THE

FERN BULLETIN

A Quarterly Devoted to Ferns

EDITED BY WILLARD N. CLUTE

VOLUME XIV

BINGHAMTON, N. Y.
WILLARD N. CLUTE & CO.
1906

CONTEN

Vol. XLV No. 1

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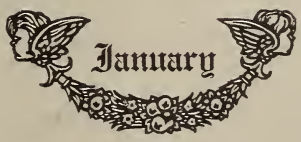

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A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, Editor

Willard N. Clute & Co., Publishers, Binghamton, N. Y.

20 Cents a Copy ; 75 Cents a Year.

AWARDED GRAND PRIZE AT THE PARIS EXPOSITION

To insure subscribers against loss of one or more numbers between the expiration and renewal of their subscriptions the journal will be sent until ordered stopped. All arrearages must be paid. Personal Checks Must Contain Ten Cents Extra for Collection. Otherwise credit will be given for the amount less collection fees.

Entered at the Postoffice, Binghamton, N. Y., as second-class mail matter.

The American Fern Society

(Formerly Linnæan Fern Chapter)

President, James H. Ferriss, Joliet, Ill.

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Fern students are cordially invited to join the Society. 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, Oneida, N. Y.

PLATE I

FORMS OF BOTRYCHIUM MATRICARIÆFOLIUM

THE FERN BULLETIN

VOL. XIV. JANUARY, 1906. No. 1

THE FERN FLORA OF CONNECTICUT.

BY CHARLES H. BISSELL.

The little state of Connecticut forms the southwestern corner of the group of six states generally known as New England. It has an average width of about sixty miles, from north to south, and from east to west a length of over ninety miles. Its southern boundary is formed by the waters of Long Island Sound. The general contour is a series of hill ridges extending north and south, reaching their greatest elevation along the northern border and decreasing gradually in height as they approach the seashore. The highest point in the state is in the extreme northwestern corner where Bear Mountain reaches an elevation of 2355 feet. The state is cut across from north to south by three rivers, the Housatonic to the west, the Connecticut in the central part, and the Thames to the east; except for small streams emptying directly into Long Island Sound practically the entire surface of the state is drained by these rivers. Small lakes and ponds abound, but Bantam Lake, in the town of Litchfield, noted as the home of *Marsilia,* is the largest body of fresh water in the state, being about three miles long with an average width of at least three-fourths of a mile.

The greater part of the rock formation is granitic in character, but other forms occur. A belt of Connecticut River sandstone stretches across the state from north to south in the central part, and this in places is mingled with ridges or dykes of trap rock. In the northwestern part of the state are districts where the

prevailing rock is limestone. Geological formations have an important bearing on the distribution of ferns and we have enough of the basalt and limestone to furnish homes for a number of species that prefer such a habitat.

The more interesting parts of the state have been very thoroughly botanized for many years, but in spite of this fact several of the rarer species listed are of recent discovery. It has not been thought desirable to increase the number of species and varieties by listing all the slight variations or abnormal forms that have at some time been described. Only those varieties seeming to have in this region well marked and permanent characteristics are given a place in the list. Further study may show that some of these excluded forms are good varieties and give them a place in future publications. The nomenclature used is in accordance with the new Vienna code adopted by the Vienna Congress of 1905.

POLYPODIACEÆ.

Polypodium vulgare L. Common Polypody. Frequent throughout on shaded ledges. The form known as var. *Cambricum* with broader pinnæ and cut segments sometimes occurs.

Phegopteris polypodioides Fee. Long Beech-fern. In rich moist woods and on shaded banks; rare or local in eastern and southern districts, becoming common to the northwest.

Phegopteris hexagonoptera Fee. Broad Beech-fern. Frequent of occasional in rich woods, either moist or dry, throughout. Some forms approach *P. polypodioides* Fee. in appearance.

Phegopteris Dryopteris Fee. Oak Fern. Rocky woods in rich moist soil. Rare or local over most of the state, becoming frequent to the northwest.

Adiantum pedatum L., Maidenhair. In rich woods frequent throughout.

Pteris aquilina L. BRAKE. Common in open woods and thickets, usually in dry sandy soil.

Cheilanthes lanosa Watt. HAIRY LIP-FERN. Known from only one station in the state, growing on the precipitous face of West Rock, New Haven. Discovered there by Mr. Gilbert van Ingen (see FERN BULLETIN, IX-7). This is called the northern limit of the species.

Pellæa atropurpurea Link. PURPLE CLIFF-BRAKE. Rare or occasional on dry exposed ledges of either limestone or trap.

Cryptogramma acrostichoides R. Br. SLENDER CLIFF-BRAKE. Very rare and of recent discovery in the state, growing on moist shaded ledges of calcareous rock. Kent (Eames and Austin) Salisbury (Mrs. Charles S. Phelps). It is also reported from New Haven.

Woodwardia virginica J. E. Smith. CHAIN-FERN. Wet swamps often in sphagnum. Plentiful at some stations, but rather local in its distribution.

Woodwardia areolata Moore. CHAIN-FERN. Occasional in wet or swampy woods near the coast, becoming rare or absent inland.

Asplenium pinnatifidum Nutt. One of our rarest ferns. It was found growing on rock ledges at Sharon by Mr. E. I. Huntington (see FERN BULLETIN, XI-14). I have no other report of it from the state.

Asplenium ebenoides R. R. Scott. This rare species, now regarded by many as a hybrid, has been reported from only two stations in the state, both in the town of Canaan. The first collection of it was by Mr. J. S. Adam in 1876. Mr. Adam informs me that the plant flourished there until 1891, but has not been seen since. One plant was found at another station a few years ago by Mr. C. K. Averill.

Asplenium Trichomanes L. MAIDENHAIR SPLEENWORT. On shaded ledges. Rare or occasional near the coast, becoming frequent northward.

Asplenum platyneuron Oakes. EBONY SPLEENWORT.

Frequent in dry rocky ground, more often in half shade, throughout. The form with more deeply cut pinnæ known as var. *serratum* occurs occasionally.

Asplenium montanum Willd. Mountain Spleenwort. Rare. Growing in crevices of dry, usually overhanging ledges. Known from a few widely scattered stations. North Stonington, Scotland, Franklin, East Haddam, Beacon Falls and Salisbury. The last named station, discovered by Mrs. C. S. Phelps, is believed to be the northern limit of its known range.

Asplenium Ruta-muraria L. Rue Spleenwort. Occasional on rocks in the limestone district, rare on the trap dykes, not reported elsewhere.

Asplenium angustifolium Michx. Narrow-leaved Spleenwort. Rare in moist, rich woods, apparently confined to the region of trap dykes. Guilford, Berlin, Meriden, Southington.

Athyrium thelypteroides Michx. Silvery Spleenwort. Moist rich woods occasional throughout.

Athyrium Filix-fœmina Bernh. Lady-fern. Common in woods, thickets, and along fence-rows in various soils throughout. There are many described forms, most of which seem to be caused by the soil, the exposure or some special habitat.

Camptosorus rhizophyllus Link. Walking-leaf. On shaded ledges of limestone, granite, sandstone or basalt. Rare or occasional throughout, becoming frequent in the limestone district.

Polystichum acrostichoides Schott. Christmas Fern. Common throughout in woods and on shaded banks. Several forms have been described and are occasionally seen.

Nephrodium Thelypteris Desv. Marsh Fern. Common in swamps and wet ground throughout.

Nephrodium simulatum Davenport. Massachusetts Fern. Rare or local in wet woods and cedar swamps in southern part of the state. Not reported from northern districts.

Nephrodium Noveboracense Desv. New York Fern. In moist woods, frequent throughout.

Nephrodium marginale Gray. Evergreen Wood-fern. Common in dry woods in rocky ground throughout.

Nephrodium Goldieanum Hook. Moist rich woods, rare or local. Not reported from eastern part of state.

Nephrodium Boottii Davenport. Occasional throughout in moist or wet woods, usually growing near *N. cristatum.*

Nephrodium cristatum Michx. Crested Shield-fern. Frequent in wet woods and shaded swamps throughout.

Nephrodium cristatum var. *Clintonianum* Gilbert. Rare or occasional in wet woods and swamps, often growing with the typical form.

Nephrodium cristatum X marginale. This hybrid form has been collected at Granby (I. Holcomb) Waterford (Dr. C. B. Graves) and at East Lyme (Miss A. M. Ryan).

Nephrodium spinulosum Desv. Spinulose Wood-fern. Occasional in moist or wet woods throughout.

Nephrodium spinulosum var. *intermedium* Davenport. Occasional or frequent in rich moist woods. Forms approaching var. *dilatatum* Hook. occur: also those seeming to answer to var. *fructuosum* Gilbert.

Cystopteris fragilis Bernh. Frequent on moist shady ledges throughout. One of the earliest ferns to appear in the spring.

Cystopteris bulbifera Bernh. Bladder-fern. Common in rich moist woods and meadows and on wet ledges in western districts, becoming rare and extinct eastward.

Woodsia ilvensis R. Br. Rusty Woodsia. Rare or occasional on dry exposed ledges.

Woodsia obtusa Torr. Occasional throughout in dry rocky woods or in half shade.

Dicksonia punctilobula Gray. Hay-scented Fern.

Common throughout in woods and pastures both dry and moist, often forming large colonies.

Onoclea sensibilis L. Sensitive Fern. Common Throughout in low fields and in swamps. The form with the same frond, part sterile and part fertile, called var. *obtusilobata* sometimes occurs.

Onoclea Struthiopteris Hoffm. Ostrich-fern. Frequent in alluvial soil along the Connecticut and Housatonic rivers and their larger tributaries; rare elsewhere.

SCHIZÆACEÆ.

Lygodium palmatum Swartz. Hartford Fern; Climbing Fern. Occasional or rather local in moist thickets and open woods, usually in sandy soil.

OSMUNDACEÆ.

Osmunda regalis L. Flowering Fern. Frequent throughout in low thickets, wet pastures and meadows and along streams.

Osmunda Claytoniana L. Interrupted Fern. In old pastures, along fence-rows and in open woodlands, frequent throughout.

Osmunda cinnamomea L. Cinnamon Fern. Common in wet thickets and swamps and in boggy ground. A form occurs with the pinnæ of the sterile fronds more or less cut, called var. *incisa.*

OPHIOGLOSSACEÆ.

Ophioglossum vulgatum L. Adder's-tongue. Moist meadows and old pastures throughout. Considered rare, but probably more frequent than usually supposed, as the plant is very inconspicuous in the field.

Botrychium simplex Hitchcock. Small Grape-fern. Rarely reported. It grows in moist woods in leaf mould sometimes with *B. matricariæfolium* and *B. lanceolatum.* The plant listed in the Berzelius Catalogue as *B. Lunaria* evidently belongs here, and probably also

collections from the state reported as *B. tenebrosum* A. A. Eaton. Small forms of *B. matricariæfolium* are sometimes difficult to separate from this.

Botrychium matricariæfolium Braun. Rare or local but reported from a number of widely scattered stations. Growing in rich leaf mould as does the following species. So far as observed its spores are matured at an earlier date than those of *B. lanceolatum.*

Botrychium lanceolatum Angs. Rare, but widely distributed, often growing with or near *B. matricariæfolium.*

Botrychium obliquum Muhl. Grape-fern. Widely distributed and frequent in moist meadows and pastures, or sometimes in dry sandy soil. This passes by a variety of intergrading forms into the following:

Botrychium obliquum var. *dissectum* Clute. Occasionally seen in its extreme form with finely dissected pinnæ when it is very distinct from the type in appearance.

Botrychium ternatum var. *intermedium* D. C. Eaton. Occasional in rich woods throughout. Sometimes large when it is called var. *australe* and in shaded places with a small and thinner frond approaches var. *Oneidense.*

Botrychium virginiaum L. Rattlesnake Fern. In rich woods frequent throughout. Sometimes seen with two fertile sections to the frond.

MARSILIACEÆ.

