

Botrychium obliquum and *Onoclea sensibilis* are found on the Campus of Indiana University besides other places near Bloomington.

While there are no marshes in the vicinity, *Osmunda claytoniana* is occasionally found. There is also an authentic record of *O. cinnamomea* from the bottoms of the Bean Blossom, a creek northeast of Bloomington. The sandstone region to the west is extremely rich in ferns, one small glen furnishing eleven species, among which were *Polypodium vulgare* and *Nephrodium spinulosum intermedium.* This makes, altogether, a list of twenty-five species, all but two of which have been found by the writer and Mr. I. M. Lewis within the last year.

New Albany, Ind.

THE FAMILIES OF FERN-LIKE PLANTS.

Many botanists divide the plant world into four groups, the Thallophytes, Bryophytes, Pteridophytes and Spermatophytes which include respectively the algae and fungi, the mosses and liver-worts, the ferns and fern allies, and the conifers and flowering plants. So greatly do the plants differ, however, that this arrangement is becoming more and more unsatisfactory and various rearrangements have been suggested. In "University Studies" for October, 1907, Prof. Charles E. Bessey of the University of Nebraska offers a plan in which, instead of the four divisions, fifteen are proposed. Whatever objection may be brought against the new arrangement, it is certain that it comes more nearly representing the correct relationships of the plants than those now in use. Since the fern and fern allies are the living representatives of those plants which have bridged the gap between the lower spore-plants and the flowering plants, we append Prof. Bessey's arrangement of the entire group both living and fossil, slightly abridged as to descriptions beginning with the ninth division or phylum which is the one next higher than the mosses. The unfamiliar technical terms in the descriptions of the orders will be made clearer by a re-reading of the article "But Half a Fern" in the January number of this magazine.

Phylum IX. PTERIDOPHYTA. The Ferns.

Chlorophyll-green, mostly terrestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte, which is small and short-lived, and (2) the sporophyte which is large with roots, stems and leaves and long-lived.

CLASS 20. EUSPORANGIATAE.

Order Ophioglossales. Gametophyte tuberous, chlorophylless, subterranean; sporophyte with large often compound sporophylls (leaves) certain branches of which are spore-bearing.

Family 1.—Ophioglossaceae. *Ophioglossum, Botrychium.*

Order Marattiales. Gametophyte flat, chlorophyllose, attached by rhizoids; Sporophyte with large, compound sporophylls.

Family 2.—Marattiaceae. *Angiopteris, Marattia, Danaea.*

Order Isoetales. Gametophyte dioecious, the male rudimentary, one celled, very small; the female larger, many called, but little larger than the megaspore; sporophyte with an erect stem bearing many crowded, narrow sporophylls.

Family 3.—Isoetaceae. *Isoetes.*

CLASS 21. LEPTOSPORANGIATAE.

Order Filicales. Spores of one kind; sporangia mostly with an annulus (ring); gametophyte monœcious, foliose.

Family 4.—Osmundaceae. *Osmunda, Todea.*

Family 5.—Schizaeaceae. *Schizaea, Anemia, Lygodium.*

Family 6.—Gleicheniaceae. *Gleichenia.*

Family 7.—Matoniaceae. *Matonia.*

Family 8.—Parkeriaceae. *Ceratopteris.*

Family 9.—Cyatheaceae. *Dicksonia, Cythea, Alsophila.*

Family 10.—Hymenophyllaceae. *Hymenophyllum, Trichomanes.*

Family 11.—Polypodiaceae. *Polypodium, Asplenium, Nephrodium.*

Order Hydropteridales. Spores of two kinds, microspores and megaspores; sporangia without an annulus; male gametophyte one-celled, minute; female gametophytes larger, many-celled but little larger than the megaspore.

Family 12.—Marsiliaceae. *Marsilia, Pilularia.*

Family 13.—Salviniaceae. *Azolla, Salvinia.*

Phylum X. CALAMOPHYTA. The Horsetails.

Chlorophyll-green terrestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte, which is small and short-lived, and (2) the sporophyte which is large with roots, leaves and stem and long-lived. Stems of the sporophyte solid or hollow, jointed, erect or creeping, leaves whorled, relatively small.

CLASS 22. SPHENOPHYLLINEAE.

Order Sphenophyllales. Palaeozoic plants of tree-like aspect and dimensions, long since extinct. Stem solid, jointed, bearing relatively small wedge-shaped leaves; sporophylls in cones, each sporophyll with one or two isosporous sporangia.

Family 1.—Sphenophyllaceae. *Sphenophyllum.*

CLASS 23. EQUISETINEAE.

Order Eqisetales. Palaeozoic to recent plants, mostly extinct. Stems hollow, jointed; leaves very small, narrow, and united into a sheath; sporophylls peltate, in close terminal cones, each sporophyll with several pendant isosporous sporangia.

Family 2.—Equisetaceae. *Equisetum, Equisetites* (extinct).

CLASS 24. CALAMARINEAE.

Order Calamariales. Palaeozoic plants, often of tree-like aspect and dimensions, long since extinct. Stems, hollow, jointed; leaves mostly narrow distinct; sporophylls in cones, each sporophyll with one or more heterosporous sporangia.

Family 3.—Protocalamariaceae. *Asterocalamites.*

Family 4.—Calamariaceae. *Calamodendron, Eucalamites.*

Phylum XI. LEPIDOPHYTA. The Lycopods.

Chlorophyll-green, terestrial plants, exhibiting two generations in each life cycle, viz: (1) the gametophyte which is small and short-lived, and (2) the sporophyte which is large, with roots stems and leaves and long-lived. Stems of the sporophyte solid, not jointed, erect or creeping; leaves relatively small, scattered or crowded upon the stem.

CLASS 25. ELIGULATAE.

Order Lycopodiales. Gametophyte much larger than the spore; sporophyte with a central vascular bundle; spores uniform (isosporous).

Family 1.—Lycopodiaceae. *Lycopodium, Phylloglossum.*

Family 2.—Psilotaceae. *Psilotum, Tmesipteris.*

CLASS 26. LIGULATAE.

Order Selaginellales. Sporophyte stem with a central fibro-vascular bundle incapable of thickening; spores of two kinds (heterosporous).

Family 3.—Selaginellaceae. *Selaginella.*

Order Lepiodophytales. Sporophyte stem with a central fibro-vascular bundle and thickening by a cortical meristem. Palaeozoic and Mesozoic trees, long since extinct.

Family 4.—Lepidodendraceae. *Lepidodendron, Lepidophlois.*

Family 5.—Bothrodendraceae. *Bothrodendron.*

Family 6.—Sigillariaceae. *Sigillaria.*

Family 7.—Pleuromoniaceae. *Pleuromonia.*

PHYLUM XII. CYCADOPHYTA. THE CYCADS.

Chlorophyll-green, terrestrial plants in which the alternation of generations is obscured by the reduction of the gametophyte to a condition of dependence upon the long-lived, leafy-stemmed sporophyte; spores of two kinds, borne in sporophylls, the microspores set free, the megaspores retained in their sporangia where they develop gametophytes.

CLASS 27. CYCADOFILICES. (Pteridospermeae)

Family 1.—Lynginopterideae. *Lyngiopteris, Megaloxylon.*

Family 2.—Medulloseae. *Medullosa, Steloxylon.*

Family 3.—Cladoxyleae. *Cladoxylon, Voelkelia.*

Family 4.—Protopityeae. *Protopitys.*

Family 5.—Araucarioxyleae. *Araucaryoxylon.*

CLASS 28. CORDAITINEAE.

Family 6.—Cordaitaceae. *Cordaites, Dadoxylon.*

CLASS 29. BENNETTITINEAE.

Family 7.—Bennettitaceae. *Bennettites.*

CLASS 30. CYCADINEAE.

Family 8.—Cycadceae. *Cyas, zamia.*

CLASS 31. GINGKOINEAE.

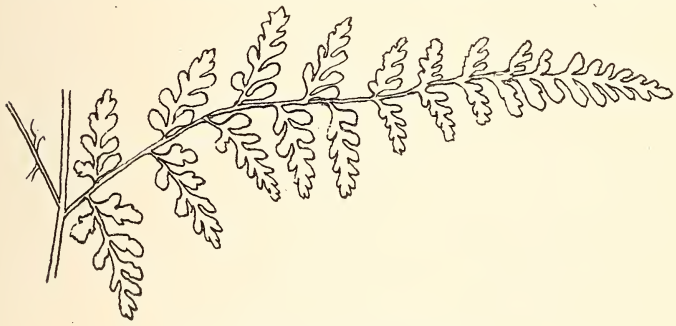
Family 9.—Gingkoaceae. *Gingko.*

PHYLUM XIV. STROBILOPHYTA. THE CONIFERS.

RARE FORMS OF FERNS.—VII.

A Slender Leaved Cystopteris.

The brittle bladder fern (*Cystopteris fragilis*) is distributed practically throughout the world. From Alaska and Iceland to the tropics, from Japan and Siberia to the Cape of Good Hope, from sea level to altitudes of more than three miles above it, on wet or dry rocks and its woods, it finds a home. The varying habitats to which it has been obliged to adapt itself have not failed to leave their impress upon the plant in the shape of changed form in the fronds and altered stature, yet through all these vicissitudes it has man-



Basal Pinna Reduced One-Fourth.

aged to maintain its characteristic features so nearly unchanged that all the varying forms are still considered as belonging to a single species. The differences exhibited by different plants, however, have not failed to confuse the systematists and in looking up the synonmy of the species, one finds that no less than twenty-five different names have been given to it. In view of these facts, one must be confident, indeed, who would venture to describe a new form, but the specimen which is illustrated herewith is so markedly dif-

ferent from any that have been named before that I feel warranted in naming it

CYSTOPTERIS FRAGILIS TENUIFOLIA sub-sp. nov.

Stipes 4 to 6 inches long, brownish; blade lanceolate 10 to 14 inches long, 6 to 8 inches broad, bipinnate; primary pinnae distant, about ten pairs 1 to 1½ inches broad at base tapering to a slender tip; secondary pinnae lanceolate deeply cut into four or more pairs of obovate segments; sori one to each segment, large for the genus; indusium, heavy, persistent. Found in rich soil, Carr Canyon Huachuca Mountains, Arizona by James H. Ferriss, November 1907. Type in my herbarium.

In appearance this is very distinct from the ordinary forms of *Cystopteris fragilis*. The type is described as having fronds from 4 to 8 inches long and 1 to 2½ inches broad. This is more than twice as long and three times as broad. A distinguishing feature of the type is found in the secondary pinnae which are decurrent on the rachis but in this the wing is not visible to the unaided eye. Unlike the type, also, this grows upright in rich soil instead of more or less spreading on rocks. Specimens identical with this were collected many years ago in Conservatory Canyon by J. G. Lemmon who also noted its deviation from the type. Although his labels read "A very curious form," he neither named nor described it. Conservatory Canyon is only a few miles distant from Carr Canyon and it is probable that the fern is not uncommon in the region. Without doubt the plant owes its slender pinnules and marginless rachis to the conditions which prevail in its habitat, but it is a strongly marked plant that apparently does not intergrade with the type and which

does not grow in the same situations; in fact, the ordinary *Cystopteris fragilis* does not appear to occur at all in this region. Since recent rules of nomenclature make special inducements for changing the names of plants when the plant is changed from variety to species, it may be observed that this plant may also be called *Cystopteris tenuifolia,* and *Filix fragilis tenuifolia.*—W. N. C.

A QUESTION OF NOMENCLATURE.

BY A. A. EATON.

The editor of the *Bulletin* seems to enjoy the unique position of being the only person who at present adheres to the principle that a name given to a variety must be retained if the variety becomes a species, and inversely a name given to a species must be retained if the species is reduced to a variety. Article 49 of the Vienna Code reads in part: "When a subdivision (variety) of a species becomes a species, or the reverse: and generally speaking, when a group changes its rank, the earliest name received in its new position must be regarded as valid." It is *recommended,* however, that the old name be carried over. This is one of the few points in which the Vienna and American codes agree. Indeed, Dr. Underwood in conversation with me singled it out as the only rule of the Vienna Code that was worthy of adoption. Let us illustrate this rule by instances in recent numbers of the *Fern Bulletin.* Several years ago I described *Isoetes Dodgei.* Later, when I had access to Dr. Engelmann's material, I found it to be his *I. riparia* var. *Canadensis.* Doubtless the only reason Dr. Engelmann made this a variety was because his material was rather under-ripe and

he thought it safer to do so. When I found the two names represented the same thing, I changed *I. Dodgei* to *I. Canadensis,* as I then held the view which the editor holds, that the earliest name, of whatever rank, must stand. According to all codes of nomenclature but the editor's, however, *I. Dodgei* must be the name of the species as it is the first name of specific rank the plant bore.

In the *Bulletin* for January, 1908, p. 18, No. 227 of the fern list,*Equisetum hiemale robustum* (A. Br.) is given as the name which we must suppose the editor countenances, but he says further on: "It may be noted that the correct name for this plant is *E. hiemale prealtum* (Raf.)." Aside from the question of morals involved in making combinations in this off-hand way, which must perhaps be called citation in synonymy, the name proposed violates article 49 of the Vienna Code in that *E. hiemale* var. *robustum* was the first combination for the plant in its present rank. When dealing with this plant in the *Fern Bulletin* articles I ignored Rafinesque's name because of the uncertainty as to what species it should be applied. Since then, however, I have become convinced by the process of elimination that it applies to the plant named *E. robustum* by A. Braun, and if it were a good species we should use Rafinesque's name: but it is simply a variety of *E. hiemale* and must retain the name first applied to it as such; *E. hiemale* var. *robustum.* The recent great upheavel of nomenclature has been for the purpose of arriving at uniformity. On the question under discussion the two major codes are agreed, and their adherents will work in harmony. I write this note that the readers of the *Bulletin* who have not the means in keeping in touch with the larger affairs of

botanical activity may know that on this point, as on many others, the editor's code represents himself alone. Whatever may be said in regard to controverted nomenclatorial points, upon which codes differ, it would hardly be deemed advisable to take exceptions to those points on which there is unanimity. If everyone with a pet theory insists on embodying it in practical usage we shall have a condition of anarchy in which no one can understand current botanical literature without a voluminous card catalog for reference.

The Ames Botanical Laboratory.

[The foregoing is an excellent example of the reasoning that some people adopt to convince us that a species once named is not named. One can make rules for anything, but this does not prove that they are right. Mr. Eaton and his friends seem to have a code which assumes that the editor belongs to a different species because he does not subscribe to all the absurdities their rules require, but we are inclined to think that the differences are only varietal. As to the editor being the only person who objects to changing the names of plants to accommodate those who would write their own names after them, this seems to be a misunderstanding upon the part of our critic. You can stand a man so near a cathedral that he can only see the bricks and stones right in front of him and misses entirely the beauty of the whole. So, too, one can contemplate his own brand of nomenclature so closely that he cannot see the relationships of the whole subject in proper perspective. This seems to be the trouble with our correspondent. The facts in the *Isoetes* case from our angle are these: Engelmann found a plant and gave it a name. Eaton later found the same form, did not recognize it and gave it

another. Now because Eaton was mistaken we are asked to change the name of the plant, the excuse for the change being that in giving the new name, Eaton disagreed with Engelmann as to the amount of difference between it and the nearest related form. "*I. Dodgei* must be the name of the species as it is the first name of specific rank the plant bore," may be good enough logic for those who change names to get their own into print, but the editor's "code" as outlined by Mr. Eaton reads "*I. Canadensis* must be the name of the species because it is the name first given to the plant," and the editor is ever ready to maintain that if a few botanists can form an "American Code" in defiance of the Vienna Code that all the rest of the world has agreed upon, he has quite as much right to form a "Fern Bulletin Code" or an "Editorial Code." This magazine and its editor, however, are not trying to make an impression upon botanical nomenclature, but instead are endeavoring to use the terminology that squares most readily with common sense. In the case of the great scouring rush mentioned, we never considered "making combi in this off-hand way" very demoralizing except perhaps to the peace of mind of those who consider nomenclature a god or master instead of a servant. If our critic really believes that "the earliest name received in its new position must be regarded as valid" we wonder why he takes the trouble to get excited over this "off-hand way" of stringing latin words together to indicate a mere form. Mr. Eaton may, as he claims, have been convinced by the process of elimination that the name *prealtum* applies to the plant in question, but he might have saved himself considerable mental effort by turning to Vol. XI. No. 1 of *The*

Fern Bulletin where the name and its application are set forth by Prof. R. S. Cocks. In Mr. Eaton's treatment of *Equisetum hiemale* in this magazine, we fail to find any mention of this correct first varietal name of the plant. While we have the highest regard for Mr. Eaton, personally, we have many instances to show that his judgment is not infallible and occasionally prefer to think for ourselves. "Those who have not the means to keep in touch with the larger affairs of botanical activity" are at liberty to take what opinion they choose or to make a new one for themselves. The editor's aim is to advance fern study, not to club it into a straight-jacket of nomenclature. We trust that Mr. Eaton will continue to favor our readers with his view of such matters.—*Ed.*]

THE CHECK-LIST OF NORTH AMERICAN FERNWORTS.

By Willard N. Clute.

The completion of the check-list of our fernworts makes it possible to get a better idea of our fern flora than could be had heretofore. The list is what might be termed a conservative one. Only such plants as seemed fully entitled to specific rank were given the dignity of a generic and specific name, and of these there are 196 ferns and 70 fern allies. Strongly marked forms, such as *Nephrodium spinulosum dilatum,* have been considered sub-species and given three names, of these there are 19 among the ferns and 8 among the allies.

In the number of forms listed, the Check-list is far ahead of any other list published. An effort has been made to include every variation from the normal

that has been thought worthy of a variated name. Of these there are no less than 121 among the ferns and 82 among the allies. A large majority of these have been described in the past few years, and many of them represent merely small changes in the texture and cutting of the leaves due to variations in the habitat of the plant. Still others are forms that were once considered species but which further study has shown to be unentitled to rank as such.

It was inevitable that while this list was being printed a number of new forms and species should have been added to our flora. These have been listed below with places of publication given when the forms are new.

ADIANTUM HISPIDULUM f. STRICTUM Gilbert. Fern Bulletin, O. 1905.

ACROSTICHUM LOMARIODES f. LOBATUM A. A. Eaton Torrey Bulletin, 1906.

ASPIDIUM CICUTARIUM Baker. (*Tectaria coriandrifolia.* Und).

ASPIDUM TRIFOLIATUM AMESIANUM (A. A. Eaton). Torrey Bulletin, 1906. (*Tectaria Amesiana* A. A. Eaton.)

ASPIDIUM TRIFOLIATUM MINIMUM. Underw Torrey Bulletin, 1906. (*Tectaria minima* Underw.)

ASPIDIUM TRIFOLIATUM HERACLEIFOLIUM (Willd). *Tectaria heracleifolia* (Willd).

ASPLENIUM FERRISSI Clute. Fern Bulletin, Ja. 1908.

ASPLENUM TRICHOMANES X RUTA-MURARIA Dav. Rhodora, Ja. 1906.

DICKSONIA PILOSIUSCULA f. NANA Gilbert. Fern Bulletin, O. 1905.

LOMARIA PROCERA Spreng. *Stenochlaena Kunzeana.* (Presl).

NEPHRODIUM CLINTONIANUM f. SYLVATICUM W. A. Poyser. Fern Bulletin, Ja. 1908.

OSMUNDA REGALIS f. ORBICULATA Clute. Fern Bulletin, Ja. 1908.

POLYPODIUM VULGARE f. ALATO-MULTIFIDUM Gilbert. Fern Bulletin, O. 1906.

POLYPODIUM VULGARE f. AURITUM Willd.

POLYSTICHUM ACROSTICHOIDES f. MULTIFIDUM Clute. Fern Bulletin, Jl. 1907.

SCHIZAEA GERMANI. (Fee). *S. pennula* Sw.

STRUTHIOPTERIS GERMANICA f. PUBESCENS Terry. Fern Bulletin, Ja. 1908.

SUMMARY.

Numbered ferns in the list	211	
Numbered Fern Allies in list	86	
Total		297
Forms of ferns not numbered	121	
Forms of fern allies not numbered	82	
Total number of forms		203
Species and sub-species added herewith	7	
Forms added herewith	11	
Total number added		18
Grand total		518

Species in Stebbins' list 1878	147
" " D. C Eaton's list 1880	167
" " Davenport's list 1883	188
" " Fern Chapter list 1895	249
" " Maxon's list 1901	307
" " Gilbert's list 1901	438
" " Fern Bulletin list 1908	518

The great interest that is now being manifested in the study of the forms of ferns is likely to annually add other items to this list for many seasons to come. It is not likely that many more species of ferns new to science will be discovered in our region but species new to the region, may still be expected from our southern border. There is practically no end to the number of forms that may be discovered and this form of fern study is bound to prove fascinating since it does not require extended expeditions into unsettled regions for its pursuit.

FRUITING OF BOTRYCHIUM.

BY MRS. A. E. SCOULLAR.

Very near our camp at Standish, Maine, is an old fence row where many *Botychiums* are found. Following the suggestion of Mr. Waters in "Ferns," Mr. Scoullar and I determined to watch the fruiting of one each of the following plants (selecting in each instance the most robust and marking them, so that no mistake could be made in identification). I submit this report hoping it may prove of interest. We will continue our observation of the same plants. We are also watching a plant that has not borne fruit for three years and has changed in the cutting of its frond each season.

Botrychium matricariaefolium: June 15, 1904 (fertile), June 18, 1905 (two fruiting spikes) June 16, 1906 (sterile) June 21, 1907 (fertile).

Botrychium obliquum: Aug. 25, 1904 (fertile). Sept. 1, 1905 (fertile). Sept. 7, 1906 (fertile). Sept. 7, 1906 (fertile). Sept. 5, 1907 (sterile).

Botrychium obliquum dissectum: Aug. 20, 1904 (fertile). Sept. 1, 1905 (fertile). Sept. 8, 1906 (sterile). Sept. 10, 1907 (two fruiting spikes).

[This is an excellent contribution to our knowledge of these fern-worts, and an example of careful work that might be followed with profit by others. It seems likely from the above, that in these plants, as in others, heavy fruiting is followed by a sterile year. We are ready to mark the second species fertile in 1908 and the third species sterile in advance of the promised report.—Ed.]

POLYPODIUM VULGARE AURITUM.

I think before you give Mr. Henry Merrill, of Hiram, Me., the honor of finding *Polypodium Vulgare auritum* you had better consult some back numbers of *Rhodora*. Several years ago I found this fern here and Mr. Fernald, of Harvard, identified the same as variety *auritum*. I have known of people before who thought that the finding of a large station of a plant was of vastly more value, that finding the species for the first time by some other collector. The plant figures as one in the list of Maine ferns and I furnished the station and reported the same to Dr. Fellows, of Portland. Don't try and take away the honor from the man who found the first station in the state of Maine. At the time I sent the plant to Mr. Fernard, he told me it was the second time it had been reported from North America, so Mr. Merrill's station is third. I think an apology is due in your paper for trying to give Mr. Merrill an honor which he in no way deserves or is entitled to if the law of priority means anything. I have another form of *P. Vulgare*, which I have named *Polypodium vulgare* forma *elongata* Jewell. The form

grows in small quantities of earth in crevices of ledges four inches in length half an inch wide from the middle of frond and an inch and a half from the middle to the base of frond. I have other forms that are somewhat out of the ordinary. *Phegopteris dryopteris* forma *interrupta* Jewell is a form in which the two lower pinna are nearly two inches below the second pair, giving the plant a queer look.

H. W. Jewell, Farmington, Maine.

[Mr. Jewell read that paragraph in the April 1907 *Fern Bulletin* too hastily. A second reading will show him that Mr. Merrill distinctly states that his find is the second one for the state. This second find, however, is not so important as the find of *P. v. hastatum* a form new to the state. Of course the patient editor apologizes for even seeming to cast a shadow upon Mr. Jewell's honors—that is what many people think an editor is for. He cannot help adding, however, that honors of this kind will settle more thickly upon his correspondent when he learns to forsake the daily newspaper and publish his finds in a reputable scientific journal.—*Ed.*]

PTERIDOGRAPHIA.

The Common Brake as Food.—A nursery some time back sent me a packet of the dried material with directions for cooking and after soaking and boiling for the specified time a soft and by no means unpleasantly tasting dish resulted. In this connection, why *Pteridium* in this case and the only really recognized name *Pteris aquilina* in the succeeding article. This and many other instances demand a dose of editorial blue-pencil as per the editorial note on page 61.—*Chas. T. Druery, F. L. S., London.* [There are many reasons

why we occasionally use *Pteridium* instead of *Pteris*. Variety adds to the spice of life, we are told, and what is the use of sticking to one term when the name-tinkerers have given us more. The English language owes not a little of its expressiveness to its abundant synonyms, then why should we use *Lastrea* all the time when we have a choice of *Nephrodium* and *Aspidium* and *Dryopteris* and then some more? Or why stick to *Polypodium* when we may use *Phegopteris, Goniopteris* or even *Dryopteris?* To come down to well-known facts, the bracken has a sort of fugacious indusium inside the common one. The genus *Pteris* lacks this; therefore the bracken is often considered worth placing in a separate genus. The editor of this magazine does not believe that so small a matter as the occasional presence of a fugacious indusium is of generic importance but if his contributors do, he lets them have their own way confident that they will reform in due time.—Ed.]

Ferns as Food Preservers.—An item has recently appeared in several horticultural publications to the effect that fern leaves are much superior to any other vegetation for packing fruit, vegetables, butter, etc. According to "Consul-General Richard Guenther" potatoes packed in fern leaves keep much better than if packed in straw which is due to the high percentage of salt in fern leaves. To one familiar with the ferns, this appears like a story made to fit the facts. It is well known that various fruits fish and vegetables have been sent to market from time immemorial packed in fern leaves, but this is without doubt due to the fact that such packing material is usually both cheap and handy rather than because it contains any substance that acts as a preservative. As a matter of fact, most fern leaves, being adjusted to a shady, rather than to

a sunny, habitat, are likely to wilt rapidly and thus form but an indifferent packing so far as keeping products fresh is concerned. Ferns, especially the bracken, are of much more extended use in packing in Great Britain than with us, and the people are not allowed to cut brackens when and where they please. The whole subject is one of considerable interest and we hope some of our British readers may give us more light on the subject.

Fern Genera.—I am pleased at the attitude you take on the nomenclature question. It is the only sensible one. I have recently been looking up fern genera and the changes that Underwood made in species because of so called priority. It is astonishing how many blunders he made. Take *Filix* for *Cystopteris* for instance, and *Drypoteris* for *Aspidium.* They are based on Adanson's genera created in his Fam. des Phlantes. So far as I can learn no species of *Filix* ever was published till Underwood renamed *Cystopteris;* at least none were published till long after the species of *Cystopteris* were. It should be noted that Adanson never published any species in connection with his proposed genera and so the genera fall without someone else took them up and used them later. The same is true of *Dryopteris;* no species of that genus were published till long after Swartz published his species of *Aspidium,* and so *Dryopteris* falls. In addition there is nothing in Adanson's description of *Filix* to tell whether it refers to *Phegopteris* or *Cystopteris,* and none in *Dryopteris* to indicate whether it refers to *Nephrodium, Phanerophlebia* or other segregates from *Aspidium.* He speaks of the indusium as being peltate, while it is not so in *Aspidium.*—*Marcus E. Jones, Salt Lake City, Utah.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from this list.

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JEWELL, H. W. *The Polypody.* Maine Woods, Mr. 1908.—*Polypodium vulgare* f. *elongata* desribed as new.

MERRILL, H. W. *Polypodium vulgare auritum.* Fern Bulletin, Jl. 1907.—A new station for this eared form in Maine recorded. The occurrence of *P. v. hastatum* noted.

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SHEPARD, J. *Solar Prints of Plants.* Illust. Fern Bulletin, Ap. 1908—A new method of making prints of ferns without a camera described.

TAYLOR, MRS. A. P. *Range of Pteris serrulata.* Fern Bulletin, July 1907.

TRUNDY, A. H. *Fairy Rings of Lycopodium sabinaefolium in Maine.* Fern Bulletin, Jl. 1907.

WATERS, C. E. *Equisetum hyemale.* Fern Bulletin, Jl. 1907.—Reprint from *Linnaean Fern Bulletin*, No. 6.

WATERS, C. E. *Notes on Aspidium cristatum.* Fern Bulletin, Jl. 1907.—Reprint from *Linnaean Fern Bulletin* No. 1.

A NEW FORM OF POLYPODY.—In the *Maine Woods* for March, 1908, H. W. Jewell describes a new form of the common polypody as *Polypodium vulgare f. elongata.* A blue-print of the form shows it to consist of five or six pairs of pinnae, longest at the base and rapidly diminishing upward ending in a long terminal segment that is deeply lobed below to meet the pinnae. The whole fern is not more than five inches in height and was collected in a rock crevice. The scanty moisture in such a situation is doubtless responsible for the form of the plant, which in most respects, corresponds to young phases of the ordinary species. Since there have already been named six different *elongatums* in *Polypodium* this fern would doubtless need a new name if distinct enough to merit one, but the describer should select some other place of publication than a newspaper, and get his adjectives to agree with his nouns.

EDITORIAL.

The missing number of this magazine for October 1907 is partly in print at this writing, but it will not be sent out until the October number for this year is ready when the two will be sent together. At the same time the title pages and tables of contents for volumes 12, 13, 14 and 15, which have been promised so long, will be issued, but since some of our subscribers do not bind the magazine, and therefore do not care for the title pages, copies of these will not be sent out to our regular list. Copies will be sent to all public libraries and scientific institutions without further notice because these carefully preserve the magazine, but others who wish the title-pages are requested to indicate the fact. The pages are absolutely free and postpaid and all that is needed to secure them is a request at any time.

* * *

A complete set of the FERN BULLETIN has recently been acquired by C. Belhatte, 7 Rue Fresnel, Paris, France. This is the only complete set of the magazine in the Old World and will doubtless be valued accordingly. It also adds one more to our list of complete sets making twenty-nine in all. The herbarium in which M. Belhatte is in charge is the largest in France containing about 25,000 sheets of ferns and more than a million flowering plants. He is desirous of adding more tropical ferns to his collection and offers in exchange for them, European plants, botanical works or cash.

* * *

A feature of fern study that has not, as yet, been very extensively exploited in America, is the search for

forms of ferns of commercial value. In Europe this appears to be one of the main indications of an interest in ferns and in consequence the named varieties are almost limitless. Often the appearance of the cultivated forms are scarcely attractive from the point of view of beauty, but their odd shapes seem to please the public for it may be observed that if our own florists cultivate any of these European forms they almost invariably select the crested, tasseled and frilled specimens. It cannot be denied that variation along certain lines adds to the beauty of an already beautiful race of plants. Illustrations of this may be seen in the many sports of the sword fern (*Nephrolepis exaltata*) all of which are undoubtedly more beautiful than the type, and in *"Adiantum farleyense"* which is well known to be a sport from a species that is not celebrated for its appearance. Since most of our greenhouse ferns are tropical in origin, the search for desirable forms will go on most vigorously in the tropics and may lend zest to every outing, but such fern hunting need by no means be restricted to the tropics. The demand is steadily increasing for the ferns of temperate regions, hardy enough to endure our winters out of doors unprotected, and if people are willing to pay for the Christmas fern, the ostrich fern and the *Osmundas* as they are, surely they will pay more for improvements in these forms, perhaps even coming to the point when they demand the new form and refuse the type, as they now do in the case of the so-called Boston fern. Mr. Terry's *multifidum* form of the Christmas fern is one that would always be selected in preference to the type and the same may be said of various forms that Mr. Hans has produced; indeed a decided and characteristic form of *Polystichum acrostichoides incisum* would no

doubt sell well, as would a crested form of the lady fern or the *Dicksonia*. There is a satisfaction in giving to the world a more beautiful form of anything than it now possesses, quite aside from any monetary consideration, but when art, beauty and commerce join forces, the student of ferns has cause to rejoice.

* * *

Publication of the fern floras of the States has not been given up, and several new ones are being prepared. The issuing of the floras for the States at the extremes of our range, such as California, Washington, Maine, Florida, Vermont, Texas and Louisiana, have shown us a great deal regarding the distribution of species as regards the country as a whole, but there are various minor problems of distribution which the forthcoming floras may be expected to elucidate. This is especially true of the States in the Mississippi Valley where the Eastern and Western floras meet, and of those on the borderland where Northern and Southern species intermingle. In time all these will appear, but in many the observers are so few that considerable work will have to be done before anything like completeness in the list can be attained.

BOOK NEWS.