Marsilia quadrifolia L. Plentiful in Bantam Lake, Litchfield, its only native habitat in this region, though it has been introduced at other stations.

LYCOPODIACEÆ.

Lycopodium Selago L. Fir Club-moss. Known only from cool shaded ravine, New Haven (J. A. Allen, 1879). Has been collected at Mt. Holyoke, Massachusetts, and should occur at intermediate stations along our trap dykes.

Lycopodium lucidulum Michx. Shining Club-moss. Frequent throughout in cool damp woods.

Lycopodium inundatum L. Bog Club-moss. Rare or local in open bogs usually in sandy soil throughout. The larger form called var. *Bigelovii* Tuckerm. is apparently confined to the vicinity of the seashore.

Lycopodium annotinum L. Stiff Club-moss. In wet woods, rare or local, confined to the northwestern part of the state.

Lycopodium clavatum L. Ground-pine. Occasional in woods and thickets, more often in dry sandy soil throughout. Does not often fruit here.

Lycopodium clavatum var. *monostachyon* G. and H. This variety with more appressed leaves and only one larger fruiting strobile on a stalk occurs locally and seems to fruit freely.

Lycopodium obscurum L. Tree Club-moss. Frequent in woods and pastures, either dry or moist throughout. Most of our plants are of the form called var. *dendroideum* D. C. Eaton, having all the leaves alike.

Lycopodium complanatum L. var. *flabelliforme* Fernald. Ground-pine. Common in dry woods and pastures throughout.

Lycopodium tristachyum Pursh. Occasional in dry woods throughout. Fruits several weeks earlier than the previous species.

SELAGINALLACEÆ.

Selaginella rupestris Spreng. Occasional on dry ledges throughout.

Selaginella apus Spreng. In moist meadows, common.

EQUISETACEÆ.

Equisetum arvense L. Horsetail. In sandy soil, both dry and moist, common throughout.

Equisetum pratense Ehrh. Known only from moist

sandy alluvium on the banks of the Housatonic River. Oxford (Dr. E. H. Eames and E. B. Harger) Newtown (E. B. Harger).

Equisetum palustre L. Local in wet alluvial along the Connecticut River. Lyme (Dr. C. B. Graves) East Windsor (C. H. Bissell). Both this and the preceding species seem to have been overlooked and should be found elsewhere.

Equisetum sylvaticum L. Wood Horsetail. Rare or local, in wet ground about springs or in moist places throughout.

Equisetum fluviatile L. Water Horsetail. Occasional or local in wet meadows or in shallow water. Very plentiful at some stations.

Equisetum hiemale L. Scouring-rush. Frequent in either moist or dry, usually sandy soil throughout. Many forms of this have been described. The variety *affine,* and variety *intermedium* both occur.

Equisetum variegatum Schl. Rare in alluvial soil at a few stations. Canaan (Dr. Robbins, Dr. A. W. Evans), Cornwall (C. H. Bissell), Hartford (H. S. Clark). Our plant seems to be the form called var. *Jesupi.*

Equisetum scirpoides Michx. Dwarf Scouring-rush. Rare or local in rich moist woods confined to the northwestern part of the state.

ISOETACEÆ.

Isoetes Tuckermanni A. Br. Occasional, growing submerged on gravelly shores of ponds.

Isoetes foveolata A. A. Eaton. Known at present only from a collection made from a pond in Meriden by F. W. Hall in 1873.

Isoetes saccharata Engelm. var. *Amesii* A. A. Eaton. Rare in shallow water of ponds and rivers; Griswold (E. B. Harger), Ledyard (C. B. Graves), North Stonington (Graves and Bissell).

Isoetes echinospora Durien. var. *Braunii* Engelm. In shallow water, muddy borders of ponds and streams, frequent throughout.

Isoetes echinospora Durien. var. *muricata* Engelm. This form with longer, very slender leaves is reported from a few stations.

Isoetes Gravesii A. A. Eaton. Occasional or local on muddy border of ponds and slow streams. Widely distributed and plentiful at certain stations.

Isoetes Engelmanni A. Br. Occasional throughout on muddy border of ponds and streams where it would be submerged during high water. The slender form called var. *gracilis* is sometimes seen.

Isoetes Canadensis Engelm. In shallow water of streams. Rare. Westport, Fairfield (Dr. E. H. Eames.)

A few comments on the preceding list may be of interest.

Three of the ferns listed, *Cheilanthes lanosa, Asplenium pinnatifidum, Asplenium montanum,* are not known elsewhere in New England, and our Connecticut stations are supposed to be the northern limit of their range. One of the fern allies, *Marsilia quadrifolia,* has not been collected as a native plant anywhere in the United States except at the Bantam Lake station. I do not know that anyone has ever claimed for Connecticut an extremely large fern flora, but investigation shows that our list will bear comparison with that of almost any other state.

Mr. Eggleston in his Fern Flora of Vermont states that Vermont has a surprisingly large number of ferns for its area. Vermont is not a large state, but it covers practically twice as much surface as Connecticut. Figuring both lists on the same basis of species and varieties of the ferns proper, the Vermont list has nine species lacking in our list, while we have seven not on the Vermont list. Of the fern allies, Vermont has six not on our list, and we have eight not on theirs. That is, we

have two species less of the ferns proper and two more species of the fern allies.

Our total number is the same as theirs with only about half the area to collect from. If the Vermont list is surprising, what shall we say for Connecticut? Of the varieties omitted *Nephrodium spinulosum* var. *dilatatum* should probaby have been included, but as authorities disagreed in regard to our material it seemed better to err on the safe side and leave it out. Other species that might be looked for are *Asplenium Bradleyi* in the western part of the state, and *Schizæa pusilla* in sandy ground along the shore; some species can probably be added also in the genus *Isoetes*.

BOTRYCHIUM MATRICARIÆFOLIUM A. Br

An Enquiry into the Relationships between Botrychium Neglectum Wood, Botrychium Matricariæfolium A. Braun, and Botrychium Ramosum Ascherson.

By George E. Davenport.

The subject of this note involves two propositions. The first relating to the identity of American and European plants, and the second to the identity of *Botrychium ramosum* and *B. Matricariæfolium*, and the question of priority of names. In regard to the first there has been not the shadow of a doubt in my own mind, and I am very glad that Mr. Gilbert has received an object lesson from abroad that has convinced him that the two are identical. (See Fern Bulletin for July, 1905.) In support of this position I offer here some comparative figures from specimens selected, out of many, from an extensive geographical range that will, I believe, convince the most skeptical of its truth. (See frontispiece.) Now, I do not mean to assert, even with this convincing evidence of their positive specific identity, that there are no differences between American and European plants, because precisely the same differences are to be found

between them as exist in any given series of either of them—that is to say, differences may be found between different individuals of any series of European plants, and similar differences may be found between the individual specimens of any American series, so that differences between the two series are to be expected—but the differences that do exist are merely individual and superficial. such as are common to all species, especially in the *Botrychia,* where scarcely two plants are ever exactly alike. Nevertheless, in spite of geographical separation and range, specimen plants of equal age and development from similar environments are to be found plentifully enough to corespond perfectly in their fundamental, and even in their external general characters.

We cannot expect to find in nature exact agreement among plants, such as we look for in the physical world where patterns are struck off by dies so that each individual is an exact counterpart of the other, but only such agreements and differences as differentiate naturally through the untrammeled operation of the forces of nature, and no intelligent naturalist will ever become so thoroughly imbued with the teachings of the schools as to lose sight altogether of this great truth. One of the unwritten laws of nature is that of Diversity—call it evolution if you will, for it is evolutionary in its character—but it is that which gives to all living forms their individuality. their agreements and divergences, by which we are enabled to classify them within appreciable limits for purposes of study. This classification and arrangement of forms into such groups as exhibit close relationships, artificial as it unquestionably is, appears to be necessary for a complete understanding of the constantly varying whole. But the broader and more elastic the sections into which any system is divided are made, the greater latitude given to the subordinate divisions, and the more flexible species and varieties are. the nearer we get to a natural arrangement of the complex forms that are to be found everywhere in nature.

Holding such views as these, I look upon some of the recent extreme segregations which narrow species down to very nearly individual limitations, as contrary to nature, and as tending to complicate rather than to facilitate the work of general students. Applying these principles to the American and European forms of the species under consideration, the bond of unity between them is strengthened, and becomes more absolute. On the other hand subjecting our American forms to the same treatment that the forms—mere forms, too—of *B. ternatum* have received, would result in the formulating of many false species, and an equally deplorable result would follow such segregation of European forms; yet they both can furnish fully as much material for the manufacture of new species! as *B. ternatum* itself.

At the time Wood published his *Botrychium neglectum* the species was scarcely known to American botanists, and most of the few specimens that had been collected were sadly confused with *B. simplex*— just as similar specimens abroad had been confused with *B. Lunaria*— as I demonstrated in my monograph on *B. simplex* in 1877, so that it was only natural for Wood to suppose that his plant was new, and to name it accordingly; but when its identity with *B. matricariæfolium* became known, Wood's name necessarily lapsed, and the attempt to restore it should be abandoned, as it cannot be successfully maintained.

Our American plant is true *Botrychium matricariæfolium* Al. Braun, and Wood's *B. neglectum* exactly represents Milde's var. *subintegrum*. Dr. Milde himself recognized the identity of American forms with his when he cited for it Hooker's figure of a plant from Canada, in "Icones Filicum" (tab. 82, left hand figure). But in further confirmation of this, I have appended a copy of Luersen's illustrations of European *matricariæfolium* from his "Die Farnplanzen," 1889 (Plate 2). Those figures which represent Milde's *var. subintegrum* correspond very well indeed with Wood's *B. neglectum*.

Milde's *var. compositum* and *var. palmata* have both been found in this country, the first having been collected in Rhode Island by Collins and Chamberlain, and in Vermont by Miss Slosson, and the second in Colorado by Suksdorf. Specimens of Milde's "monstrosities" *Lusus furcatus,* and other forms, have been collected in the North Woods, New York State, by Mrs. Charles Barnes, in the Rangely section of Maine by Miss Furbish, on Mt. Tobey, Mass., by Mr. Fuller, and elsewhere by others. In fact there does not seem to be any possible form of this wonderfully variable species that has not been found, or is likely to be found, in this country.

Now, in regard to the identity of *B. ramosum* Ascherson, and *B. matricariæfolium* A. Br., the real question here is on the identity of the latter with *Osmunda ramosa* Roth, since Ascherson's combination rests on the assumption that the two are identical. So that, while it may be true that *B. ramosum* Ascherson, is identical with *B. matricariæfolium* Braun, if it is not identical with Roth's *Osmunda ramosa,* on which it was founded, the name can have no legitimate standing, and whether *B. matricariæfolium* A. Br., equals *B. ramosum* Ascherson, or not, is immaterial if *B. ramosum* Ascherson does not equal *Osmunda ramosa* Roth, on which it rests.

Our enquiry, therefore, is the more important at the present time, because if *B. matricariæfolium* and *Osmunda ramosa*—this being the real question at issue—are identical, then, under the new conditions created by the Vienna Congress—which has so happily presented to the botanical world such an admirable basis for universal agreement—Ascherson's combination would prevail.

Those of us who have heretofore upheld the first correct combination under a genus as the proper name of a species, may regret the necessity for its abandonment, but we are the more willing to acquiesce in the adoption of the first legitimate specific name since the nomenclatorial section of the Vienna Congress so overwhelmingly rejected its use where its adoption would lead to such

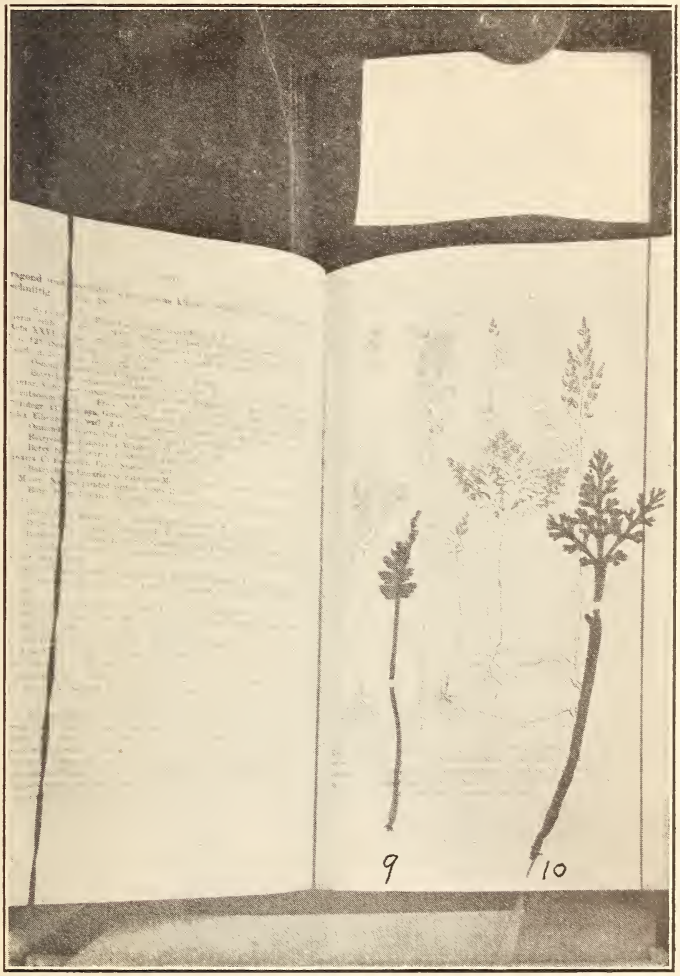

PLATE II

FORMS OF BOTRYCHIUM MATRICARIÆFOLIUM

double naming as *Phegopteris Phegopteris* and similar abominations. I should therefore most cheerfully adopt Ascherson's combination if it could be shown beyond question that it is the oldest name for our plant. Let us therefore review briefly its historical standing:

It is true that Ascherson's *B. ramosum* is generally considered identical with *B. matricariæfolium,* and it has been so regarded by Milde, Luersen, and others but neither Milde nor Luersen cite *Osmunda ramosa* Roth as a synonym, although the latter cites *O. ramosa* of Lamarck and Borckhausen, but questions their identity with our plant. Ascherson himself established his *B. ramosum* on Roth's *Osmunda ramosa,* and published his combination in the Flora of Brandenburg in 1864.

Now it so happens that, according to Milde, Roth's *Osmunda ramosa,* which was published in "Flora Germanica" in 1788, was founded on a form of *Osmunda Lunaria,* and that in a later edition of the same work, published in 1800, Roth himself referred his plant to *Osmunda Lunaria* (L.) as *var. ramosa,* citing for it three synonyms which Milde declared were referrable "to a plant which at best is a monstrosity of *B. Lunaria,* if, indeed, it is not to be regarded as a product of Art!"

The name *ramosa* itself appeared in 1737 as a citation from Tournefort's Institutes in "Hortus Cliffordianus," where Linnæus described two varieties, "*Lunaria racemosa ramosa major,*" and "*Lunaria racemosa minor adianthifolio*" Breyn. The first of these, according to Milde, belonged to a monstrosity of *B. Lunaria,* and the second is *var. incisum* of the same species. This last I have personally verified, and it is accurately borne out by the fine figure in Breyn's "Plantar Centuriæ."

This may be made still more clear by the following extract from Milde's monograph on *B. Lunaria:* "In the 'Hortus Cliffordianus,' 1737, Linnæus distinguished two *Botrychiums, B. Lunaria* and *B. ternatum.* The former appears on p. 472 as '*Osmunda* with pinnatifid, cauline frond, pinnæ lunulate. H. Lapp. 389,' with two vars.

'a *Osmunda foliis lunatis ramosa,* Tourn. Inst. 547.'" As the synonyms show, the monstrous form of *B. Lunaria* is here meant (*Lunaria racemosa ramosa major* Bauh. Pin. 355).

In further confirmation of the identity of *Osmunda ramosa* and *Osmunda Lunaria,* Hoffman, in "Deutschlands Flora," 1795, cites Bolton's figure in "Filices Britannicæ" (t. 21), that being good *B. Lunaria. O. ramosa* and *Lunaria* appear as synonyms also in "Flora Danica" (t. 18), where it is well figured.

But it is needless to pursue this enquiry any further. The evidence is by no means exhausted, but enough has been brought forward to show that Ascherson's *B. ramosum* does not equal Roth's *O. ramosa,* and that it cannot therefore displace Braun's *B. matricariæfolium,* established by Braun in Doell's "Rheinische Flora," p. 24, 1843. We may then continue to write *Botrychium matricariæfolium* A. Braun, with perfect fealty to the principles of the Vienna Congress.

Finally, the following genesis of the species, with an explanation of the figures, is appended for convenient reference:

In tracing the early history of *B. matricariæfolium,* we find it to be pre-Linnæan, going back to 1677, when it was described and figured by Jacob Breyn in his "Plantar Icones Centuriæ Primæ."

Tablet 93, in the same work, gives an admirable figure of *B. Lunaria,* v. *incisum,* as I have before attested, but I mention it again here to show that Breyn recognized the distinctiveness of the two plants and kept them apart.

In 1755, Linnæus placed Breyn's "*Lunaria racemosa minor matricariæfolio*" under his *Osmunda Lunaria,* in "Flora Sueciccæ," Ed. ii., where it appears as a variety, but without any more definite designation than that of Breyn's.

It should be observed here that Roth did not at any time cite this plant for his *O. ramosa,* while on the other hand he did cite the "*Lunaria racemosa ramosa major*"

of Bauhini (Pin. 305), which, as we have seen, belonged to *B. Lunaria,* and here undoubtedly is the starting point for *B. ramosum* Ascherson. To claim anything to the contrary is to decide against the evidence, and it is difficult to see how that name can have any claim upon our consideration, even if it was intended for *B. matricariæfolium,* since the name *ramosa* was preoccupied by another plant and our own plant had already been properly named by Braun.

The next appearance of our plant in anything like definite form was in 1809, when Schkur published it in his Grypt. Gen. tab. 55. fig. b. as *Botrychium rutaceum,* and this was the first time that it had received a distinctly specific designation. The name *rutaceum,* however, was already in use by Swartz (1800) for a form of *B. ternatum,* and so had no standing. Nevertheless, in 1810 Willdenow, and in 1814 Fries, published our plant under *rutaceum,* and the latter in 1828 reduced it to the rank of a variety of *B. Lunaria,* as *var. rutaceum.* In 1836 it was again restored to specific rank as *B. rutaceum* (Kirschleg. Prodr. p. 214), and in 1843 received from Braun its present name.

EXPLANATION OF PLATES.

PLATE 1. Figures 1 to 8 comprise a series of American and European specimens arranged for comparison; 1 and 3 were sent to me by Dr. Christ, and are from the collections of Dr. Hakansson; 4 and 7 were sent to me from Berlin by Dr. Greenman; 2 is from Dorset, Vt., from Mrs. Terry; 5 and 6 are from Rhode Island, Collins and Chamberlain; and 8 is from Conway, Mass., collected by Jesup. Compare especially 4 with 5, and 3 with 6. The difference in the development of the fertile panicles is, of course, wholly due to the different ages of the specimens. Figures 9 and 10 (Plate 2) are photographed on Luersen's fine figures for comparison. Figure 9, which was collected in Conway, Mass., by Jesup, corresponds with Luersen's figures b, c, and d, which repre-

sent Milde's *var. subintegrum,* and figure 10, collected in Rhode Island by Collins and Chamberlain, is practically the same as Luersen's figure g. This specimen was collected in May (30th), before the sporophyll—which is seen just emerging from the common stalk below the lamina—had developed; but the lamina agrees perfectly with Milde's description of his var. *compositum.*

Plate 2 is an exact photographic reproduction of Luersen's page, and the specimens are, of course, all European, but they clearly show the absolute specific identity of European plants with our own. Furthermore, an examination of figures 4 and 5 in Dr. Underwood's "Index to the Described Species of *Botrychium,*" 1903, will show that while those figures faithfully represent Wood's *B. neglectum,* they none the less correspond very well with these European figures of Luersen.

In conclusion, a summing up of the results of our enquiry shows, first, that so far as the question of identity is concerned, the evidence overwhelmingly sustains my contention; as well deny the identity of American and European *B. simplex*—which everyone admits—as deny that of *B. matricariæfolium.* As for its nomenclature, historical testimony could not seemingly be stronger than that which we have reviewed, and which shows conclusively that *Osmunda ramosa* Roth equals *Botrychium Lunaria* (L.). *Botrychium matricariæfolium* A. Br., therefore remains undisturbed.

Medford, Mass., U. S. A., Dec., 1905.

We have received for name from Mrs. Charles H. Beach, Catskill, N. Y., specimens of *Pteris serrulata* from Charleston, S. C. She writes that they were growing from the foundation to the eaves of old houses in the company of *Asplenium ebeneum,* mosses, *Marchantia,* etc. It was common on old houses near the wharves.

SPORANGIAL TRICHOMES.

By E. J. Durand.

Several years ago while examining some sporangia of *Dryopteris thelypteris,* my attention was attracted to certain trichomic outgrowths on the lateral walls near the annulus. These took the form of rather stout glandular or capitate hairs about equal in length to the diameter of the sporangium. While some sporangia possessed several hairs, others might be entirely free from them.

The presence of trichomes in such a position seemed rather odd, so that the literature was examined to learn whether the occurrence of such structures had been recorded. The only reference to anything at all comparable that I could find was the classical figure, reproduced in nearly all the text-books, of the branch arising from the stalk of the sporangium of *Dryopteris filix-mas,* and which was regarded as a paraphysis, or perhaps an aborted sporangium. The structure was, however, quite different from the trichomes mentioned. About the same time similar hairs were noticed on the sporangia of greenhouse varieties of *Hypolepis repens* and *Nephrolepis exaltata,* which led me to believe that their presence was not accidental, as I had previously suspected, but that they might occur regularly in certain species.

The interest thus aroused led me to examine herbarium specimens, in order to see how frequent the occurrence of such hairs might be. About two hundred species, both native and exotic, were looked over. Of these, fifteen were found to possess sporangial trichomes. Eight have only capitate hairs, viz.: *Dryopteris thelypteris, Polypodium crassifolium* (Cuba), *P. pectinatum* (Cuba), *P. tenuifolium* (Cuba), *P. taxifolium* (Brazil), *Phegopteris crinalis* (Hawaii), besides the greenhouse plants of *Hypolepis* and *Nephrolepis* mentioned above. In every case similar glandular hairs were also present on the surface of the frond. Acute hairs occur in *Phegopteris appendiculatus* (India), *Polypodium heteromorphum*

(Ecuador), *P. crenatum* (Cuba), and *P. urophyllum* (Penang). In the last named species the sporangium fairly bristles with spine-like hairs which give them quite a formidable appearance. In these species also similar hairs occur on the frond. Our own *Phegopteris polypodioides* and *P. hexagonoptera* possess both glandular and acute hairs on both sporangia and frond, the acute ones being as long as the sporangium. *Polypodium Hookeri* (Hawaii) is peculiar in having its frond clothed with stiff dark brown hairs, which also occur several on each sporangium. They are long and tapering and several times the length of the sporangium.

It is of interest to note that trichomic outgrowths occur also on the heads of the paraphyses which are found among the sporangia in the sorus of *Polypodium vulgare.*

Briefly summarized, these observations indicate that outgrowths strictly trichomic in their nature occur on the sporangia of certain ferns, arising from the lateral walls near the annulus; that sporangial trichomes occur only in such ferns as have similar trichomes on the surface of the frond. Such an occurrence is perfectly consistent with the known epidermal origin of fern sporangia. If it is desired to find a use for all such structures, it is suggested that the trichomes may be protective, since they exist most commonly in non-indusiate species.