In "Contributions from the United States National Herbarium" Volume X part 7, issued March 30, 1908, appears the first of a series of "Studies of Tropical American Ferns" by William R. Maxon. Mr. Maxon has spent more time collecting in the tropics than any other American student of ferns and it is very fitting that he should take up the work of making the species better known. The initial study, however, has a considerable tinge of the book work that always results in

new ways of distinguishing tweedledee form tweedledum. For instance, when Linnaeus made the name *Asplenium rhizophyllum* he seems to have had three plants in mind, the American walking fern, the Siberian species and the very characteristic Jamaican fern which has since been known as *Fadyenia prolifera.* The connecting of the specific name *rhizophyllum* with our species of *Camptosorus* of course left the Jamaican plant without a name, and in 1840 Hooker called it *Fadyenia prolifera,* taking as the specific name the name given by Swartz to this plant 120 years ago. Unfortunately, Lamark, two years earlier, gave the same specific name to an *Asplenium* but although his name never gained currency, we are now asked to substitute *Hookeri* for the long-used specific name. But doctors disagree in this case, as usual, and Christiansen's recent "Index" uses the specific name *Fadyenii!* A similar complication gives occasion for a new name for *Polypodium crassifolium.* When it could no longer rest easy as a *Polypodium* Schott called it *Anaxetum.* Fee declined to accept this because the name had once been applied to a genus of Composites, and called it *Pleuridium.* Maxon now objects because this latter name has been given to a genus of mosses and suggests *Pessopteris.* To make ourselves understood we must still use *Polypodium.* For similar reasons *Anathacorus* is a new generic name suggested for certain species usually regarded as belonging to *Vittaria.* Fourteen ferns in various genera are described as new and no less than fifteen names given to ferns by older botanists have been so re-arranged as to have Maxon's name in the author citation. Mr. Maxon's knowledge of the plants in the field and his situation in a great herbarium gives him unusual facilities for an exact account

of tropical ferns, and we venture the hope that he may find time to take them up, genus by genus, and give us correct descriptions of the known species without too much consideration of what they might have been called by botanists who have been dust for a century or more.

AMERICAN FERN SOCIETY.

Since the last report, the American Fern Society has gained three additional members as follows: F. T. Pember, Granville, N. Y., Harry C. Ridlon, Cuttingsville, Vt. and Samuel A. Lurvey, Southwest Harbor, Maine. These will be included in the new list of members to be published in the Annual Report which it is hoped may soon be issued. The address of Dr. C. E. Waters, should be Bureau of Standards, Washington, D. C., instead of Bureau of Soils as recently printed.

The annual election of the Society occurs as usual in October. The committee in charge of the selection of candidates for office will be glad to receive suggestions in the matter, which may be sent to the editor of this magazine. Two candidates for each office are nominated so that the members may have a choice, but this does not bind them to vote for either. Any member receiving a majority of the votes for an office will be declared elected, whether regularly nominated or not. It is well, however, to have your candidate regularly nominated, and to this end expressions of preference are invited.

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"Botanical books especially, of late years, have been remarkable for wealth and beauty of illustration, but even among these "How Ferns Grow" is notable. The pictures are purely scientific, nearly all are the size of nature, and they are so numerous and so carefully arranged as to make the text almost superfluous. . . . A beautiful book that every fern lover will want."—N. Y. Sun.

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Willard N. Clute & Company

Joliet, Illinois

Vol. XVI No. 4

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A Quarterly Devoted to Ferns

October

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Willard N. Clute & Company
1903

The Fern Bulletin

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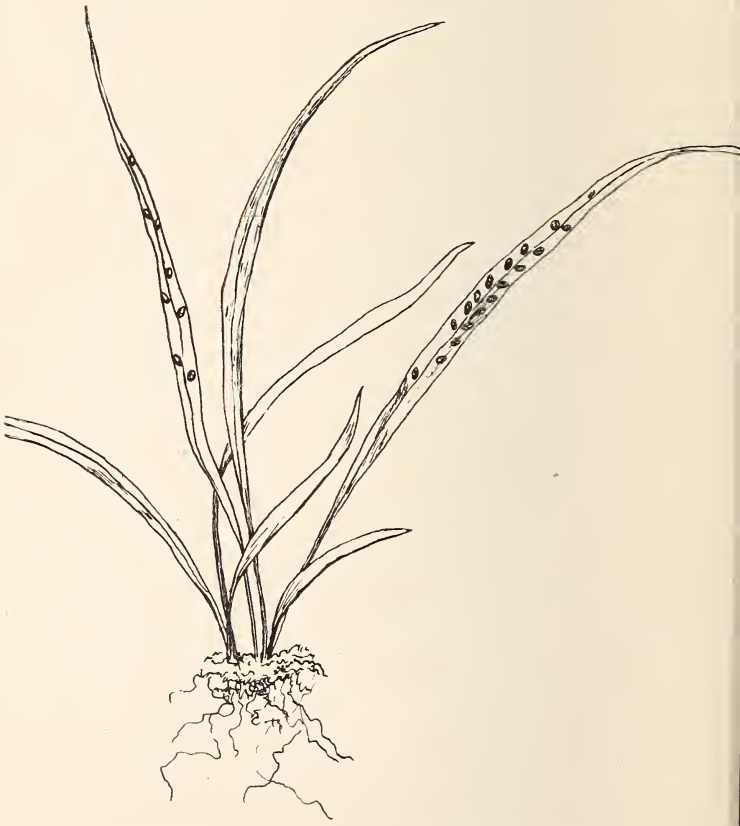


THE GRASS-LIKE POLYPODY.—*Polypodium gramineum.*

THE FERN BULLETIN

Vol. XVI OCTOBER, 1908 No. 4

NOTES ON SOME HYBRID FERNS.

By Margaret Slosson.

When the hybrid fern *Dryopteris cristata x marginalis* was first described, * it had been found only with a caudiciform rootstock, like that in *D. marginalis,* that is, a rootstock of upright growth, capped by a central crown. This character was supposed to be always dominant in the cross. It appeared in both of the two plants I obtained by artificially crossing *D. cristata* and *D. marginalis,* † which corresponded with the wild hybrid in all other respects as well.

Now, however, it is certain that a decumbent, creeping rootstock, like that in *D. cristata,* does sometimes occur in plants of this hybrid. It seems the exception, far from the rule, but I have seen it repeatedly in plants taken from different parts of a large swamp in Pittsford, Vt. In the plants that have it, the influence of *D. cristata* seems more marked than in those with the caudiciform rootstock; often the fertile leaf's pinnae appear farther apart and the leaf's apex is more abrupt, the leaf's general outline suggesting that in *D. cristata x spinulosa intermedia* (*D. Boottii*); the leaf's texture also, is perhaps slightly thinner, giving a slightly more lax appearance to the plant. But these differences are scarcely noticeable. It is possible, of course, that those plants with the creeping rootstock may be the result of a cross between *D. cristata x marginalis* and pure *D. cristata,* or that they may be offspring of *D. cristata*

* Bot. Gaz. 19: 497; 1894.

† See "Fernwort Papers," 24; 1900. Leaves from these plants are in the Herbarium of the New York Botanical Garden.

x marginalis in which traits of *D. cristata* are re-appearing, but cannot be said to be probable, as it is doubtful if spores capable of germination are ever found on plants of *D. cristata x marginalis.*

An interesting feature of this hybrid is the half-evergreen character of its leaves. It stands, in this respect, midway between the parent species. The fertile leaves last more or less into the winter, not so late as those of *D. marginalis,* but long after those of *D. cristata* have withered.

D. clintoniana x marginalis was found by me in Pittsford some years ago, and has since been collected by others elsewhere. Its occurrence is noted in the latest edition of Gray's Manual. I believe no description of it has been published, and there is not space for one here, but, for the benefit of those looking for it, it may be said to resemble a large much over-grown *D. cristata x marginalis,* standing in much the same relation to that fern that *D. clintoniana* does to *D. cristata.* Specimens of it were shown with those of other hybrid ferns, by Mr. Ralph C. Benedict, at a meeting of the Torrey Club in New York last winter.

The study of hybridity in ferns promises to solve many problems presented by puzzling "finds" of collectors, and opens up a wide field for investigation, of absorbing interest.

The numbers of known American hybrid ferns is rapidly increasing. Of these the oldest and best known probably is *Asplenium ebenoides* Scott = *Asplenium platyneuron x Camptosorus rhizophyllus.* Several years ago, *Asplenium trichomanes x Belvisia ruta-muraria* described by Ascherson and Graebner in 1896, * was found for the first time in America, in Proctor, Vermont, by G. A. Woolson. † In the genus *Dryopteris*

* Synopsis der Mitteleuroparschen Flora, i: 79; 1896.

† See *Rhodora,* 8: 12; 1906. Also *Fern Bull.* 16: 46; 1908.

there are at least six ferns which intercross, namely, *D. cristata, D. clintoniana, D. goldieana, D. maginalis, D. spinulosa* and *D. spinulosa intermedia.* Mr. Benedict has pointed out that there are fifteen combinations possible here. Of these we already have the following: *D. cristata x marginalis,* Davenport; *D. cristata x spinulosa intermedia* Dowell * = *D. Boottii; D. clintoniana x goldicana* Dowell * = *D. goldieana celsa* Palmer; *D. clintoniana x marginalis; D. clintoniana x spinulosa intermedia,* Dowell; * *D. goldicana x marginalis,* Dowell *; *D. goldicana x spinulosa intermedia* Dowell *; and *D. marginalis x spinulosa* = *D. Pittsfordensis,* Slosson †; *D. cristata x spinulosa* is known to occur both in this country and in Europe. * Four of the six remaining members, of the group were exhibited by Mr. Benedict at the meeting of the Torrey Club already mentioned, and will soon be published. This leaves two yet to be found. I confidently assume that they exist, and am convinced that collectors have only to look, to find, perhaps neglected in their own herbaria, both these and many other examples of hybridity in our native ferns.

Pittsford, Vt.

THE GRASS-LIKE POLYPODIUM.

Polypodium gramineum.

By Willard N. Clute.

In the popular mind finely-cut foliage and ferns are indissolubly connected. To such, the leaves of yarrow and columbine always have ferny characteristics and the adjective fern-like is always understood to refer to a much-divided leaf. The further one extends his knowledge, however, the less the word fern-like repre-

* Bull. Torrey Club, 35: 135; 1908.
† Rhodora, 6: 75; 1904.
‡ Bull. Torrey Club, 35: 135t 1908.

sents any definite mode of outline or cutting. In our own flora, simple and entire fronds are the exception, but if we search the world over we shall find that such species are not as rare as the study of our own flora may have led us to think; in fact, there are few genera without at least one or two of these simple-fronded species. In large works devoted to the ferns it is customary to arrange the species in the order of their cutting, the simple fronds coming first, then those that are pinnatifid, then pinnate and so on. Each group has much in common, and the species are more closely related among themselves than they are to the rest of the genus, but there are usually connecting links to join one group with another.

In the genus *Polypodium*, if we exclude the species usually placed in the section or genus *Phegopteris*, the fronds as a rule are not very extensively divided, nevertheless there are not a very large number with simple fronds. One of this number we have chosen for illustration. It derives its specific name *gramineum* or grass-like from the narrow fronds which are not unlike blades of grass in shape and size. It is most abundant in the elevated parts of Jamaica where it grows on the branches of trees often many feet from the ground. According to Jenman it may be distinguished from the species that resemble it by its horizontal root-stock, distinct stipes and median sori. Like so many of the *Polypodiums* its sori are somewhat oblong instead of round.

Owing to the fact that it grows on trees at a distance from the earth and depends upon the rains for its moisture it cannot grow in regions where rains are not abundant and comparatively frequent, though, like

several of its alies, its thick epidermis and scaly rootstock enable it to retain its moisture for a long while and endure considerable drouths unharmed. Our illustration is natural size.

FERNS OF THE UPPER SUSQUEHANNA VALLEY.

By George T. Cleveland.

When Mr. Willard N. Clute published his "Ferns of the Upper Susquehanna Valley" he gave the least attention to the region extending from Binghamton, Broome County, to the true headquarters of the Susquehanna, surrounding Otsego Lake. This region comprises a strip of country approximately 170 miles in length, with a width of from one to thirty miles, including of course the watershed and smaller tributary streams. This region consists mainly of rolling hills having an average elevation of 1600 ft., reaching in a few places to nearly 3000. The country north of the Susquehana River itself is mainly composed of valleys and ranges of hills running in a north and south direction, while the southern side consists of two or three nearly parallel valleys running approximately east and west, namely the Ouleout, Charlotte and Schenevus creek valleys, divided by hills about 2500 ft. in height, lying in the southern half of Otsego County and the northern edge of Delaware.

The rock formation is of sandstone and shales belonging to the Oneonta, Ithaca and Catskill groups, the latter not reaching north of the river. This part of New York state shows the action of glacial ice as evidenced by numerous glacial lakes, striations, drift and a few traces of moraines. The summit of Rock Hill and Catamount Mountain, at Oneonta, and Mt. Inde-

pendence near Cherry Valley, appear however to have been above the ice and show distinct wave marks, as also do most of the hills along the valley of the Susquehanna, yet the hills to the south, of a higher elevation, are covered with glacial drift, some of which must have come from far to the north, as indicated by the kinds of rock composing it.

During the past three years I have covered the territory extending from Sidney, Delaware County, to Otsego Lake fairly well. While the fern flora is perhaps not particularly rich as a whole, yet in certain sections it is rather varied, as the following will illustrate. For lack of space the commoner species are passed over, and only those which are worthy of note are mentioned.

Camptosorus rhizophyllus, found in numerous rocky ravines throughout the section.

Asplenium ebeneum, Rock Hill and Catamount Mt., Oneonta, and at Franklin, Delaware County.

Nephrodium Spinulosum dilatatum, common on every heavily wooded hillside and on sides of wooded ravines.

Nephrodium Boottii, found in nearly every wooded swamp about Oneonta, and southward in the Ouleout Valley.

Nephrodium Goldieanum, two or three stations about North Franklin in the Ouleout Valley.

Nephrodium cristatum x Marginale, swamp near "Chinese Wall," Oneonta.

Cystopteris bulbifera, found in several ravines on the north side of the Susquehanna Valley, also throughout the Ouleout Valley.

Woodsia Ilvensis, a small station of exceedingly vigorous plants on the summit of a cliff on Rock Hill. Oneonta, elevation 1500 ft.; on the top of a dry shale

cliff on Catamount Mt., Oneonta, about 1600 ft. and extending for nearly three-quarters of a mile east and west. Thousands of plants but not particularly large, and exposed to the full blaze of the sun. Natty Bumpo's Cave and Prospect Rock, near shore of Otsego Lake; plentiful, large fine plants. Elevation 1800 feet.

Botrychium simplex, in rocky upland woods on the Mills Farm, North Franklin, Ouleout Valley.

B. lanceolatum, same station as *simplex.*

B. marticarifolium, one station in beech and maple woods, Goodyear Lake, near Portlandville, Otsego County.

B. Obliquum, forms *dissectum, matricariae, Oneidense* and *intermedium,* in hilly pastures and along country roadsides; common.

Polystichum Braunii, in exceedingly deep and heavily wooden ravine on the south side of the Schenevus Creek opposite Chaseville, Otsego County. The rock formation of this particular ravine is curious in that it seems to be different from anything in the surronding territory. It is a shale almost approachinng to a gray slate. The sides of this gorge rise in places to a height of nearly 200 ft., making an angle of about 80° to the horizontal. About twenty-five or thirty plants of *P. Braunii* were observed growing at the base and on the shelves of this rocky wall. The rock is so weathered and shattered that it is impossible to scale the walls even for a short distance. The elevation of this gorge is from 1400 to 2000 ft.

This leaves the region north and east of Otsego Lake, which is on a point of the limestone ridge running through Central New York east to the Hudson, as yet unexplored.

OBSERVATIONS ON NEPHRODIUM SIMULATUM.

By J. C. Buchheister.

A piece of low woodland near Little Ferry, New Jersey, on the banks of the Hackensack River, on a perfect September day. All around the two *Woodwardias W. areolata* and *W. virginica* form a veritable sea. Interspersed, equally abundant, are *Nephrodium noveboracense* and *N. thelypteris,* with here and there some *Athyrium thelypteroides* and *Athyrium filix foemina,* the latter often forked and crested. At certain intervals arise fine plants of *Osmunda regalis,* and *O. cinnamomea,* with fronds often 5 feet long. There are hardly any flowering plants in this particular woods. The trees are mostly hickories and chestnuts, the underbrush *Clethra alnifolia.* But it is not any of these plants, on which my attention is riveted. Sitting on a tree stump, I gaze upon several sturdy plants of *Nephrodium simulatum,* which grow in a sort of "fairy ring" around a mouldering stump, which is mostly decayed, forming a little hillock of rich earth. The descriptions of the books are in my mind, but here I am making some observations of my own, in the field, face to face with the living plant.

The habit of this fern reminds me of nothing so much as it does of *N. cristatum.* There are the stiff erect fertile fronds standing up in the middle, while the sterile ones droop around them in lax manner. The latter have a much larger leaf surface, for fruit-bearing contracts the cells of a frond. *Nephrodium noveboracense* grows in a lax way, and. the habit of *N simulatum,* as it grows here, is so marked, that I would never confound it with the New York fern. In fact, this station was new to me, and my attention was at-

tracted quite from a distance by this habit, as above described. It has been said, that the pinnules do not seem to become revolute, as in *N. thelypteris.* They do! It is the rule here, indeed.

By the beginning of October the sterile fronds have become so limp, brownish, and generally ragged, that it is hard to find a good frond for the herbarium, but the fertile ones still stand upright, bright and green. As this interesting fern grows here, the fertile fronds resemble those of *N. thelypteris.* The pinnae are also drawn out in a rather long acute point. They could never be taken for the New York fern, not even by a beginner, if he is observant. But the sterile ones might. Is it possible that *N. simulatum* is a hybrid between *N. noveboracense* and *N. thelypteris,* as *N. Boottii* appears to be a hybrid between *N. cristatum* and a swamp form of *N. spinulosum?*

LYCOPODIUM LUCIDULUM POROPHILUM IN OHIO.

By Almon N. Rood.

I am sending you under separate enclosure a specimen of *Lycopodium* which I first found last season growing at Nelson Ledges, Portage Co., O. At that time only a single plant was discovered which Prof. C. C. Curtis of Columbia University pronounced *L. Selago.* As this is out of any reported range for *L. Selago,* I was naturally very anxious to re-establish my discovery and wrote to several friends who collect in this region to be on the lookout for it, giving them its probable locations. As a result my friend R. J. Webb, of Garrettsville, O., and Prof. L. S. Hopkins of Pittsburg, Pa., re-discovered it at my old station at Nelson

Ledges on Aug. 18th and on the 23d a friend of mine, F. N. Barber, of Crafton, Pa., and myself found it in considerable quantity growing at a place called Woodworths' Glen in Portage Co.

This *Lycopodium,* whether *"Selago"* or not, grows on the exposed face of conglomerate cliffs along the cracks or seams, seeming to prefer the upper and more inaccessable points of rocks where it flourishes, green and fruitful. However, our rocks are mere outcrops worn by streams or glacial ice and do not exceed 50 feet in height and our general altitude is not above 1000 feet. *L. Selago* has not, to my knowledge been reported from Ohio.

Phalanx, Ohio.

[As Mr. Rood suggests, the specimens sent were not specimens of *Lycopodium selago,* but of *L. lucidulum porophilum. L. Selago* is not found at low altitudes so far south. In passing it may be noted that the new "Gray's Manual" gives as the habitat "mountains and cold ravines." It is quite apparent, however, that this form is due to drouth rather than to cold or elevation and may be expected wherever the type is found on cliffs.—*Ed.*]

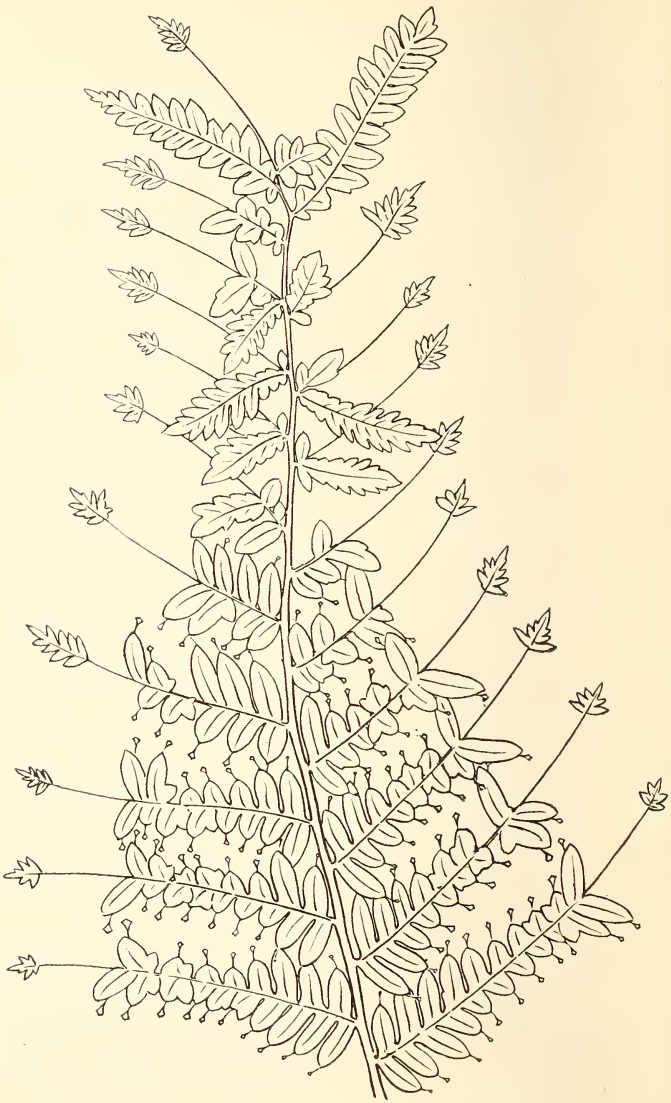
Woodsia Oregana—This species, though named for a State in the Far West is also recorded from Northern Michigan and Wisconsin. There seems to be no good reason why it should not be found further east and it was recently reported by Prof. M. L. Fernald as abundant in Rimouski Co., Quebec. Mr. Fernald suggests that it may yet be found in the higher elevations in Vermont.

RARE FORMS OF FERNS.—VIII.

An Abnormal Cinnamon Fern.

It was once thought, on this side of the water, that there must be something peculiar to the soil or climate of Great Britain that would account for the great variation in its fern species, but the longer we study our own ferns, the more certain it appears that fern variation in the old world is not so much a matter of soil and climate as it is of careful observation and search on the part of fern students themselves. Within a comparatively short time several variations from normal *Osmunda* plants have been recorded from America and it is quite likely that others will be noted in the future. In fact, to this lengthening list must now be added the form illustrated in the accompanying cut which was drawn from a frond collected by A. S. Bossart in a bog near Burton, Geauga Co. Ohio, in the early part of the summer of 1907.

A glance at the illustration will show that the new form is characterized by pinnae that are devoid of pinnules for some distance toward their tips leaving the slender mid-ribs as stalks supporting the apical cluster of pinnules. In a large number of pinnules toward the base of the frond a tendency is shown to repeat the outline of the pinnae, but a careful examination of the frond, itself, shows the terminal structures to be not mere expansions of green tissue but those more remarkable structures known as ascidia or pitchers. Ascidia are known on a great variety of flowering plants in some being the normal condition as in the pitcher-plants. In others, as in clover-leaves which sometimes assume this form, they are clearly abnormal. Some few ferns are known which normally form as-



OSMUNDA CINNAMOMEA F. CORNUCOPIAFOLIA

cidia but in the present case, this is, of course, a mere sport.

Another interesting feature in connection with our plant is the fact that the pitchers are not direct continuations of the main vein of the pinnule, but that they rise upon a separate veinlet given off by the main vein somewhere about the middle of the pinnule, and of course on the underside of the frond. Prof. L. S. Hopkins, to whom we are indebted for the drawing and notes concerning the plant, writes that when first discovered there were about twenty strong and vigorous plants of it growing under apparently normal conditions. During the present autumn the locality was visited again and additional plants of the form discovered.

Although this is recognized as being a mere abnormal form, it is quite likely that it can be propagated as a curiosity and since such forms are more easily discussed if given a name, it is suggested that it may be called *Osmunda cinnamomea* forma *cornucopiafolia.* From some observations made on half-fertile fronds of the cinnamon fern, it would appear that the cornucopias rise from the pinnules in much the same way as the sporangia do.—*W. N. C.*

DEATH OF ALVAH A. EATON.

Once more death has removed from our midst one to whom we have looked for many years as an authority in matters relating to ferns. Alvah A. Eaton died at his home in North Easton, Mass. Sept. 29, 1908. Mr. Eaton was among the most prominent of present day students of ferns, although but forty-three years old. He was the author of numerous papers on

Equisetum and *Isoetes,* described many species and forms in these groups, and revised the matter relating to them for "Gray's New Manual of Botany." Although the Pteridophytes were his favorites, he was also much interested in the flowering plants, especially the grasses and orchids and a grass has been named in his honor. For the past six years he has been connected with the Ames Botanical Laboratory at North Easton, Mass., and in the interests of this institution he made one trip to Europe and three collecting trips to Florida. On these latter he pushed his way into untrodden parts where he discovered more than a dozen ferns new to the United States.

Mr. Eaton was born at Seabrook, N. H., Nov. 20 1865. When he was twelve years old his family moved to Salisbury, Mass., where the rest of his boyhood was spent and where he became familiar with the cultivation of plants which stood him in good stead later in life when failing health led him to take up the business of florist and gardener for a time. He was graduated from the Putnam School at Newburyport, taking the four years course in two years. He then taught school in Seabrook one year and in California three years. Returning to the east he again took up teaching for some years until he turned florist.

Like many of our most enthusiastic botanists, Mr. Eaton was entirely self-taught, but his work was none the less thorough on that account. He early became a member of the Linnaean Fern Chapter, now the American Fern Society, and was a contributor to the *Fern Bulletin* almost from the beginning. The bulk of his scientific writings have appeared in this journal and in the miscellaneous publications of the Fern Society.

He has also published more or less in *Torrey Bulletin* and *Rhodora.*

Mr. Eaton was for two years Secretary of the American Fern Society and President for one year, refusing a re-election to the latter office on account of a pressure of other matters. Later he took up the formation of an herbarium for the Society. He was appointed the first curator and retained this office until his death. The Herbarium now numbers more than one thousand sheets being particularly rich in rare and unusual forms of ferns. The mounting is the work of the curator. A portrait of Mr. Eaton was published in the tenth volume of *The Fern Bulletin.*—W. N. C.

ASPLENIUM EBENOIDES IN NEW YORK.

By Stewart H. Burnham.

My attention was called to a very fine plant of Scott's Spleenwort (*Asplenium ebenoides*), October 14, 1905; when visiting Miss Hattie T. Burnham. Miss Burnham had found what she considered to be a peculiar fern, in July of that year, in a limestone pocket, in company with *Asplenium platyneuron* and *Camptosorus rhizophyllus,* in the northwestern part of the town of Hartford, Washington County, N. Y., and had transferred the plant to a flower pot where it was growing finely. A more careful search was made about the rocks in the neighborhood of the station, but no other plants were found. However, several hundred rods away, a station for the uncommon *Asplenium platyneuron incisum* (E. C. Howe) Robins. was found. In August 1906 the plant had grown so well that it was divided, Miss Burnham keeping part of the plant which has not grown so luxuriantly as the other portion of the plant which came into my possession at that time.

In its general appearance the plant shows more of the characters of the ebony spleenwort; except in the tapering and rooting fronds which are like the walking-fern. My original plant is growing in a medium-sized plant jar and ten of the eleven fronds are heavily fruited. Seven of these fronds are over 12 inches long: and three or four of them 20 inches long by 4½ inches broad. The tips of five of the fronds are forked: the forks being linear and from 2 to 4 inches long, making the extreme length of one frond 2 feet. From the forks proliferous plants have been produced; and in several instances the pinnatifid pinnae have also produced individual plants, which would root if they were brought in contact with the soil. During the spring of 1908, three of the proliferous fronds were placed in the earth of a side jar and have grown well, producing plants with eight or nine fronds similar to those of the original plant. These side plants, November 22, had fronds that were beginning to fork at the tips and two of the fronds had begun to fruit. Very evidently the plant has the mode of propagation of the Walking-fern: and if proper care is taken of it, will within a few years form a mat of considerable extent. The plants in the side jar have not severed their connection with the main plant; although they probably will in time, for there is some discoloration of the parent fronds.

The habitat of this hybrid fern is very similar to the station at Proctor, Vt., noted by G. A. Woolson in *Fern Bull.* 9:89-90, Oct. 1901 and in *Rhodora* 3:248-249, Oct. 1901, where the fern was found growing in a limestone pocket with the two parent species. The station for G. H. Ross's Rutland, Vt. plant, which is deposited in the herbarium of University of Vermont, cannot be over thirty miles distant from the Hartford

station in New York. The only other record of this rare fern in New York State is in the N. Y. State Mus. Rep't 36:36. 1884; from near Saugerties, Ulster County and also four miles southeast of Poughkeepsie where it was found by C. Lown. Specimens of the Saugerties plant are found in the State Herbarium at Albany.

Geological Hall, Albany, N. Y.

NOTES ON EQUISETUM HYEMALE

By Chas. C. Plitt.

I. Spore Shedding.

When does *Equisetum hyemale* shed its spores? The following notes upon observations will throw some light upon this subject. They cover a period of three or four years and were made, as opportunity offered, upon plants in various locations. For convenience they have been arranged as if they were all made in the same year. Little inconsistencies arising are due to the inequalities of the season, some seasons are so much ahead of others.

Mar. 18. Today found spore cases on the old stalks of *Equisetum hyemale* swelling.

April 17. Found plants of *Equisetum hyemale* shedding spores. The weather has been quite pleasant for several days.

April 26. Spore cases are swollen and some are shedding spores. It would seem that with the approach of warm weather in spring, growth takes place and the spore cases become several times their size during winter. The white bands on this plant show out beautifully today.

April 29. Spore cases are shedding spores. In

some localities not so far advanced as in others.

May 10. New stalks of *Equisetum hyemale* are coming up, and I had a chance of seeing the blackish teeth. Already the most of them have fallen off, although the stalks are scarcely out of the ground and are but a few inches in height.

June 1. Young shoots of *Equisetum hyemale* still appearing. Old stalks that have fruited are branching near the top.

July 1. Young shoots of *Equisetum hyemale* are shedding spores.

July 13. Young shoots of *Equisetum hyemale* still shedding spores.

From the above records, although rather incomplete, I am led to believe that *Equisetum hyemale* has a prolonged fruiting period, occurring most abundantly in the early part of July, when it covers a period of about two weeks, and continuing until cold weather.

However, after the middle of July, spore-shedding specimens are certainly less frequently seem, (I have no record of seeing any), although fertile spikes are continually being produced(?). It would seem that most of these late-formed fertile shoots, do not fully mature, for some reason or other. At any rate, they persist through the winter in tightly-closed spore-cases, and await the warm days of spring. Then, already in the latter part of March, there is a noticeable increase in size of these old late-formed spore-cases, and during the latter part of April, covering a period of about two weeks, there is again a shedding of spores, this time from these late-formed cases. The beginning and length of these two fruiting periods vary with the locality. In some localities, especially those in shady woods, this *Equisetum* is seldom, if ever found in fruit;

but, in the sunny places, along roadsides, and along the river-banks, fruited specimens may be found in great abundance.

II. Production of Roots and Shoots.

When stalks of *Equisetum hyemale* are put into water, small papillae show themselves in five days on the lowest node. Two days later they have appeared also on the node, next above. These little papillae have been produced by new shoots penetrating the tissues, and which, a few days later grow out into the air. These shoots grow out from the nodes only, not only from those in water, but also from those above. None ever appear at the injured end. The shoots are true stems, and grow upward into the light; from the lower end of the shoots roots appear which grow downward into the water. Whether the base of the stalk or its apex be placed in water, the results are practically the same.

As cuttings rooted so well in water, and which later could be transplanted into soil and grow, I tried rooting them in soil direct. On April 10, planted 8 cuttings upright in soil and then placed two flat on the ground, covering them only, here and there, lightly with soil. On June 30, visited the spot again, and found 7 of the upright specimens rooted and growing, also one of the specimens that had been lying on the ground.

Cuttings taken from very young stems, while yet of that light green color, do not root at all, only those taken from mature stems will do so, and that too, at all seasons, whether winter or summer, spring or autumn.

It is interesting that cuttings will root whether placed upright, with base in water, or inverted. Stems

of willow will do the same, but with this difference. In the willow we find that roots are produced from the nodes on the portion of stem in water, and leaf-bearing stems from those nodes out of the water, and that, too, no matter whether the base of the cutting or its apex, be placed in water. With *Equisetum hyemale,* all the shoots produced are stems, roots appearing later from the base of each newly formed shoot.

The shoot, when it is first produced, grows very slowly, so slowly, that the roots, although formed later, soon grow quite beyond it. For a little while the stem is apparently at a standstill. But, after the new roots have made a little growth and are absorbing nourishment, the little stems begin to shoot upward quite rapidly. More shoots, on the average, are produced from the lowermost nodes, that is the nodes in or nearest the water, no matter whether it is the base of the stem or its apex which is in the water. We notice also, that growth here is more marked—it is here that the shoots are the strongest, these, too, show strongest root-growth and later the more rapid growth of the stem.

It is interesting, too, to note, that the papillae showing where shoots are about to penetrate the stem, do not continue upward farther than the fourth node, in most cases to the third node only, and that after the third or fourth day after the appearance of the papillae, all that are likely to be formed, have been formed, so that on the fifteenth day of the experiment, there are no more shoots than on the ninth. It seems, too, that three shoots are the greatest number of shoots, from any one node.

Baltimore, Md.

Botrychium lunaria.—This species was omitted from the California Fern Flora, published in the first number of volume twelve (1904) of the *Fern Bulletin*, as no reliable evidence of its presence in the state could be obtained, although it had been reported. It may now be added, as I have received authentic specimens. collected near Mariposa, by Mr. J. W. Congdon.—*S B. Parish.*

Slender Cliff-brake in Japan.—The Flora of Japan is very much like that of Eastern America, and many of the ferns are common to the two countries. A list of Japanese ferns would contain *Osmunda regalis, O. Cinnamomea Asplenium trichomanes, A. viride Pteris aquilina, Botrychium ternatum* and many more whose names are familiar to us. Last to be added to the list is the slender cliff-brake (*Cryptogramme Stelleri* or *Pellaea gracilis*),which was discovered recently on Mt. Yatsugatake in the province of Shinano, by T. Makino.

Lomaria Spicant's Variable Sporelings.—That so many variants should have arisen from a sowing of *contractum* mentioned recently is of particular interest inasmuch as they apparently embrace exact counterparts of two British forms, *concinnum* and *lineare,* and also of another section altogether viz: *multifurcatum.* It is, however, not quite clear from text and illustration whether all the forms figured were raised from *contractum* or whether the English types are introduced to show approximation. I am strongly of the opinion that this latter is the case. Apart from these

the variable extent which the contracted part assumes is to be expected in sporelings from the *contractum* type. I have found *contractum* repeatedly here, but *concinnum* only once. *Concinnum Drueryi*, in which the lobes are round and markedly serrate, like scallop shells, is so far unique. Finally in this connection, why *Lomaria? Blechnum* is differentiated from *Lomaria* by possessing an independent intramarginal indusium instead of the reflexed margin itself, serving this purpose. The distinction is so marked that it is a puzzle how any botanist can ignore it. It is perfectly clear as *Blechnum spicant* and it is due to this that such a form as is described by your contributor with sori in short strips on each side of the rachis on otherwise undifferentiated fronds is possible. The form occurs here wild and is termed *B. s. anomalum.* Lomaria could not do this without sacrificing its generic character.—*Chas. T. Druery, F. L. S., London.* [Mr. Druery apparently overlooks the fact that there is such a thing as a difference of opinion. Fern students have never agreed as to the disposition of the fern in question. Both Link and Desvaux considered this a *Lomaria,* and many others since their day have done so. But in return for Mr. Druery's "Why *Lomaria?*" we can retort with equal vigor,"Why *Blechnum?*" Surely Mr.Druery must know that the modern world now calls this plant *Struthiopteris spicant.* In any case, however, we are surprised to find anyone objecting to *Lomaria* while still clinging to the out-of-date and discredited *Lastrea* in place of *Nephrodium.* If Mr. Druery will promise never to use *Lastrea* again we will agree hereafter to bluepencil all references to *Lomaria.*—Ed.]

Some Curious Nomenclature.—In Gray's "New Manual of Botany" a form of Goldies fern found in the Dismal Swamp some time ago by William Palmer is listed as *Aspidium Goldieanum* var *celsum* (Palmer) Robinson. The excuse for attaching the last name to the author-citation is difficult to discover. Several years ago the combination of *Aspidium Goldieanum* forma *celsum* was made by another author and the only reason, if reason there be, for attaching the second name to this string of latin words is that the word variety is used instead of form. There is absolutely no exact botanical definition of either form or variety extant. Either one may represent any grade of variation less than a species, in fact the two words are practically synonymous, and instances are plentiful in the volume cited where variety is used for a mere ecological form and form for a well-marked subdivision of a species. The only difference between the two conceptions that we can see, is that one should always use variety if it will get one's name into the combination.

Botyrychium dichronum.—In an article dealing with the Ophioglossaceae in the May *Torreya,* R. C. Benedict continues the error made by L. M. Underwood in reference to the Jamaican form of *Botrychium Virginianum.* Relying upon the fact that the sterile portion of this plant survives the winter in the mild climate of that tropical island, Underwood made it a distinct species. Jenman, whose work on the Jamaican ferns was most painstaking, overlooked a most important fact in the life history of this plant and writes of it "There are two fronds to each plant, one without and the other with the fertile division. * * * the fronds perish after fruiting." It remained for the editor of

the *Fern Bulletin* to point out that Jenman was mistaken in supposing that the fronds perish after fruiting and that what appears to be a second sterile frond is in reality the old fruiting one of the year before from which the fertile part has dropped. Thus reduced to facts, the basis for making *B. dichronum* a species is that it survives the winter in the tropics. We shall ever maintain that species should differ from one another in important particulars and not be separated upon differences of latitude and temperature in their habits. Having seen the plant in question in its native woods, we are confident that it does not deserve even varietal rank.

Changes in Fern Names.—In a paper published in *Torreya* shortly before his death, Dr. Underwood called attention to some overlooked names for American ferns, which the appearance of Christiansen's "Index" has made apparent. All but one of these have been noted in the check-list of fernworts now being published in this magazine, but it may be well to bring them together here. If we follow Christiansen we shall have *Ceratopteris pteriodes* (Hook) in place of the well-known *C. thalictroides* (L), and *Polypodium glycerrhiza* D. C. Eaton for *P. falcatum* or the more recent *P. occidentale* applied to the liquorice fern of the Northwest. Owing to a confusion of references to old plates we are asked to use *Pteris multifida* Poir in place of *Pteris serrulata*. L. f., although all authors confess that there is no other *P. serrulata* and even the original home of the plant which has been called *serrulata* is unknown. If we follow Christiansen we will also write *Pellaea mucronata* D. C. Eaton in place of *P. Wrightiana* Hook, and *P. scabra* Christiansen in place of *P.*

aspera Baker. Two *Asplcniums* also are in danger, the name of *A. abscissum* Willd. endeavoring to supplant *A. firmum* and *A. cristatum* Lam. endangering the well-known *A. cicutarium.*

Fall-fruiting of Osmunda.—Mr. J. C. Buchheister writes that during the past dry autumn he found in the Hackensack meadows a plant of the royal fern (*Osmunda regalis*) that was fruiting for the second time. Almost every frond bore fruit and there were ample remains of the spring fruiting fronds. The plant did not appear to have been injured in any way and the reason for the second crop of fruit is not apparent.

Ferns of Ohio.—There are various ways of making a fern list and each has its advantages from an educational standpoint. The fern floras of the States while giving a survey of the whole fern-flora fail to convey an adequate idea of the way in which the ferns are associated or the habitats they prefer. Prof. L. S. Hopkins has sent us a list of Ohio ferns catalogued in another way. Those who have the ferns of their own locality well in hand may find it interesting to list them in the new way. Of the 61 ferns and fern allies in Ohio, 29 species are evergreen. Catalogued according to the habitat we have 10 that grow in marshes with or without shade, 24 that grow in rich woods and thickets, 13 that grow on rocks, and 3 that grow on nearly pure sand. In addition to these there are 10 that grow in several habitats, among which may be numbered the bracken, marsh fern, sensitive fern, and others. If desirable the divisions could be made still finer, as for instance those that prefer open swamps,

those that prefer shaded swamps, species of dry woods, wet woods, on sandstones and shales, on limetones, in sand, in clay, in alluvial soil, in stony soil. The soil usually has considerable to do in determining the kinds of ferns growing in a certain locality. Some ferns can grow in several different soils but others seem confined to a single one.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omission from, this list.

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WINSLOW, E. J. *Polystichum acrostichoides var. incisum interpreted.* illust. Fern Bulletin, O. 1907.—A form of *Polystichum acrostichoides* bearing much enlarged and pinnate pinnae figured.

EDITORIAL.

The long-expected title-pages and indices to the past four volumes of this magazine are ready for the printer but cannot be sent out with this issue because two numbers are to be mailed in one wrapper and it would make the package too bulky. The indices will be issued at once and sent to all the libraries on our lists as well as to all others who have asked for them. If there are others among our readers who need these indices we shall be glad to send them free upon request.

* * *

A few months ago, we had occasion to warn our subscribers against sending money to us in the mails since there was a leak, somewhere, that absorbed a great deal of the cash which should come to us. Those who lost money in this way may be interested in hearing that investigation by the secret service showed that the mail-carrier on our city route was the guilty party. He has ceased to be connected with the postal service but will continue to work for the government, having already been provided with a nice striped suit and a guarantee of three rather plain meals a day for some time to come. It is to be regretted that our country has not, as yet, devised a very safe and convenient means of transmitting money by mail. The best way to send is by an express money order or bank-draft. Those who have an account with any bank can usually obtain drafts on a bank in New York or Chicago without paying a fee. Checks drawn upon banks in New York, Boston or Chicago are also usually accepted at face value and can be cashed only by the person to whom it is payable or to his order. Registered letters

and postal money orders are issued for a small fee and some of these methods are much better than to trust stamps or bills in a letter.

* * *

So far as we are aware, there are but two societies for the study of ferns in the entire world. The American Fern Society has a world-wide membership, but the second society is confined to Great Britain and Ireland and is known as the British Pteridological Society. The latter has been in existence about as long as the American Society, but has a much smaller membership and issues no publications, save an annual report which contains rather more about ferns, however, than the annual reports of the American Fern Society Recently the British society has apparently concluded that the time has come for a more extended propaganda of their cult and under the leadership of Mr. C. T. Druery, a member of the American Fern Society and well-known on this side as a writer on ferns, are considering the establishment of a serial publication. Upon our part we view with pleasure this move for advancing British fern study and have no doubt that Mr. Druery and his association will be able to make a most readable journal and one that would secure not a few subscribers in this part of the world. We trust that the scheme may be carried out.

* * *

It may be news to many fern students that there is a series of publications on ferns and related matters in addition to the issues of the *Fern Bulletin,* but such a series exists. We refer of course to the annual reports of the American Fern Society, which taken in connection with the three special publications entitled "Papers

Presented at the Boston Meeting," "Fernwort Papers," and "An Index to the first 10 volumes of the *Fern Bulletin*" form a body of considerable size. The first paper contains 32 pages, the second 48 and the third 32. The first three Annual Reports were published in this magazine, but the others, ranging from 8 to 20 pages were issued separately. These contain a good deal of matter of more than passing interest and are beginning to be in demand by people not members of the American Fern Society. Such odd numbers of the Annual Reports as have accumulated at this office have recently been made up into sets and a set will be sent for 10c until the supply is exhausted. The best set contains a complete set of the Reports, a history of the Fern Chapter, Constitution of the Society, and various papers relating to the meetings of fern students. The three special papers, of course, are not in this collection but they may be purchased separately at a price that is small considering their value.

* * *

Every little while some kindly disposed subscriber writes to tell the editor how to run the magazine, and when the editor, mindful of past failures and successes declines to depart from the course which he knows is the best, said kindly disposed subscriber is kindly disposed no longer. Indeed, he is quite likely to cancel his subscription and write forthwith to his friends, proposing to establish a new fern publication that shall simply wipe this magazine and its editor off the map. Sometimes it is a matter of nomenclature that excites the subscriber's ire; again it is the exasperating way the editor has of interpreting species to suit himself, or his failure to be impressed by long descriptions of small differences in big words. Some have seriously pro-

posed that the magazine adopt a standard of nomenclature and allow contributors to contribute in no other. This interesting method of binding and gagging the opposition has never appealed very strongly to us, perhaps because we have a very decided objection to being made the victim of such proceedings ourselves. The editor believes in everybody having his say, and has never yet refused to print an article because it attacked him or his opinions. He continues to have opinions every little while just the same, and when he does he is quite likely to express them. The ideal editor in the minds of many who have axes to grind is that he should be a sort of combined proof-reader and office boy, and not meddle with the contents of his publication; but we think otherwise. We must emphasize the fact, however, that the columns of this magazine are open to anybody anywhere to say what he pleases on fern matters, so long as his remarks will pass through the mails unchallenged. He may use any brand of nomenclature he likes—antiquated, international, or New York local; he may be as conservative as a Chinaman or as radical as the worst of the "I-saw-it-first" school; he may describe genera as species or forms as genera—in short, we shall place no restrictions on the nature of contributions, so long as we are not asked to subscribe to them or forget that we have a mind of our own.

Just here we picked up an editorial in the *Independent* that expresses our position so much better than we can do it ourselves that we quote as follows: "We have an idea of what such a journal as this ought to be. It is not a bunch of posies nor even a bundle of herbs or a package of candy. Its purpose is not to be sweet and please everybody. What is it in a journal that holds the affection of its readers, that makes them take it

year after year? It is not its miscellaneous stories and things that are as timely a hundred years hence as now. To our notion an intelligent reader wants to find something that has force; something that he is inclined to either clasp or kick. A journal secures real lovers only as it presents a definite and strong editorial policy which, on the whole, commends itself to them."

AMERICAN FERN SOCIETY

The Annual Election in October resulted in the election of Prof. E. J. Winslow of Elmira, N. Y., as president and the re-election of Miss Mirick as treasurer. The vote for vice-president resulted in a tie and the vote for secretary is still being canvassed by the advisory council. This issue of the *Fern Bulletin* has been held for some time in the hope of announcing the complete list of officers, but further delay seems unadvisable. The result will be announced in the January number.

For some unexplained reason, no Annual Report for 1907 has been issued and in consequence the list of members contains many inaccuracies. It is to be hoped that the regular report will soon be issued and that members will promptly notify the officers of any change in address. Since the annual dues must soon be forthcoming it is suggested that members notify the treasurer of such changes when sending in dues.

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THE

FERN BULLETIN

A Quarterly Devoted to Ferns

EDITED BY WILLARD N. CLUTE

VOLUME XVII

JOLIET, ILL.
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A Quarterly Devoted to Ferns

January

Joliet, Ill.
Willard N. Clute & Company
1909

The Fern Bulletin

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THE FERN BULLETIN

Vol. XVII JANUARY, 1909 No. 1

THE FERNS OF COCHISE COUNTY, ARIZONA.

By James H. Ferriss.

The Southern Pacific in Arizona carries the tourist among a wonderful supply of wonderfully beautiful ferns. However, breathe this not upon their trains. You would be a marked passenger. To be known as a reporter upon a yellow journal would be as mild as you could expect.

Regardless of speed the train seems to creep through the desert valleys hour after hour the day long. The mountains pass slowly, they are so much farther away than they seem to be. The land is dry, perhaps dusty, and the specimens of vegetation are so far apart that to tourists, except the enthusiastic botanist, the land must seem to have been forsaken and forgotten. To the botanist it is a land of milk and honey. Also chille-con-carne and hot tamales. His sharp eyes will see a few ferns in the passes and if he turns off at Benson to take the Sonora branch there will be good entertainment all the way to the Mexican line.

The trains of the El Paso & Southwestern from El Paso to Benson hug the mountains closer and the passenger can step from the sleeper into a canyon. Thereafter traveling is largely a matter of taste or expense. Vehicles can be used from canyon to canyon but saddle horses and donkeys will go up the canyons and across the range. The one who can pack his own provisions

and sleep where night overtakes him may rise early with his specimens and he will see great sights.

A happy collector is one who has a partner willing to stay with the animals. Thus the supplies may be transported into the box canyons and close to the high peaks and precipices where the rarest and best specimens are to be found. Little time is then thrown away in long walks after supplies or between camp and specimens. I have visited Cochise county on five of my annual vacations, giving a large part of my time to ferns. The first trip, 1902, I attempted to overtake Dr. D. T. McDougal, chasing Cacti. He got away into Mexico and I stopped at Nogales. Then followed trips with Frank Woodruff, ornithologist, Chicago Academy of Sciences, 1904; Dr. H. A. Pilsbry, conchologist, Philadelphia Academy of Natural Sciences, 1906; L. E. Daniels, conchologist, Indiana survey and H. S. Swarth, ornithologist Field Museum of Chicago (now of the Berkley college) 1907; and with Dr. Eltweed Pomeroy, sociologist, wife and son of Newark, N. J. in 1908.

Probably August and September are the best mountain months in Arizona, following the rainy July. Then the flowers are in bloom. This year the vacation extended from Sept. 15th to Nov. 15th. One day the snow fell upon the mountain tops heavily but every day was a delight. On a windy day we dodged all the falling pines and only lost a hat. The tent was pitched in a mountain park and nearly all the plant driers were found and found dry.

There are nine rattle-snakes in Arizona and about 50 of the squirrel kind. I have found about thirty new species of land snails, and the flowers and trees, the large animals and small, the birds and lizards are

Arizonian almost wholly—at least unlike anything eastern. Old acquaintances are more often found with the lower orders, the small snails, the fungi, mosses and liverworts. The evolutionary development from one canyon to another would delight a Darwin. It will take the conchologists twenty-five years to fairly survey Arizona and New Mexico.

Cochise county, about 150 miles square, in the southeast corner of the territory, has forty ferns I am sure of. Thirty-five of these are in the Chiricahua (cherry cow) mountains. Nearly all of these and five more are in the Huachuca (Wawchuca) mountains and four more have been reported from the latter range that I did not find. Eleven more are reported in Underwood from the territory. Thus there are probably fifty-five in the territory. Three *Selaginellas* and two *Equisetums* are also reported.

At the foot of the ranges, some 6,000 feet above the sea, upon the small shadeless foot hills will be found three of the smallest ferns, *Cheilanthes Wrightii, Notholaena Grayii* and *Gymnogramma hispida,* in the hot sun.

As the trail is ascended up the canyon, under the cliffs and large rocks will be found *Pellaea Wrightiana* first and then perhaps *P. intermedia. P. ternifolia* will follow and then *Cheilanthes tomentosa, C. Eatoni, C. Lindheimeri, C. Fendleri,* and *Notholaena Hookeri.* If the hillsides are open, not covered with timber, then *Gymnogramma triangularis* and *Notholaena sinuata.* In this list so far are some of the most beautiful ferns of the earth, sure. These may continue up the mountain 3,000 feet further in company with *Cystopteris fragilis,* and the *Woodsias* on the hillsides, *Cheilanthes Feei* in crevices of the rocks that are so small that

apparently no soil is possible. *Notholaena dealbata, Pellaea atropurpurea, P. ternifolia* and *Cheilanthes lendigera* will also come in around the cliffs and in the deep gulches.

If the timber has not been destroyed oaks, black walnuts, juniper and sycamores will fill the canyon in the first thousand feet, not like our oaks, etc., but they will be known. Probably a fine stream of mountain water also will cheer the collector, to disappear in the sand at the desert's rim. The shade grows more dense, the rocks more rugged, and at 7,000 feet and thereafter, the pines, spruce and other conifers come in and it is quite like a New England or Tennessee landscape. At 10,000 feet quaking asp, mountain ash, scarlet dogwood, willows, cherries, more conifers, hanging moss, more kinds of Mistletoe and meadows of tall grass and Iris.

Large perpendicular crevices from a few inches to 100 feet wide, perhaps a thousand feet long, is the home of glorious *Aspidium juglandifolium,* but now known more properly as *Phanerophlebia auriculata.* This species usually dwells midway in the mountain where the atmosphere has the most moisture, but I have found it in the lower rocks at the desert's edge. When the fern hunter sees the crevices at a distance he can make a good guess concerning *auriculata,* and up in the mountain he finds the plants nearly every day.

Asplenium Ferrissi lives in one of these large crevices in company with *auriculata* and has never been found elsewhere. I also found a variety of *Polystichum aculeatum* under similar circumstances and also but once. *Nephrodium filix-mas* and *Cheilanthes Eatoni* were found also in the last instance. In deeper shade and with more than the usual moisture I found *Asplen-*

ium monathemum in one of these crevices. Again it was found in the walls of a box canyon where the spray from a water fall tempered the atmosphere. Here too grew *A. trichomanes* and a maidenhair.

A. parvulum is also found in the walls of the box canyons but also in the dry roof of the caverns and about the base of the rocks.

Pteris aquilina is abundant above 7,000 feet along the streams and in the parks. At 8,000 feet *Nephrodium filix-mas* may be found in the bed of the stream among the rocks or in the springy nooks, and at 9,000 feet, in the last mile of the stream, will be found *Asplenium cyclosorum* with its feet in the stream, sometimes a spreading cluster eight inches in height and again under almost the same conditions it will be less spreading and four feet in height.

Pellaea marginata and its mass of lace-like foliage thrives in the deep shadow of the cliffs at 8,000 feet, but I also found it at about 6,500 feet upon the north side of a shadeless cliff in company with *Nephrodium patula, Polypodium thysanolepis* and *Notholaena dealbata,* all in great abundance. I found *patula* again in a deep crevice at 8,000 feet.

The Maidenhairs settle about the limestone springs, or live in the spray of a water fall and seem to require a moist atmosphere.

The *Polypodiums* are found rarely, and then *falcatum* hangs down from the roof of the dry caves, and *hesperium* and *thysanolepis* cling to the face of a cliff, where long poles are needed to punch them off. Once *hesperium* was found facing the hot sun upon an exposed mountain peak. Again a plant was found in the leaf mould and shade with *Cystopteris fragilis,* and again another in the cold springy soil at the mouth of a cavern.

Both *Notholaena sinuata* and *N. ferruginea* usually grow erect in the soil among the rocks. The latter is often found in the pockets of the rocks apparently without soil and it is then a small plant. With good soil both grow two feet in height.

With the exceptions mentioned, all are found plentifully if the ground is not too closely fed by the stockmen.

I found but one plant of *Notholaena aschenborniana,* though I may have passed it often supposing it to be *N. ferruginea. Asplenium glenniei* has the general appearance of an Arizona *Woodsia.* Then too, it may ripen too early for fall collectors. I never found it.

Three plants of a *Nephrodium* were found at 9,000 feet in the Chiricahuas in Nov., 1907. The foliage had dropped but the growth for the next year was different from anything I had seen and the plants now are growing nicely under Joliet glass. These may be *N. Mexicanum* but I am not sure of the determination at this writing. In Oct., 1908 I visited the same bank again and worked it over for three days without finding another plant and thus this too may be an early ripener.

A new *Asplenium* of the ebony stem group was also found in 1907, and it too remains nameless. But I did not find *Woodwardia radicans, Notholaena Lemmoni, N. nivea; Cheilanthes Pringlei, C. Alabamensis, C. myriophylla* and *C. microphylla; Pellaea flexuosa* and *P. pulchella; Asplenium firmum, A. Glenniei, A. septentrionale* and *A. filix foemina; Woodsia scopulina* and *W. Oregana.* These are reported from Arizona but perhaps some are reported erroneously.

Those I have found in Cochise County are as follows:

Polypodium: falcatum, thysanolepis and hesperium.

GYMNOGRAMME: triangularis, and hispida.

NOTHOLAENA: sinuata, ferruginea, Aschenborniana, Hookeri, Grayi, dealbata.

ADIANTUM: capillus veneris, pedatum rangiferinum.

PTERIS: aquilina pubescens.

CHEILANTHES: Wrightii, Lendigera, Feei, tomentosa, Eatoni, Fendleri, Lindheimeri.

PELLAEA: atropurpurea, marginata, ternifolia, Wrightiana, intermedia.

ASPLENIUM: parvulum, trichomanes, monanthemum, cyclosorum, Ferrissi and an undetermined species.

NEPHRODIUM: filix-mas, patula, and a new species to the U. S.

POLYSTICHUM: aculeatum var.

PHANEROPHLEBIA: auriculata.

CYSTOPTERIS: fragilis and fragilis tenuifolia.

WOODSIA: Mexicana and Plummerae.

All of these were found in the Chiricahua mountains except *Notholaena Aschenborniana*, *Asplenium Ferrissi*, *monanthemum*, and *Cystopteris fragilis tenuifolia*. These were found in the Huachuca mountains.

Joliet, Ill.

FRUITING OF BOTRYCHIUM.

By Mrs. A. E. Scoullar.

The following may be added to the report on the fruiting of *Botrychium* published in this magazine for July, 1908.

I am very sorry to disappoint Mr. Clute, but I am obliged to report that *Botrychium matricariaefolium* bore, on June 25th, 1908, two fertile fronds, also a few spores on the sterile frond.

Botrychium obliquum was in fruit Sept. first, 1908 but the plant was not so robust as in the preceeding years, owing to the drought.

Botrychium obliquum dissectum in fruit Aug. 28, 1908 in fine condition, being in the shade. A plant of *Botrychium* that we have been watching to note the changes in the cutting of the fronds, did not come up this season (1908).

Standish, Maine.

[All of which indicates that it is not safe to prophesy unless you are dead sure! We are certain, however, that there is a reason for the failure to produce fruit and we hope continued observations of these plants will bring it out. Many plants can be made to fruit by with-holding water or by pruning the roots. Can it be that the dry season forced these species into fruiting when they would normally be sterile? Another angle of the subject develops when it is known that the young fronds of *Botrychium* are usually formed several seasons in advance. How late in their development they may be influenced by a good or bad season is a question. Any of these speculations may fall in the face of the facts and we hope the specimens may be kept under observation long enough to determine just why the plants are or are not fertile in certain years. —Ed.]

Nephrolepis Scholzeli.—This is the name of a new form of *Nephrolepis exaltata* and should properly be called *N. exaltata* f. *Scholzeli* though it originated from another named form, viz: *N. exaltata Scottii.* Its fronds are shorter than the ordinary Boston fern and nearly erect with the pinnae much divided otherwise it is manifestly a close relative of the other sports of that species.

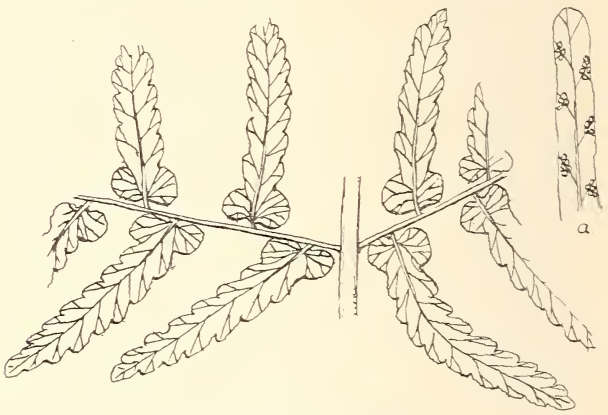
RARE FORMS OF FERNS.—IX.

Four Aberrant Osmundas.

It is difficult to say whether the unusual number of abnormal plants of the genus *Osmunda* recently reported is due to the size and conspicuousness of the plants, to their extreme abundance or to the assiduity with which they have been searched for variable specimens, but certain it is that the list of such finds is steadily growing. Herewith we illustrate four new forms which must be included. A few years ago, these abnormal plants would have been passed by as of no value, but the impression is growing that by means of such freaks we may often get a glimpse behind the scenes, as it were, and discover much that is ordinarily hidden in the methods of nature, and we therefore place these on record.

One of the most interesting of the present specimens was sent us more than a year ago, by Mr. Severin Rapp, of Sanford, Florida. It is very evidently a form of *Osmunda regalis* but differs from the type in having pinnules much narrower than usual, and with the edges beautifully wavy. The venation is also abnormal, there being only about half as many veins as usual with the single forks somewhat nearer the margin than the midvein. The lack of the usual number of veins also account for the wavy margins for it is evident that the tissues are filled out in the vicinity of the vein-tips but sunk in where the veins are lacking. The usual number of veins in the base of the pinnules makes a very pretty earlike expansion there. The most remarkable characteristic of the plant, however, is its manner of fruiting. In my specimens, the fertile portion is partly leaf-like and the sporangia are borne on the backs of the veins at the point where they fork

and some distance inside the margins. They are borne several in a cluster and form a sort of rudimentary sorus. The method is shown at *a* in the illustration. This form appears to be quite persistent. Specimens were reported in this magazine for January, 1902 and other plants were found several years later as we have stated. In reference to the slender pinnules the form may be called *Osmunda regalis* forma *linearis*. The

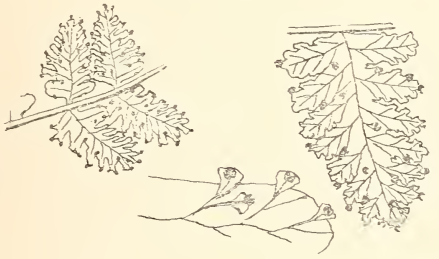


OSMUNDA REGALIS F. LINEARIS.

method of bearing its spores is quite anomalous among ferns of its genus and may well be the subject for further study.

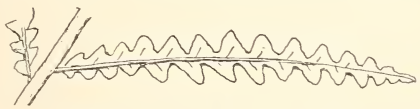
A second abnormal fruiting specimen may be referred to *Osmunda cinnamomea*. Like the form of *O. regalis* described above, it bears sporangia on the backs of the pinnules and is manifestly akin to, if not identical with, certain forms of the variety *frondosa*. The interesting thing about the present specimens is that while many of the sporangia are borne on the margins of the pinnules and at the tips of the veins, not a few are found at some distance from the margin. In the

case of the latter, a vein is given off from the surface of the pinnule and terminates in a sort of green triangle upon which the sporangium is borne. It will be noted in the illustration, which shows parts of the pinnae variously magnified, that the parts of the margin which bear sporangia are inclined to be triangular in shape. Incidentally it may be observed that the mar-



gins of the pinnules are variously lobed and this may possibly throw some light upon the origin of dissected pinnules in other forms. The present specimens were received through the kindness of Messrs. James Shepard and H. C. Bigelow of New Britain, Conn.

Some four years ago, Mr. D. Lewis Dutton found in a cedar swamp near Leicester, Vt., several plants of a curious form of the cinnamon fern having very narrow

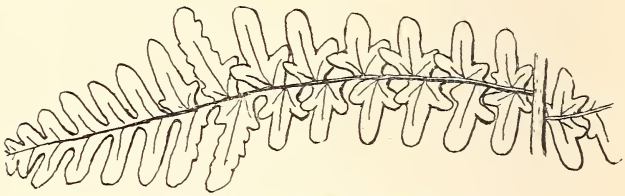


OSMUNDA CINNAMOMEA F. AUGUSTA.

fronds and pinnae with rather sharp-ended pinnules that give it a remarkable resemblance to *Nephrodium unitum glabrum* at first glance. The plants have since retained their peculiar characteristics and it is quite likely that the same form will be located in other

places where the cinnamon fern grows. When found it may be labelled *Osmunda cinnamomea* forma *angusta.*

A handsome variation of the cinnamon fern has also been received from Mr. Severin Rapp. It is allied to the variously cut and divided fronds of this species but differs from them all in producing trilobed pinnules which are evidently due to a pair of veins, stronger than ordinary, that are given off from the base of the



OSMUNDA CINNAMOMEA F. TRIFOLIA.

mid-vein. A little beyond the middle of each pinna one or two pairs of pinnae tend to become longer than the rest with wavy or lobed margins, but elsewhere the trilobed pinnae are quite uniform, and occur regularly over the basal two-thirds of each pinna. This form may receive the name of *Osmunda cinnamomea* forma *trifolia.* The types of the four forms illustrated are in the writer's collection.—*W. N. C.*

NOTES ON INDIANA FERNS.

By F. C. Greene.

Kosciusko County.

This county is situated in the glaciated part of Indiana and contains numerous moraines, lakes, tamarack swamps and marshy lands. The two latter localities contain several peculiar species, while the morainic uplands produce many of the species common to other parts of the state. The list is as follows:

Botrychium Virginianum, Osmunda regalis, O. Claytoniana, O. cinnamomea, Onoclea sensibilis, Cystopteris fragilis, Nephrodium thelypteris, N. acrostichoides, N. cristatum, N. spinulosum intermedian, Phegopteris hexagonoptera, Woodwardia Virginica, Asplenium angustifolium, Athyrium thelypteroides, A. filix-foemina, Adiantum pedatum, Pteris aquilina.

Most of these species are common with the exception of *Nephrodium cristatum.* A single species of the latter was found in a small tamarack swamp near Winona Lake and identified by Mr. Willard N. Clute. This species is not given in Coulters 1899 list of the Flowering Plants and Ferns of Indiana.

Eastern Greene County.

The surface rock of the eastern part of this county is mainly Huron sandstone and it is the cliffs of this formation which furnish most of the more uncommon species. Several other species besides those given in the list will undoubtedly be found upon further search. *Botrychium Virginianum, Osmunda claytoniana* (one plant), *Cystopteris fragilis, Nephrodium acrostichoides* var. *incisum, N. spinulosum intermedium, N. goldieanum, Phegopteris hexagonoptera, Asplenium angustifolium, A. ebeneum, A. trichomanes, Athyrium thelypteroides, Adiantum pedatum, Camptosorus rhizophyllus, Woodsia obtusa, Polypodium vulgare.*

The goldies fern, which is generally rather rare, is very common near the head of a small ravine just west of Richland Creek. The ravine is surrounded by sandstone cliffs. No less than twenty-five fine plants of this species were seen.

Indiana University Farm.

This property is located three miles east of Mitchell,

Lawrence County. The surface rock is the Mitchell limestone which furnishes many cliffs on the farm. Species noted:

Botrychium Virginianum, Cystopteris fragilis, C. bulbifera (A cliff was covered with profusion of fine specimens). *Nephrodium acrostichoides, N. noveboracense, Phegopteris hexagonoptera, Camptosorus rhizophyllus, Asplenium angustifolium, A. ebeneum, Athyrium thelypteroides, A. filix-foemina, Adiantum pedatum.*

Martin and Orange Counties.

The ferns identified in these counties were collected on a walking trip from Indiana Springs, Martin County to French Lick Springs, Orange County. Both sandstone and limestone cliffs occur but nearly all the species listed here were found in the sandstone area. Many other species could undoubtedly be found in other parts of the counties.

Botrychium Virginianum, Onoclea sensibilis, Woodsia obtusa, Dicksonia pilosiuscula, Cystopteris fragilis, Nephrodium acrostichoides, N. marginale, N. goldieanum, N. spinulosum intermedium, Phegopteris hexagonoptera, Camptosorus rhizophyllus, Asplenium pinnatifidum, A. ebeneum, A. angustifolium, Athyrium thelypteroides, Adiantum pedatum, Pellaea atropurpurea, Polypodium vulgare, P. incanum. The last species was seen in the forks of a tree about eighteen feet above the earth, on the grounds of the French Lick Springs Hotel, and having no means of reaching it, the identification is based on the habit of the species of growing in trees. (See Floyd County list).