I might also say that while examining a student's preparation of developing sporangia in *Pteris cretica* recently, I noticed a branch from the stalk of one, which appeared in all respects similar to the figure mentioned above of *Dryopteris filix-mas.* It bore every appearance of being an aborted sporangium which had started to develop from the stalk of an older one.

Botanical Laboratory, Cornell University.

Mr. E. J. Winslow sends us a frond of *Woodsia hyperborea* that measures more than eight inches in length. This is rather above the maximum measurements given for this plant.

TROPICAL FERNS IN SOUTHERN STATES.

By Willard N. Clute.

The fern study of the Southern States has one fascinating element about it that those who have confined their collecting to regions further north can know little about. When a northern collector goes after ferns he knows pretty much what to expect. On the rocks he counts upon finding the polypody, the bladder ferns, the woodsias, and some of the smaller spleenworts; in the woods, the larger spleenworts, the wood or shield ferns, and the grape ferns; in the swamps, the osmundas, the sensitive fern, and the ostrich fern; along the highways and in the field, the bracken, the dicksonia, and a sprinkling of the hardier species of wood and swamp. If fortune is kind to him he may chance upon the walking fern or the cliff brakes among the rocks, or the woodwardias in the swamps, but in any event his rarities are species known to grow in the general region, and zest is given to his excursions, not by the hope of finding something new, but by the hope of finding some rare species that, according to all the indications of the soil, shade, and moisture, should be found there.

With the southern collector the case is different. He is confined to no previously cut and dried list of species, but may continue to ramble among familiar scenes warranted in the expectation of being a discoverer of unrecorded species. The reason for this is two-fold. First of all, the country has not been as thoroughly explored by the botanist as have the Northern States, and in addition, the explorations, due to the peculiarities of growth and habitat assumed by southern ferns, have to be conducted in a different way. At the north, where the struggle for existence is not the most strenuous, the plants of a single species may form extensive colonies over large areas, so that a single trip of any length may show approximately what the fern flora of a given region contains. As one approaches the equator, however, the competition of spe-

cies with species for light and air is so fierce that only individuals specially adapted to the habitat can hope to form extensive colonies. Even our cinnamon fern, which inhabits almost every swamp and wet woodland in the north, is reduced to a few acres in a single marsh in Jamaica. In the tropics many ferns are obliged to grow upon other ferns, or on the branches of trees, to find room for existence, fitting themselves into any vacancy as best they can. The behavior of the common gray polypody or resurrection fern, so common on the live oaks about New Orleans, is an illustration of this. In the northern part of its range it grows on the earth or on rocks; hereabouts it is usually an epiphyte.

Thus it happens that while southern ferns are more abundant as to species, and, taken plant for plant, are more abundant as to individuals, a single species rarely becomes conspicuous because of its numbers. It may grow in one restricted spot and not be found again in the same country. In Jamaica the rattlesnake fern is confined to a few acres of woodland, while the representative of the common grape fern, *Botrychium Jenmani,* is found on a single scrubby hillside. One might search the island for years without finding either. Owing to this isolation of species, southern regions must be examined more carefully than others before their species are all catalogued. This doubtless explains Mr. Eaton's recent successful trip to southern Florida, which added half a dozen or more species to the fern list of the United States. The performance might possibly be repeated again with equal success by varying the route a bit.

Again, the Southern States are most advantageously situated for obtaining additional species of ferns from other regions. At least 75 per cent. of Florida's ferns are species whose centers of distribution are in the West Indies or further south. And if we divide the State into the northern and southern half, the percentage of tropical ferns in the southern half rises to more than 90 per cent. Whether these species were derived from the West

Indies while yet the two regions had a land connection, or whether they have since arisen from wind-blown spores, we cannot here stop to discuss, but the fact that new plants may arise in the latter manner appears to be too well substantiated to need additional proof. It has been but a few years since *Pteris longifolia* and *P. serrulata* were discovered in Louisiana in positions that show conclusively that they, at least, have originated from wind-blown spores. The floating fern also has but recently been reported from the State, but in the latter case it is possible that currents of water instead of currents of wind wafted it to these shores.

The question may then be asked, are we to conclude that these species are the only ones capable of making the journey from Florida or the West Indies? I think no botanist would be inclined to say that they are. In the West Indies are upwards of five hundred species of ferns annually producing millions of spores which are floated away on winds that for much of the year set directly toward the southern United States. The spores are so light and the distance so short that it appears certain that the spores of many tropical species must have fallen again and again within this region. There are good reasons why they should not all germinate, or germinated, why they should not come to maturity, but that any of them at any time may accomplish both ends is quite within the bounds of possibility. Quite recently, single plants of *Hypolepis repens* and *Asplenium auritum* have been reported from Florida, which seems to make our possibility into a probability.

This, then, gives the fern collector reason to expect many species yet unrecorded from our southern boundaries. If *Meniscium* and *Davallia* and *Taenitis* can live in Florida, why not their companion plants in tropical islands? Two new filmy ferns have recently been added to the Florida list. Who knows how many other species are thriving on the trunks of trees in the everglades as yet unseen by man? It is not enough that they do not

grow on the trees thus far examined. In their native haunts they do not grow on every tree nor in large areas. In fact, one Jamaica species, *Trichomanes trichoideum,* seems to be found only on the trunks of a certain kind of tree fern—*Cyathea pubescens*—in that island. And if *Pteris longifolia* can thrive in Louisiana, why should it not also grow in Alabama and Mississippi? Why, too, should not the species that have the same general habitat be found with it? If *Nephrodium patens* is common, why not expect *N. molle,* which is so much like it? It is not entirely a matter of climate, as some may be inclined to think. Climate may be granted as a most important factor, but it may sometimes be over-estimated. The Florida crest fern, which grows naturally nowhere except near the Gulf, has proven hardy in northern Illinois, and *Nephrodium patens* in New York and Vermont.

Doubtless many tropical ferns, especially those with a thick epidermis like the polypody, the grass fern and *Taenitis,* are hardy enough to withstand the southern winters. These grow in Florida, and may yet be reported from the lower delta. So, too, we seem warranted in expecting *Acrostichum aureum* from the coastal swamps. In fact, we seem warranted in expecting a large number of other tropical species. When they will be found, or whether they will be found at all in this region, remains a problem for fern students to solve.

DRYOPTERIS FILIX-MAS IN VERMONT.

By Tracy E. Hazen.

The industrious searching of the large body of fern-lovers within recent years has brought to light a number of forms and sub-species new to systematic botany. To discover, however, a well-known species not before reported in New England, is a matter of great interest. Mr. Eggleston, in his article on the ferns of Vermont in the Fern Bulletin, made the suggestion that *Dryopteris Filix-mas,* among other ferns, might be looked for in the

State. This prediction has been fulfilled by the discovery of this fern in the town of Hartland, in September last, by Miss Nancy Darling. To find this northern form here seems somewhat surprising in view of the fact that the nearest stations previously known were in Gaspé, Quebec and Nova Scotia; but it is evident that northern conditions are present in some degree, for from the same town, which has no great elevation, are reported *Polystichum Braunii, Woodsia glabella* and possibly W. *alpina,* though the latter has not been confirmed by specimens submitted to the writer. Specimens of the *Dryopteris Filix-mas* have been deposited by Miss Darling in the herbaria of the University of Vermont and of Columbia University.

New York City.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

Campbell, D. H. *Affinities of the Genus Equisetum.* Illust. American Naturalist. My. 1905.

Clute, W. N. *Check-list of North American Fernworts.* Fern Bulletin, O. 1905. Notes on previous fern lists and tables of orders, families and genera.

Davenport, G. E. *Reversions and Their Fluctuations.* Fern Bulletin, O. 1905.

Fernald, M. L. *An Alpine Adiantum.* Rhodora, N. 1905. Records a form of *A. pedatum* (var. *Alenticum* Rupr.) from the far North.

Gilbert, B. D. *Mrs. Taylor's Georgia Ferns.* Fern Bulletin, O. 1905. Notes with description of *Adiantum hispidulum f. strictum.*

Gilbert, B. D. *Observations on North American Pteridophytes—II.* Notes with description of *Dicksonia pilosiuscula f. Nana.*

Hans, A. *Ferns for Everyday Use.* Illust. Horticulture, D. 10, 1904; Ja. 7, 28; Mr. 4, 11; Ap. 15, 22;

My. 6, D. 9, 1905. Cultural notes on the best species *of Adiantum, Asplenium, Cyrtomium, Davallia, Polypodium Polystichum* and *Pteris.*

KELLERMAN, W. A. *The Gray Polypody in Ohio.* Torreya, N. 1905. Records of several stations.

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LYON, F. *The Spore Coats of Selaginella.* Illust. Botanical Gazette, O. 1905. Recounts the formation of spore coats principally in *S. rupestris* and *S. apus.*

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MAXON, W. R. *A New Lycopodium from Guatemala.* Proceedings of the Biological Society of Washington. D. 9, 1905. *Lycopodium dichæoides.*

MAXON, W. R. *A New Fern from Porto Rico.* Proceedings Biological Society of Washington, O. 17, 1905. Substitutes *Polystichum Krugii* for *Aspidium Krugii* of Kuhn.

MAXON, W. R. *A New Name for Kaulfussia Blume, a Genus of Marattiaceous Ferns.* Proceedings Biological Society of Washington, D. 9, 1905. Proposes to substitute *Christensenia* for *Kaulfussia* of Blume.

NICHOLS, G. E. *Selaginella Pusilla in Cape Breton.* Fern Bulletin. O. 1905. Description of a new station.

WOOLSON, G. A. *A Precocious Cystopteris.* Illust. Fern Bulletin, O. 1905. Describes a viviparous frond.

WOOLSON, G. A. *Indoor Ferneries for Winter.* Illust. Garden Magazine Ja. 1906. Directions for using native species.

WOOLSON, G. A. *Rock-loving Ferns in the Garden.* Illust. Garden Magazine. F. 1906. Describes the making and planting of rockeries.

EDITORIAL.

Some shrewd observers are of the opinion that the present system of writing botanical names offers altogether too many inducements to that species of scientist familiarly known as the name-tinker. Suppose we have a species so nicely balanced that it might without great impropriety be placed in either of two genera; or suppose a section of a certain genus is so strongly specialized that its claims to rank as a separate genus may find supporters; if we make it a meritorious act to change the species about, or to elevate the section to the rank of a genus, we may be sure there will be plenty to claim the reward. That the common practice of botanical writers does offer such reward by writing after the new combination, in addition to the name of the one who discovered the species, the name of the man who made the new combination is very clear, and the sooner this prize is withdrawn, the sooner will that long-sought stability in nomenclature appear. Still more abominable than the practice alluded to above, because it omits all mention of the discoverer of the species, is the scheme of crediting the name-juggler with the combination. This has gained considerable favor recently, and we have used it to some extent in this journal, but never expect to do so again. Those who favor this practice assert that the specific name is only part of the name of a species and that not until the correct specific name is joined to the correct generic name is any plant properly named. They would therefore write after the combination only the name of the one who made it. After carefully looking the matter over, however, it has seemed to us that the one who has the first right in the name of a species is the one who discovered it, and we believe that this name, and this name alone, should be attached to the combination. When the species has later been transferred to

some other genus, the fact can be indicated by enclosing the author's name in parenthesis. This is the method long in use by ornithologists, and it seems to work satisfactorily. We look to see it adopted soon by all other branches of science. We have adopted it in the new list of species published in this journal, and the same method was used in the editor's "Fern Allies." So accustomed have botanists been, however, to expect an author to claim all species in which the parenthesis is not followed by an author-citation that an official in one of our great herbariums seeing the second citation omitted in the "Fern Allies" wrote to the author to inquire if he meant to claim all those species as his own! This way of indicating the species, on the contrary, removes entirely the excuse for anyone claiming a species he did not discover, and gives no credit to the nomenclaturist for juggling the names about. By its use we may avoid many serious upheavals in the future and ultimately get each species firmly connected with a single scientific name.