The peculiar specimen of *Botrychium virginianum*

figured in the *Fern Bulletin*, Vol. XVI, page 66, was found on this trip in Martin County on the banks of White River.

Floyd County.

The topographic features of this county are varied, there being some rather low marshy land and cliffs of shale, sandstone and limestone. All of the species listed, with the exceptions noted, are found on the knobs.

Botrychium virginianum, B. ternatum, Osmunda regalis, Onoclea sensibilis, (Knobs and wet shade; banks of Silver Creek). *Woodsia obtusa* (shades; banks of Silver Creek). *Dicksonia pilosiuscula* (banks of Silver Creek). *Cystopteris fragilis, Nephrodium acrostichoides, N. noveboracense, N. goldieanum, N. marginale, Phegopteris hexagonoptera, Camptosorus rhizophyllus, Asplenium ebeneum, A. angustifolium, A. ruta-muraria* (Coulter's list), *Athyrium thelypteroides, A. filix-foemina, Adiantum pedatum, Pteris aquilina* (on a dry hillside in the knobs region). *Polypodium incanum.* According to Coulter's list, this last species occurs in the southern part of this state on trees or rarely on rocks. Clark, Floyd, Perry, Posey and Jefferson.

Crawford County.

Both limestone and sandstone cliffs occur in this county but all of the following species were found in the limestone area. Many others will no doubt be found in the county.

Botrychium virginianum, B. ternatum, Woodsia obtusa, Cystopteris fragilis, C. bulbifera, Polystichum acrostichoides, Phegopteris hexagonoptera, Camptosorus rhizophyllus, Asplenium ebeneum, Adiantum pedatum, Pellaea atropurpurea.

A RUNNING FERN.

Rhipidopteris peltatum.

By Willard N. Clute.

In the tropics the fern collector must have a quick and discriminating eye if he would recognize all of the ferns. In more temperate regions we have but to scan the undergrowth in the woodlands and marshes and the vegetation on the cliffs to be sure of not missing the objects of our quest, but as we approach the equator, ferns of tree-like size begin to appear and with them smaller ferns in all sorts of places; on the trunks and branches of trees, among the mosses on moist rocks, on old walls and even on the roofs of houses. To add to the collector's confusion, many of the ferns are no longer fern-like in the usual sense of that word. They climb like vines up the stems of trees or over lower forms of vegetation, they creep about on rocks and old logs, they decrease in size almost to the vanishing point or their fronds become so thick and leathery that we may pass them by without a thought as to their true character.

One of the most curious of these species is the trailing plant once known as *Acrostichum peltatum* but now usually called *Rhipidopteris peltatum.* I have yet to find anyone who would take it for a fern at first glance. It is almost exactly like our common ground pine (*Lycopodium complanatum*) though smaller and trails over the soil in deep woodlands in much the same way. Probably the first intimation one has that it is a fern, is the finding of the strange little rounded fertile fronds covered with sporangia on their under sides, as he looks his specimen over to locate the fruiting parts.

This plant was originally called an *Acrostichum* be-

cause like all the species of that genus it bears its sporangia in a dense layer on the backs of the fronds without indusium or protection of any kind. Most of the *Acrostichums,* however, have entire or but slightly divided fronds while the present species has fronds that are flabellately much divided. This fact, together with its wide-creeping habit, has been assumed to be sufficient reason for putting it in a separate genus, yet when it fruits its entire little fronds are a very characteristic *Acrostichum* feature. Our plant is also remarkable for reversing ordinary fern procedure when fruiting, for instead of producing its spores upon fronds that are smaller than the sterile ones, as all of our common ferns do, if they differ at all, it forms the only broad fronds, it has for this purpose. Not infrequently, however, one may find pinnatifid fertile fronds which may indicate that it is slowly progressing toward a more distinctive form of fruiting part.

The rootstalk is about the size of stout twine and often several feet long. At intervals of an inch or two it sends up a frond two or three inches high and roundish in outline, but so many times divided into linear forked divisions as to present a very graceful appearance. After it has produced from three to five sterile fronds a single fertile one is developed. It does not appear to be known how many times a year it fruits, but it is certain that the sterile fronds outlast the fertile for a considerable time for here and there one finds a break in the regular arrangement of the fronds and looking closer discovers the short spur that formerly bore a fertile frond and from which it has finally fallen.

There are two other species that are regarded as belonging to the genus *Rhipidopteris.* All are natives of the West Indies or South America, being found in

rather elevated regions, and seldom in very great abundance. The specimen from which our illustration was made was collected in Jamaica at nearly a mile above sea level.

Joliet, Ill.

FERN NOTES.

By Mrs. A. E. Scoullar.

Osmunda Cinnamomea f. Frondosa.—In the summer of 1906 I used a plant of Cinnamon fern for house decoration and in the autumn I planted it on the border of a pine grove, where it received the morning sun. In 1907 this fern sent up three nomal sterile, two normal fertile, and two partly sterile and partly fertile fronds. The fertile portion being from the apex to near the middle of the frond. The plant differed in no way from the type in the season of 1908.

An Interesting Fern Colony.—While on a tramp in East Stroudsburg, Penna., on Oct. 23, 1908, Mr. Scoullar and I came across a limestone boulder, in a grove of oak and hickory. This boulder was about seven feet high and nine feet square. On it's top was growing Polypody, on the east side, in a crevice, several plants of maidenhair spleenwort, on the west side a mat of walking fern, on the south obtuse woodsia, at the base, close against the stone ebony spleenwort, not two feet away grew maidenhair, marginal, and Christmas ferns. Beside the ferns grew Columbine, Hepatica and many other plants that I could not recognize, the foliage having been destroyed by frost. We think that our "find" more than repaid us for our long walk.

Aspidium simulatum.—After tramping miles about Standish, Maine, for three seasons, searching for

the *Aspidium simulatum* in "deep wet woodlands" I stumbled upon quantities of the plants, growing on the bank of a brook, in open sunlight. Its companions were marsh, cinnamon, crested, spinulose wood ferns, and a short distance away, on higher ground the New York fern grows.

Osmunda cinnamomea incisa.—There is a colony of *Osmunda cinnamomea incisa* growing on low ground, on the border of a wood about half a mile from our camp at Standish, Maine, that has borne no for the years 1906, 7 and 8. Is this the usual habit of this form?

Botrychium matricariaefolium tenebrosum.—On August 19th, 1907 I found growing in moss at the foot of a maple tree, on the bank of a brook at Standish, Maine what I thought a group of *Botrychium simplex*. There were eight plants bearing fruit. I sent one to Mr. Eaton who pronounced it *Botrychium matricariaefolium tenebrosum*. In Aug. 1908, I visited the spot and found several plants in flourishing condition. Near by are several plants of *Ophioglossum vulgatum*.

Onoclea sensibilis f. obtusilobata.—At Standish, Maine there is a strip of meadow land, about three hundred feet long by fifty feet wide, extending through a hay field. It begins at the shore of a pond and ends in an alder thicket. This meadow and field were mowed during the first week of July and no cattle ever enter there. On August 29th, 1907, Mr. Scoullar, Miss Alice Paine and I, divided this meadow, each taking a portion, and searched it carefully for the *obusilobata* form of *Onoclea sensibilis* without success, until we reached the alder thicket, where we found three clumps

showing a fine grading, from the normal down. These plants were growing far back in the bushes, together with the cinamon, marsh and lady ferns, well protected by tall blackberry vines, where neither mowing machine or scythe could possibly have reached them.

Elizabeth, N. J.

MORE ADDITIONS TO THE CHECKLIST.

In publishing the Check-list of North American Fernworts it was inevitable that some inconspicuous forms should have been overlooked and that others should have been described after the part of the list which would naturally contain them was in print. It is our purpose to call attention to these as they are located and at present we add the following:

NEPHRODIUM SPINULOSUM f. ANADENIUM (Robinson) *Aspidium spinulosum anadenium* Robinson. This is said by the author to be in all respects like *N. s. dilatatum* with the exception that the indusium lacks glands.

LYCOPODIUM SELAGO f. PATENS (Beauv.) This plant with slightly narrower, spreading leaves is reported from Quebec and Northern Vermont. It is without doubt the plant that has given rise to the opinion that *L. Selago* runs into *L. lucidulum*. Apparently the same form was collected in Europe by Mr. Robt. A. Ware who identified it as *L. lucidulum*. Whether there is any close connection between the form and species remains to be determined.

LYCOPODIUM CLAVATUM BREVISPICATUM Peck. This has short spikes solitary or in pairs and is reported from Northern New York.

Botrychium ternatum f. alabamense (Maxon.) *B. alabamense* Maxon. Another of the ecological forms of the common grape fern.

Asplenium platyneuron incisum (E. C. Howe) is offered as a substitute for *A. ebeneum Hortonae* Dav. or *A. platyneuron Hortonae* (Dav.) It may well be questioned whether the law of priority should be either expected or allowed to interfere with the name of a mere monstrous form of a fern. A plant well-known under a form name is not in any need of a change.

Polypodium vulgare var.*cristatum* Moore reported in Gray's New Manual of Botany is properly the variety *bifido-multifidum* Druery. The plant is a mere monstrous form and not in any way entitled to a place in a work supposedly dealing with normal species and varieties, but since it has been listed under an erroneous name it may be pointed out that when Mr. Gilbert made his study of *Polypodium vulgare* in America he had a set of named British forms for comparison sent by Mr. C. T. Druery. In this set were both *cristatum* and *bifido-multifidum* and Mr. Gilbert was most positive that the latter, and not *cristatum* is the form found in America.

Death of J. G. Lemmon.—Prof. J. G. Lemmon died in Berkeley, Calif., Nov. 24, 1908, aged 74 years. Prof. Lemmon was one of the best known botanists on the Pacific Coast and contributed much to our knowledge of the ferns of that region. A species of *Polystichum* found near Mt. Shasta, California, and at first referred to *Aspidium mohroides* was later named in his honor by Dr. Underwood.

Color of Fern Spores.—Fern students seldom trouble themselves about the color of fern spores, though familiar with the changes of color that the sporangia go through in the process of ripening. The spores are by no means the rusty-brown objects that some may be led to think they are from a hasty glance at the sporangia or sori, in fact although brown is the prevailing color, there is quite a range of color outside of this that the spores may adopt. According to "The Book of Fern Culture" the spores of the *Osmundas* are bright green, in *Pteris argyrea* they are quite black. In most of the *Davallias* the spores are yellow, in some of the *Gymnogrammas* they are nearly black while in a few *Adiantums* they are pale yellow. The shapes and markings of fern spores are subjects that as yet have been practically untouched though in allied plants, as the *Isoetes,* these points may serve to distinguish species. A study of fern spores would be a most interesting pastime for those who have a compound microscope.

Leaf Shoots.—This is the term which Conard adopts in his "Structure and Life History of the Hay Scented Fern" for the curious stems that arise from the base of the stipe in the fronds of *Dicksonia Pilosiuscula.* According to this author about twenty percent of the fronds produce such shoots. Occasionally a stipe will produce two shoots, one on each side. These shoots have a varying history; they may remain dormant as mere bud-like protuberances or they may grow rapidly into a true rhizome from which new fronds develop. This method of vegetative reproduction is rarely mentioned in discussing the multiplication of

ferns by other than sexual processes, and seems confined to this single species in our fern flora.

Spore-bearing in the Crest Fern.—Besides those ferns which have their vegetative and spore-producing fronds separate, such as the cinnamon fern (*Osmunda cinnamomea*) and the curly-grass (*Schizaea pusilla*), there are many others that have the two functions more or less restricted to separate fronds. Thus in many of the *Nephrodiums* the spore-bearing fronds are narrower than those which are sterile, but the presence of green tissue shows that even the fertile fronds aid in the vegetative work of the plant. One of the most conspicuous examples of the differentiation that has taken place between the two sorts of fronds is found in *N. cristatum* where the fertile are not only narrower but are taller more erect and not so long lived. The sterile spread out on the earth and last through the winter, while the fertile seldom do so. That the separation of the two is not so fixed as one might be inclined to infer, however, is shown by a frond recently sent from Kutztown, Pa., by C. L. Gruber. In this, although the frond is manifestly a sterile one in form, it is quite well supplied with sporangia.

Writings of Alvah H. Eaton.—In *Rhodora* for December 1908, Miss M. A. Day published a list of the writings of the late A. A. Eaton, consisting of 52 titles covering a period of about ten years—the period in which the study of our ferns has proceeded with the greatest activity. The majority of Mr. Eaton's contributions to science appeared in the *Fern Bulletin*, but he also published in *Rhodora*, *Torrey Bulletin* and *Proceedings of the Biological Society of Washington*. In the same number of *Rhodora* also appears a tribute

to Mr. Eaton's memory from the pen of his former associate, R. G. Leavitt.

Polypodium aureum Mandianum.—At the recent flower show in Chicago a much divided form of the common golden polypody (*Polypodium aureum*) was shown under the name of *Polypodium aureum Mandaianum*. The form is named for the originator, W. A. Manda, who claims it to be a sporeling from *Polypodium aureum glaucum*. The *glaucum* in this combination is apparently the trade name for what scientists know as *Polypodium aureum areolatum* H. B. K., or if you choose *Phebodium aureum areolatum*. The new form, then, is properly named *P. aureum areolatum Mandaianum* or *P. aureum f. Mandaianum*. As the study of fern forms is receiving increased attention, it is very desirable that the new forms originated be placed on record under their proper names. Considered from the purely decorative view-point, the new form is a very handsome plant.

Fern Mycorhizas.—There is a growing list of plants known to botanists in which the older parts of the root are inhabited by threads of fungi which act like root hairs in securing food materials for the plant. Such associations are known as mycorhizas and are quite common among the heaths, conifers, orchids and many others. Among the true ferns, however, at least among the Polypodiaceae, mycorhizas have until recently been unknown, though it is possible that they will be found to be not uncommon when the roots are more extensively studied. At present the only member of the Polypodiaceae known to have mycorhizas is the boulder fern (*Dicksonia pilosiuscula*), although a species of *Cyathea* has been reported in a rather indefinite way as possessing them.

Hairs of Dicksonia.—The boulder fern (*Dicksonia pilosiuscula*) is frequently called hairy dicksonia, fine-haired mountain fern and other names of similar import to indicate its vestiture of hairs; indeed, the specific name here used also refers to the fact that the fronds are hairy. Going further we find that these hairs, or rather one of their qualities, is responsible for several other common names of the plant for the etherial oil which they secrete gives it the fragrance which has caused it to be named hay-scented fern, sweet-grass fern, sweet fern and the like. Microscopic examination of the leaf surface shows that the frond bears two kinds of hairs, acicular and glandular. The acicular hairs are simply pointed, but the glandular ones are terminated by a bulb-like swelling from which the fragrant and volatile oil is exhaled. The glandular hairs are most abundant on plants grown in dry sunny places, following the rule for vegetation in general in this respect. According to C. E. Waters the oil distilled from this plant has a rather disagreeable odor at close quarters, but diluted with ether and exposed to the air reminds one of the usual fragrance of the fern.

The Ladder Fern.—According to a recent gardening paper, our so-called Boston fern (*Nephrolepis*) is often called ladder fern on the other side of the water. With us it is frequently called the sword fern while the Christmas fern (*Polystichum acrostichoides*) which is constructed like the *Nephrolepis* but shorter, is known to the trade as the dagger fern. Despite Shakespeare's query as to what's in a name we are inclined to think that our British cousins have the better of us as regards the cognomen of the species in question.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from, this list.

Benedict, R. C. *Notes on Ferns Seen during the Summer of* 1908. Torreya D. 1908.

Burnham, S. H. *Asplenium Ebenoides in New York.* Fern Bulletin. O. 1908.—Report of an unusually thrifty plant from Washington County, N. Y.

Buchheister, J. C. *Fall-fruiting of Osmunda.* Fern Bulletin. O. 1908.

Buchheister, J. C. *Observations on Nephrodium simulatum.* Fern Bulletin. O. 1908.

Cleveland, G. F. *Ferns of the Upper Susquehanna Valley.* Fern Bulletin O. 1908.

Clute, W. N. *Botrychium Dichronum.* Fern Bulletin O. 1908.

Clute, W. N. *Changes in Fern Names.* Fern Bulletin O. 1908.

Clute, W. N. *Rare Forms of Ferns.—VIII. An abnormal cinnamon Fern.* illust. Fern Bulletin O. 1908.—A fern with pinnules turned to ascidia described as forma *cornucopiafolia.*

Clute, W. N. *The Grass-like Polypody.* illust. Fern Bulletin O. 1908.

Druery, C. F. *Lomaria Spicant's Variable Sporelings.* Fern Bulletin O. 1908.

Parish, S. B. *Botrychium Lunaria.* Fern Bulletin O. 1908.—Record of this fern from Mariposa, Calif.

Plitt, C. C. *Notes on Equisetum hyemale.* Fern Bulletin O. 1908.—Notes on spore shedding and on the production of roots and shoots.

Rood, A. N. *Lycopodium Lucidulum porophilum in Ohio.* Fern Bulletin O. 1908.

Schaffner, J. H. *The Air cavities of Equisetum as Water Reservoirs.* Ohio Naturalist N. 1908.

Slosson, M. *Notes on Some Hybrid Ferns.* Fern Bulletin O. 1908.—Various hybrids between species of *Nephrodium* (Dryopteris) in Eastern America discussed.

Nephrolepis Scholzeli illust. Gardening D. 15, 1908. —A crested form of *N. exalta Scottii.*

Polypodium aureum Mandaianum illust. Gardening D. 15, 1908.—A multifid form of *Polypodium aureum areolatum.*

THE COAL FERNS.

The Coal Ferns. It has long been believed that the bulk of our Coal Measures consists of the remains of ferns, but discoveries made within the past few years show that these guesses at the past history of these deposits have been all wrong. While it seems reasonably certain that plants with true flowers were not in existence when the coal was formed yet the pines, or rather certain relatives of the pines were most amundant. Ferns were plentiful, to be sure, but many of the plants we have been calling ferns, and which, to judge from appearances only, are very fern-like turn out to be more nearly related to flowering plants or at least to the Gymnosperms, as the pines and their allies are called. These latter plants bore seeds, and are therefore certainly not ferns, while they are so fern-like in structure that any botanist would hesitate to call them true gymnosperms. They have therefore been placed in a class by themselves as Pteridosperms. A rather full account of them may be found in the Report of the Smithsonian Institution for 1907.

EDITORIAL.

Very soon after the October number of this magazine was issued, the indexes for volumes 12, 13, 14, 15 and 16 were printed and the work completed to date. It has been a long, hard pull to get those delayed numbers out in addition to our other work, but we have somewhat stubbornly refused to do as most other publications would do under like circumstances and combine two or three issues in one. There is no immediate prospect that we shall again get very far behind our dates, though it must be remembered that the production of fern literature is not going on at the rate it formerly did and unless we have plenty of contributed material the issues must wait until the editor gets time to fill them. Our readers can all call to mind magazines that are thick when articles are plenty and thin when they are not, but this publication always consists of 32 pages and does not purpose making any change. It is therefore up to our contributors to do their share. If those who do not like to publish in *Fern Bulletin* would only publish in some other magazine so that we could copy their articles it would not be so bad, but to have no chance to even purloin from other publications is the limit. This magazine will continue to appear if everybody else ceases to write about ferns, but we would appreciate more contributions.

* * *

The recently issued indexes have been sent to all that have indicated a desire for them. Any other subscriber who would like them has only to make his wants known and they will be sent postpaid. We did not print a very large surplus and it would be well to order soon.

At the recent election of the American Fern Society, one of the members, by canvassing, secured more votes for a certain office than either of the regular candidates but as pluralities do not elect under the constitution the Advisory Council was obliged to make a selection and very naturally and properly, elected the regularly nominated candidate who polled the higher number of votes. At first glance it might seem that the election should have gone to the person securing the most votes but it is quite conceivable that the votes given the other two candidates would not have been distributed as they were had all the members been aware that a third candidate was in the field, therefore the regularly nominated candidates were accorded the preference. In early days, the American Fern Society required the officers to annually nominate two candidates for each office, and although these officers invariably selected the best people in the society as candidates, it was pointed out that these officers by placing in nomination members who were not well known might make it possible to keep themselves in office almost as long as they pleased. Aside from this rather remote danger the officers had the ungracious task of renominating themselves for office. The Advisory Council was therefore instituted and since the society had grown so large that it was impossible for all the members to be acquainted with one another, the new Council was made to consist of the past presidents with the idea that they not only ought to know most about the members, but ought also to have the affairs of the society most at heart. For some years, this plan of nominating candidates has worked very well, but there have always been a few individuals to object to a rule that would prevent the nomination of indepen-

dent candidates. We should not lose sight of the fact that the nomination of independent candidates is usually the beginning of a civil war over some point at issue and that it is the desire of the better element in the society to avoid politics of all kinds, yet in a spirit of absolute fairness, it is probable that provision should be made for the naming of an independent candidate when occasion seems to demand it. Under these circumstances a clause might be inserted in the constitution stating how such nominations should be made. Such candidates should not be selected from those who have recently joined the society and they should be nominated by several old members in good standing, for the society should not waste its votes on such candidates unless there is some appreciable demand for their election. The names of such candidates should be added to the regular list of nominations sent out and all still hunting for office should be emphatically discountenanced. The editor of this magazine, though president of the Advisory Council and firmly of the opinion that the council is able to select members who will make excellent officers, will willingly support a proposed amendment as outlined above if it appears that any considerable number of the members desire it.

* * *

Those who have complete files of this magazine may be interested in hearing that a set recently changed hands for a consideration of $25.00. This may be understood to be a "gilt-edged" price, but the set was in excellent condition and its rarity warranted the price. It is to be observed, also, that this was for a complete set. The volumes sold separately would not have brought half as much. There are various libraries in this country and the Old World that would be willing

to pay well for certain odd volumes to complete their files, but these sold out of a set would take from it its chief value. All the numbers of this magazine previous to volume IX are worth more than face value and should be preserved. If for sale, we can usually find a purchaser for them.

BOOK NEWS.

A new book of interest to fern students has appeared in the John Lane Company's series of Handbooks of Practical Gardening. This is "The Book of Fern Culture" by Alfred Hemsley. The author is a practical fern-grower of many years experience and gives us a most business-like treatment of the subject in hand. The book is written from the standpoint of the gardener, rather than from that of the scientist and while intended primarily for British readers is not confined to native species but embraces all the ferns commonly cultivated either at home or abroad. The usual directions regarding watering, potting, propagating, etc., are given and then the various groups of ferns such as the filmy ferns, climbing ferns *Adiantums,* etc., are taken up and the various specimens commented upon. The names used are in general the ones commonly employed and little attention is paid to the quarrels of the nomenclaturists. Some twenty-five excellent illutsrations of specimen ferns are included in the book. The paper and press-work are very good, but the proof-reading has evidently been done by persons unacquainted with scientific terms. (New York. The John Lane Co. 1908. $1.00 net).

We have recently received from Dr. C. Brick, St. Georgskirchof 6I, Hamburg, Germany, a reprint of all

references to ferns published in 1906. This covers nearly a hundred pages most of it in German, and is divided into (1) references to Text-books, (2) Prothallia and sex-organs (3) morphology and physiology (4) Sporangia and spores (5) Systematic and geographic further divided into references to the literature of each country (6) cultivated ferns (7) variations (8) fern diseases (9) uses (10) articles relative to plant names (11) a list of all new species and varieties named in 1906. Nearly five hundred articles about ferns appeared in 1906 and about the same number of new species and forms were described. As might be expected the two Americas and the Philippines furnished most of the material for this work. Dr. Brick's publication is exceedingly valuable and it would be a good thing if it could be placed on sale in this country. Possibly the Fern Society might secure copies at reduced rates for its members.

THE AMERICAN FERN SOCIETY

President, Prof. E. J. Winslow, Elmira, N.Y.
Secretary, Prof. S. L. Hopkins, Central High School, Pittsburg, Pa.

Fern Students are cordially invited to join the Society. Address either President or Secretary for further information. The Fern Bulletin is sent free to members. The Annual Dues are $1.00, and should be sent to Miss Nellie Mirick, Treas., 28 East Walnut Street, Oneida, N. Y.

—Hon. O. M. Oleson, Ft. Dodge, Iowa, was named as vice-president of the Society by the Advisory Council in deciding the tie for this office at the last election. Prof. L. S. Hopkins was also elected Secretary.

—The Annual Report for 1908 is already under way. Since no report for 1907 was printed, this will contain the reports of officers for 1907 also.

ALL THE AMERICAN FERN BOOKS
AND SOME OTHERS

Ferns of Kentucky, Williamson (Out of Print.)
Ferns of North America, D. C. Eaton, 2 vols. (Out of Print.)
Fern Collector's Handbook, Sadie F. Price. (Out of Print.)
Ferns in Their Homes and Ours, Robinson. (Out of Print.)
Ferns of the West, Marcus E. Jones, paper.....$ .50
Ferns and Fern Allies of New England, Dodge..... .50
New England Ferns and their Common Allies, Eastman..... 1.33
Our Native Ferns, Underwood, 6th Ed..... 1.08
Ferns, Waters..... 3.34
Our Ferns in Their Haunts, Clute..... 2.00
How to Know the Ferns, Parsons..... 1.60
Fern Allies of North America, Clute..... 2.00
Fern Collector's Guide, Clute..... .54
How Ferns Grow, Slosson..... 3.34
Ferns and How to Grow Them, Woolson..... 1.18
Fern-wort papers. Paper..... .25
Ferns of the Upper Susquehanna, Clute. Paper..... .15
Boston Meeting Papers. Paper..... .25
Index to Vols. 1-10 Fern Bulletin. Paper.....25
North American Pteridophytes, Gilbert. Paper..... 25
Ferns of Iowa, Fitzpatrick. Paper..... .20
Mosses and Ferns, Campbell, 1st Ed..... 4.00
Mosses and Ferns, Campbell, 2nd Ed..... 4.50

FOREIGN WORKS

Ferns of Nicaraugua, Shimek. Paper.....$ .50
The Fern Allies, Baker..... 1.25
A Fern-book for Everybody, Cooke..... .50
Book of Fern Culture, Hemsley..... 1.08
Wayside and Woodland Ferns, Step..... 1.75

Any of the above, to which a price is attached will be sent postpaid upon receipt of price. Out of print books may occasionally be obtained second hand nearly as good as new. The Fern Bulletin may be clubbed with any book listed at a dollar or more for 50 cents additional. A year's subscription will be given free with every order amounting to $5.00 or more.

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THE DWARF SPLEENWORT.—*Asplenium pumilum.*

THE FERN BULLETIN

Vol. XVII APRIL, 1909 No. 2

NOTES ON NEPHRODIUM HYBRIDS.

By E. J. Winslow.

On the Fourth of July, 1905 I was in Barton Landing, Orleans County, Vermont, and, driven to botanizing to get away from the noise, I ventured to try what I then considered a rather unpromising strip of swamp stretching along one side of the intervale just below the village. The swamp was quite heavily wooded, very wet, and in quite a primeval condition with fallen trees in all stages of decay and a rich growth of plant life.

I noticed with some curiosity frequent clusters of *Nephrodium marginale* which usually grows in drier situations, and many plants of *N. cristatum* that seemed unusually broad and lax but did not quite fit the conception I then had of *N. Clintonianum*. One plant that I collected struck me as intermediate between *N. marginale* and *N. cristatum* and I wrote Mr. A. A. Eaton mentioning it as probably a hybrid.

Circumstances prevented any further exploration in that vicinity until the summer of 1907. By that time I was fully impressed with the interesting character of some of my previous collection and took the first opportunity to visit the swamp prepared to make a good representative collection. I divided this collection into two parts and carried one to North Easton and laid it before Mr. Eaton. He pronounced most of my cristatums,—"*Clintonianum*," suggested that two or three

were probably *Clintonianum X marginale,* and laid several aside for further study.

In 1908 I again searched the swamp collecting all the odd forms of *Nephrodium* and making a careful study of them. I now found several plants of *N. cristatum X marginale,* and one very striking form with the proportions of a small *cristatum,* the cutting of *Boottii,* and the texture and smooth light colored indusia of *spinulosum.* This I sooon identified as *N. cristatum X spinulosum.*

Among the plants were thirty-five or forty of a form quite common and classed doubtfully as *"Clintonianum-Boottii."* It had the form and general aspect of *Clintonianum,* but the cutting of *Boottii.* Later a close examination showed that, while some of those were characterized by a glandular indusium like of Bootii, most of them were entirely smooth. This suggested that they were *N. Clintonianum X spinulosum* and *N. Clintonianum X intermedium.* I had read Mr. Philip Dowell's article on hybrid ferns in the *Torrey Bulletin* for March, 1908, but did not have it with me in Vermont. On returning to New York State I immediately looked it up, and got into correspondence with Mr. Dowell, and sent him some of my collection. He confirmed most of my identifications and pronounced that doubtful hybrid, collected in 1905, *Clintonianum X marginale.*

As *N. Goldianum* was not found in this swamp, the possible hybrids in this group number ten in place of the fifteen suggested by Miss Slosson in the *Bulletin* of October 1908. If you allow some rather questionable forms to be named *N. Clintonianum X cristatum,* and some *intermedium X spinulosum* about which I am fairly confident, nine of the ten were taken from an

area not over 40 by 80 rods, all but two of them several times. The missing number is *N. marginale X spinulosum,* Miss Slosson's *Pittsfordense.* The parent plants were abundant in close proximity, and with another chance I should look for this with considerable confidence of success.

Recorded collections indicate that *Nephrodium* hybrids are of rather frequent occurrence in suitable localities; that is in wooded swamps. Last fall, while in the midst of study on the Vermont collection, I received a fine frond of *N. Clintonianum X Goldianum* collected by Mr. Trundy in Farmington, Maine. *N. cristatum X marginale* is very commonly reported from the New England and eastern Middle states. While Boottii is so common as to place its hybrid origin in question. In some localities it is more common than *cristatum.* This suggests that it reproduces itself. I am satisfied that such is the case for I have raised plants from spores of *Boottii,* not to the fruiting stage but to fronds one foot in length. I hope to have more to say about this later.

While the recognition and description of several of this group of hybrids by Prof. Dowell and Mr. Benedict, (*Bulletin of the Torrey Botanical Club,* Vol. 36, No. 1.), adds greatly to the fern collector's interest in and comprehension of the genus, of course it does not exhaust this field for study, but raises as many questions as it settles besides leaving many old ones unanswered. For instance those suggested by the varying form of *N. cristatum* and *N. Clintonianum.* As *N. cristatum* is frequently associated with *N. spinulosum,* why is *N. cristatum X spinulosum* so rarely found? I believe it is sometimes taken for *N. Boottii.* Since working out my Vermont collection I have carefully

examined all my *Boottii* and found one splendid frond of *N. cristatum X spinulosum* collected last June at Lowman, N. Y. It has exactly the appearance of *Boottii*, but its identity is easily discovered by an examination of the sori. The indusium of *spinulosum* is distinguished from that of *spinulosum intermedium* not only by its smoothness but by its lighter color. My Vermont specimen of this same hybrid was not at all like *Boottii* but totally different from anything I ever saw.

In the Barton Landing swamp while *N. Clintonianum* is common, typical *N. cristatum* is much less so, and it is interesting to note that *Boottii* is also rather uncommon. But I found about three plants each of *N. Clintonianum X spinulosum* and *N. Clintonianum marginale*. However several elements of doubt are here involved. Many of the *Clintonianums* seem to me to approach *cristatum* and some of those called *cristatum X marginale* may be *Clintonianum X marginale*.

N. Clintonianum X spinulosum and *N. Clintonianum X intermedium*, which I did not distinguish from each other while in Vermont, were about as common as *N. Clintonianum*. But I found later that I had collected about three of the former to one of the latter. That is about 30 of the *spinulosum* hybrid and about ten of the *intermedium* hybrid besides some that were sent to Mr. Eaton before making the distinction. It is my impression that *N. spinulosum intermedium* was fully as common as the species. I believe these two hybrids will prove to be rather common. I suspect many of them may be found in herbaria among the *Clintonianums* and *Boottii*. Mr. Eaton had for several years collected unusual forms of this genus and more than suspected the hybrid origin of some of them. He fre-

quently mentioned in his letters a very broad form of *Boottii,* and once spoke of finding several sheets of it in the Gray Herbarium among the *Clintonianums,* and again he says, "Gilbert makes it the type of his var. *multiflora.*" Later I sent Mr. Eaton a duplicate of what I have recently determined to be *N. Clintonianum X intermedium* and he identified it as *N. Boottii* var. *multiflora* Gilbert. I have seen heavily fruited specimens labelled "var. *multiflora*" which were not the *Clintonianum* hybrid, but I have not seen any of Gilbert's material.

Another interesting question concerns the position of *N. thelypteris N. noveboracense,* and *N. simulatum* in the genus. Although *N. thelypteris* was common in the locality just described, no hybrid of that species was found and as far as I know none has ever been reported. This adds a little emphasis to the fact, which every observer of the group must appreciate, that the evergreen *Nephrodiums* bear to each other an entirely different relationship from that which they bear to the herbaceous *Nephrodiums.* (See Davenport in *Rhodora* Vol. IV. page 10.) *N. Clintonianum* is getting to be pretty generally accepted as a species, and judging by the ease with which its hybrids are recognized *N. spinulosum intermedium* deserves the same consideration. Then how can we do less than to make a genus or at least a sub-genus distinction between those species and the *thelypteris* group?