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The publication of De Vries' views on the origin of species by mutation is likely to have a rather disquieting effect upon the radical species-maker. De Vries claims that species do not become differentiated gradually, as Darwin taught, but that new species spring full-fledged, as it were, from older ones. By cultivating various plants he has actually been able to see them throw off these new forms. This certain species have done again and again, and he properly concludes that these various forms are all part of one systematic species. To these minor forms he has given the name of elementary species. Some systematic species are known to be made up of immense numbers of these elementary species, the common little whitlow-grass (*Draba verna*) possessing more than two hundred. Although De Vries has only attempted to show the method by which new species and varieties have arisen, we believe the facts he has demonstrated also

point to the conclusion that many of what have been recently called species of *Botrychium, Selaginella,* etc., are really in the nature of elementary species. This opinion has long been held by The Fern Bulletin, and nearly ten years ago, we suggested editorially that "Botrychium dissectum" is but a form (or elementary species) of the better-known *Botrychium ternatum.* The past decade has been characterized by the inordinate multiplication of species in the ferns and fern allies, but this has now come to a halt for want of further material. Doubtless the coming years will see a disposition to more carefully study these plants in field and garden, to the end that they may be given the rank to which they really are entitled. That we have twenty or more good species in the *Selaginella apus* group in America is simply preposterous. A student who will work out their true relationships is desired.

BOOK NEWS.

Christensen's "Index Filicum" has reached its sixth fascicle. Nearly four hundred pages have thus far been issued.

Since John Robinson's "Ferns in Their Homes and Ours" went out of print there has been real need of a new book on the culture of ferns. This G. H. Woolson has attempted to fill in his little book entitled "Ferns and How to Grow Them."[1] The author is well qualified for the work, having cultivated ferns for many years and had considerable experience in writing of them, but his efforts have been sadly hampered by publishers who evidently do not understand the making of fern-books, notwithstanding their reputation in such matters. In several instances three illustrations have been reproduced on one

[1] Ferns and How to Grow Them by G. A. Woolson. New York: Doubleday, Page & Co., 1905. 12 mo., 150 pp. $1.00 net.

small page to the ruination of what were evidently fine pictures. There is no uniformity in the text, some specific names being italicised and others not and the capitalization is equally bad. Most deplorable of all is the egotism that prompted a list of "Standard Names," as if gardeners and fern cultivators could be induced to use *Matteuccia, Filix, Pteridium, Phyllitis* and others upon the mere statement of a publishing house. Two other lists are given, one according to Gray and the other according to Britton, but throughout the book the objectional names are used. Although these are called "standard" a large number have been repudiated by botanists. In at least two places we are told that the best authorities now agree that the royal fern of America and Europe are not identical! The eleven chapters in the book treat of how and where ferns can be grown, describe the making of rock-work and wardian cases, directs how and what to plant and where to get specimens, and discusses the cultivation of ferns, both indoors and out. The author's style is clear, direct and practical and the book abounds in hints that only long acquaintance with the growing ferns can develop. It will be welcomed by all growers of these graceful plants.

THE AMERICAN FERN SOCIETY.

Formerly Linnæan Fern Chapter.

Mr. Saunders's long absence in California has made the appointment of a new Treasurer necessary. Miss Nellie Mirick, Oneida, N. Y., has been appointed to that office, and all dues should now be sent to her.

The folder of information about the Society is ready for the printer, and will soon be distributed to members. It contains such facts as are likely to interest those who contemplate joining the Society, and will no doubt do much to increase our membership.

At the recent election the following officers were se-

lected for the Society for 1906: President, James H. Ferriss, Joliet, Ill.; Vice-President, D. W. Fellows Portland, Maine; Secretary, Willard N. Clute, Joliet, Ill.; Treasurer, C. F. Saunders Philadelphia, Pa. A full account of the elections will appear in the Annual Report.

The mailing list of the FERN BULLETIN is made up from the list of members published in the Annual Report of the Society and in order that members receive their copies of the magazine it is important that this list be correct. Your name in that list at present stands as addressed on this copy of the magazine. If not correct, have it changed at once before the New Report is printed.

There has been an unusual number of new members admitted to the Society during the past quarter. Following is the list: Miss M. A. Marshall, Still River, Mass.; Miss Alice W. Card, 205 South Perry street, Johnstown, N. Y.; Miss Bridget M. Rooney, St. Johnsbury, Vt.; Mr. Percy L. Grubb, 713 Capitol street, Harrisburg, Pa.; Mr. Everett O. Brown, Pomfret Center, Conn., and Mr. A. B. Klugh, Guelph, Ontario, Canada. These names will be added to the list in the Annual Report soon to be published.

The Linnæan Fern Chapter changed its name to the American Fern Society just in time to take in chapters of its own. The first of these is the Woodsia Chapter of Muscatine, Iowa. This is an Iowa idea that may well be followed. In many cities there are large numbers of fern students who might profitably form a chapter for an occasional outing for ferns or the reading and discussion of papers about them. Such chapters pay one dollar annually to the Society and receive one copy of the FERN BULLETIN. The members rank as associate members but their individual names will not appear in the list of members. The chapters have all the rights of individual members and are self-governing. If members in other cities wish to organize such a chapter, the names of all known fern students in the vicinity will be sent by the Secretary upon application.

ABOUT THE FERN BULLETIN

In offering back numbers of *The Fern Bulletin* for sale, we are not attempting to get rid of some surplus stock. We print hundreds of extra copies of each number for the express purpose of supplying new subscribers with the numbers issued before they became acquainted with the magazine. The great demand for these is shown by the fact that the first five volumes are out of print, volume 6 nearly so, and other volumes are becoming scarce. The illustrations and articles in these numbers are not only still of interest, but *they are becoming more valuable with age.* The price of each volume is 75c. except volume 6, which is $1.00. Volume 6 is not sold separately except to complete files of our subscribers.

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"Fern Allies" and American Botanist, one year....	2.75

These works scarcely need description. A folder describing them will be sent, however, upon application.

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(Formerly Linnæan Fern Chapter)

PRESIDENT, JAMES H. FERRISS, JOLIET, ILL.

SECRETARY, WILLARD N. CLUTE, JOLIET, ILL.

Fern students are cordially invited to join the Society. 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, Oneida, N. Y.

WANTS AND EXCHANGES

WANTED—Linnæan Fern Bulletin Nos. 2, 3, 4, 6 and 12. Any reasonable price will be paid for these numbers. Address, stating price, Miss E. W. FISHER, 1502 Pine Street, Philadelphia, Pa.

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POLYPODIUM PILOSELLOIDES.

THE FERN BULLETIN

VOL. XIV. APRIL, 1906. No 2

POLYPODIUM VULGARE ITS VARIETIES IN AMERICA.

BY B. D. GILBERT.

During the last few years I have been collecting material for a monograph on *Polypodium vulgare* and its varieties in this country. I have obtained specimens from Alaska to Maine and southward, showing what influence climate, soil, and other environments will exercise upon even such a stable plant as this. Such a collection was necessary if one were to attempt to give an account that should be anywhere near to a full and inclusive statement of the forms that grow on this continent.

But it was also evident that one must have authorities, and on such a subject authorities are neither plentiful nor very available. Lowe's works contain a few varieties, but although the figures are fine, the names given are not always trustworthy. The work that is most helpful and describes the greatest number of forms is Lindley & Moore's "Nature Printed Ferns." The forms there illustrated are not very many, but there are seventeen varieties named and described, and these cover nearly all the forms known in Great Britain forty years ago.

There was still another source of information more important and necessary than the books in determining the identity of specimens. Nothing can satisfactorily take the place of authoritatively determined specimens of the ferns themselves. This want was kindly supplied by Mr. C. T. Druery of Acton, London, England, and by Dr. H. Christ of Basle, Switzerland, both of whom are acknowledged authorities on ferns. Mr. Druery sent me

a beautiful set of *P. vulgare* varieties growing in the British Isles, from native plants, not from mere garden varieties. Dr. Christ contributed a fine set of varieties collected in Switzerland, Germany, and Italy. With these in my possession, it has been comparatively easy work to determine the American specimens sent me, and also to decide whether they have ever been named or not. Nearly every year something new has been received, nor has the tale yet been completed, as is evidenced by the new and remarkable form discovered last fall by Miss Church at Lake George, a description of which is included in the accompanying list.

POLYPODIUM VULGARE Linn. is one of the most easily recognized of our ferns. The fronds are usually subcoriaceous, deeply pinnatifid, in some varieties fully pinnate, and even bipinnatifid, 5 to 50 cm. high, 2 to 10 cm. wide, the pinnae faintly serrate to deeply laciniate, the veins branched from once to four or five times, but in one case at least simple, the sori round, medium to large in size, situated generally in the middle of the pinnæ at the end of the lowest anterior branch of the vein, uniserial. It grows preferably on rocks or walls, but sometimes in shaly soil, and ranges as I have indicated from Alaska through Canada to all the Northern States and as far south as Arkansas and North Carolina. Of course in these more southern localities it is only found among the high mountains.

In the FERN BULLETIN for April, 1899, Mrs. E. G. Britton gave a short account of the varieties of *P. vulgare* then known in America, in which she mentioned four that had been found here, viz., *cambricum*, *cristatum*, *angustum* and *rotundatum*. Since that time a good many others have been added to the list, and it seems desirable that it should be brought down to the present time, in order that those who are collecting may know what they are liable to find.

Prof. D. C. Eaton in "The Ferns of North America" enumerated ten varieties described by Milde. Of these,

the only ones which he seems to imply have been found in this country are *auritum*, *cambricum* and *cristatum*. Variety *auritum* was given on the authority of Prof. John Robinson, but as I have never seen any American specimens of that variety, and as other forms have been so often mistaken for that, it is not included in my list.

I have arranged the varieties in four groups, as follows:

Group I. With normal fronds.
Group II. With serrate or sinuate or lobed pinnae.
Group III. With branched fronds.
Group IV. With crested fronds.

GROUP I.

1. Var. *angustum* Muell. The peculiarity of this variety is that the pinnæ are long lanceolate, acuminate and often doubly serrate. It includes Maxon's *deceptum*, Millspaugh's *biserratum*, and Gilbert's *acuminatum*. Habitats: West Virginia (Millspaugh, Maxon); Fox' Fall, Herk. Co., N. Y. (Gilbert); Hancock, N. Y. (Mrs. Britton); Shandaken, N. Y. (Mary F. Miller); Onteora, N. Y. (Anna M. Vail).

2. Forma *attenuatum* (Milde). A rather large, slender form, 36 cm. or more long, 8 cm. wide, with many bluntly acute pinnæ, which are alternate. Tip of frond slender, 2 cm. long, slightly sinuated, fruit often extending up into it. Hab.: Lake Sunapee, N. H. (C. E. Waters).

3. Forma *marginale* f. nov. This represents a very regular form of the species, but it is chartaceous rather than coriaceous. Its distinguishing feature is that the fruit dots are marginal instead of central or near to the costa. As the sori are usually situated at the end of the anterior venule in this species, and as that venule extends very nearly to the edge in this form, instead of half way between the edge and costa, it follows that the sori extend in a distinctly marginal row nearly from the midrib of the frond to the ends of the pinnæ. In all the fronds

I have seen, also, the pinnæ are alternate throughout, which means that one pinna stands distinctly alone at the base of the frond. The form was gathered on rocks on a partly cleared hillside, July 8, 1904, at McCall's Ferry, on the Susquehanna River in Pennsylvania, by Dr. C. E. Waters.

4. Forma *platylobum* Christ. This has a short and rather broad frond with unusually broad pinnae, which are rounded at the ends. In our American specimens the pinnæ are sensibly diminished in length at the base of the frond, rendering it ovate in shape; the sinuses between the pinnæ are sharp' thus bringing them close together, and the sori are nearer to the costa than to the edge. The terminal pinna is broad and blunt, very often with three or four pairs of short, almost rotund lobes at its base, and with the sori extending nearly to its apex. The rootstock is uncommonly heavy for the size of the fern. The only North American examples I have seen came from Alaska, and were gathered by J. B. Fleet of Tacoma, Wash., who reports the form as "growing everywhere" in Alaska.

5. Var *rotundatum* Milde. Fronds about 25 cm. long, 3 to $3\frac{1}{2}$ cm. wide, stipe one-half the entire length of the frond. Pinnae alternate throughout, fifteen to sixteen on each side, regularly spaced between and very uniform in length nearly to the tip, very round-ended. This is one of the prettiest varieties of the species on account of the regularity in all its features. Gathered by Dr. C. E. Waters on rocks in dense woods at McCall's Ferry, Susquehanna River, Pennsylvania; Black Hills, South Dakota (Dr. P. A. Rydberg).

GROUP II.

6. Var. *cambricum* (L.) Willd. In this variety the pinnæ are broad and deeply lobed nearly down to their costae, the three or four pairs of lower pinnæ are much contracted at their bases, the lowest pair being quite

free from the rest; fronds 16 to 27 cm. long, 8 to 17 cm. wide, the broadest pinnæ being about 2 cm. wide and cut irregularly in the middle about half way to the costa; pinnæ on the upper half of the frond decurrent and united, ends of pinnæ rather sharply acute. Habitats: Rock City, Dutchess Co., N. Y. (Prof. C. H. Peck); West Goshen, Conn. (Dr. L. M. Underwood); Shandaken, N. Y. (Miss M. F. Miller); Cold Spring, N. Y. (Miss Moncks); Mt. Desert, Me. (Miss E. L. Shaw).

7. Var. *Columbianum* Gilbert. A small fern with coriaceous frond. Whole plant 13 cm. long at most, and $3\frac{1}{2}$ cm. wide; pinnæ numerous, closely placed, blunt or bluntly acute, two lowest pairs often deeply lobed on the lower edge and somewhat on the upper edge also; stipe very short about one-quarter the length of the whole frond; sori round, large, at length confluent and covering nearly the whole under surface of the pinnæ, somewhat immersed and prominent on the upper side; upper surface covered with glands which are sometimes golden and give a golden hue to the fern. Habitats: Arrow Lake, Columbia River, B. C. (A. J. Hill); near O'Kanagan Lake, Rocky Mts., B. C. (B. T. Gilbert).

8. Forma *deltoideum* f. nov. The fronds of this form are strongly deltoid in shape, much the broadest at base and more than half as wide there as they are long. The lowest pair of pinnæ often have an auricle on the *lower* edge at the base. The frond bears only from four to seven pairs of pinnæ, and ends in a lanceolate pinna slightly pinnatifid at base, two to three centimeters long and serrate or sinuate on the edges. Three or four sori on the terminal pinnæ seem to be all the fruit which they bear. Habitat: Rocks at Griffin's Corners, Delaware Co., New York (J. C. Buchheister). Dr. Waters sent me a blue-print of the same form, but without details as to locality. It is one of the easiest forms of all to recognize.

9. Forma *hastatum* f. nov. In a general way this much resembles *deltoideum*. But in two respects it dif-

fers: the lower pinnæ are hastate, with a spur on *each* side at base; and instead of ending in a single long pinna, the frond is pinnatifid to the summit. Nor is it so strongly deltoid in shape. Habitat: Rocks at Griffin's Corners, N. Y. (J. C. Buchheister).

10. Var. *semilacerum* Moore. On the European continent this is ranked as a variety of the sub-species *serratum* Willd., which is a form 35 centimeters long and 16 centimeters wide. In this variety not only are the edges of the pinnæ serrate, but some of the pinnæ are irregularly cut into quite deep lobes. My largest American frond of the variety is 30 centimeters long by 8.5 centimeters wide. Habitat: Rocks, Griffin's Corners, N. Y. (J. C. Buchheister).

11. Var. *sinuatum* Willd. This variety is about the same size as the preceding and much resembles that. The main difference is that the pinnæ are beautifully sinuate or waved on the edges instead of being deeply cut. It is merely a difference of degree, the one being a form of the other, but distinguished from each other by foreign writers. Habitat: Griffin's Corners, N. Y. (J. C. Buchheister): Lake Sunapee, N. H. (C. E. Waters).

GROUP III.

12. Var. *multifidum* Moore. While this variety is about the usual size and outline of *vulgare,* it is very distinct from the species proper in having the rachis forked about 5 centimeters below the summit with two perfectly natural tips to the frond. Both of these tips are liable to be fruited and the sori seem to be confined to them, or occasionally to one or two pinnæ below them. The rhizome with its scales and rootlets is unusually large for the size of the fern. Habitat: Rocks, Griffin's Corners, N. Y. (J. C. Buchheister).

13. Var. *ramosum* Moore. The peculiarity of this form is that one or more of the regular pinnæ is developed into something like a separate frond which is divided

into other regular pinnæ just like the original frond. In other words, a part of the frond is bipinnate. This may occur either in the middle or toward the end of the frond. It is not a forking of the rachis but a branching thereof. Habitat: Rocks, Griffin's Corners, N. Y. (J. C. Buchheister).

GROUP IV.

14. Var. *bifido-multifidum* Druery. This was originally published in America as var. *cristatum* Lowe, and was so given in my List of N. A. Pteridophytes. Nor did I suspect that it was wrong until Mr. Druery's set of English varieties was received. The set included both varieties and it was seen at once that what had been called here *cristatum* was not that variety but was *bifido-multifidum*. The two are entirely different in their characters. They are nearly of the same size and general contour, but the pinnæ of *bifido-multifidum* are like clubs with big knobs on them. The lower edges of the pinnæ are nearly straight. The outer end is enlarged and blunt with a couple of blunt lobes, while the upper edge half way to the mid-rib has one to three more blunt lobes, and the mid-rib at the end of the frond is bifid or flabellate, running out into other lobes. But these terminal lobes are always blunt and bifid. This differs from *cristatum* decidedly, as the ends of the pinnæ in that, although split and somewhat enlarged, lack the big lobes, while the end of the frond is more delicate and graceful. I have seen no American specimens of *cristatum*, and Mrs. Britton's few words in regard to it evidently indicate the variety *multifidum*. Habitat: Rock City, Dutchess county, N. Y. (Chas. A. Coons, also Prof. C. H. Peck).

15. Var. *Churchiæ var. nov.* When this plant was found it contained only two fronds, neither of them fruited, but as nearly alike as two peas. Following is a description of them: Rootstock not seen. Frond 17 centimeter long, stipe 9 centimeters, slender, naked, channeled,

lower part dark, upper part stramineous; rachis 6 centimeters long up to the point where it forks, lamina 5 centimeters wide at base where it is broadest, fully pinnate, the pinnæ rapidly decreasing in length from the middle upward, the 2 centimeters at tip divided and beautifully crested, the rest more or less dentate; seven lower pairs fully separate from each other, the lowest 1 centimeter from the pair above, the four lower pairs rounded at base and *stalked,* those above more and more adnate and decurrent; texture moderately thick, but veins distinct, being more or less sunk in the parenchyma, nearly all but the one or two lowest on such pinnæ being *simple,* the lowest once or twice forked each vein running into a crenature, the outermost flabellate. Fruit not known. There are some peculiar features belonging to this fern. The most remarkable one for a variety of *P. vulgare* is that the four or five lowest pairs of pinnæ are stalked with a pedicel. No other form of the species with which I am acquainted possesses this feature. Without exception all the other forms have adnate pinnæ throughout, except that anomaly in the species called *corymbiense,* and even that has the green part a trifle expanded at the base of the pinnæ. Some forms of var. *cambricum* come near to it in this respect, such as *cambricum* itself and the variety Prestonæ, which is found only in the lake district of England. In the lower pinnæ of these the parenchyma is entirely eliminated from the under side of the veins at the base of the pinnæ, and is very much narrowed on the upper side, so that the pinnæ are fully separated from those above. Still, they are not stalked.

Another peculiar feature is the simple unbranched veins which extend quite to the edge of the pinnæ. This also is an anomaly in the species. The dark shade of the lower part of the stipe and of the upper part of the rachis is another peculiarity. In the fresh plant the costæ of the stalked pinnæ and the rachis above the point where it forks are as dark as in the ebony spleenwort. But when pressed the greater part of this discoloration disappears.

leaving only a light shading of brown. Of course without seeing a sorus, it is a little hazardous to make a positive assertion as to the affiliation of this fern. It can hardly be a cross between two other species, for, so far as I am aware, nothing of that kind is known which takes on a crested form. My opportunities for comparison with other forms are so exceptionally good that I feel safe in allying it with *P. vulgare*. Miss Church, who discovered it, took up the plant and potted it carefully, hoping that it would grow and put forth other fronds which would bear fruit. But it has failed to do so. It may have been like the var. *cambricum* which persistently refuses to produce fruit.

Habitat: On the old wall of Ft. George, Lake George, N. Y. Gathered by Miss Alice Church of New York City, September, 1905. Type of one frond in Gilbert Herbarium.

Clayville, N. Y.

Mrs. Ora Parker Phelps has called attention to the fact that the form of the Christmas fern known as *Polystichum acrostichoides recurvatum* was illustrated in the *Plant World* for April, 1902. The specimens from which this illustration was made were found by Mr. W. R. Maxon, near Falls Church, Virginia. The description accompanying them shows very clearly that they belong to the form *recurvatum* and the illustration removes all doubt. It appears to have been Mr. Maxon's opinion that the fronds were merely odd sports, but there seems to be an inherent tendency in the Christmas fern's constitution to produce such specimens, as is shown by the finding of the same thing in widely separated localities. To Mrs. Phelps is due the credit of recognizing the value of such finds. Although the first record of the collection of this form dates back to 1901, the plant was not named until July, 1904, from specimens collected that year by Mrs. Phelps.

THE RESTING OF BOTROCHIUM.

By Bridget M. Rooney.

Five years ago I began to notice that there were many *sterile* plants, as well as fertile ones among all *Botrychiums,* and on close examination of sterile plants I noticed an abortive, or blasted fertile portion on each stipe, remaining throughout the season. I noticed especially that all the varieties of *Botrychium,* when sterile had this abortive portion on the stipe.

In the hope of getting help from a botanist at some time, I collected some of the stipes possessing this interesting part of the plant which seems to be " resting " and put it in wide-necked bottles, using alcohol as a preservative. Also some " buds " of both fertile and sterile plants. I thought that a botanist could take the stipe out of the bottle and see this blasted portion at any time for study, for I knew that with a good magnifier he could see whether the plant which had been fertile this year, would have a good, healthy fruiting portion in bud for the next season, and since the plant which was sterile, would contain a budded fruiting portion, he could say whether he thought it would continue to " rest " a second season.

After I had completed my collection of stipes and buds, I began to think that we could not be very sure about the abortive portion in bud. I did not feel sure, but that the fruiting portion in the bud might look like a healthy thing and blast after the plant began to develop, or meet with an accident, so I went into the woods this fall to study the points. I took *B. Virginianum* for the study because it matures so early and is very common in our woods, and is so large in the bud that you can see with the naked eye the lamina and fruiting portion. It is very beautiful when you come upon it,—after removing the fallen leaves, and digging down into the earth,—just as green and tender as any little plant would look in the Spring. It comes out as if to get a good start before the frost gets into the

ground. On examination of the buds one sees at once that the portion which gave me so much trouble was blasted in the bud. It is not like the healthy fruiting portion either in size, shape, or color. It does not seem to have any chlorophyll in it, and it looks just the same in the bud as it does on the stipe at the end of the season. I think that the number of years for a plant to be fruitful, or to be found sterile, varies. They may be found fruiting one year, and resting another. I examined four buds which I found sterile this season (1905) in late October. Three of them contained healthy fruiting portions, but one of the buds had the blasted or abortive portion and would be found sterile again in 1906. Out of seven fine fertile plants of 1905, three would have been sterile in 1906, the other four showing the green, large, healthy fruiting portions in the buds. The buds which I have are so large, that the opening on the stipe at the base shows quite well. I do not know whether or not one could view the parts of the plant in the buds which I collected and be able to say after using a magnifier what the plant would do two years hence, but a plant which was *fertile* in 1905 and shows a fertile portion in its bud for 1906, might indicate what its condition would be in 1907. I have some fine buds of this year (1905) in a bottle. I used an oil instead of alcohol so as to preserve the color of the abortive portion as well as the beautiful green in the buds, I do not like alcohol as well because it changes the color. The buds are from 1 inch to 1½ inch in length, if not more in large plants. The abortive portion is about 1¼ inch in length, but the normal fruiting portion of the plant is as long as the sterile lamina, and the same color, green, and bent all together.