One question more. There are two distinct forms commonly called *N. spinulosum dilatatum,* one is collected at high elevations, the other in swamps or wet woods. I call them the swamp form and the mountain form. The mountain form is probably the true *dilatatum.* It is well shown in Waters' *Ferns,* page 220.

The swamp form is perhaps a rather extreme form of the species. I have a swamp *dilatatum* with glandular indusia, collected in Lowman, N. Y. I had labeled it *N. spinulosum fructuosum* Gilbert. I now believe it to be a *spinulosum X intermedium* hybrid. I have not seen Gilbert's material but from the localities given I judge that his specimens were collected on low ground; and he says—"not as glandulose as var. *intermedium*."

I shall look with interest for data and suggestions from fern students bearing on any of these questions.

Elmira, N. Y.

COLLECTING IN THE EVERGLADES.

By Charles T. Simpson.

Late in the Autumn of 1903 A. A. Eaton, John Soar and Charles F. Simpson the well known writer on mollusks, made a collecting trip to Southern Florida. The following letter was written to a friend and not intended for publication but it gives a more vivid impression of botanizing in that part of the world than pages of the usual perfunctory description and we have accordingly obtained permission to publish it.

"Eaton, Soar and I returned home from a collecting trip as far as Long Key, in the Everglades, a week ago. I have not had life enough to write to you since, though I sent a package of ferns by mail, and a postal card. We had a terribly hard trip following our former road to near the end of the Homestead settlement and then taking a new road broken by the engineers of the East Coast Railroad, to haul supplies over.

For eleven or twelve miles there is no settlement, an awful desolate country without a cap full of soil. Nothing but the old coral reef, evolved into sharp

corners and pot holes. We broke our buggy and tore the shoes from our newly shod horses and could only travel by tying up their feet in gunny sacks, which they would cut through in a quarter of an hour.

In a hammock at about the last point of civilization we found a new *Asplenium,* a beauty with hard, glossy fronds and a new *Polypodium,* which does not agree with *angustifolium, pectinatum* perhaps. We stopped at Camp Jackson, on the border of the Everglades the second night. Leaving the team and driver, we pushed on afoot the next morning, wading the glades, through the saw grass and muddy water which gradually became knee deep. Finally we reached the channel, a clear, deep looking stream, thirty or forty rods wide.

Eaton waded in, and when about waist deep, stepped on a fourteen foot alligator. The gator got up and apologized and offered his seat. Eaton sat down, then Eaton arose and came back looking very white and until the trip was at an end, was trying to explain why he came back. We then went up higher and crossed where the stream was shallow. Before us lay Paradise Keys, the most lovely bit of tropical scenery I have ever beheld. It might have covered a hundred acres—a low rounded dome of giant trees, and rich tangled vegetation, punctuated here and there with magnificent royal palms, singly or in groups, rising from 60 to 120 feet in height, their beautiful plumy heads swaying low in the morning breeze.

We left our baggage, provisions and blankets under a very lofty royal, and began to search the hammock. A loud shout from Soar called us and we found on the trees great numbers of *Oncidium luridum* var. with leaves five inches wide and 2½ feet long, thick and lea-

thery with scapes of variegated flowers 6 feet high, by far the noblest orchid in Florida and one of the finest in the West Indies. Eaton found another epiphytal orchid, genus and species unknown, and we again went crazy. When we at last went back after killing a big rattlesnake that Soar stepped over, we could not find the tree where we left our things, so thick was the forest, and we were delayed a couple of hours before we found them. We then concluded to go back to Camp Jackson, as we had a big load, each man having from 50 to 60 pounds, the great *Oncidium* being quite heavy. After passing the channel, Soar was taken very ill. Eaton generously took part of his load, but Soar still lagged behind. Eaton then pushed ahead and left his load on some low shrubs, and returned for Soar's load. We then tried to reach a low key in the glade, and camp, as it was nearly dark and Camp Jackson a long way off. Eaton pushed ahead, I followed, and poor Soar staggered along in the rear. From where Eaton hung up his baggage, to the Keys, the bottom was rocky, full of pot holes and the sharp points covered with a thin deposit of slippery mud. Here and there was water. The saw grass was thick enough to conceal the pitfalls and in going this distance I fell seven times at full length. In the darkness I lost my sack of orchids and baggage. When I reached the hammock, I called for Eaton but got no reply. Fortunately I stumbled on his stuff, and at once set to work at building a fire. My matches were damp, although in an upper pocket, and the paper containing them was wet. After striking nearly all of them, I got a light although the leaves and twigs were damp. Eaton came with a dry piece of pine and we soon had a fire. We called to Soar, and finally got a reply. When he

came in he was very pale, and at once became very sick and was sick most of the night.

We had a miserable place, an irregular rock, eight or nine feet long, 5 or 6 feet wide with a pot hole in the middle, and not more than a foot above water, and quite wet, and we slept but little. Soar was a little better the next morning and he and I made our way to Camp Jackson, while Eaton went back and got the stuff he left in the glades.

Not far from Camp Jackson I discovered a lovely little fern in a pot hole in the pine woods, a *Davallia*. In a hammock on our right we found a new *Tectaria*, smaller and simpler than *trifoliata*, a *Polypodium* close to *phylliditis*, with shorter, broader fronds, and a longer stipe, a peculiar *Trichomanes* looking like a liverwort and a dwarf *Nephrodium*, perhaps. Eaton found here an *Oncidium* with long narrow leaves and a five foot scape of very pretty flowers, partly epiphytic and partly terrestrial. We had seen this before but not in bloom. Eaton also found several terrestrial orchids, new to the United States, probably a number of these are already described from the West Indies.

Eaton is a splendid man, jolly, energetic and made of steel, full of resources and an excellent collector. Soar and I are pretty well used up. It was a hard trip for a man nearly 58, and I doubt if I could go through it again. But all the fatigue and hardship will soon fade away while the memory of lovely Paradise Key will remain as long as I live.

Eaton found a few plants of *Cheiroglossa palmata*, on a former trip at Snapper Creek. It has been cold here, two frosts, one of which nipped some of the leaves and undergrowth of small plants that are strictly tropical. We found marks of the frost at Camp Jackson."

Lemon City, Fla.

THE NEW YORK FERN.

By Adella Prescott.

The New York fern (*Nephrodium noveboracense*) was one of my first discoveries after I began the study of ferns. In the light of further knowledge and experience my delight seems quite disproportionate to the cause for I am sure that nothing less rare than the moonwort or curly grass would afford me equal pleasure now. Of course the Christmas fern and maidenhair were old friends but this was the first of all those that "look just alike" that I was able to identify from the description in the book.

There are many ferns more striking in appearance than the New York fern, and the stroller in search of ferns for a background for her bouquet of wild flowers will do well to pass it by, for it wilts quickly when cut and rarely revives even under favorable conditions, but to the fern-lover the delicate fronds have an unfailing charm in the delightful *fernу* odor which in this species is unusually rich and strong.

This fern loves shady hillsides and seldom remains long when the shading trees are cut away. I have found it growing on the hilltop in full sun, but with dwarfed and stunted fronds. The crosiers of the New York fern resemble those of the marsh fern but the stipes are shorter and the mature fronds thinner and more delicate.

In shape they are broadly lanceolate and taper from above the middle to the pointed tip. Below the middle the pinnae grow farther an farther apart, and are gradually reduced in size until the lowest are mere green ears, and this peculiarity was what convinced my delighted eyes that I had really identified a fern. And

indeed this is the quickest and surest means of identifying it, for while it has the round fruit dots common to all *Nephrodium* and bears a superficial resemblance to the marsh fern which sometimes confuses young collectors (especially as the habitats of the two ferns often overlap) yet one glance at the lower pinnae will settle the question for none of our other ferns possess this peculiarity in so marked a degree.

The New York fern is found from Newfoundland to North Carolina, Arkansas and Minnesota. It has a slender creeping rootstock and its delicate yellow green fronds with their pinnatifid pinnae seldom reach a greater height than two feet. The fertile fronds differ but little from the sterile though sometimes heavily fruited fronds are slightly taller and narrower.

The books say it is easily cultivated, but I have failed to establish a plant in my garden though I have tried several times to do so.

New Hartford, N. Y.

ASPLENIUM BRADLEYI IN NORTH ALABAMA.

By Dr. E. L. Lee.

It may be of interest, to some Fern students, to know something of the ecology of *Asplenium Bradleyi,* as it is found near Bridgeport, in North Alabama. This fern is accredited, by Dr. Mohr, our former State Botanist, to the Cumberland range of mountains with its spurs and ridges stretching across the states of Kentucky and Tennessee, and breaking up in minor spurs and ridges in the northern counties of our state. The general direction of these mountains is nearly that of the river, —north-east, as viewed from our place. This mountain range with its ridges from the Kentucky line to

Alabama is from 2200 feet above sea level at the line to 1600 feet at our place. This long range of mountains is capped by sandstone cliffs, from twenty to two hundred feet thick, as described in Safford's Geology of Tennessee. It is in this sandstone that *Asplenium Bradleyi* is found, at a uniform height of sixteen hundred feet. Its habitat was ascertained by Mr. Bradley at Coal Creek in Walden's Ridge, and near the Cincinnati Southern Railroad, in East Tennessee. That point is about eighty or ninety miles from our place. At that place plants are normal at least and ought to be at their best.

Asplenium Bradleyi is described in our works on ferns as being eight to ten inches high, and growing preferably on limestone rocks. At our place it grows only in the seams of the sandstone cap. Have never found a plant growing on the rocks, but out of the closest seams on the face of the cliffs up to a height of fifteen feet from the ground. A majority of these plants are found on the naked face of the cliff, where they are exposed to the hot sun, at least half the day, but they like to grow under shelving rocks, in what our people are pleased to call "rock houses;" that is, where the brow of the cliff hangs over a perpendicular, some ten of fifteen feet, or where the stone near the ground is eroded by the elements and makes a natural shelter. But the plant grows out of those narrow seams just the same way, in the rock houses. These little plants, after leaving the seams spread their fronds against the face of the rocks like little stars, or rosettes. They can easily be covered with a common tea cup. Where they grow under shelving rocks no rain can reach them. If the rocks dip to the center of the mountain, as they do as often as to the outside they

cannot be watered by seepage, and in no other way that I can see unless by capillary attraction and by the fogs that hang around the mountain tops during the early hours of the morning. These dwarfed plants grow thus in the seventy-five miles from Coal Creek to this place; and this place is no exception to the rest of our state, and the Western portion of Georgia. All the stations found by Dr. Mohr are reported "plants very small." You may say this is due to environment, want of proper nourishment, want of moisture, and exposure to the hot sunshine, any one of which would kill a common fern, and all together kill an uncommon one. The top of the limestone here is about 1200 feet. From Coal Creek it has left the limestone and crawled up the mountain some 400 feet, and set up house keeping with the sandstones as a cliff dweller.

Bridgeport, Ala.

RARE FORMS OF FERNS. — X.

LYCOPODIUM ALOPECUROIDES ADPRESSUM POLYCLAVATUM.

Although the *Lycopodiums* are certainly not ferns, they are closely enough related to these plants to warrant their inclusion in a series of this kind and we select for illustration in this number the plant named some years ago, *Lycopodium adpressum polyclavatum* or perhaps more properly *Lycopodium alopecuroides* variety *adpressum* forma *polyclavatum*. This plant with the long name is simply a monstrous form of one of the club-mosses that is found along the Atlantic coast, from Massachusetts to Texas. In the south the plant is usually tall and stout with spreading leaves: further north its height diminishes until it often re-

sembles large forms of *Lycopodium inundatum.* In any region where it grows a lack of moisture, or exposure to sun, may cause the leaves to be less spreading and thus provide the extremist with an excuse for dubbing it a new species as *L. adpressum,* and if some slip in its internal make-up should cause it to develop several half-fertile, half-sterile fruiting spikes—a sort of fasciation, probably—then we have the added excuse for giving it the form name. As to the plant itself, being but an abnormal fasciated form, it is likely to be found anywhere where the normal plants grow. Until recently it was known from Southern Staten Island, only, but Mr. Severin Rapp has since found it at Sanford, Florida and it is doubtless growing at many places between these two points. Those who do not despise the variations exhibited by plants should be on the watch for it.

In the writer's opinion, the normal plant is itself a mere ecological form; a northern extension of the well-known southern fox-tail club-moss (*L. alopecuroides*). As long ago as 1878 it was recognized by Chapman as being different from the type of *alopecuroides* and he called it *L. inundatum* variety *elongatum* and also *L. inundatum* variety *appressum.* In 1900 Lloyd and Underwood, putting a finer point on all the *Lycopodiums* called it *Lycopodium adpressum.* Then a year later Maxon, browsing around in some ancient literature discovered that Desvaux had used the name *appressum* for a form of another species of *Lycopodium* about a hundred years earlier and our plant was forth-with christened *Lycopodium Chapmani.* If the matter were worth while we might challenge Maxon's right to change the name so long as *appressum* and *adpressum* are not spelled alike—upon such slender hairs

does the fate of specific names often depend—but a club-moss by any other name would smell as distinct, so what's the use? As to who it was that first called it *L. alopecuroides* f. *adpressum,* history such as we have at hand is silent. Possibly it was the present writer. It does not matter. The specimen illustrated was collected near Sanford, Florida by Severin Rapp. —*W. N. C.*

THE DWARF SPLEENWORT.
Asplenium pumilum.

By Willard N. Clute.

Those who have confined their fern studies to a limited region often have an erroneous conception of the range in form of genera that makes collecting in any distant country a series of surprises. Sometimes the impression of a genus is correct, as when we assume from experience with the cinnamon fern, the interrupted fern, and the royal fern, that all the *Osmundas* are large, but we are as likely to go astray in our judgment as we do when we infer from a few diminutive specimens that all the filmy ferns are as small and delicate. In general the smaller the genus, the greater is the likelihood that the species composing it are all quite similar; indeed one of the reasons brought forward for separating our common boulder fern (*Dicksonia pilosiuscula*) from the other *Dicksonias* was that it differed from the others so much in size and habit.

In any large genus, however, it is usual to find a wide range in the size, shape and cutting of the fronds. The species are likely to begin with entire fronds, shade into pinnatifid or pinnate species and end with

forms that are often many times compound. So, too, in the matter of size, there are species, small and inconspicuous, almost lost among the other herbage of their haunts and others that reach sizes that render it impossible for them to escape notice. After one has spent a day collecting polypodies so small that it is necessary to carefully examine the mossy tree-trunks upon which they grow in order to find them at all, it is an impressive contrast to find on the way home some species such as *Polypodium crassifolium* with fronds like broad-swords.

Nor do size and delicate cutting have any necessary relationship. The large fronds are as likely to be deeply cut as are those of small species but no more so. In the case I have mentioned both forms happen to have entire fronds, though one is possibly fifty times larger than the other. Size very frequently depends upon habitat. In ground inhabiting species, there is usually no reason for a diminution in size, but those species which live upon trees, must keep their proportions within the bounds which their habitat places upon moisture, light and root-hold.

Some thoughts of this nature must pass through the mind of anyone who examines any extended series of tropical *Aspleniums*. At one end of the list is the great simply pinnate fronds of *Asplenium marginatum* like a gigantic *Asplenium angustifolium,* taller than a man and at the other is the little *Asplenium pumilum* chosen to illustrate this article. Although so small our fern does not grow on trees or rocks, but is to be found among the grasses and herbs on shrubby half open hillsides. The variation in the fronds presented by the fertile, and therefore presumably mature, plants would delight those botanists who thrive by making distinc-

tions between tweedledum and tweedledee. A set of specimens could be selected that would make an unbroken series beginning with entire fronds and ending with pinnate forms with pinnatifid pinnae. In drawing up a description of the species, the scientists have fortunately described the larger forms. Had they by chance first discovered only the small forms and described them, it is likely that the larger ones would have been considered distinct.

Like a large number of our spleenworts, the present species has black stipes with a tendency to become green as they approach the blade of the frond. The largest specimens are usually less than five inches high and being so inconspicuous, have failed to attract much notice. The species, however, is pretty widely distributed, being found in the West Indies, Mexico, Columbia, East Africa and India. The specimens illustrated were collected near Gordon Town, Jamaica, by the writer in 1900.

THE FAMILIES OF FERN-LIKE PLANTS.

There was recently published in this magazine (Vol. 16, p. 70) an outline of the families of fernworts suggested by Prof. Chas E. Bessey. The arrangement there presented is undoubtedly a step in the right direction, but we are as yet so much in the dark as to what are, and what are not, essential differences in the plant world that there is still room for speculation upon the subject. In the *Ohio Naturalist* for February, 1909 Dr. John H. Schaffner has tried his hand at a re-arrangement of the great plant groups. In this the author divides the plants into seven groups which he calls Protophyta, Nematophyta, Bryophyta, Pteridophyta Homosporae, Pteridophyta Heterosporae

Gymnospermae and Angiospermae. The first two represent what we are accustomed to call the thallophytes, the next includes the mosses, and the last two represent the conifers and flowering plants. We reprint the part of the list devoted to the ferns and fern allies which will be very useful for comparing with Prof. Bessey's arrangement. It will be noted, as an excellent illustration of the way in which scientists differ regarding classification, that Prof. Bessey makes a dividing line of the origin of the spores, whether Eusporangiate or Leptosporangiate, while Prof. Schaffner bases a division upon the difference in size of the spores. This latter separation removes the Selaginellaceae from their usual position beside the Lycopodiaceae and places Isoetaceae farther away from the true ferns than in Prof. Bessey's list. It seems here to be a case of "paying your money and taking your choice." In a later paper by Prof. Schaffner (*Ohio Naturalist*, Vol. 9, p. 495) the plants are divided into sixteen groups the Pteridophytes are again rearranged, this time the *Lycopodiums* and *Sclaginellas* are placed together in the Lepidophyta, the *Equisetums* and certain fossils have the Calamophyta, while the ferns, *Isotes*, Marsiliaceae and Salviniaceae are placed in the Ptenophyta, this last a new word coined to include the plants named. No mention is made of the Ophioglossaceae but these would of course be included with the ferns. The earlier list relating to the Pteridophytes is here printed.

IV. PTERIDOPHYTA HOMOSPORAE.

Filices. Ferns. 4,000 living species.

Sporophyte herbaceous or tree-like, usually with a horizontal rhizome, simple or branched; leaves usually large, alternate and mostly compound, rarely grass-

like; sporangia borne on the under side of the leaves or on simple or branched sporangiophores; eusporangiate or leptosporangiate; sporophylls not forming cones. Gametophyte comparatively large, tuber-like without chlorophyll and subterranean, or developed as a flat, simple or branched thallus, hermaphrodite or unisexual; spermatozoids multiciliate.

Equiseteae. Horsetails. 25 species.

Sporophyte perennial, herbaceous, with a rhizome, and with jointed, mostly hollow, simple or branched, aerial stems which are either annual or perennial; vascular bundles in a circle; leaves reduced to sheaths around the joints, the sheaths toothed; sporangia borne on small peltate sporophylls arranged in whorls on a terminal cone; eusporangiate; spores with four narrow, strap-like, hygroscopic appendages. Gametophyte a small green thallus, usually unisexual; spermatozoids multiciliate.

Lycopodieae. Lycopods. 155 species.

Sporophyte perennial, herbaceous, with or without a rhizome, the aerial stems upright or trailing; branching monopodial or dichotomous; leaves small, without a ligule, scattered on the stem, into two to many ranks; sporangia solitary on the upper surface of the leaves or in their axils, eusporangiate; sporophylls in bands alternating with the sterile leaves or arranged in spirals in terminal cones; spores small, not appendaged. Gametophyte small, sometimes subterranean, with or without chlorophyll, hermaphrodite; spermatozoids biciliate.

V. PTERIDOPHYTA HETEROSPORAE.

Calamarieae. Fossil.

Paleozoic plants, sometimes of tree-like aspect and dimensions, with hollow-jointed stems with a circle of

collateral vascular bundles; stems increasing in diameter by a cambium zone; heterosporous, the sporophylls in cones.

Sphenophylleae. Fossil.

Paleozoic plants of tree-like aspect and dimensions, with solid jointed stems with a central triarch vascular bundle; leaves wedge shaped, comparatively small; probably heterosporous, the sporophylls in cones.

Hydropterides. Water-ferns. 75 species.

Sporophyte with a horizontal rhizome or floating on the surface of the water; leaves alternate or whorled; microsporangia and megasporangia borne together enclosed in sporocarps, leptosporangiate. Gametophytes developing entirely within the spore walls or protruding only slightly, very short lived; spermatozoids large, spirally coiled, multiciliate.

Isoeteae. Quillworts. 60 species.

Sporophyte with a short tuberous stem with a peculiar type of secondary thickening and with long, erect, grass-like leaves which have a ligule; roots dichotomous; microsporangia and megasporangia large, borne singly, sunken in the expanded bases of the leaves, eusporangiate. Gametophytes very much reduced; spermatozoids spirally coiled, multiciliate.

Selaginelleae. Selaginellas. 500 species.

Sporophyte dorsiventral or erect, with monopodial or dichotomous branching and dichotomous roots; leaves small, opposite or spirally arranged, ligulate; cells often with a single chloroplast; sporophylls in bisporangiate cones, the eusporangiate microsporangia and megasporangia single in the axils of the sporophylls. Gametophytes small and short-lived; spermatozoids very minute, biciliate. Some fossil species de-

veloped as large trees with secondary thickening by a cortical meristem.

The Gymnospermae which follows the ferns, is made to include the Pteridospermae or fern-like seed-plants, the Cycadeae or sago palms, the ginkgo and our well-known cone-bearing trees.

HOW TO MAKE BLUE PRINT PAPER FOR FERN PRINTS.

By James Shepard.

First prepare two separate solutions in separate bottles. For solution No. 1 dissolve one ounce of red prussiate of potash in eight ounces of water. The potash is not quickly soluble and it will dissolve quicker if pulverized. For solution No. 2 dissolve one ounce and eighty grains of ammonia-citrate of iron in eight ounces of water. The iron dissolves quickly. Always use the same bottle for the same solution. The solution will keep only a short time when mixed, but the potash alone will keep good indefinitely and the iron keeps fairly well except in warm weather. Both solutions better be kept in the dark.

The most important of all is to get good paper for coating with the solutions. The paper must be smooth firm and hard or sized so that the solution or coating will stay on the surface and not strike in. Good results are obtained with a paper called Mikado Bond, also with "Parson's Defundum, Linen Ledger." These names may be seen as "water marks" by looking at the paper before a light.

For coating the paper, make a solution consisting of an equal part of solutions Nos. 1 and 2. Then with a sponge or brush coat the entire surface of the paper

evenly on one side with the solution and hang the paper in a dark place to dry. In order to cover all the surface, it is best to draw the sponge or brush back and forth across the paper rapidly until the paper is covered and then go over the paper the second time cross brushing the strokes of the first application. The quicker the coating can be evenly applied the better the result. Too much rubbing of the paper or taking too much time in covering the surface tends to work the solution into the paper instead of staying on the surface only. If the solution strikes into the body of the paper it will not wash out after printing so as to give the white that is necessary for a good print. It is not necessary to coat the paper in the dark, as the coating does not become sensitive until it begins to dry. It is best to coat only enough paper to last a short time as fresh paper always gives the best results. As soon as the paper is dry, it is ready for use or for storage, well protected from the light.

New Britain, Conn.

TRAVELING FERNS.

Among the fern lovers' most delightful experiences is always numbered his first sight of the curious little walking fern. The ordinary observer, used to our common ferns, would never think of classing the long tapering, entire fronds of this species with the others, but the botanist is always on the lookout for it. Its rarity, too, adds to the charm of finding it, for the plant rather prefers calcareous rocks and is not to be found in every locality. On damp, shaded, limestone rocks, however, it is fairly common, often covering the slopes of mossy ledges. Like most ferns it bears numerous spores, but the plant does not depend upon spores alone

for its propogation. The slender tips of the fronds bend over, touch the ground, take root and the walking fern has taken another step and also produced a new plant. In consequence of this fact, the walking fern is justly celebrated, but it is not the only fern that seems to have a suspicion that spores cannot always be depended upon and has adopted other ways of getting on in the world. The process of producing ferns from the spores is a long and tedious one and several ferns have found a quicker way. That lusty giant the ostrich fern (*Struthiopteris germanica*) sends out long subterranean stolons that come up at some distance from the parent plant and produce new ferns to continue the race. Still another method has been adopted by the bladder fern (*Cystopteris bulbifera*). Instead of either rooting fronds or stolons, (which may be considered only another form of rooting frond) this fern bears small bulblets on the under side of the pinnae. These finally drop to the ground and a new fern is the result. That the bladder ferns method is capable of being improved upon is shown by an exotic fern rather common in cultivation. This has gone a step further and produces a row of small ferns on the rachis of each frond. In the course of time the fronds become prostrate and each row of ferns is ready to set up in business for itself. There is another class of ferns that multiply by division. This is a division not of the crown of fronds but of the underground rootstock or rhizome. All these are great travellers but not after the manner of the walking fern. A good example of this class is the brake or bracken (*Pteris aquilina*) whose slender rhizome dodges under roots and stones to send up a new fern, perhaps six feet away. Here and there the rhizome branches and the new ferns

spring up in all directions. In much the same way the sensitive fern (*Onoclea sensibilis*) progresses except that it grows slower and the rootstock is nearer the surface. The branching rhizomes of the common polypody (*Polypodium vulgare*) creep along on the surface and as befits a fern whose fronds survive the winter, are clothed with rusty scales. Shirley Hibberd writes in the "Fern Garden" concerning this fern "You may cut or pull to pieces this tuft almost ad lib., provided each separate portion has its own roots reserved to it." Each piece will form a new fern. The common maidenhair (*Adiantum pedatum*) grows in the same way. Plant a single frond with its bit of rootstock in the spring and before summer has passed it will increase to a dozen or more. It is generally true that those plants which produce a circle of fronds from a central crown do not move about; the wanderers are for the most part those species that send down roots, push the rhizomes outward and send up fronds at intervals all summer.—*W. N. C.* (Reprinted from Linnaean Fern Bulletin No. 1. pages 9-11).

SCOLOPENDRIUM VULGARE.

This is one of the rarest of American ferns and the possibility of finding it in some locality from which it has not before been reported may lend zest to the botanical outing. One of its best known stations is a few miles from Syracuse, N. Y., where it grows in the chinks of limestone that everywhere crops out of the ground in that region. The writer collected it there this summer in the shady depressions of a rich woodland, its fronds almost hidden in the lush growth of other vegetation. Its immediate neighbor of the fern

tribe was *Cystopteris bulbifera* but within a radius of a few rods were sixteen or eighteen different species, among them *Dryopteris Goldieana* one of the noblest of our American ferns. The fronds of *Scolopendrium* before the sporangia are developed might easily be passed by an inexperienced collector without being suspected of being ferns. They are long, narrow and entire with a heart-shaped base and grow in tufts with a rather short chaffy stipe. Investigation directed to the roots will usually show the crosiers of the infant fronds and the shrivelled fronds of last year lying on the ground, their backs showing the prominent lines of discharged spore-cases. To some the species may seem lacking in the characteristic beauty of the fern but like all of nature's handiwork, it grows in interest with acquaintance.—*C. F. S.* (Reprinted from Linnaean Fern Bulletin, Vol. 3, No. 12, page 1.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from this list.

CLUTE, W. N. *Additions to the check-list.* Fern Bulletin, Jan. 1909.

CLUTE, W. N. *A Running Fern.* Illust. Fern Bulletin, Jan. 1909.—*Rhipidopteris peltatum* discussed.

CLUTE, W. N. *Rare Forms* of Ferns. IX. *Four Aberrant Osmundas.* Illust. Fern Bulletin, Jan. 1909. *Osmuna regalis* f. *linearis, O. cinnamomea* f. *angusta* and *O. cinnamomea* f. *trifoliata* illustrated and described.

FERRIS, J. H. *The Ferns of Cochise County, Arizona.* Fern Bulletin, Jan. 1909.

GREENE, F. C. *Notes on Indiana Ferns.* Fern Bulletin, Jan. 1909.—List of ferns from Kosciusko, Greene, Martin, Orange, Floyd and Crawford Counties.

LIVINGSTON, B. E. *A Repeated Cycle of Assimilation.* Plant World, Mr. 1909.—Account of a fern which has lived for a long term of years in a sealed bottle containing some moist soil.

PEASE, A. S. *Cryptogramme Stelleri in New Hampshire.* Rhodora, Mr. 1909.

SCOULLAR, MRS. A. E. *Fruiting of Botrychium.* Fern Bulletin, Jan. 1909.—Report on the species of *Botrychium* whose fruiting seasons have been noted for some years.

SCOULLAR, MRS. A. E. *Fern Notes.* Fern Bulletin, Jan. 1909.

PTERIDOGRAPHIA. Fern Bulletin, Jan. 1909.

Coal Ferns, The
Crest Fern, Spore bearing in
Dicksonia, Hairs of
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Ladder Fern, The
Lemmon, J. G., Death of
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EDITORIAL.

For six summers the editor of this magazine has made a tour of some of the eastern chautauquas talking on various phases of nature, getting acquainted with a lot of intelligent people interested in the out-door life and having a good time generally. This summer, however, he goes to the University of Illinois to take charge of some classes in botany for teachers, hoping to contribute his share toward making the teaching of botany a live and urchin-attracting subject. There is no more delightful study than botany, provided one knows how to get the delight out of it; but one must know how. Other botanical courses at the University will be under Dr. H. A. Gleason, an out-door botanist, an enthusiast, and a teacher of ability. If the editor was not listed on the teaching force of the University he would advise all who intend to brush up in botany, to go there—perhaps he may suggest that they investigate the merits of the session, anyway. Eastern teachers desirous of seeing the best of the prairie flora, especially, will find this an excellent opportunity to combine pleasure and study.

* * *

A note from Dr. Brick informs us that his report on ferns mentioned in the January issue is not for sale. Only fifteen copies of this remarkable report are made and these are used in exchange for other publications on ferns. The editor of this journal considers himself fortunate in owning a full file of the reports. The items in these reports are, of course, reprinted from other journals, but what ones the reports do not state. It is to be regretted that it is not possible to have a larger edition of the report, since few students will care

to subscribe for the other publications in which the notes appear, yet all would be glad to purchase the collected notes.

* * *

"Lest we forget," we mention again that a few more notes and articles for publication would be acceptable. Those who were busy with our common ferns, ten years ago, have turned their attention to other things but that is no reason why the beginners among our readers should conclude that everything worth while has been written. Those who find present numbers too technical should get the early numbers. It is astonishing how many useful points they contain for beginners in the study.

* * *

Dr. E. F. Bigelow expects to hold a summer school for the study of nature at Sound Beach, Connecticut, for four weeks beginning June 21st. This is in furtherance of the general plan for advancing the interest in the out-door world taken up by the Agassiz Association. Dr. Bigelow has had considerable experience in such work having lectured on similar lines to large audiences in many parts of the country and having conducted at least two schools of this kind. It looks as if Sound Beach would be a good place to put in a month this summer.

* * *

In this issue we reprint a second installment of matter from the early numbers of this magazine. This is at the request of a large number of subscribers who have been obliged to give up all hope of ever securing a complete set of the magazine but who wish to possess the articles which they contained. We are sure that

those fortunate enough to have a complete file will not object to our devoting a few pages in several issues to this work, since it will not impair in the least the value of their own sets. The plan is to republish from time to time the articles that are still of value in the first four volumes omitting the shorter notes, news items, etc. We do not contemplate printing extracts later than volume IV unless there is a considerable demand for them since a large number of subscribers possess sets beginning with volume V.

"The New Gray's Manual" has at last appeared and as far as the flowering plants are concerned is likely to prove more useful than any other manual at present obtainable. The nomenclature is in accordance with the Vienna rules and the interpretation of species is fairly conservative. The nomenclature of the Pteridophytes, however, is a distinct disappointment since it follows no rule for such matters that we can recall. To be sure the rules for naming the ferns have not yet been distinctly formulated by a botanical congress, but even so, it is not likely that *Aspidium* will ever again be used for our ferns that formerly went by that name. *Nephrodium* or *Dryopteris* is almost certain to prevail. Nor would one longer think of putting the sensitive and ostrich ferns in the same genus. It may also be pointed out that the treatment of varieties, forms and sub-species leaves much to be desired, no hint being given either by text or typography, that will enable the student to distinguish between good varieties and mere ecological forms. Some of these latter are also quoted with all the pomp and ceremony attendant upon the citation of distinct species. Up-to-date fern students will scarcely consider this book a

safe leader. For flowering plants, however, it is sure to be the standard and everyone will, of course, want a copy.

BOOK NEWS.

George Lincoln Walton has written a "Practical Guide to Wild Flowers and Fruits" which attacks the problem of finding the names of plants in a somewhat different way from the other books on the market. While color is the basis upon which the main groups are divided, the lesser groups are keyed out according to the arrangement of their leaves, size of the plant, shape of the flowers, etc. Technical terms are conspicuous by their absence. Naturally only the more showy flowers and fruits are included in the book. There are nearly a hundred drawings in the book, but few illustrations. The book is published by Lippincott, at $1.50 *net*.