In 1903, four fertile plants were removed to my little fern garden, they were fertile this year (1905), and I took a plant up this fall to see what would be the condition of the bud, and it showed a fertile portion. *Botrychiums* apparently do not rest alternate years, regularly; they vary. I did not find this abortive portion on the stipe

of the little Adders-tongue fern (*Ophioglossum vulgatum*). If it was on the stipe of the plant it was too small to see with my pocket glass. There are, I should say, as many sterile plants as fruited ones where I studied them.

St. Johnsbury, Vt.

THE FORMS OF THE CINNAMON FERN.

By Willard N. Clute.

The forms of the cinnamon fern have never struck me as being important enough to merit much attention, although it seems reasonable that form names should be given to such variations as are fairly constant and distinct enough to be visible. Such variations as have been named *glandulosa* by Mr. Waters, and *incisa* by Mr. Huntington belong, I am sure, to this category. Gray's *frondosa* may also be retained for this peculiar form, although we now know it to be due to some injury to the plant and quite comparable to the *obtusilobata* forms of the sensitive and ostrich ferns.

For some years I have been cognizant of a very distinct form of the cinnamon fern which I had supposed was to be referred to Mr. Huntington's *incisum*, but recently in looking up the description of that fern I find that he says his specimens are *incised*. In my specimens, however, the half dozen pairs of pinnules nearest the rachis in each pinna are regularly and deeply lobed, making such fronds nearly tripinnate and forming an exceedingly graceful plant. It is noticeable that the variation is basal; the deepest lobes are at the base of the pinnules, the deepest lobed pinnules at the base of the pinnæ and the greatest amount of lobing is at the base of the frond. I have seen specimens from both Illinois and Pennsylvania and in each case the plants grew in deep, rich woods where the soil was wet. The form appears to be produced by an abundance of shade and plant food and would no doubt revert to the type in sun or poor soil. I

have no specimen of *incisa* for comparison, but if my form is not identical with it, it may, for purposes of description, be called *Osmunda cinnamomea bipinnatifida.*

AN ALABAMA STATION FOR BOTRYCHIUM BITERNATUM.

By W. C. Dukes.

Just west of Mobile, Alabama, there is a gradual rise until, some four miles from the city, one reaches at Spring Hill an elevation of 200 feet or more. In antebellum days this eminence was utilized by Mobilians as a summer resort, and here many of the prominent families of the city built summer-houses, where their descendants still reside. The spacious grounds were planted in cedars and other evergreens; but owing to the changed conditions many of the grounds have been curtailed, and others allowed to grow up to various kinds of second growth. This gives an ideal condition for the growth of Ophioglossaceæ, and here flourish three species of Botrychium, viz.; *B. obliquum* var., *tenuifolium, B. Alabamense,* and *B. biternatum.*

After the first two are well under way, and are flaunting their yellow-tasselled, powder-laden spikes, *B. biternatum* begins to push up its sterile blade, usually towards the last of August or the first of September. At first it seems to grow slowly, but the later rains cause it to develop more rapidly, and by the middle of October to the first of November the sterile frond is well on toward maturity. At this stage the sterile frond lies flat upon the ground, so close in fact that it is in little or no danger from browsing animals.

Even at this date (November 10th) the fruiting frond is formed and lies coiled just at the surface of the ground, dormant, and hidden away from biting frosts in the sedge and grass until the coming of spring.

The whole plant seems to be resting at this stage, and

shows no material signs of growth until January or February. At this time the stalk begins to lengthen, and the blade assumes a semi-erect position, but never so much as in the other species. It is now far easier to find than at any other time. The fruiting period generally lasts through March into April, and by the last of April the spores are all shed, and the plant presents a ragged appearance.

Along the edge of fields and pastures, where the ground is kept moist and mellow by a carpet of pine and cedar needles, is the place to find our plant. Occasionally it is found out in the open, but the specimens are smaller, and of a reddish cast. The general outline of the sterile frond is triangular, 2 to 3 inches wide, and 3 to 4 inches long. As the name implies, it is twice-ternate. The sterile frond when at the fruiting stage rises 3 to 5 inches above the ground, and is nearly sessile. Some specimens even branch from the surface of the ground. The outer segments are rounded, decurrent on the secondary rachis, and finely crenulate.

In the early stages of its growth the plant shows a bright clear green, which gradually deepens with age; some plants showing a decided bronze tint, especially those which obtain more sunlight. As in other *Botrychia* the roots are clustered. They are rather more abundant than in most species, although not so large, and branch horizontally two or three inches below the surface, never running as deep as in the taller species.

Mobile, Ala.

THE AUTHOR CITATION.

By Willard N. Clute.

The subject of nomenclature has been pretty well ventilated during the past ten years with the result that the principles upon which plants are juggled from one genus to another are well known even to the novice. As yet, however, we have been unable to shake the cumber-

some author citation at the end of every combination of genus and species. The time is not yet when such combinations may appear without author citation of any kind, except in the cases of our most familiar plants, but that the day will some time arrive can scarcely be doubted. If we ever get that "stable nomenclature" so much talked of and so little practiced, there will be no need for appending the name of any authority. Meanwhile it seems to me, we have arrived at a point where we may well dispense with the second of the two author citations.

Two very good illustrations of the evils that may come from retaining both citations have recently come to hand. The first is Christensen's "Index Filicum," in which owing to the arrangement of many species under new generic names, hundreds of new combinations are made. After each of these we find "C. Chr. Ind." and the number of the page upon which the particular name is printed. Does anybody believe that the printing of a mere list of species is sufficient to entitle an author to attach his name to say even one-tenth of the ferns in the world? Is it not perfectly plain that if one can secure immortality in this way, one may easily stretch a point or two to attain it, especially when there are no hard and fast lines for species making among the ferns?

The second instance is found in Lyon's proposed new generic name for the ternate species of *Botrychium*. On account of certain differences in the structure of the gametophyte or prothallium and the behavior of the young sporophyte, the name *Sceptridium* is proposed. At once the familiar names at the end of the *Botrychium* combinations vanish and those who thought they had their hold on the genus *Botrychium* cinched find themselves shut up in parentheses while a Lyon stands guard over two dozen grape fern specific names. This game of tag need not stop here, however. We all know, whether we will admit it or not, that many of the so-called "species" of grape ferns are nothing but varieties, and since *Sceptridium Californicum* (Underw.) Lyon is

really *S. ternatum Californicum* (Underw.) and *S. Coulteri* (Underw.) Lyon is *S. ternatum Coulteri* (Underw.). While *S. dissectum* (Spreng.) Lyon is mere *S. ternatum dissectum* (Spreng.) and *S. Jenmani* (Underw.) Lyon is only, *S. ternatum Jenmani* (Underw.) how easy it would be to give these their rightful standing and displace Lyon's name with our own. *Sceptridium tenuifolium* (Underw.) Lyon is almost universally regarded as a mere form—*S. ternatum tenuifolium* (Underw.) and so is *S. Underwoodianum* (Maxon) Lyon, which should be *S. ternatum Underwoodianum* (Maxon). If anyone chooses to cite these and others in the list with a proper show of synonomy and citation of publication he may ultimately be cited in the scientific name of nearly half of them. In no wise would such changes alter our own opinion of the parts they represent and I submit that the addition of the second author citation is both unnecessary and undesirable.

THE DISTRIBUTION OF BOTRYCHIA.

In the first installment of your Check List of the North American Fernworts several species are assigned a habitat which is at variance with my experience and observation. For *Botrychium matricariæfolium* you have, "Rare; in moist shades." I have collected the plant in Maine and Vermont. In Maine I find it locally abundant in sterile fields and pastures; in Vermont occasional in rich woods or hillside pastures. In Fern Bulletin X. p. 55, Mr. A. A. Eaton writes of having "seen a quarter acre almost completely covered with *B. matricariæfolium* several years in succession." Now, I would venture to guess that the locality referred to was a sandy pasture infested with sweet fern and spreading juniper. Certainly this *Botrychium* is not entitled to be called rare in northern New England. As it grows in dry fields it develops many freakish forms which might easily suggest the name *neglectum*, while in woods it is usually smooth

and regular and about twice as tall as the average open field specimen.

I suppose the fact that Mr. Eaton has abandoned his species *B. tenebrosum* and concedes it to be a form of *B. simplex* does not make it necessary that everyone else should adopt the same opinion. But it would interest me to know just your reason for making it a variety of *matricariæfolium*. I have collected it about six times, usually in cedar swamps. *Botrychium simplex* is not "rare" in northern New England. In June of this year I hunted for it about six times in different places about Auburn, Me., and never failed to find it. In ten or a dozen different localities I collected about two hundred specimens, and must have seen several thousand. A little later I was in Vermont and collected it in three different townships. I never collected it in the woods unless my *tenebrosum* is *simplex*. I always find it, if at all, in hillside pastures or sterile fields. In Vermont several ferns grow in open pastures which are generally found in the shade or in the swamps. Such are *Botrychum Virginianum,* and *Osmunda regalis.* Of course it is impossible to give a habitat that will cover every case, but it seems to me that some of the statements in the Check List should be amplified in order to be approximately correct. —*E. J. Winslow, Elmira, N. Y.*

[One of the objects in issuing the Check List was to bring out comments like the above. As to the rarity of this species in question, opinions may differ. The editor has collected more or less for twenty years in six States within the plant's range without seeing it more than twice. Where it was found it grew in great abundance and looking at the single spot one might jump to the conclusion that it is common. Again, this plant is one of those most frequently asked for by exchangers, another indication that it is not always easily found, and probably not common. It would be interesting to hear from others on this subject. Mr. Gilbert writes that he thinks it

rather common. The exact reasons for our considering *tenebrosum* a variety of *matricariæfolium* is that in form, place of growth, time of fruiting, etc., it resembles *matriariæfolium* enough to be a form of it. The last time we heard from Mr. Davenport on the subject he also thought as we do. We suspect, though, that Mr. Eaton would hardly subscribe to the statement that he had given up *tenebrosum*. It may be added that comments, criticisms and corrections of the check-list are invited from all. In no other way can we place a correct list before American fern students.—Ed.]

FERN CULTURE.

The raising of ferns from spores is at once the easiest and most convenient method of increase with varieties that adapt themselves to this means of propagation. The selection of spores is necessarily the first step. This, with some of the varieties, requires strict observation and some little experience to catch them just at the proper stage. Though as a general rule ripeness is indicated by the sori turning brown or beginning to shake off. Some of the genera, notably the *Davallias* shed the spores more easily than others and the inexperienced are often apt to delay too long and gather instead of ripe spores fronds with but empty cells.

The fronds when gathered should be wrapped closely in paper and laid in a dry, warm place for a week or two until thoroughly dry, after which the spores can be readily shaken off. The general opinion is that the sooner they are sown after being thoroughly ripened the better, and although not usually necessary to keep them for any length of time, I have sown spores of *Pteris tremula* that had been wrapped up in paper for two years with satisfactory results. Another somewhat difficult matter is to get spores of the individual varieties true or unmixed. Fern spores are of such a light nature that the least breath of air will carry them all over the house,

the spores of one variety finding lodgment on the fronds of another. I have sown spores from *Adiantum* fronds and reaped instead of *Adiantums* an excellent crop of *Pteris* where the spores had got mixed in this way; the *Adiantum* spores were there all right, but the *Pteris* spores being the stronger growing and quicker germinating variety it was simply a case of the survival of the fittest. The lesson thus learned is to keep the varieties by themselves and as far away from others as possible for some time previous to the selection of spore fronds.