Some time before his death the late Marshall Ward began a series of books on trees, devoting a single volume to leaves, another to buds and stems, etc. Three of these volumes appeared before his death, another devoted to fruits has just been issued and another which he left in manuscript will appear later. The present one on fruits is an excellent presentation of the subject and astonishes one by the great variety in the fruits which it makes apparent. While written especially for British readers it will be found useful on this side also. The second part of the book is devoted to short descriptions of the woody plants of Great Britain but the key to these plants is too complicated for real use. A large number of illustrations add to the usefulness of the book.

THE AMERICAN FERN SOCIETY

President, Prof. E. J. Winslow, Elmira, N.Y.
Secretary, Prof. S. L. Hopkins, Central High School, Pittsburg, Pa.

Fern Students are cordially invited to join the Society. Address either President or Secretary for further information. The Fern Bulletin is sent free to members. The Annual Dues are $1.00, and should be sent to Mr. F. G. Floyd, Treas., 325 Park St, West Roxbury, Mass.

The Annual Report of the American Fern Society for 1907 and 1908 has just been printed and mailed to members. It contains the reports of officers, list of members and biographical notes of those members who passed away during the two years mentioned. Fern students who are not members of the Society may obtain a copy of the report by addressing the Secretary.

Owing to a pressure of other work, Miss Nellie Mirick, who has been our treasurer since 1906, was obliged to resign in January and President Winslow appointed in her stead Mr. F. G. Floyd, 325 Park St., West Roxbury, Mass. Miss Mirick was third in the list of treasurers and administered the office in a very acceptable manner. We shall all regret the necessity which required her to relinquish the office.

While exploring the summit of Jay Peak, Vt., on July 17, 1908, I collected a quantity of a dwarf form of *Lycopodium annotinum* growing in the scant soil among the bare rocks. I thought it might be var. *pungens*, but Mr. Clute reports that it is not exactly that variety, but an interesting intermediate form. Of course its dwarfed condition is accounted for by the high altitude (4100 ft.) an exposed situation, but a great many interesting varieties might be similarly explained. I will send specimens, as long as it lasts, to members of the Fern Society upon request accompanied by stamped envelope.—*E. J. Winslow, 855 Grove St., Elmira, N. Y.*

ALL THE AMERICAN FERN BOOKS
AND SOME OTHERS

Ferns of Kentucky, Williamson (Out of Print.)
Ferns of North America, D. C. Eaton, 2 vols. (Out of Print.)
Fern Collector's Handbook, Sadie F. Price. (Out of Print.)
Ferns in Their Homes and Ours, Robinson. (Out of Print.)

Ferns of the West, Marcus E. Jones, paper	$ .50
Ferns and Fern Allies of New England, Dodge	.50
New England Ferns and their Common Allies, Eastman	1.33
Our Native Ferns, Underwood, 6th Ed.	1.08
Ferns, Waters	3.30
Our Ferns in Their Haunts, Clute	2.00
How to Know the Ferns, Parsons	1.60
Fern Allies of North America, Clute	2.00
Fern Collector's Guide, Clute	.54
How Ferns Grow, Slosson	3.25
Ferns and How to Grow Them, Woolson	1.17
Fern-wort papers. Paper	.25
Ferns of the Upper Susquehanna, Clute. Paper	.15
Boston Meeting Papers. Paper	.25
Index to Vols. 1-10 Fern Bulletin. Paper	.25
North American Pteridophytes, Gilbert. Paper	25
Ferns of Iowa, Fitzpatrick. Paper	.20
Mosses and Ferns, Campbell, 1st Ed.	4.00
Mosses and Ferns, Campbell, 2nd Ed.	4.50

FOREIGN WORKS

Ferns of Nicaraugua, Shimek. Paper	$ .50
The Fern Allies, Baker	1.25
A Fern-book for Everybody, Cooke	.50
Book of Fern Culture, Hemsley	1.08
Wayside and Woodland Ferns, Step	1.75

Any of the above, to which a price is attached will be sent postpaid upon receipt of price. Out of print books may occasionally be obtained second hand nearly as good as new. The Fern Bulletin may be clubbed with any book listed at a dollar or more for 50 cents additional. A year's subscription will be given free with every order amounting to $5.00 or more.

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Vol. XVII No. 3

The Fern Bulletin

A Quarterly Devoted to Ferns

July

Joliet, Ill.
Willard N. Clute & Company
1909

The Fern Bulletin

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TROPICAL FERNS—If you want dried ferns from the tropics, apply for catalogue of good scientific specimens to THIENEMANNS BUCHHANDLUNG, Gotha, Germany.

WANTED—I would like very much to have specimens of CYSTOPTERIS FRAGILIS from every reader of the Bulletin. Will send in return any duplicates in my herbarium. L. S. HOPKINS, Central H. S., Pittsburg, Pa.

EXCHANGE—Will exchange walking fern or some Berkshire orchids for fresh specimens of LYGODIUM PALMATUM, Hart's tongue, ASPLENIUM RUTA-MURARIA, A. ABENOIDES, A. MONTANUM, PELLAEA, SCHIZAEA and others. Write first. W. I. BEECROFT, Cheshire, Mass.

WANTED—Numbers 2, 3 and 12 of the first three volumes of FERN BULLETIN at any price. FOR SALE—Numbers 2 and 4 of Vol. IV, FERN BULLETIN: also No. 8, (early no.) H. E. RANSIER, MANLIUS, N. Y.

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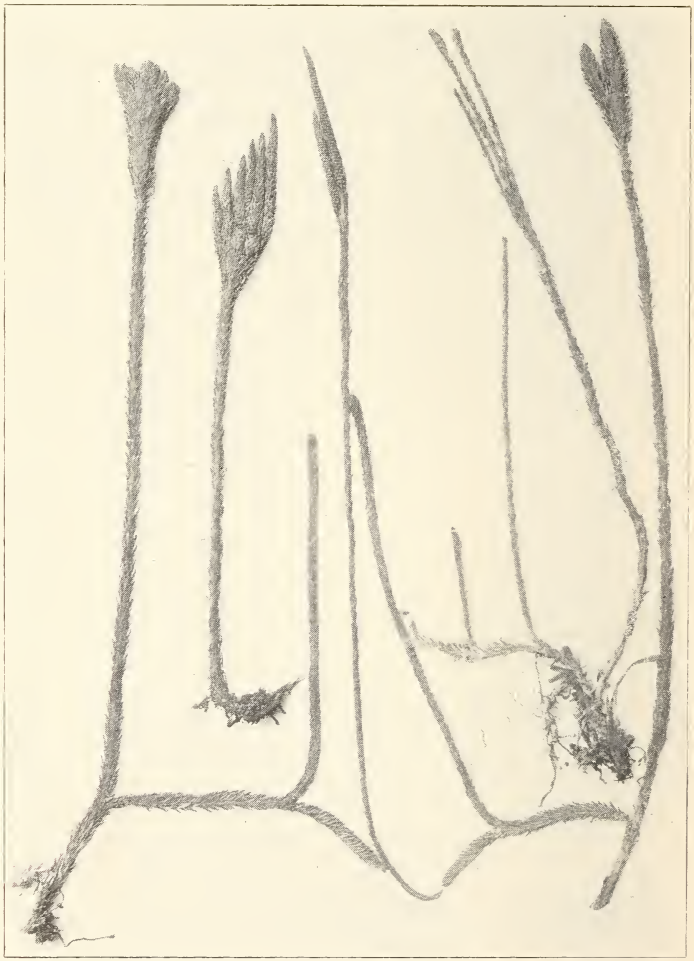


LYCOPODIUM ADPRESSUM F. POLYCLAVATUM.

THE FERN BULLETIN

Vol. XVII JULY, 1909 No. 3

THE FERN FLORA OF PENNSYLVANIA.

BY W. A. POYSER.

The Keystone State is in shape a parallelogram, lying almost entirely between 42° and 39° 43′ 26″ north latitude, and between the irregular W-shaped Delaware river and 80° 31′ 36″ west longitude. It is about 160 miles long from east to west, giving an area of 45,215 square miles. In the northwestern corner a triangular section extends to 42° 15′ north, forming part of the western boundary of New York, and giving Pennsylvania about 45 miles of coast on Lake Erie.

The Appalachian system of mountains crosses the State from northeast to southwest. It here attains its greatest breadth, but none of the ridges reaches any great altitude, though a few peaks among the Alleghenies attain a height of more than 2,500 feet. The surface of the State is naturally divided into three sections, the low district southeast of the mountains, the mountainous region, and the broken hilly plateau in the west. The triangular southeastern section consists of a narrow level plain near the Delaware, with an elevation of not more than a hundred feet above the sea, merging into a higher rolling region which extends to the base of the mountains.

The Delaware river with its tributaries the Schuylkill and the Lehigh drain the eastern portion. The Susquehanna and its branches occupy the central area,

while the greater part of the west is dependent upon the Allegheny and Monongahela rivers, the union of which at Pittsburgh, forms the great Ohio.

The climate is somewhat subject to extremes, though modified by differences in elevation. Heavy snowstorms occur in the mountains in winter and as a result, the rivers, especially in the western section are flooded in spring and early summer. This will recall one of the most disastrous floods in the history of our nation, that of Johnstown, in the southwestern portion of the State, by which 2,209 lives were destroyed on May 31, 1889.

The distribution of the fernworts is influenced generally by local conditions, by the absence or presence of the out-croppings of the various rock formations and perhaps to a certain extent by climate, especially with the species which find their southern limit of range in Pennsylvania. Nearly one-fourth of the State is wooded, the forests being fairly well distributed, though the greatest lumbering regions are in the northern part. It is to be expected, therefore, that many woodland species occur throughout. The State has been fairly well-worked, botanically, yet much remains to be recorded, at least as far as plant distribution is concerned. From the standpoint of the fern student, the flora is an extremely interesting one. The geographical position of the State is such that quite a number of northern species find their southern limit within its borders, while some southern forms just pass north of its limits, giving it a goodly admixture. Among others *Pellaea gracilis* and *Polystichum Braunii* manage to creep over the northern border on the tops of the Alleghenies, though it is stated in "The Fern Flora of New York" (*Fern Bulletin*, October,

1903,) that *Braunii* finds its limit in that State. We boast of the original station for *Asplenium ebenoides,* though it has long since been destroyed. Barring Havana Glen, Alabama, where *ebenoides* is abundant, more plants have been found in Pennsylvania than in any other State, an honor quite befitting the place of its "botanical birth." In this connection it is of interest to know that Scott was not the first to find *Asplenium ebenoides.* The Philadelphia Botanical Club has recently acquired specimens accompanied by label stating, "A fern collected by Mrs. Adams near Lancaster, Penna., in 1860." Scott's single plant was found in 1862.

Growing in crevices of the rocks along Schuylkill near (now in?) Philadelphia and not many miles from the spot where Robert Robinson Scott found *Asplenium ebenoides,* Thomas Nuttall, when the Nineteenth century was yet young, discovered the fern he afterward named *Asplenium pinnatifidum.* In apparently the same general locality it still persists, known to a few who guard it well. In 1815 Nuttall gathered a quillwort along the Delaware river shore of the coastal plain, which at the time, following the usual custom was referred to the common European *Isoetes lacustris.* Thirty years after, its distinctness was discovered and the name it now bears, *Isoetes riparia,* was given it by Dr. Engelmann. Further comments may be found in connection with the various species.

So varied and numerous have been the sources from which I have drawn the information necessary in the preparation of this flora, that it is rather difficult to make adequate expression of my indebtedness and appreciation to all. Dr. Porter's Bryophyta and Pteridophyta of Pennsylvania, barring nomenclature, has

been used as a skeleton, adding to it recent records and those omitted from that list and known to be authentic. Herbaria have been freely consulted, especially those of the Academy of Natural Sciences of Philadelphia, The Philadelphia Botanical Club, and Mr. Witmer Stone, all of which are rich in material from the eastern section of the State. Much valuable data from the western portion was contributed by Mr. Otto E. Jennings of the Carnegie Museum based upon specimens in the herbarium of that institution. I am especially indebted to the late Alvah A. Eaton for notes on the occurrence of the genera *Isoetes* and *Equisetum* in this State. My thanks are also due Mr. Harry D. Bailey of Lafayette College, Prof. Otto Hatry, Mr. C. L. Gruber, Mr. Daniel W. Hamm and Mr. W. C. Barbour, who have sent me local notes and specimens and in other ways aided me in the preparation of this list.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Adder's Tongue. Wet meadows and swamps. Local. Allegheny, Bradford, Bucks, Chester, Crawford, Delaware, Berks, Lancaster, Monroe, Mifflin, Luzerne, Wayne and Tioga counties. To be expected throughout in suitable situations. Interesting ecological forms occur.

BOTRYCHIUM DISSECTUM Spreng. Dissected Grapefern. Woods and thickets. Infrequent throughout, more common in the mountains. Grows with and occasionally grades toward *B. obliquum*. Plants with double and forked fertile and sterile portions not uncommon.

BOTRYCHIUM OBLIQUUM Muhl. Common Grapefern. Woods and thickets. With *B. dissectum*, though more common. Similar monstrosities occur,

and in one case three sterile fronds were produced by one rootstock.

Botrychium lanceolatum angustisegmentum Pease and Moore. Lanceolate Grape-fern. Woods. Rare. Confined to the mountain belt and apparently not recorded south of this State. Bradford, Cambria, Lycoming, Pike, Somerset, Susquehanna, Sullivan and Wayne counties.

Botrychium matricariaefolium A. Br. Matricary Grape-fern. Woods. Rare. The mountains and northern portion. Berks, Bradford, Erie, Lehigh, Monroe, Pike, Susquehanna, Sullivan and Wayne counties. (*B. Neglectum* Wood, *B. ramosum* Roth.)

Botrychium simplex. Hitchcock. Little Grape-fern. Woods. Very rare. Monroe, Northampton and Wayne counties in the northern part of the mountain belt.

Botrychium tenebrosum A. A. Eaton. Moist shades. Known only from Lehigh county. (Mr. Hamm.) My determination was confirmed by Mr. Eaton. Most southern locality for the species. (*B. matricariaefolium tenebrosum.*)

Botrychium Virginianum L. Rattlesnake fern. In rich woods. Common throughout. Plants having forked fertile panicles are not infrequent. The variety *gracile* has been gathered in Deleware county and should occur elsewhere.

OSMUNDACEAE

Osmunda cinnamomea L. Cinnamon fern. Swamps and wet woods. Common throughout. Though I have never found the variety *frondosa* in the field, it was produced by a plant in my garden some years ago, a year after it had been placed in position.

Osmunda Claytoniana L. Interrupted fern. Field, woods and thicket. Common throughout.

Osmunda regalis L. Royal fern. Swamps and wet woods. Throughout, though not as common as the two preceding species (*O. spectabilis* Wild.)

SCHIZAEACEAE

Lygodium palmatum (Bernh.) Climbing fern. Wet thickets. Rare and apparently confined to the eastern part of State. Bucks Carbon, Lehigh, Luzerne, Schuylkill, Philadelphia and Wyoming counties.

POLYPODIACEAE

Adiantum pedatum L. American Maiden-hair. Rich woods. Common throughout. Immature forms of this species have given rise to reports of *Adiantum capillus-veneris* in Pennsylvania.

Asplenium angustifolium Michx. Narrow-leaved Spleenwort. Rich woods. Rather rare, but to be expected throughout. Lancaster, Berks, York, Blair, Fayette, Allegheny, Erie, Clinton, Delaware, Philadelphia, Sullivan, Montgomery, Westmoreland and Monroe counties.

Asplenium Bradleyi D. C. Eaton. Bradley's Spleenwort. Crevices of exposed or shaded rocks. Very rare. Known only from Lancaster and York counties along the lower Susquehanna.

Asplenium ebeneum Ait. Ebony Spleenwort. Rocky woods, thickets and roadside banks. Common throughout. Most fruitful in dry, partially shaded situations. (*Asplenium platyneuron.* (L. Oakes.)

Asplenium ebeneum serratum Miller. In similar situations and to be expected throughout. A form with deeply serrate and sometimes pinnatifid pinnae has

been noted by the writer in Montgomery county, growing on red shale.

ASPLENIUM EBENOIDES R. R. Scott. Scott's Spleenwort (*Asplenium ebeneum. X Camptosorus rhizophyllus*). Very rare. Usually on limestone, though sometimes on other formations. If I may judge from my own experience with this hybrid in the field, I am inclined to regard its seeming preference for limestone as being due to the fact that it is only on that formation that *Camptosorus* riots in the open, there meeting *Asplenium ebeneum* in its chosen haunt, equally fruitful. I have seen the walking-fern luxuriating in the grass on the north side of a limestone boulder a foot square, on a dry, open sunny slope, "rubbing elbows" with splendid plants of *A. ebeneum.* This, of course, was an outpost of the main colony of *Camptosorus* which grew in a more shaded situation. When on other formations, I find the walking-fern confined to the deep woods, smaller, less "sportive" and carpeting mossy rocks where *ebeneum* is a mere dwarf and seldom fruitful. While both alleged parents occur throughout the State, *ebenoides* is only known from the eastern portion. Northampton, Lehigh, Chester, Berks, Lancaster, York, Monroe and Montgomery counties. Type station in last named county.

ASPLENIUM FONTANUM (L). Rock Spleenwort. On limestone rocks. North America's claim to this species rests upon two doubtful records. It is alleged to have been gathered by Mr. J. M. McMinn along Lycoming Creek, Lycoming County, Pennsylvania, in July, 1869. Specimens were sent with other plants to Prof. T. C. Porter of Lafayette College, but it was not until sometime after McMinns' death that the species was identified. Efforts to rediscover the fern have

been unavailing. The circumstances surounding the Ohio record are equally elusive. According to *The Fern Bulletin* (Vol. 5, No. 3) specimens from both localities are preserved in the herbarium of Columbia University and do not differ in any particular from Euopean material. Mr. Harry D. Bailey of Lafayette College writes me that the herbarium of that institution also contains specimens from both states. My friend, Prof. Hopkins, in his Fern Flora of Ohio (*Fern Bulletin,* January, 1907) states that the record for that state is not authenticated by any herbarium specimens. I think both records due to mixing of labels, but include the species inasmuch as it will be found credited to the state in Underwood's Manual and elsewhere, though the circumstances are generally known.

Asplenium montanum Willd. Mountain Spleenwort. In crevices of rocks. Rare though occasionally locally abundant. Lackawanna, Monroe, Carbon, Chester, Lehigh, Northampton, Lancaster, York, Somerset, Fayette and West and Moreland counties. Forked fronds not unusual. Species rather variable and sometimes fertile when half an inch high.

Asplenium pinnatifidum Nutt. Pinnatifid Spleenwort. In crevices of shaded rocks. Rare, occasionally locally abundant. Recorded from Philadelphia and Delaware Counties in the southeast. York and Lancaster along the lower Susquehanna and in Fayette County in the southwest. Very variable. Rarely laciniated specimens analogous to the laciniated form of *Camptosorus* may be found.

Asplenium ruta-muraria (L). Rue Spleenwort, Wall-rue. On shaded limestone. Very local, and apparently restricted to the central and eastern half of

the state. Northampton, Bucks, Chester, Lancaster, Franklin, Huntingdon, Blair, Centre, Lehigh and Montgomery Counties.

ASPLENIUM TRICHOMANES L. Maidenhair Spleenwort. In crevices of shaded rocks, though occasionally in exposed situations common throughout.

ATHYRIUM FILIX-FOEMINA (L). Lady fern. Woods, roadsides, thickets and in wet open situations. Common throughout, and as variable as it is common. Plants apparently referrable to varieties *angustum, incisum, laxum, ovatum, rhoeticum, distans* and *rubellum* have been found by the writer. Have noted but few forked fronds. Both red and green stiped forms occur. The red is confined to deep, rich woods while the green stiped plant may be found anywhere. The two have grown side by side in my garden for three years without any apparent change in color.

ATHYRIUM ACROSTICHOIDES (Sw.) Silvery Spleenwort. Rich and wet woods. Common in the southeastern section and probably throughout. A sterile form with somewhat distant segments, deeply toothed, is occasional in deep woods.

CAMPTOSORUS RHIZOPHYLLUS (L.) Walking Fern. On rocks, preferring limestone. Local, throughout. Most variable when growing on limestone. Forked fronds not uncommon.

CHEILANTHES VESTITA (Sw.) Hairy Lipfern. On dry rocks. Said to prefer those of igneous origin. I have seen it luxuriant and abundant on red shale. Very local and only recorded from central and eastern portions. Berks, Busks, Northampton, Chester, Monroe, Lancaster, Fulton, Montgomery and Delaware counties.

CYSTOPTERIS FRAGILIS (L.) Fragile Bladder-fern. Moist, shaded rocks and in woods. Common throughout. Very variable.

DICKSONIA PILOSIUSCULA Willd. Boulder Fern. In woods, on hillsides and in fields. "During haying season, whole counties in eastern Pennsylvania are thoroughly perfumed by the fronds cut with the hay." (Clute, "Our Ferns.") My own observations do not seem to confirm this statement. A few years ago I came across two colonies of the species growing on the brink of a small quarry a few paces apart. The fronds of one were without exception, normal while of the other colony all bore numerous forked pinnae. (Not var. *cristata* Maxon). The apices were normal.

NEPHRODIUM CRISTATUM (L.) Crested-fern. Swamps and wet thickets. Common throughout.

NEPHRODIUM CRISTATUM CLINTONIANUM. (D. C. Eaton). Clinton's fern. Wet thickets and woods. Rather rare. Susquehanna, Northampton, Delaware, Chester, Erie and Lancaster counties. The type does not occur with several colonies known to the writer.

NEPHRODIUM CRISTATUM X GOLDIEANUM. (Benedict.) Rare, known only from type station in Delaware county, where it was collected by the writer in deeply shaded wet gully. Neither alleged parent occurs within several miles, at least numerous searches have failed to disclose them.

NEPHRODIUM CRISTATUM X MARGINALE. (Davenport.) Wet thickets. Rare. Collected by writer in Delaware county and in Lehigh by Mr. Hamm.

NEPHRODIUM CRISTATUM X SPINULOSUM INTERMEDIUM. (Dowell.) Wet thickets. Rather rare. Pike, Montgomery, Susquehanna, Berks, Philadelphia, Somerset, Alleghenny, Erie, Clinton, Delaware, Le-

high and Bradford counties. (*Nephrodium Boottii* (Tuck.) of other lists. Were it possible to examine the specimens upon which these records are based, it is quite probable that some would be found to be *Nephrodium cristatum x spinulosum* (Milde).

Nephrodium Goldieanum (Hooker). Goldie's Fern. Wet woods. Local, but occurs throughout.

Nephrodium Goldieanum x spinulosum (Benedict). Rare. Known only from type station in Delaware county. Neither alleged parent occurs in the immediate vicinity of the plants, and *Goldieanum* not within several miles. (Originally described as *Nephrodium Clintonianum silvaticum* (Poyser).

Nephrodium marginale (L.) Marginal shield-fern. Rocky woods Common. Tripinnate forms have been found.

Nephrodium noveboracense (L.) New York Fern. Dry woods and thickets. Common, throughout.

Nephrodium simulatum (Dav.) Dodge's Fern. Low, wet woods. Rare. Pike, Monroe and Schulkill counties in the eastern portion of mountain belt. Reported from Chester county in Porter's list, but specimens I have examined seem better referred to *N. noveboracense.*

Nephrodium spinulosum (Muhl.) Spinulose shield-fern. Rocky woods and shaded banks. Infrequent throughout.

Nephrodium spinulosum dilatatum (Hoff.) Broad wood-fern. Woods. The mountains and western plateau. Local. Susquehanna, Lackawanna, Pike, Monroe, Lycoming, Potter, Armstrong, Erie, Bradford and Allegheny counties.

Nephrodium spinulosum intermedium (Muhl.)

Common spinulose shield-fern. Rich, wet woods. Common throughout.

Nephrodium Thelypteris (L.) Marsh Fern. Swamps, wet woods and thickets. Common.

Onoclea sensibilis (L.) Sensitive Fern. Swamps, wet woods and thickets. Common.

Onoclea sensibilis obtusilobata (Torrey). Occasional. Several efforts on the part of the writer to produce this form by mutilation have only resulted in a reduction in number of the normal fertile stems.

Pellaea atropurpurea (L.) Cliff brake. Blue Fern. On rocks, preferring limestone. Very local. Northampton, Monroe, Chester, Montgomery, Dauphin, Northumberland, Cumberland, Lancaster, Franklin, Fulton, Bradford, Berks, Huntingdon, Westmoreland, Centre and Lehigh counties.

Pellaea gracilis (Michx.) Slender cliff-brake. On limestone. Known only from Sullivan and Lycoming counties in the north-central part of the mountain belt. The southern limit of the species in the east (*Cryptogamma Stelleri* Prantl.)

Phegopteris dryopteris (L.) Oak Fern. Woods and shaded rocky slopes. Local, but occurs throughout.

Phegopteris dryopteris Robertiana. (Hoff.) Limestone polypody. Reported in Porter's Flora from Union City, Erie county in the extreme northwestern part of the State.

Phegopteris hexagonoptera (Michx.) Broad Beech Fern. Woods and thickets. The common phegopterid throughout.

Phegopteris polypodioides. Fee. Long Beech Fern. Woods and thickets. Locally abundant in the central mountain belt occasional or rare elsewhere.

POLYPODIUM VULGARE (L.) Polypody. Rocks. Common.

POLYPODIUM VULGARE *f.* MARGINALE. Gilbert. Named from material collected in Lancaster county by Waters. Since gathered by the writer in Delaware county.

POLYPODIUM VULGARE *var.* ROTUNDATUM. Milde. Reported in Gilbert's Monograph (*Fern Bulletin,* April, 1906) as having been found in Lancaster county.

POLYPODIUM VULGARE *var.* ALATO-MULTIFIDUM. Gilbert. Type collected by Edw. R. Heacock near Maunch Chunk, Carbon county, growing on red sandstone.

POLYSTICHUM ACROSTICHOIDES (Michx.) Christmas Fern. Rocky woods. Common.

POLYSTICHUM ACROSTICHOIDES INCISUM Gray. To be expected with the species. I have found it in situations that had apparently not been disturbed for years. (*P. A. Schweinitzii* (Beck) Small.)

POLYSTICHUM ACROSTICHOIDES CRISPUM. Clute. With the type reported from Allegheny county and no doubt occurs elsewhere.

POLYTICHUM BRAUNII (Spenner.) Braun's Holly Fern. Very rare. Finds its southern limit in Lycoming and Sullivan counties in northern part of the State.

PTERIS AQUILINA (L.) Bracken. In field, wood and swamp. Everywhere. (*Pteridium aquilinum* (L.) Kuhn.

PTERIS AQUILINA PSEUDOCAUDATA. Clute. Sandy wastes. Tinicune in Delaware county in the extreme southeastern corner of State which presents conditions similar to those in southern New Jersey where I find this form abundant.

STRUTHIOPTERIS GERMANICA. Willd. Ostrich Fern. Alluvial woods along streams. Local, but occurs throughout. (*Matteuccia struthiopteris* (L.) Todaro).

WOODSIA ILVENSIS (L.) Rusy Woodsia. Cliffs. Very local and mostly confined to eastern half. Luzerne, Lycoming, Huntingdon, Bucks, Monroe, Northampton, Blair, Chester and Pike counties.

WOODSIA OBTUSA (Spreng). Obtuse Woodsia. Wooded rocky slopes. Common.

WOODWARDIA ANGUSTIFOLIA Sm. Narrow-leaved chain Fern. Shaded swamps. Rare in Pennsylvania, though quite common in the pine barren swamps of southern New Jersey. Bucks, Delaware and Monroe counties. (*W. areolata* (L.) Moore.)

WOODWARDIA VIRGINIA (L.) Sm. Common chain Fern. Swamps, open or shaded. Very local. Susquehanna, Pike Monroe, Northampton, Bucks, Centre and Delaware counties.

SELAGINELLACEAE

SELAGINELLA APUS (L.) Creeping Selaginella. Wet meadows and swamps. Abundant in the southeastern section, common or local elsewhere.

SELAGINELLA RUPESTRIS (L.) Rock Selaginella. On rocks. Scarce. Recorded from Pike, Monroe, Northampton, Bucks, Berks, Chester Lancaster and Philadelphia counties. All in the eastern half. Probably in the west, though I find no record.

MARSILIACEAE

MARSILIA QUADRIFOLIA (L.) European Marsilia, Pepperwort or Water clover. Credited to Delaware county in Keller and Brown's Flora of Philadelphia and vicinity. Undoubtedly an introduction.

LYCOPODIACEAE

LYCOPODIUM ALOPECUROIDES (L.) Fox-tail. Moist wastes. Rare and local. In Delaware and Bucks counties in the southeast. Porter's List credits it to Erie county in the extreme northeastern corner of the State, but there is good reason to doubt the record. Mr. Harry D. Bailey of Lafayette College writes me that the specimens on which this record apparently rests, are accompanied by an unsigned note, stating in part, "There is some doubt as to this being an Erie specimen, but I think it is."

LYCOPODIUM ANNOTINUM (L.) Stiff Club-moss. Very local. Confined to the mountains and reaching its southern limit in Somerset county. Monroe, Tioga, Sullivan, Centre, Huntingdon, Cambria, Bradford and Somerset counties.

LYCOPODIUM CHAPMANI Lloyd and Underwood. Chapman's Club-moss. Rare. Bucks and probably Delaware county.

LYCOPODIUM CLAVATUM (L.) Common Club-moss. Woods. Locally abundant in the northern portion of the mountain belt. Infrequent or rare elsewhere.

LYCOPODIUM COMPLANATUM FLABELLIFORME. Throughout, though most abundant in the mountain counties.

LYCOPODIUM INUNDATUM (L.) Bog Club-moss. Borders of swamps and wet wastes. Rare. Monroe, Tioga, Sullivan, Centre, Huntingdon, Cambria and Somerset counties in the mountain belt. Not recorded south of Pennsylvania.

LYCOPODIUM INUNDATUM BIGELOVII. Tuckerman. Reported from Delaware county in the southeastern corner. I am inclined to doubt this record as specimens examined seem better referred to *L. Chapmani*.

Lycopodium lucidulum (Michx.) Shining Club-moss. Low, damp woods. Common throughout. I have succeeded in growing this species in a small jardinere partially filled with water for six or seven months. After several months it has a tendency to bend over the edge of the receptacle and downward as if in search of soil.

Lycopodium obscurum (L.) Tree Club-moss. Rich woods and wet thickets. Rather local, but occurs throughout.

Lycopodium selago (L.) Fir Club-moss. Rare. Top of a mountain at the Delaware Water Gap in Monroe county. The only record.

Lycopodium tristachyon (Pursh.) Woods. Rare. Fayette, Huntingdon, Monroe and Wayne counties and probably elsewhere in the mountains.

EQUISETACEAE

Equisetum arvense (L.) Field Horsetail. Roadsides, railroad banks, thickets, woods and swamps. Everywhere. The varieties, *decumbens* Meyer, *diffusum* Eaton, *nemerosum* A. Br.. and *pseudosilvaticum* Milde have been collected.

Equisetum fluviatile (L.) Water Horsetail. Open swamps. Local, but likely to be abundant when found. Tioga, Luzerne, Lehigh, Monroe, Northampton, Bucks, Bradford, Erie and Delaware counties. Is to be expected in suitable situations throughout.

Equisetum hiemale affine (Eng.) Scouring Rush. Waste places. Rather local, but to be expected throughout. Northampton, Bucks, Delaware, Chester, Lancaster, Erie, Lehigh Berks, Bradford and Crawford counties.

Equisetum hiemale robustum (A. Br.) Great

Scouring Rush. Waste places. Rare. Occurs in Delaware and Bucks counties. Probably the most eastern stations, though according to Eaton's Monograph, it is accredited to New Jersey by Milde.

EQUISETUM LAEVIGATUM (A. Br.) Smooth Scouring Rush. Reported from Northampton county, but probably a mistake for *Equisetum hiemale intermedium* A. A. Eaton which extends across New York and New England, but has not yet been recognized in this State.

EQUISETUM LITORALE (Kuhl.) Shore Horsetail. River banks. Rare though likely to be abundant when found. Northampton, Bucks, Delaware, Lancaster, York, Allegheny and Dauphin counties. Apparently not reported south of Pennsylvania.

EQUISETUM LITORALE ELATIUS (Milde.) Rare. Occurs at Safe Harbor, Lancaster county, along the lower Susquehanna according to Eaton's Monograph (*Fern Bulletin,* April, 1902.)

EQUISETUM PRATENSE Ehrh.) Shade Horse-tail. Sandy thickets along streams. Rare. Reported from Clearfield county, in central part of the State.

EQUISETUM SCIRPOIDES (Michx.) Dwarf Scouring Rush. Open woods. Credited to the State by various contemporary botanical works. I have been unable to locate specimens or definite records. The species is said to range from forty degrees northward, and should be looked for in the northern section of the mountain district.

EQUISETUM SILVATICUM (L.) Wood Horse-tail. Swamps and wet woods. Local, but occurs throughout.

EQUISETUM SILVATICUM SEROTINUM (Milde.) Swamps and wet woods. Erie and Huntingdon coun-

ties and should occur elsewhere together with other ecological forms.

EQUISETUM VARIEGATUM (Schleich.) Variegated Scouring Rush. Rare. Reported from Erie county in the extreme northern corner.

ISOETACEAE

ISOETES DODGEII (A. A. Eaton.) Dodge's Quillwort. Gravelly flats. Rare. On Delaware river shore in Bucks county, Lehigh river at Bethlehem, and in York and Bradford counties. Not recorded south of Pennsylvania.

ISOETES ECHINOSPORA BRAUNII (Englm.) Braun's Quillwort. Local. In lakes of the northern mountain district and probably elsewhere. Wayne, Lackawanna, Carbon Crawford and Erie counties.

ISOETES ECHINOSPORA ROBUSTA (Englm.) Rare. Recorded from Bucks county.

ISOETES ENGELMANNII (A. Br.) Englemann's Quillwort. Local. In lakes and streams. Monroe, Lehigh, Bucks, Delaware, Wayne, Lancaster, Susquehanna and Philadelphia counties.

ISOETES ENGLEMANNII FONTANA (A. A. Eaton.) In spring water a few inches deep at McCall's Ferry, Lancaster county. Type station.

ISOETES ENGELMANNII GRACILIS (Englm.) Rare. Delaware and Buck counties and should occur elsewhere with the type.

ISOETTES VALIDA (Englm.) Rare. Type locality in Lancaster county. Lebanon and Huntingdon counties.

ISOETES LACUSTRIS (L.) Lake Quillwort. Credited to Delaware county in The Flora of Philadelphia and vicinity (Keller and Brown). This was considered by Mr. Eaton as "Surely a mistake."

Isoetes riparia (Englm.) River bank Quillwort. On the Delaware river shore of the southeastern plain in Bucks, Philadelphia and Delaware counties. Originally collected by Nuttall near Philadelphia and until recently was considered peculiar to the Delaware. As *Isoetes saccharata* is known to grow on the New Jersey shore of the Delaware, its discovery in Pennsylvania is to be expected.

Philadelphia, Penna.

LYCOPODIUM ADPRESSUM FORMA POLYCLAVATUM FROM SOUTH CAROLINA.

BY W. C. COKER, PROFESSOR OF BOTANY UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL.

This peculiar form of lycopod was first described from Staten Island, N. Y. by McDonald and Clute in the *Fern Bulletin* vol. 9, page 8, 1901, and has recently been again reported by Clute from Florida (*Fern Bulletin* vol. 17, page 45, 1909.) While collecting at Hartsville, South Carolina, on the upper edge of the coastal plain in August, 1908, I found a number of good specimens of this rare and interesting form. The plants were all growing together within an area of a few square yards near the edge of an artificial lake. From the accompanying photograph of five of these plants it will be seen that the characteristic proliferation at the top of the upright fruiting stems varies all the way from slender and quite separate branches to broom like confluent expansions that resemble fasciations. All or nearly all of these proliferations were sporebearing.

Is this peculiarity the result of some peculiar environment or accidental injury? It would seem at least possible that it is due to the cutting off of the

tips of the fruiting branches during active growth, as for instance, by some browsing animal. It would be interesting to try the results of the removal of the tips of the upright stems at different stages of growth.

June 15th, 1909.

Since writing the above, I have made another visit to Hartsville and made a further search for these forms, which resulted in the finding of an indefinite number of them. In two large areas in damp open flats near the edge of the same lake where the first collection was made *L. adpressum* was so abundant as to be almost the dominant vegetation over hundreds of square yards. Here, mixed with the typical form, the polyclavate plants were so abundant that the number secured was determined only by the patience of the collector. In this particular area *L. Caroliniamum* is also found in large quantities overlapping to some extent the territory of *L. adpressum.*

It is interesting to compare the situations most affected by the three species, *Carolinianum, adpressum,* and *alopecuroides,* all of which are abundant at Hartsville. According to my observations *adpressum* is intermediate in its requirements between the other two, *Carolinianum* seeming to prefer a firmer somewhat dryer substratum than does the former, while *alopecuroides* is found in wetter situations than either, being happier in the sphagnum covered margins of branches, swamps and bays. *Alopecuroides* is perhaps most often associated with sphagnum, while *adpressum* is rarely so, and *Carolinianum* never.

In this journal for April, 1909, page 47, Mr. Clute gives it as his opinion that the normal plant of *L. adpressum* is "a mere ecological form; a northern extension of the well-known southern fox-tail club-moss *L. alopecuroides.*" Now it is not easy to see how Mr.

Clute can hold this opinion when we consider that *adpressum*, like *alopecuroides* itself is more a southern than a northern form, that they grow abundantly in the same territory over a large part of the south, often intermingling, and that it is never difficult to distinguish them in the field. The easiest way to separate the two in the field is by the arching, more or less clambering stems, and more flaccid texture of the former. Usually of course, the long and widely spreading leaves and sporophylls of the shoots, which gives them a not remote resemblance to the tail of a belligerent cat, will distinguish *alopecuroides* at a glance; but this character is not always so pronounced.

The difficulty of separating *adpressum* from forms of *inundatum* where the two meet in the middle and northern states is admitted, but much experience with *adpressum* and *alopecuroides* leads me to believe that they have a good title to specific distinction.

July 26th, 1909.

[It has fallen to the editor's lot to collect the so-called *L. adpressum* in numerous localities. He has brought in specimens from Long Island, N. Y., that puzzled Underwood to distinguish from *L. alopecuroides*. In all the locations where has seen "*L. adpressum*" growing it has been dryer than in the spots that produced *L. alopecuroides*. He is constrained to believe therefore, that *adpressum* is a form of *alopecuroides* due to a lack of moisture, and he is strengthened in this conclusion by the statement made above, by Dr. Coker as regards the habitat of the two forms. Cold, as well as dryness has a dwarfing effect upon plants, and it may be assumed that this will account for the absence of *alopecuroides* forms from northern regions.—Ed.]

PRONUNCIATION OF FERN NAMES

BY ADELLA PRESCOTT.

I had always supposed that any difficulties with the pronunciation of botanical names were due, partly to my ignorance of Latin, and partly to natural dulness, but when I found people who were neither dull nor ignorant, speaking with a careful precision that I well understood words that had often been stumbling blocks in my own ferny pathway, while others slurred them in a way that reminded me of the college professor who always wrote the *e* and *i* in words like *receive* exactly alike, placing the dot midway between them, I concluded that *some* of the difficulties, at least, were inherent, and not to be ascribed to the deficiencies of the students.

Having reached this conclusion I appealed to the editor of the *Fern Bulletin* for aid, to which he blandly responded that he would like to have me work out the problem myself and send the solution to the *Bulletin!* So I send these few hints hoping they will make the road to Fernland a little smoother for those who are just beginning to walk therein.

One thing that we unscientific folk miss (unless we are careful to look it up) is the helpful meaning of scientific names; for these names are not given arbitrarily but because they are descriptive, or at least suggestive, of the character of the plant. Most of them are formed according to the analogies of the Latin or Greek—mainly, I think, the Latin—and while the correct forms may always be found in a good manual it is not always convenient to look them up and the following rules may be found helpful, though perhaps not without exception.

The letter *e* at the end of a word is always sounded,

as *vul-ga-re, O-nei-den-se;* and when the *e* is followed by *s* it has the long sound as in the familiar word *Andes.*

In words that end in *ides* the *i* is long as in *eb-en-o-ides,* while *a* at the end of a word has the sound of a in father as *bulb-if-er-a. I* ending a final syllable has the long sound, but ending an unaccented syllable has the sound of *e;* as in *Boottii* pronounced *Boott-e-i.*

Among consonants *c* and *g* are soft before *e i and y* and hard before *a o* and *u.* The soft sound of *c* is like *s* as in *in-ci-sum,* and the hard sound is like *k* as *cau-da-ta.* The soft sound of *g* is like *j* as in *frag-il-is* and the hard sound like *g* in *an-gus-ta-ta.*

The letters *ch* are hard like *k* as in the familiar orchid; and initial *p* before *t* is silent as in *Pteris* pronounced *te-ris.*

Words of two syllables always have the accent on the first. If the syllable end with a vowel it is long as *fra-grans;* while if it end with a consonant the vowel has the short sound as in *sim-plex.* I do not consider this rule of much importance as very few botanical names are so short. As at least one vowel is essential to every syllable in every word there will be as many syllables as there are single vowels or single vowels and diphthongs.

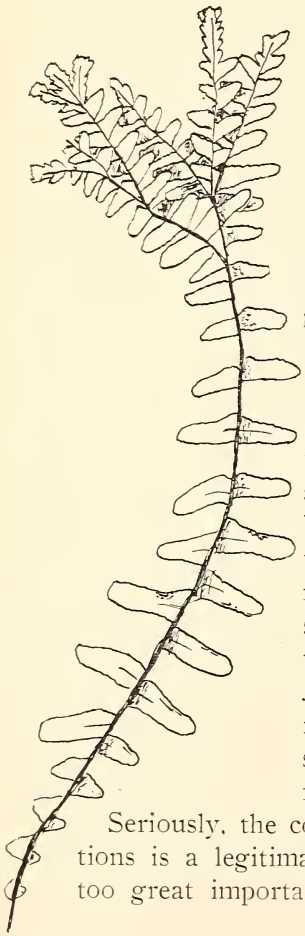
In conclusion let me say: Never pass a new word till you have established a "speaking acquaintance" with it, (which is quite a difficult thing from simply knowing it "by sight") and ere long you will find the combinations of many syllabled words slipping smoothly from your tongue to the envy of the uniti-ated who think *"polystichum acrostichoides"* is a rare exotic though in its every day guise of "Christmas fern" is may be a familiar friend!

New Hartford, N. Y.

RARE FORM OF FERNS.—XI.

A FORKED EBONY FERN.

Some day when the writer has time, he intends to write an article on variations in ferns that may be expected and in that article he expects to place well in the lead that form of variation which manifests itself in a deeper cutting of the frond than usual. In any species with toothed pinnules one is sure to find a deeply incised form if he searches long enough. The same thing is true of forking fronds. Every species may be expected to fork. Indeed, one might do as the students of violet hybrids and fern "hybrids" do, regarding their forms and predicate a theoretical forked crested and incised form for each species. I am not sure but what it would be an excellent thing to describe and name these forms in advance, so that when specimens were found it would only be necessary to add to the description the place of collection and the name of the collector. This would save nomenclature from the infliction of a considerable number of *Jonesii's* and *Smithii's* in fern names by which the collectors of such things have been most doubtfully "honored."



Seriously, the collecting and naming of fern variations is a legitimate branch of fern study, provided too great importance is not attached to the various

finds. The late L. M. Underwood was wont to call all such work "puerile" but the opinion is now pretty well current that the giving of a name to a form makes it all the easier to handle, whether in literature, in exchanging or in exact description.

In the form illustrated herewith, the expected has again happened. The incised form has been found several times and goes variously as *serratum* of Miller or *Hortonae* of Davenport. A short time ago the exact scientific name of the form was deemed of enough importance to warrant a change and it now occasionally appears in print as *Asplenium platyneuron incisum* (E. C. Howe). The forked form seems not to have been figured or described though a forked form without name was included in a list of ferns with forked fronds published in this magazine a dozen years ago. That we may in future know just what form is meant we suggest that the form illustrated herewith be known as *Asplenium ebeneum* f. *furcatum* or if the student is not very settled in his nomenclature he may prefer to know it as *A. platyneuron* f. *furcatum*. The specimen illustrated was sent to me from Asheville, N. Car., through the kindness of the collector, Miss Frances M. Wright. The plant was normal in all respects with the exception of the fronds, five in number, which were much branched at the apex. The frond illustrated was heavily fruited but sterile fronds also possessed the forking feature.—W. N. C.

OSMUNDA CINNAMOMEA FORMA ANGUSTA

BY D. LEWIS DUTTON.

In the latter part of the summer of 1904, when botanizing in a cedar swamp in Leicester, Vt., I found a peculiar form of *Osmunda cinnamomea*. It presented a withered or contracted condition and at first I thought

it might be caused by a late frost, but in following years the plants produced the same forms. I sent fronds to W. N. Clute and he considered it a form worthy of a name and called it forma *angusta*. Since first discovering it I have found plants scattered to a considerable extent through the swamp. It grows among plants of the normal type, there being more of the normal form than of forma *angusta* in any given area. I have this season found it in an open dry ledgy pasture several miles from the first station. The tips of the fronds in the open sunlight present a rusty brown shade. I have found plants that the lower portion of the fronds were normal and the tips contracted into the *angusta form*. I have a supply of material and any member wishing a frond may have the same by sending six cents to pay postage.

Brandon, Vt.

INDEX TO RECENT LITERATURE

Readers are requested to call our attention to any errors in, or omissions from, this list.

Benedict, R. C. *The Type and Identity of Dryopteris Clintoniana*. Illust. Torreya, Jl., 1909.

Clute, W. N. *The Dwarf Spleenwort.* Illust. Fern Bulletin, Ap., 1909.

Clute, W. N. *Traveling Ferns.* Fern Bulletin, Ap., 1909.—Reprint.

Clute, W. N. *Rare Forms of Ferns.—X.* Illust. Fern Bulletin, Ap., 1909. Discussion of *Lycopodium alopecuroides adpressum polyclavatum.*

Lee, E. L. *Asplenium Bradleyi in Alabama.* Fern Bulletin, Ap., 1909.

Prescott, A. *The New York Fern.* Fern Bulletin, Ap., 1909.

Pease, A. S. *Cryptogramma Stelleri in New Hampshire.* Rhodora, March, 1909.

Saunders, C. F. *Scolopendrium vulgare.* Fern Bulletin, Ap., 1909.—Reprint.

Shepard, J. *How to Make Blue Print Paper for Fern Prints.* Fern Bulletin, Ap., 1909.

Simpson, C. T. *Collecting in the Everglades.* Fern Bulletin, Ap., 1909.

Winslow, E. J. *Notes on Nephrodium Hybrids.* Fern Bulletin, Ap., 1909.

Stone, G. E. *The Power of Growth of Ostrich Ferns.* Torrey Bulletin, Ap., 1909.

The Filmy Ferns and Moisture.—One of the principal offices of the roots, stems and veins of ferns is supposed to be the supplying of water to the fronds, but the studies of Forrest Shreve lead him to conclude that the filmy ferns are not in this class. In a paper before the botanical section of the American Association for the Advancement of Science at the Baltimore meeting he stated that in the Hymenophyllaceae the leaves are the principal absorbing organs. Since most of the filmy ferns are inhabitants of tropical rain-forests living for the most part on the branches of trees remote from soil water, this is not unnatural. According to Shreve most Hymenophyllaceae can stand total submergence in well aerated water for a month, and will live and thrive without liquid water if kept in air of over 90 per cent. humidity. Even single leaves or parts of leaves will grow under such conditions. Very few filmy ferns can endure for any length of time a humidity as low as 70 per cent. though some hairy forms are able to do so.

EDITORIAL

The delay in issuing the present number is due to the fact that the editor has again been away from home. He realizes that this is a pretty good reason, but a rather poor excuse. He feels, however, that if he was always on time, it would cast more or less reproach on the other botanical publications, most of which appear occasionally. After all, we are all a bit inclined to fall behind in various things, though our intentions may be of the best. It is noticed in going over our subscription list that one or two have also been delayed in sending in their subscription. As a sort of a reminder of the fact we enclose bills for their perusual which will be found facing the frontispiece. Since delays are said to be dangerous we trust that they will take no unnecessary risks. And since 1909 is nearly gone, we suggest the precaution of renewing for 1910, as well.

* * *

When the Linnaean Fern Chapter of the Agassiz Association, which has since metamorphosed into the American Fern Society, was organized, its members were anything but skilled in fern matters and one of the main ends which it was hoped the organization of a society for fern study would accomplish, was the facilitating of exchanges between fern students. A large number of people have been helped to increase their collections in this way and the most altruistic spirit has prevailed. In a large number of cases, members have been glad to collect, press, label and pack the rare ferns of their region only asking that members who desired them should pay for their transportation. In view of the proposed Fern Exchange it may be added that the editor hopes the members who patronize

the exchange will continue also to keep up the good old practice of giving. The beginning members of our Society want all but the very commonest ferns. Indeed, we would not be surprised if an offer of the common polypody would find many applicants, for we do not all live in regions where the common polypody lives up to its name. So whether you exchange or not, don't forget to make the Society of use to new members, by offering them the interesting species of your region. Mention what you have to offer to the editor, name the amount of postage on each specimen, and he will do the rest.

BOOKS AND WRITERS

Volume 13, part 1 of "Contributions from the United States National Herbarium" is devoted to a second installment of studies of Tropical American Ferns by William R. Maxon. Several new species of Guatemalan ferns from the collection of Baron von Turckheim are described with notes on other species. In some observations on the bipinnate species of *Cyathea* one new species is described and in a revision of the West Indian species of *Polystichum* are several more descriptions of new species and various new combinations. All the new species of the revision are illustrated, a very commendable feature. It is not two much to say that all new species described now-a-days should be accompanied by a satisfactory figure, otherwise we are warranted in assuming that the novelty claimed exists only in the imagination of the described. We regret to note that this revision as usual has resulted in new names displacing several well-known old ones.

Of the sixty-one species of ferns and fern allies found in Great Britain, no less than forty-eight are

also found in North America. This singular duplication of our fern flora on "the other side" makes the literature of the ordinary British ferns of unusual interest to us. It was not so long ago, when for want of popular handbooks of our own on the subject, we resorted to such interesting little British guides as Cooke's "Fern book for Everybody" and Moore's "British Ferns," and even in view of the flood of recent American books on ferns, these foreign works have not lost their value and each new volume is welcomed by a considerable audience in America. The latest of these is a book by Edward Step entitled "Wayside and Woodland Ferns" the last of a series of volumes on plants treated in a similar way. In the present volume the author gives us a colored plate of every species as well as a photograph of the plant in its surroundings. The colored plates are not very remarkable but the photographs are excellent. There are also several illustrations of parts of fronds, sori, rootstocks, etc. Along with the plates is more or less matter of popular nature covering some 120 pages and giving information as to where the ferns grow, their reputed properties, folk-lore, etc. Each species is also described in untechnical language. The book is small enough to go into an ordinary pocket and is designed to accompany the fern collector on his rambles. It is published by Frederick Warne & Co., New York at $2.35.

Early in the Autumn, Messrs. Ginn & Co. will bring out a small volume entitled "Laboratory Botany for the High School" by Willard N. Clute. In this book which is designed to cover a year's work in high school botany the author has departed considerably from similar manuals now in use. Instead of outlining what the

student is to see, or of giving general directions for the study of certain subjects, we have here a series of definite questions on the subject to be studied. Even with the best of present manuals, the teacher has been obliged to make outlines of his own if he expected his students to go thoroughly into the work, but the questions in this book will relieve the teacher of this task. At the same time the sets of questions are so flexible that new questions may be added or others eliminated at will. Preceding each study there is more or less information for the teacher, telling where to get the materials needed, how to prepare and preserve them and how to present the subject to the pupils. With such a book botany will almost teach itself, leaving the teacher free to assist backward pupils, to set up and take down experiments, etc. The first part follows the usual half year course in botany, beginning with cells and seeds and running on through stems, leaves, flowers, fruits, etc. The second part, which is designed to cover the second half year of botany takes up the "spore plants," beginning with the simplest. Here again may be noticed a departure from the usual, for instead of a series of types to illustrate evolution there is offered a study of evolution illustrated by typical examples. Other unique features of the book are glossaries of different terms following each section, outlines for the study of floral ecology and a key for outdoor study of trees. A series of thirty-six experiments in plant physiology is designed to acquaint the pupil with the main facts relating to this subject by the use of the simplest materials. The book is written by a high school teacher for high school teachers and it is hoped that all live botany teachers will at least investigate its merits and methods.

THE AMERICAN FERN SOCIETY

President, Prof. E. J. Winslow, Elmira, N.Y.
Secretary, Prof. S. L. Hopkins, Central High School, Pittsburg, Pa.

Fern Students are cordially invited to join the Society. Address either President or Secretary for further information. The Fern Bulletin is sent free to members. Annual Dues are $1, and should be sent to Mr. H.G Rugg, Treas., Hanover, N.H.

The wife of Henry Merrill dide May 13th, after a long illness.—H.

Prof. E. J. Winslow will take up his residence in Auburndale, Mass. about Sept 1, where he will have charge of the science work in Lasell Seminary.—H.

Mr. Floyd has found it necessary to resign the office of Treasurer and Mr. Harold Goddard Rugg, of Hanover, N. H. has been appointed for the remainder of the year.—H.

In a circular letter signed by the President and recently sent to members is a sentence which is worth reprinting. It is as follows: "Send items of news for publication in *The Fern Bulletin* to the Secretary. Do not be over modest but report all changes of residence, botanical excursions, weddings, elections to office, etc. This will help us to get interested in each other. Do not hesitate to send to members of the Executive Committee any criticisms and suggestions regarding the conduct of Society affairs."

The following new members have recently joined the Society: Mrs. Clement B. Penrose, 182 West Cheltenham Ave., Germantown, Pa., C. M. Goethe, 2615 K St., Sacramento, Calif. The address of Mrs M. A. Noble is to be changed to Iverness, Fla., and that of Miss H. Mary Cushman to 3301 Powelton Ave., Philadelphia, Pa. Miss Cushman will teach botany in the Girl's High School in Philadelphia during the coming school year.—C.

ALL THE AMERICAN FERN BOOKS
AND SOME OTHERS

Ferns of Kentucky, Williamson (Out of Print.)
Ferns of North America, D. C. Eaton, 2 vols. (Out of Print.)
Fern Collector's Handbook, Sadie F. Price. (Out of Print.)
Ferns in Their Homes and Ours, Robinson. (Out of Print.)
Ferns of the West, Marcus E. Jones, paper..... $ .50
Ferns and Fern Allies of New England, Dodge..... .50
New England Ferns and their Common Allies, Eastman..... 1.33
Our Native Ferns, Underwood, 6th Ed..... 1.08
Ferns, Waters..... 3.30
Our Ferns in Their Haunts, Clute..... 2.00
How to Know the Ferns, Parsons..... 1.60
Fern Allies of North America, Clute..... 2.00
Fern Collector's Guide, Clute..... .54
How Ferns Grow, Slosson..... 3.25
Ferns and How to Grow Them, Woolson..... 1.17
Fern-wort papers. Paper..... .25
Ferns of the Upper Susquehanna, Clute. Paper..... .15
Boston Meeting Papers. Paper..... .25
Index to Vols. 1-10 Fern Bulletin. Paper..... .25
North American Pteridophytes, Gilbert. Paper..... 25
Ferns of Iowa, Fitzpatrick. Paper..... .20
Mosses and Ferns, Campbell, 1st Ed..... 4.00
Mosses and Ferns, Campbell, 2nd Ed..... 4.50

FOREIGN WORKS

Ferns of Nicaraugua, Shimek. Paper..... $ .50
The Fern Allies, Baker..... 1.25
A Fern-book for Everybody, Cooke..... .50
Book of Fern Culture, Hemsley..... 1.08
Wayside and Woodland Ferns, Step..... 1.75

Any of the above, to which a price is attached will be sent postpaid upon receipt of price. Out of print books may occasionally be obtained second hand nearly as good as new. The Fern Bulletin may be clubbed with any book listed at a dollar or more for 50 cents additional. A year's subscription will be given free with every order amounting to $5.00 or more.

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The Fern Bulletin

A Quarterly Devoted to Ferns

October

Joliet, Ill.
Willard N. Clute & Company
1909

The Fern Bulletin

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WANTS AND EXCHANGES

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WANTED—I would like very much to have specimens of CYSTOPTERIS FRAGILIS from every reader of the Bulletin. Will send in return any duplicates in my herbarium. L. S. HOPKINS, Central H. S., Pittsburg, Pa.

EXCHANGE—Will exchange walking fern or some Berkshire orchids for fresh specimens of LYGODIUM PALMATUM, Hart's tongue, ASPLENIUM RUTA-MURARIA, A. ABENOIDES, A. MONTANUM, PELLAEA, SCHIZAEA and others. Write first. W. I. BEECROFT, Cheshire, Mass.

WANTED—Numbers 2, 3 and 12 of the first three volumes of FERN BULLETIN at any price. FOR SALE—Numbers 2 and 4 of Vol. IV, FERN BULLETIN; also No. 8, (early no.) H. E. RANSIER, MANLIUS, N. Y.

PHILIPPINE FERNS or cash offered for Nos. 2 and 3, Vol. 1, of FERN BULLETIN. D. LEROY TOPPING, Treasury Bureau, Manila, P. I.

POLYSTICHUM ACROSTICHOIDES MULTIFIDA.

THE FERN BULLETIN

Vol. XVII OCTOBER, 1909 No. 4

MOUNTAIN SPLEENWORT IN NORTH-EASTERN OHIO

BY ERNEST W. VICKERS.

In June, 1893, during one of his early excursions in Mahoning county, the writer was so fortunate as to discover a new station for that rare Ohio fern the mountain spleenwort. The county is one of the north-eastern Ohio counties, known as the Highland counties and belongs to the Alleghanian life zone. The matter was allowed to rest without publication until the extent of the fern's local distribution might be ascertained. Thus far, however, the station has proven to be confined to a solitary, gigantic, river-eroded rock —a sort of stone island, shaped not unlike the body of a huge unwieldly canal-boat or, better, like Noah's ark. This unique and interesting mass of sandstone stands in the Mahoning river which gives the county its name in Berlin township near Shilling's Mill.

The geologist finds in this isolated rock interesting material for study in the line of dynamic force and time. Originally a peninsular prolongation of a sandstone ridge or "hog's back" the river sweeping in on one side and a tributary stream on the other finally cut it loose from the main land. And there it stands one of the most picturesque pieces of water statuary in the whole valley of the Mahoning.

"Standing Rock" is known for many miles around

and here the visitor comes to dine out of a No. 9 shoe box and scale its almost dangerous sides. The bather may take a high dive into its pool on the deep side or the desciple of Izaak Walton may cast his lure. How often it has sat for its picture so that people far away who perchance never never saw or heard of it may have its souvenir post cards. But it is of equal if not greater interest to the botanist for its flora, being one of the three or four stations in Ohio for *Asplenium montanum.* Small tufts of the plant are found growing below the middle line of the rock, just above high water. And as ice frequently jams at this point forming gorges in the valley behind, it is probably not surprising that so few plants grow there. According to Kellerman and Werner's "Ohio Plants" 1893, *A. montanum* is credited to Elyria, Lorain county, Lawrence county, Cayahoga Falls, Summit county and Clifton, Green county.

In his "Fern Flora of Ohio" Prof. Lewis S. Hopkins says that it is represented in the Ohio State Herbarium by specimens from Summit county, and records the collection of excellent specimens at Graber's Rocks, Tuscarawas county, Ohio. Having no specimens from other stations grown under different conditions, I am unable to say whether the fronds of my collection are up to the average or not. They are at least very fertile. As the plants are not numerous nor fronds plenty I have taken specimens very gingerly being exceedingly loth to reduce the station by so much as a single plant. As I am sending some of the best fronds collected to the Editor, he will kindly make note in passing, whether he thinks the plants are growing under what is normal or typical environment. They cling by

slender foot-hold in such clefts in the rock where nothing stronger rooted could grow.

Ellsworth Station, Ohio.

[The fronds sent were not much smaller than normal. Apparently the fern finds a rock crevice quite acceptable as a home.—Ed.]

RARE FORMS OF FERNS.—XII.

Polystichum acrostichoides multifida.

In this journal for July, 1907, a form of the Christmas fern having bipinnatifid pinnae was described as forma *multifida*. The description there given, however, appears not to have adequately described the form or, rather, it did not indicate all the vagaries of which the specimen in question is capable. Our frontispiece gives a clearer idea of the case. Of the four fronds there illustrated, the two nearest the center are from the original plant, while the two on the outside are from new plants raised from divisions of the original. But this is not all. The owner, Mr. William A. Terry, writes that young fronds now being produced by this plant are still more finely cut, each pinna being divided into numerous stalked pinnules and even the earlike projections of the original pinnae are pinnatifid. The plants are also increasing in luxuriance some specimens already standing nearly three feet high with fronds eight inches wide. The specimens photographed were but 19 inches high exclusive of the stipes.

In this remarkable specimen we seem to have a form in the making. It is not stationary as a mere bipinnate form but responds to a changed and protected environment with still more finely divided fronds. The species is not a distant relative of *Nephrolepis exaltata*,

the exotic fern that has yielded more desirable varieties to the cultivator than any other, and it is practically certain that our native species may be induced to do something similar, or even better. The ordinary Christmas fern is valued for decorative planting, and the new form, like the species, being perfectly hardy, while *Nephrolepis exaltata* is not, will have unusual value for out of door planting. Unfortunately the fern is slow to multiply. Up to the present, all new plants have originated from divisions of the crown, but it is likely that other ways of increasing it will be found.

GRAPE FERNS.

By Adella Prescott.

One who thinks of a fern as a graceful plant, tall and stately like the ostrich fern or dainty and exquisite like the maidenhair or oak fern finds it hard to believe that the *Botrychium* with its short fleshy stalk and spreading horizontal blade has even a remote relationship to so elegant a family. But an examination of the fertile part of the frond will convince the most skeptical (if he has any real knowledge of ferns) that these sturdy plants are surely ferns though some degrees removed, perhaps, from the highest forms, and while they lack the stateliness of some and the daintiness of others they yet have an attractiveness all their own in the rich coloring of their substantial fronds and the sturdy common sense that makes these late comers keep close to the ground where they are soon snugly covered by the falling leaves. *Botrychium Virginianum,* the rattlesnake fern, is perhaps the tallest member of the family and, making its appearance in early summer, has something of the delicacy and grace

that we commonly associate with ferns, but the ternate grape fern or *Botrychium obliquum* does not appear until July or August—the latest to arrive of all our ferns.

Beteween these two extremes come several of the small *Botrychiums*—the tiny moonwort by whose magical power the shoes are drawn from the feet of the newly shod steed; the little grape fern, the lance-leaved, and others which in spite of their wide range are rarely found, either because of their diminutive size which causes them to be easily overlooked, or because they are really rare, or at least very local, in distribution. You may look for them in rich woods or old pastures where the ground is moist but not wet but it will be a red letter day indeed when you find them!

But while many of us must get our knowledge of these rare forms from books or the herbariums of more fortunate collectors we who live in the north-eastern States may quite probably find on some sandy hillside or beside some old pasture fence the common grape fern, *Botrychium obliquum,* with some or all of its varieties. It is a very fleshy plant and seems to share the mechanical difficulties of fleshy people for it is only bent over in the bud instead of being coiled in the manner characteristic of ferns. The root-stock is short with numerous fleshy roots and the stalk rises from six to eighteen inches in height—rarely the latter—and the somewhat triangular blade springs from the common stalk near the base. It is twice pinnate with stalked pinnae and lobed or incised pinnules the lowest pair of pinnae being nearly as large as the rest of the frond.

The fertile part of the frond is three times pinnate, much taller and quite erect. The pinnules of the

sterile frond are quite variable in cutting; more so than one would realize without a careful comparison of specimens though several forms are so distinct as to be regarded as varieties if not species.

Perhaps the most attractive of these varieties is *dissectum* a fairly constant companion of *obliquum* and about the same size but with pinnules much divided and ending in *y* shaped segments that give it a lightness and grace lacking in other members of the family. *Intermedium* has a super-abundance of pinnules that lap and overlap in the press, while *Oneidense* like a middleaged matron (of by-gone time) is plain and severe in outline scorning all suggestion of frills. All are interesting and give zest to the excursions of late summer when many ferns are past their prime.

New Hartford, N. Y.

OPHIOGLOSSUM VULGATUM IN ONTARIO.

By F. J. A. Morris.

In spite of what you have published on the subject. I was, till the middle of July 1909, under the same impression as most amateur botanists that the fern was rare and local. On July first I found by accident about a score of these ferns in the corner of an upland pasture. Investigation disclosed hundreds up and down both banks of a little brook near Garden Hill ten miles north of Port Hope. About July 20th I was fern hunting with an old Oxford chum near Lanark, Ontario and while examining a fine clump of interrupted fern which was surrounded by sterile fronds of the native fern, I once more, by accident spied a group

of the adder's-tongue. Further search revealed a populous colony.

Three or four days later at the Rideau ferry while my friend was inspecting some *Botrychium ternatum* on the turf-grass margin of a beaver meadow he spied the adder's-tongue and we soon ran to earth an extensive colony. We showed the plant to an old pupil of mine who is working a mica property in the township of Burgess. He said he was sure it grew "out at the mine." This we ventured to doubt, for we still clung fondly to the fair illusion of its rarity. He drove us to the mine and we found the plant in and about two moist hollows of beaver-grass. Till then our finds had been accidental and we had stumbled on a singly colony in three distinct localities, but that day we went deliberately to likely places and in two out of three beaver meadows that we examined, the adder's-tongue was growing.

That was the last week of July and we spent August in the Algonquin Park, one of Ontario's Provincial forest reserves. As there are no meadows and few clearings we no longer thought of. *Ophioglossum* At the beginning of September my friend having sailed for Liverpool I returned to the Rideau and on a visit to the little brook where we had found the *Ophioglossum* a month ago, I found the beaver grass had been mown and the *Ophioglossum* had faded yellow and was quite easily detected. It was quite sad to see how many of the spikes of the fern had been mutilated by the mowers. I found four colonies of the plant established on both banks of the little stream over a space of about a quarter of a mile. Then I spent two days at the mica mine and found four more colonies in various parts of the property.

On September 12th I returned to Port Hope and spent a fortnight in scouring the neighborhood. Briefly the results are as follows: On the outskirts of the town in rolling country extendng over half a square mile which we call Monkey Mountain I have found the adder's-tongue abundant up and down and on both banks of three separate brooks as well as in the folds of the grassy valleys that traverse the district. In similar country near Quay's crossing, four miles north of the town, I have found six distinct colonies one of them numbering many hundreds of plants. In similar country six miles east of the town I have found three very large and populous colonies of this quaint little fern.

On October 3rd, while walking across country some seven miles north-east of here, I found three more stations for *Ophioglossum.* The first two containing each a few plants faded and with fertile spike in the proportion of 30 to 60 percent. Both had the plants growing on peaty hummocks of turf grass within or round the margin of marshes filled with *Nephrodium thelypteris.* The third containing some hundreds of plants in a dry hummocky pasture. Many of the plants were quite green with fruit spikes not yet fully grown.

I may add that while "old pastures" seem its favored location these are never the lush green grass of cow pastures, but upland meadows of the sheep pasture sort. The grass is more like mountain turf, often with an admixture of moss and a diminutive cyperus. The hummocks upon which it grows plentifully are usually rotted open at the top and not seldom crowned with the barren fronds of *Nephrodium thelypteris* or stunted *Onoclea sensibilis.* The adder's-tongue is us-

ually round the base and sides of hummocks. The plants that are still green and growing are always exposed in the short turf. Whenever the plant has had shelter by growing under a cedar or in sedge grass or in a clump of tall *thelypteris* it has fruited in July and faded. I gathered three such plants a week ago and their height was respectively, 9, 11 and 12 inches. The plants that are only now in season range from half an inch to four inches in height. Though thus stunted they are evidently healthy and at least fifty percent of them fruit abundantly.

Port Hope, Ontario.

BOTRYCHIUM LANCEOLATUM IN NORTHERN VERMONT

BY E. J. WINSLOW.

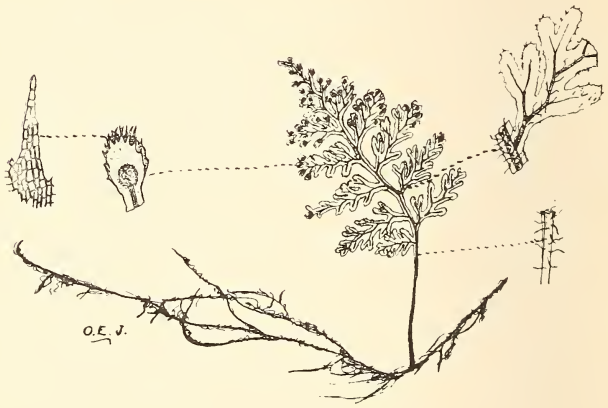
Last July while botanizing in the vicinity of Jay Peak, Vt., I found in the woods near the base of the mountain a single specimen of *Botrychium lanceolatum.* The plant was small but unquestionable. It was my first collection of this species, and the first I have seen reported from that part of the state. Eggleston, in the "Fern Flora of Vermont," (*Fern Bulletin* XIII, 2), says in two places that *B. lanceolatum* is only found in the lowlands of the southern part of the state. So this find almost on the Canadian line and at an elevation of upwards of 1500 feet seems worthy of note. Like most of the States, Vermont has large areas practically unexplored by botanists, and it is unsafe to say that any plant with a northward range is confined to a particular part of the state.

HYMENOPHYLLUM DENTICULATUM IN CENTRAL CHINA.

By Otto E. Jennings.

There was recently sent to me for identification a very pretty little fern which had been collected in August of this year by Mr. William Millward of the Nanking Methodist Mission while he was visting a summer resort, Kuling, in the mountains near Kiukiang, China.

The specimen turns out to be a rather under-sized but otherwise very typical plant of *Hymenophyllum*



denticulatum as described by Swartz in 1800 from specimens collected in Moulmein, Burma. Later, as reported by C. B. Clarke in the Transactions of the Linnaean Society for 1880, the fern had been found quite plentiful around Cherra Station in northern India, at Bhutan in the eastern Himalayas, and frequent at Khasia in Assam at an altitude of 4000 to 5000 feet. Christensen in 1906 gives the distribution of this

species as tropical Asia. It has been found in the Malay Peninsula and Islands.

From what has been said of the distribution of this plant it will be seen that our specimens are of considerable interest in that the natural range of the species is thereby extended to the north and east by about 1000 miles. The small size of the plant might, of course, explain why it has not before been reported from this region, even though it may not be uncommon there, and this possibility makes the discovery of the species of even higher interest to one interested in its distribution.

The drawings show a plant natural size with enlarged detail drawings of certain portions, as indicated by dotted lines.

Carnegie Museum Herbarium, Pittsburgh, Pa.

HUMUS-COLLECTORS AND MYRMECOPHILOUS FERNS IN THE PHILIPPINES.

The amount of study which has already been devoted to two of the most extraordinary specializations of ferns, those for collecting humus and for association with ants, spares me the necessity of entering into the details of either. Of humus collectors, we have at San Ramon, the nest-builders, *Asplenium musaefolium, A. phyllitidis* and *Drynaria rigidula; Polypodium punctatum* which makes brackets of leaf-bases interlaid and overlaid with humus and detritus which are sometimes 15 centimeters broad and almost as deep but which does not normally form round nests; *P. heracleum* and *Drynaria quercifolia,* which in their best development, form spiral brackets the supporting leaves being in a single series but imbricate; and *Thay-*

eria which makes a perfect independent receptacle of each leaf. Other Philippine humus-collectors are *Dryostachyum splendens* in Mindanao and Luzon and *"Polypodium" Meyerianum* in Luzon.

In its humus-collecting structures, *Thayeria* is wholly unlike any other known plant, the specialization having gone beyond the frond to the rhizome. Each leaf is a unit, a complete receptacle, wholly out of contact with the main rhizone. It is the most perfect of the humus-collecting organs developed in its group, the material being enclosed on all sides and protected from dessication with a thoroughness not attained even by *Asplenium nidus*. The specialization of the branch-end as a root-bearer in the bottom of the cornucopia is a very novel feature.

Our two remarkable myrmecophilous ferns, *Polypodium sinuosum* and *Lecanopteris* have recently been thoroughly studied by Yapp in which paper the previous literature is summarized. With regard to the anatomy there is nothing essential to add; but with regard to the significance of the bizarre form and structure of these and other myrmecophilous plants of this region, Yapp followed Treub and Goebel in a puzzling over-sight of the service rendered the plant by the ants, which insects furnish their hosts with mineral food.

Our myrmecophilous plants are, without exception, epiphytes. As such they are exposed to dearth of water and dearth of mineral food. When they protect themselves against the former by using devices to reduce transpiration, they aggravate the latter difficulty. Epiphytes have many ways of overcoming the difficulty of obtaining their mineral food, such as the maintenance of remote ground connections, the ac-

cumulation of an aerial "soil" in the mossy forest and in tree-top gardens at lesser altitudes; epecial humus-collecting structures such as have just been described; the insectivorous habit in *Nepenthes* and the attraction of insects for the debris they bring or for their excreta or their carcasses as with the plants now under discussion. The plants waste none of their parts for the support of the ants, offering them only a tolerably moist shelter and this is very evidently a sufficient inducement for the ants to seek them for I have never found a healthy individual of one of those plants without its tenants. The latter are not specialized in adaption to their specific hosts for the same ant inhabits the chambers of different plants; for instance, I have found one kind in *Polypodium sinuosum*, *Myrmecodia* and *Hydnophyllum* all in a single tree.

Although ants have not the reputation of being untidy house-keepers, the chambers which they occupy are never entirely clean. The plant can of itself, effect the quick removal of liquid ejecta; it can get rid of solid ones only as they are dissolved. I have found a fungus in an apparently healthy *Polypodium sinuosum* growing in the lining of the chamber and at first I imagined it might be analogous in function to mycorhiza, but it is not always present and it is probably merely accidental. Both of these ferns are without roots other than such as are necessary for their firm attachment and they habituality grow on bare branches, without any mass of epiphytes; therefore they would be in special straits for mineral food if it were not for their tenants ants. Nevertheless they are conspicuous for the ready falling of their leaves conclusive evidence that they are not in practice obliged to husband their ash constituents. The fact that *Polypodium*

sinuosum can live after its chamber is plugged (Goebel) and that *Hydnophyllum* and *Myrmecoidea* can grow and develop their chambers without the presence of ants (Treub) does not prove that ants are useless to the plants any more than the power of *Drosera* to live under favorable conditions without insects is a demonstration that the plant is not insectivorous. Of the two ferns, *Lecanopteris* is the more highly developed in myrmecophily, not only in grosser, conspicuous characters, but also in the perfection of its chamber, the walls of which, described and figured by Yapp, are made up of pockets which are doubly serviceable as collectors of possible food and as increasing the absorbing area.

The doctrine that these stems are enlarged water reservoirs and chambered and the reservoir tissue removed because they are too fleshy has a fit companion in that other which interprets the leaves of *Dischidia* as protectors of the roots but does not tell us what purpose roots serve in such a place. As a matter of fact these plants are also myrmecophilous, the leaves furnishing shelter for the ants and the ants furnishing food which the roots absorb. *Dischidia* is rarely without ants and rarely without a considerable amount of debris brought by them about the root inside each leaf. There are other Asclepiadaceae, epiphytic without evident structural modifications, the roots of which are invariably in aerial ants nests. In all these cases it is likely enough that the plant derives some organic as well as mineral food from its tenants..—*From an article on Sam Ramon Polypodiaceae in Philippine Journal of Science.*

THOMAS MINOT PETERS.

The smallest fern in the United States is named *Trichomanes Petersii* and commemorates a distinguished Southern botanist about whom, however, little seems to be known. We therefore publish the subjoined sketch from "Plant Life in Alabama" sent us by Dr. E. L. Lee.

Thomas Minors Peters, of New England parentage, but a graduate of the University of Alabama was engaged in the practice of law until his death June 14th, 1888. He served his state as a representative in the legislative assembly and afterwards as State Senator. In 1869 he was appointed a judge of the Supreme Court for a term of six years. In his love of Botany he found recreation from his professional duties, and his greatest enjoyment was to wander through the adjacent mountains in search of plants. The study of Lichens, and fungi attracted him particularly, and he was one of the few Mycologists, working in the southern field along with Curtis and Ravenel. Of his zeal and activity in his line, the long list of southern fungi, of his contribution published by M. A. Curtis and Berkley bears ample testimony. He was also a close observer and accurate student of the plants of higher orders. He first brought to light the delicate and extremely rare fern *Trichomanes Petersii* descibed by Gray with others like it hidden in the dark recesses of rocky defiles, and the so-called "rock houses." He gave close attention to the species of *Carex* furnishing the investigators of this difficult genus with material from a region unknown to botanists. In acknowledgment of the services rendered him, Boott of London, one of the first authors on these plants presented him with a copy of his magnificent work, "Il-

lustrations of the Genus Carex." These classical and valuable volumes Judge Peters bequeathed to the University of Alabama, his Alma Mater together with his mycological herbarium and collection of carices all mounted and labeled. In 1880 the writer had the privilege of enjoying the company of this venerable botanist during his investigation of the forests in Laurence and Winston countries, and also received from him much valuable information on the mountain flora of the state.

PTERIDOGRAPHIA.

New Station for Mountain Spleenwort.—Dr. L. G. Pedigo reports the recent finding of *Asplenium montanum* on the summit of Bald Knob in Virginia at an altitude of 4,500 feet.

A Variant Osmunda.—Through the kindness of Miss S. E. Hilt, we have received specimens of *Osmunda cinnamomea,* collected at Petersham, Mass., in which the margins of all the pinnules are revolute making a close resemblance to *Osmunda cinnamomea* f. *Angusta* recently illustrated. If this new form retains its unusual character it may prove worth naming.

Schizaea Pusilla in Newfoundland. — In *Rhodora* for May, E. H. Eames notes the finding of *Schizaea pusilla* in a salt marsh near the railway at Bay St. George Newfoundland. Of the other stations for this fern in Newfoundland that of Waghorne was in the vicinity of the Bay of Islands, 125 miles away and that of La Pylaie was probably on the French Islands. The discoverer of the new station reports as follows: "The plants were somewhat smaller than in

New Jersey, and as is sometimes the case they were more or less associated with *Aster nemoralis.* As particularly indicating the situation may be named *Xyris montana, Juncus stygius Americana* and *Bartonia iodandra* any of which may sometimes lead to other finds of this fern." The island abounds in situations of the same character, this tract alone covering many square miles.

Polypodium vulgare auritum.—On August 1st. in company with Mr. and Mrs. A. E. Scoullar and Mr. Henry W. Merrill, I searched several ledges in Standish for forms of *Polypodium vulgare.* We found a number of specimens of *Polypodium vulgare auritum,* eared on the lower side of the pinnae only, and it was also our good fortune to find a few specimens of *Polypodium vulgare auritum* (Merrill), eared on the upper side of the pinae only.—*Alice M. Paine, Sebago Lake, Maine.*

The Red-stiped Lady Fern.—Why is so little interest shown in the *rubrum* form of the lady fern? In this locality it is the first fern to unroll its fronds. We find it growing with the type, in the same soil, and same exposure to the light. Yet while one has a green stipe and rachis the other has both of a beautiful wine color, and often the midveins and blade have the same color in a lighter shade. Three seasons ago, I transplanted a plant of each fern, which I found growing side by side in a moist woodland, into drier soil, and an eastern exposure. The type has taken on a lighter hue and the segments are broader than before. The *rubrum* remains the same retaining its color in both stipe and rachis throughout the season. The same year that I transplanted them, I potted a small *rubrum*

and have wintered it in a cool cellar. Each spring it comes up true in color but the fronds are long and drooping, covering the side of the pot and lying on the table.—*Mrs. A. E. Scoullar, Sebago Lake, Maine.*

Shelter Island Ferns.—Shelter Island is a small island at the east end of Long Island, New York. The country is not one particularly favorable for ferns, but no less than sixteen species are known to grow there. The following list has been sent us by Miss Lavinia E. Chester: *Pteris aquilina, Asplenium ebeneum, A. filix-foemina, Nephrodium thelypteris, N. noveboracense, N. cristatum, N. marginale, N. spinulosum, Polystichum acrostichoides, Dicksonia pilosiuscula, Onoclea sensibilis, Osmunda cinnamomea, O. regalis, O. claytoniana, Woodwardia Virginica* and *Botrychium ternatum.* Doubtless several others will be found when every nook has been searched.

The Fertile Spike of Ophioglossum.—After a study of the vascular system of the sporophyte of the Ophioglossaceae M. A. Chrysler supports the view that the fertile spike is to be regarded as consisting of two fused pinnae. This is true of the species of *Botrychium* in which the fertile spike has a double vascular supply. The allied genus *Aneimia* is remarkable for always having two fertile spikes on each frond, both springing from the base of the frond and very evidently transformed pinnae. In view of this the double vascular supply to the *Botrychium* spike is quite according to nature. The Ophioglossaceae have always been regarded as a very ancient and simple family of ferns, but if the new view is correct, they may now be considered rather highly specialized.

Another Complete Set.—Still another complete set of *Fern Bulletin* may be recorded. Mrs. Wm. F. Brooks, New Britain, Conn., has completed her files. This is the thirtieth set to be reported.

Nephrolepis Magnifica.—Another form of the well known Boston fern has appeared and has been named *Nephrolepis Magnifica.* It is a course, more properly called *N. exaltata* forma *magnifica,* and appears to be but another of the many cut-leaved sports of this fern. Additional named forms may be expected until the gardening craft uses up all the superlatives.

Herbarium of B. D. Gilbert.—One of the finest of private fern herbariums was that made by the late B. D. Gilbert. It was accumulated by much collecting and exchanging and the naming of the specimens had been very carefully done. Shortly after the death of Mr. Gilbert, his library and herbarium were given to the Utica Public Library where they are at present. It is to be hoped that some provision will be made by which fern students will have access to the fern collection.

Ferns of the Malay Region.—In the *Philippine Journal of Botany* for April, 1909, E. B. Copeland has begun an enumeration of the ferns of the Malay-Asiatic region. The first part is devoted to the species not included in the Polypodiaceae and Hymenophyllaceae. In this part is also included a natural and an artificial key to the families of ferns and similar keys to the genera and species are found in the text. Each species is described and its range given. One notes in a cursory examination of this part, many familiar names of genera in-

cluding *Ophioglossum, Botrychium, Marsilia, Salvinia, Azolla, Osmunda, Lygodium, Schizaea* and *Ceratopteris.* Often the identical species with which we are most familiar are listed. Some idea of the great variety of tree-ferns that occur may be gained from the fact that 101 species of *Cyathea* (including *Hemitelia* and *Alsophila*) are listed. Not the least valuable part of the work are the twenty-one full page plates illustrating each genus treated.

Tree Ferns.—The development of an erect trunk and consequent formation of a tree fern appears to be due to a constantly humid condition of the atmosphere being maintained as then the roots springing from the bases of new fronds are not starved. Most of the crown-forming ferns maintain life in their old caudices to a distance from the growing terminal. Some display a tendency to raise the caudex perpendicularly while others push it horizontally. Our *Lastrea pseudo-mas cristata,* a variant of the tough evergreen species *L. filix-mas* has formed in my collection an erect trunk eighteen inches high under glass and this being wetted whenever the plant is watered has at the present time no less than 28 four-foot fronds forming a good specimen of the British tree fern. By the way few tree ferns produce thorns on the caudex. Your article gives one the impression that it is a general character. What is the species referred to?—*Chas. T. Druery, F. L. S., London.* [To one who has collected among tree ferns, Mr. Druery's question about the thorns will be astonishing. *Hemitelia horrida* is so named because of its stout sharp thorns and several other species have thorns either on the trunk or on the stipes where they join it. Almost all the American *Alsophilas* are thorny or prickly as their names often indicate. Some of the prickly species that come to mind at present are *A.*

aspera, A. armata, A. infesta and *A. sessilifolia.* Of the *Cyatheas,* we may mention *C. Concinna, C. Tussacii* and there are plenty of others. So far as the editor's observation goes, prickly tree-ferns are by no means rare.—Ed.]

Still Another Nephrolepis.—The naming of new forms of the old Boston fern (*N. exaltata*) goes merrily on. The latest is, to give the full name, *Nephrolepis exaltata elegantissima compacta.* It is a compact form of that plant with much-divided fronds known as *Nephrolepis elegantissima,* but in reality a form of *N. exaltata* as indicated above. While the names given to plants by gardeners and florists have very little significance to the scientific botanist we shall be none the worse for keeping these trivial names in mind. Although rather cumbersome and usually gradiloquent they represent forms that are quite distinct from the view point of the cultivator.

Permian Ferns.—The note on Coal Measures ferns in the January 1909 *Fern Bulletin* called to mind a deposit of Permian ferns or fern-like plants discovered in 1906 by one of the field parties of the University Geological Survey of Kansas. We were mapping the Permian-Dakota contact in Washington County, Kansas and noted a fern horizon in a layer of limestone concretions near the top of the Winfield (?) limestone. The next day we returned to the exposure with some tools and opened up the deposit. By properly splitting the limestone, whole fronds were exposed in an almost perfect state of preservation. A large quantity of the material was shipped to the University of Kansas where it was identified by Prof. E. H. Sellards and will soon be published, along with other Permian plants. *F. C. Greene.*

A Correction.—In my article in the April *Bulletin*, page 36, line 15 for *N. Clintonianum X spinulosum* read *N. cristatum X marginale* the typographical error arises from copying the fifth line below.—*E. J. Winslow.*

Fossil Ferns.—Rev. James A. Bates asks for information regarding fossil ferns. Who has studied them and where can the literature of the subject be obtained? The United States Government has issued several quarto volumes with numerous plates on the fossil flora of various coal measures but we know of no complete list of such publications. If any of our readers can supply additional information we shall be glad to publish it. It is about as easy to recognize the common genera of fossil fern-plants as it is to recognize modern genera, and various species can usually be as readily distinguished. The region immediately south of the home of the *Fern Bulletin* is famous for its coal fossils and has recently yielded new material that throws an important light on the origin of the flowering plants. Every mineral collection, hereabout is sure to contain specimens of fossil ferns which may be had for the picking up about the dumps of many mines.

More Nephrolepis "Species."—Gardeners everywhere ought to be thankful that a single variable species of fern is likely to produce forms enough to allow each grower to name one after himself. The namers of the new forms of *Nephrolepis exaltata* have not the slightest idea of nomenclature, except the fact that if one adds an i to the end of his name and adds this to the generic name of the fern in question it is supposed to be named for him. That the canons of good taste forbid that anybody should name a species or variety

for himself seems never to have entered the heads of these makers of new varieties. Since the forms in question are all mere variations of *Nephrolepis exaltata* giving names to them can be looked upon as a harmless diversion. Nevertheless it seems desirable to keep track of these names and we therefore add to the list previously published the names *N. Pruessneri* (*N. exaltata f. Pruessneri*) and *N. Galvestoni* (*N. E. f. Galvestoni*). In the language of the country newspaper "let the good work go on."

Pollination and Fertilization.—It is singular how long a misconception in science can linger on in out-of-the-way parts of the world. One would think that by this time the essential difference between pollination and fertilization might be understood, but thousands of Darwin's countrymen continue to confuse the two. In a recent article on reproduction in ferns by an English author the statement is made that the sperms of ferns enter the archegonia and "fertilize the seed at their base precisely in th same way as pollen fertilizes the seed of flowering plants." Since pollen in no case ever "fertilizes a seed" in any kind of a plant we fail to see where the "precisely" comes in. What pollen really does when it falls upon a stigma is to germinate producing a structure that is homologous with the structure formed by a spore in ferns; in fact, a pollen grain *is* a spore, exactly like the spores of ferns. The structure produced by the pollen grain produces sperms in its turn and these fertilize an egg which has been developed in the embryo seed. Pollination is the term used to indicate the application of pollen to the stigma while fertilization denotes the union of an egg and a sperm. Pollen grain and

sperm are so far apart that they do not even belong to the same generation, but because Darwin once wrongly used th term fertilization all loyal Britons continued to use it. Whether a fern springs from a seed or spore is of no particular significance to the collector, but if the processes intervening between asexual spore and fertilized egg are to be explained at all, it is just as well to have the matter right, and we repeat that neither sperms nor pollen grains ever "fertilize a seed."

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any errors in, or omissions from this list.

CLUTE, W. N. *Rare Forms of Ferns.—XI. A Forked Ebony Fern*, illust. Fern Bulletin Jl. 1909. A plant with five forked fronds reported from North Carolina and named *A. ebeneum* f. *furcatum.*

CLUTE, W. N. *The Dwarf Spleenwort,* illust. American Botanist, Ag. 1909.—Reprint.

COKER, W. C. *Lycopodium adpressum forma Polyclavatum from South Carolina,* illust. Fern Bulletin Jl. 1909.—This form reported in abundance near Hartsville and figures of some of the most remarkable given.

DUTTON, D. L. *Osmunda cinnamomea forma angusta.* Fern Bulletin Jl. 1909.—Further notes on the range of this form.

MARQUETTE, W. *Concerning the Organization of the Spore Mother-cells of Marsilia quadrifolia,* illustrated. Transactions of the Wisconsin Academy of Science, Ap. 1908.

Poyser, W. A. *The Fern Flora of Pennsylvania.* Fern Bulletin Jl. 1909.

Prescott, A. *Pronunciation of Fern Names.* Fern Bulletin Jl. 1909.

Pteridographia. Fern Bulletin Jl. 1909. *Filmy Ferns and Moisture.*

FERNS FOR WINTER.

Some ferns grow much better in ferneries than others and it is well to have this in mind when selecting ferns for that purpose. Of all our native ferns there are probably none that respond so readily to this method of growing as the common polypody and the beech and oak ferns. They often grow so luxuriantly that the older fronds have to be cut away to make room for the new growth. Plant these by all means. The curious little walking leaf is always an object of interest and one of the best ferns for indoor culture. Of the spleenworts, the ebony and maidenhair spleenworts are very fine and grow rapidly. The circular tufts of the latter are just the thing for miniature rockeries. Small plants of *Nephrodium cristatum, marginale, spinulosum* and *acrostichoides* can be recommended and the two species of *Cystopteris* should not be forgotten. The common maidenhair ultimately sends up an abundance of fronds but requires some time to get started. Many species of our common ferns grow too tall and rank for the fernery unless it happens to be a large one but if one can secure a tiny specimen of some of these they are very pretty. None show a greater contrast than the broad fronds of *Onoclea sensibilis* among the much divided foliage of other species. —*Reprinted from Linnaean Fern Bulletin No. 7.*

EDITORIAL.

Readers of this magazine should keep in mind the fact that we are always glad to replace free any soiled or torn copies sent out. It is manifestly impossible for us to see every page of any issue and occasionally the printer's devil leaves the inpress of his hoof or claws on a sheet that gets past us, but any who receive copies of this kind should ask for new ones at once. Now that another volume is completed it would be well for subscribers to examine their files and if any copies are not in good condition to secure perfect ones without delay, since the numbers on hand are now made up into volumes and any odd numbers left over are sent out as sample copies. It is not necessary to return the soiled copy; ask for the new one you want.

* * *

The suggestion so often made in these pages that fern study in other parts of the world would be helped by another publication devoted to the subject, has at last borne fruit in the shape of *The British Fern Gazette* the first number of which bears date of September 1909. The magazine is issued by the British Pteridological Society and is edited by Mr. Charles T. Druery well and favorably known to readers of *The Fern Bulletin.* This first issue is a very attractive one, the most attractive one that could be made, we are inclined, with pardonable pride, to think, since it is the exact size of our own publication and duplicates numbers of a few years ago even to the color of the cover the possession of a frontispiece and the style of type. This, however, is said in no disparagement of the magazine, for it is quite desirable that fern literature have something like uniformity in the style of its

publications. The twenty-four pages of the first number are taken up entirely by various articles of its editor, and shadows forth the peculiar British bias regarding ferns, in that it deals almost exclusively with abnormal forms. In subsequent numbers we are promised articles from other contributors though the present one is well worth the reading as the titles of such articles as "Our Native Ferns," "The Life History of a Fern" and "Fern Hunting Episodes" will indicate. We have looked through the edition in vain for a statement of the price of subscription, but we assume that it may be somewhere near a dollar a year since the publication is sent free to members of the British Pteridological Society who pay annual dues of five shillings. We are not advised as to whether sample copies will be sent or not, but those who are inclined to investigate the matter should address the editor at 11 Shaa Road, Acton, London, W., England. Evidently the magazine is to be strictly a British one for in listing the literature of British ferns no account is made of American works that treat of British species and this publication, which has had considerable matter in past volumes relating to British ferns, is not even mentioned.

* * *

Not so long ago, a fern hybrid was considered to have only a mythological existence and Dr. Underwood is on record as insisting that *Asplenium ebenoides* is not a hybrid but a distinct species. The production of this form by the crossing of *Asplenium ebeneum* and *Camptosorus rhizophyllus* showed how wide of the mark the opinion of even an eminent fern student may be, and at the same time gave room for the suggestion that many variations of common ferns

are also hybrids. In the opinion of the editor of this magazine, the contention that an immense amount of hybridization exists in a group of the wood ferns (*Nephrodium*) must be set down as not proven. It is true that many forms that do not fit our descriptions of the species have been found and it is also true that some of them look as if they might be intermediate between two species, but if we can read anything from the recent literature of hybridization it is clear that the first cross seldom gives individuals intermediate between the two parents but that it requires the second generation to bring out the distinctions. The work of crossing ferns is an infinitely more delicate operation than crossing flowering plants and, owing to the nature of the plants in question, a generation of so-called hybrids may not be hybrids at all but mere variations. The prothallium may produce new ferns by budding, which avoids crossing at all, and even the best of crossing is largely guess-work due to the fact that prothallia from which one or the other sex-organ has been removed can develop new ones, or the eggs may have been fertilized before the sperms were removed. If we hoped to produce variable ferns, mutilating the gametophyte or prothallium would be one of the first means suggested and it is not to be wondered at that a lot of mutilated prothallia should give some variable plants. We do not insist that the wood-ferns do not hybridize but we venture the opinion that they do not do so as regularly as the description of new hybrids in the group would lead one to believe. If the variation in the wood fern is to be ascribed to hybridization, to what shall we attribute similar variation in the grape-ferns? One of the fundamental principles of any kind of organic evolu-

tion is that animals and plants vary, and we are inclined to look with suspicion on any scheme that would do away with such variation.

* * *

In the "Smithsonian Miscellaneous Collections," vol. 5, part 3, Carl Christiansen, author of "Index Filicum" has an article on "The American Ferns of the group *Dryopteris opposita* contained in the U. S. National Museum" which illustrates very interestingly the nice distinctions that now subsist between the tropical species of ferns. Every little while we have a suspicion that some of the described new species are not as important as the sounding names bestowed upon them would indicate, but it is seldom that we find an account of them that so naively admits the questionable validity of the so-called new species. We fear Mr. Christiansen lacks the yankee ability to throw dust in the eyes of his critics when proceeding to split up tweedledee and tweedledum. For instance, of his new species, *Dryopteris columbiana* he says: I now prefer to refer here this number, determined previously by myself and Hieronymus as *D. oligocarpa* from which it differs in its longer leaf and by the shorter pubescence of the rachis. Nevertheless, I have some doubt if my proposed species can be held distinct from *D. oligocarpa.*" Here our author is too modest. Instead of having some doubts he ought to be dead sure of it. A longer leaf and shorter pubescence does not make a species. Of *D. Muzensis* he says "The main difference from *D. Columbiana* is in the absence of long setae on the veins above." And the author doubts if *Columbiana* is in itself a good species! Another species, *D. Melanochlaena,* based on a *single leaf* is distinguished from its nearest relative "by its coal-black

scale-like indusia, ciliate with whitish hairs." Seems to us that a species founded on the color of the indusia of a single frond or any number of fronds for that matter, is not very well founded, to say the least. *Dryopteris pittieri* "is founded upon an imperfect specimen without rhizome or stipe," and so the list goes. There can be no doubt that many of the species mentioned in this article are different from others, but that the differences are anything more than trivial variations is beyond belief. They rather belong to the category of what De Vries calls "Elementary species." Those who wish to consider them good species are welcome to do so, but for ourselves we prefer a more conservative view. When a long list of new species from the tropics are described again, however, it is well to remember what small differences the scientists are selecting to distinguish them and be governed in one's judgment accordingly.

BOOK NEWS.

A very well written account of the common objects of nature for use in nature study is contained in S. C. Schmucker's "The Study of Nature." It begins with a chapter on "what nature study is"—all such books do—and runs on to aims and purposes from the teaching standpoint. Then comes the bulk of the book devoted to the materials of nature study which we heartily commend, and the work is finished with directions for a course in nature study. In the chapter on "Helpful books" the author betrays his unfamiliarity with much of the literature of the subject. All the books mentioned, however, are useful in their own field. The book is published by Lippincotts.

Publication No. 94 of the Carnagie Institution is entitled "The Structure and Life History of the Hay Scented Fern" and is devoted to an extended study of the boulder fern which the author calls *Demstaedtia punctilobula* (Moore). The microscopic structure of the plant is very thoroughly outlined. In the synonomy of the plant there are fourteen combinations quoted from the works of sixty-one authors. Of these, *Dicksonia pilosiuscula* seems to be the favorite to judge from the number of authors who have used it. Twenty-four plates containing 270 figures add much to the value of the work. The price is 50 cents.

THE AMERICAN FERN SOCIETY

President, Prof. E. J. Winslow, Elmira, N. Y.
Secretary, Prof. S. L. Hopkins, Central High School, Pittsburg, Pa.

Fern Students are cordially invited to join the society. Andress either President or Secretary for further information. The Fern Bulletin is sent free to members. Annual Dues are $1, and should be sent to Mr. H, G. Rugg, Treas., Hanover, N.H.

Owing to delays in making up the list of candidates for office in the Society for 1910, the time for voting will not end until the first of December. The result of the vote will be announced in the January issue of this magazine, since it would make the present issue too late to wait for it Notices of election have been sent to all members. If anyone fails to receive such notice a new one may be obtained from the chairman of the Advisory Council.

The Society is making gratifying gains in membership. We welcome to our lists the following who have joined since the July issue of this magazine was printed: Dr. G. M. Winslow, Lasell Seminary, Auburndale, Mass.; John R. Swinnerton, 2115 Chestnut

Ave., Newport News, Va.; Geo. L. Moxley, 1161 East 40 st., Los Angeles, Calif.; W. J. Dowkes, 175 Painter St., Owens Sound, Canada; Miss Kate Jones, 240 Jewett St., Lowell, Mass.; Miss Nancy Darling, R. D. 2-34 Woodstock, Vt. and Miss Flora B. Neumont, 336 N. Craig St., Pittsburg, Pa. The membership is now 162, the largest it has been in the history of the Society.

The address of S. Fred Prince is now University of Illinois, Urbana, Ill. Mrs. Emily Hichcock Terry, long connected with Hubbard House, at Smith College, Northampton, Mass., has left because of ill health and is now at Bennington, Vt., where she should be addressed in care of W. B. Sheldon, Esq.

The Society has recently reprinted the circular of invitation which may be used in soliciting others to join the Society. It also includes a proposition for a fern exchange. Extra copies of the folder may be obtained by addressing the Secretary.—C.

Secretary Hopkins has had several calls for the early Annual Reports of the Society and asks members having extra copies of any Reports previous to 1907 that they are willing to part with, to send them to him.

President S. M. Newman of Front Royal College in Virginia, has accepted a similar position in Kee Mar College, Hagerstown, Md., and should be addressed there in future.—C.

Dr. Dana W, Fellows, formerly Vice President of the Society, has been appointed a member of the Board of Examiners in the practice of dentistry for the State of Maine.