The next thing is the preparation of the seed-pans. These should be thoroughly cleaned to insure that no germs of moss or fungus are left lodging around. A great deal of what is known as damping off has its origin from this source, being the work of a minute fungus. Fill the pans about one-third full of broken crocks, larger ones in the bottom and those on top finely broken. Over this place a layer of moss, then fill to within an inch and a half of the top with ordinary potting soil. On this place half an inch of soil which has been subjected to a baking process long enough to kill all vegetation in it. This insures against the growth of moss, which in unbaked soil would be more rapid than that of the ferns and prove a source of considerable trouble. This baking of the soil was at one time one of the secrets of fern cultivation, but it is now pretty generally practiced. The surface soil in the pan should be pressed down and made as smooth as possible. A good soaking with water should be given and allowed to drain off before sowing the spores. Sow the spores thinly, I may say very thinly. The spores being very minute, it is an easy matter to sow too thickly without being aware of it. Do not cover the spores, but leave them on the surface of the soil and place over the pan a close fitting pane of glass. The pane must be turned frequently to prevent the moisture from dripping, which would throw the spores into little bunches. Water should never be given from the top, but the pan should be set in a saucer which

should always be kept full and from which sufficient moisture will be drawn.

The best place to start spores is in a close atmosphere in a bottom heat of from 60 to 65 degrees. Shade should be provided during the day, but should be removed when the sun is not shining directly on the house. In from ten days to two weeks, depending on the variety, the surface of the pan will assume a green mossy appearance. This is produced by the protalli, which as they become larger will be seen to be small heart-shaped bodies. These in due time produce the sexual organs, the antheridia and archegonia. By sowing two or more varieties in one pan the possibility of the spermatozoids from one variety coming in contact with the archegonium of another may bring about cross fertilization.

The difference in the time needed for the maturing of the sexual organs of the different varieties would need to be studied with the microscope to give a fair chance of bringing about a cross, but this is hardly within the sphere of the ordinary gardener who has to plod along by rule of thumb and take his chance of striking it by accident. No doubt many of the varieties now cultivated have been thus produced.

The crested and variegated forms are mostly the result of sporting, which is the only other means by which new varieties are produced. If the spores have been thinly sown it may not be necessary to transplant until they begin to throw up the little fronds, though they generally require transplanting before that stage is reached. For this shallow flats are the most suitable, a loose sandy compost being provided. They should be lifted in small bunches on a wooden ladle which has been rounded and thinned down on one end for the purpose. The back of the ladle is pressed down into the soil sufficiently to make a little hollow receptacle and when withdrawn from below leaves the little clumps in proper position without having to be touched by hand. Being of a very fragile nature the least touch will bruise them. Some do not

believe in watering at this stage, but I make it a practice to sprinkle them lightly after transplanting and find no bad results from it. I always, however, use water at a temperature of about 65 degrees. Covering with glass will be necessary for some time after transplanting, but this should be gradually removed as the little fronds gather strength. Shading must be attended to through all this stage of their growth, as a few minutes sunshine would work irreparable damage. They must also never be allowed to suffer from dryness.

When plants begin to get crowded they should be potted up into thumb pots, using a compost of loam, leaf mold and sand in about equal proportions. The plants need not be singled out individually, but if potted four or five together will make serviceable plants much quicker. For subsequent pottings, which should be given just as soon as the pots they are in are well filled with roots a rather heavier moderately enriched soil should be employed. Raising from spores is by far the most convenient way of keeping up the supply of small ferns, the demand for which seems to be on the increase. The demand for certain classes of plants or flowers is apt to be controlled to a great extent by fad or fashion, but the fern pan, it seems to me, is not going to be lightly thrown aside.

If I were to enumerate all the varieties suitable for the purpose I have no doubt they would fill a good-sized book. But I am sorry to say that the varieties generally met with are not very numerous. I am sure it would pay the growers who would have enterprise enough to keep on procuring and trying varieties different from what are commonly used. They need not be new varieties, for there are hundreds of old ones to pick from, which are worth a trial.

About six months from the time of sowing it is usually required to give useful sized plants a night temperature of about 60 degrees and a day temperature of 75. In stronger heat they could be grown in shorter time, but

it does not pay to rush them, as they would not be so compact and bushy, and would of course be much softer. Successional batches should be sown as required, as they soon become too large and if confined for any time in small pots assume a stunted and sickly appearance.

When larger plants are wanted they should be kept moved up, as they need it and receive as little check as possible, and if it is intended to grow them into specimens they should be kept moving just as fast as possible, as the size of the plant does not depend on age or size of crown, as it does upon length of frond. To procure this the chief agencies are intensive culture and quick growth. Most ferns can be materially assisted in this by the application of liquid manures, but this should not be applied unless the pots are pretty well filled with roots, otherwise the residue not used by the plants would have a tendency to clog the soil and cause sourness.

Most ferns adapt themselves to be propagated by division, but this is a slow method with some, and when they come readily from spores need hardly be practiced. Some, however, notably *Nephrolepis,* can be propagated very rapidly by offsets and some, notably *Adiantum Farleyense,* can only be propagated by division of the crown. This latter variety is one of the most beautiful ferns we have, but one that is rather difficult to grow. One of the chief causes of failure with this variety is the lack of heat in winter. It requires a temperature of not less than 65 degrees to keep it growing even slowly.

All ferns require shade to a greater or less extent, but it is a very common mistake to make the shade too heavy. This causes drawn-up, weakly growth, and in a good many cases spoils the individual character of the fronds from lack of proper development. All that is necessary in applying shade is to prevent the strong sunlight from burning or eating the color out of the fronds. Further than to prevent this, shade is unnecessary. Fresh air, also, plays an important part in the health of the frond maintaining the health of the plants.

In conclusion I would like to say a few words in favor of the more general use of hardy ferns for beautifying the surroundings of the home. These adapt themselves to filling corners where few other plants would thrive and we have a great many beautiful native varieties besides a number of foreign varieties that are quite hardy in this latitude. They will grow and thrive in any shady corner as long as they are not under the dense shade and drip of trees.—*From an article by William Scott in Gardening.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

BISSELL, C. H. *Fern Flora of Connecticut.* Fern Bulletin, Jan. 1906.

BRAINERD, E. *Nephrodium Filix-mas in Vermont.* Rhodora, Jan. 1906. The first record for Vermont.

CLUTE, W. N. *Tropical Ferns in the Southern States.* Fern Bulletin, Jan. 1906. Discussion of the species likely to be found in the Gulf States.

DAVENPORT, G. E. *A Hybrid Asplenium new to the Flora of Vermont.* Rhodora, Jan. 1906. A supposed hybrid between *Asplenium trichomanes* and *A. ruta-muraria.*

DAVENPORT, G. E. *Botrychium Matricariæfolium,* illust. Fern Bulletin, Jan. 1906. An enquiry into the relationships between *Botrichium neglectum* Wood, *B. matricariæfolium* A. Br. and *B. ramosum* Ascherson.

DURAND, E. J. *Sporangial Trichomes.* Fern Bulletin, Jan. 1906. Records the occurrence of trichomes on the sporangia of various species.

HAZEN, T. E. *Dryopteris Filix-mas in Vermont.* Fern Bulletin, Jan. 1906.

WEATHERBY, C. A. *An Extreme form of Botrychium Virginianum.* Rhodora, Feb. 1906. A plant with three fertile panicles.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

HYMENOPHYLLACEÆ.

Trichomanes L.

23. **Trichomanes Krausii** Hook. and Grev. Rare; on roots and tree-trunks. Southern Florida; also in the West Indies, Mexico and south to Peru and Brazil.

24. **Trichomanes Petersii** A. Gray. Rare; on moist rocks. Confined to a few localities in Alabama, Georgia and Mississippi.

25. **Trichomanes radicans** Sw. Killarney Fern; Filmy Fern. Rare; on moist rocks from Kentucky to Alabama and Florida; also throughout the warmer parts of the world.—*T. Boschianum* Sturm.

26. **Trichomanes sphenoides** Kunze. Very rare; on wet rocks. Southern Florida; also in the West Indies and the mainland of tropical America. This species is sometimes referred to *T. reptans* Sw.

PARKERIACEÆ.

Ceratopteris Brong.

27. **Ceratopteris thalictroides** (L.). Floating Fern. Rare; floating on the water even where it is brackish. Florida and southern Louisiana; also around the earth in the tropics from Mexico to Brazil and from India to northern Australia.

POLYPODIACEÆ.

Acrostichum L.

28. **Acrostichum aureum** L. Rare; in brackish swamps. Southern Florida; also in Bermuda, the West Indies, Brazil and throughout the East Indies.

29. **Acrostichum lomarioides** Jenm. Rare; in swamps near the coast. Southern Florida; also in Bermuda and the West Indies. Formerly confused with *A. aureum.*

30. **Acrostichum sorbifolium** L. Rare; in moist shades. Southern Florida; also in the West Indies.

ADIANTUM L.

31. **Adiantum capillus-veneris** L. VENUS'-HAIR FERN. Tolerably common; on moist rocks. Virginia to Florida, Utah and California; also about hot springs in Dakota. Found around the world in the tropics and extending to England and Cape Colony.

The form **elongatum** Lemmon is an elongated form from Arizona; forms with round-ended pinnules have been collected in New Orleans.

32. **Adiantum emarginatum** Hook. Not uncommon; in moist shades. California and New Mexico to Oregon.—*A. Jordani* C. Mull.

33. **Adiantum hispidulum** Sw. Naturalized near Thomasville, Georgia. Found also in the East and West Indies.

34. **Adiantum modestum** Underw. Rare. New Mexico. Closely related to *A. capillus-veneris*

35. **Adiantum pedatum** L. COMMON MAIDENHAIR. Common; in moist shades. Nova Scotia and British Columbia to Georgia, Mississippi, Arkansas and Utah; also in eastern Asia.

36. **Adiantum pedatum rangiferinum** Burgess. Not uncommon; in woodlands. Pacific Coast from Oregon north to Alaska. By some this is regarded as a distinct species.

36a. **Adiantum pedatum Aleuticum** Rupr. Not uncommon; in woods. Gaspè Peninsula, Unalaska and the Far North.

37. **Adiantum tenerum** Sw. Not common; on moist calcareous rock. Southern Florida; also in the West Indies and southward to Peru.

38. **Adiantum tricholepis** Fee. Rare; in moist rocky soil. Western Texas and New Mexico.

ASPIDIUM Sw.

39. **Aspidium juglandifolium** Kunze. Rare; in crevices of rocks and in shaded rocky soil. Texas, New Mexico and Arizona.—*Phanerophlebia auriculata* Underw.

40. **Aspidium trifoliatum** Sw. Rare; in moist shades. Florida and Texas; also in the West Indies and southward to Brazil and Peru.—*Tectaria trifoliata* (L.).

ASPLENIUM Sw.

41. **Asplenium angustifolium** Michx. NARROW-LEAVED SPLEENWORT; SWAMP SPLEENWORT. Tolerably common but unevenly distributed; in wet woodlands and open swamps. Southern Canada to Georgia, Tennessee and Missouri.

—. **Asplenium auritum** Sw. Reported from Sumter County, Florida, on the strength of a single frond said to have been collected there in 1894 and now in the herbarium of the New York Botanical Garden.

42. **Asplenium Bradleyi** D. C. Eaton. Rare; on damp shaded rocks. New York to Georgia, Arkansas and Missouri. Specimens described as *A. Andrewsii* Nelson are probably forms of this.

43. **Asplenium cicutarium** Sw. Rare; in moist soil. Florida; also in the West Indies and Mexico south to Peru; in Guinea and Abyssinia.

44. **Asplenium dentatum** L. TOOTHED SPLEENWORT. Rare; in lime "sinks." South Florida; also in the West Indies, Mexico and Guatemala.—*A. trichomanes-dentatum* L.

POLYPODIUM PILOSELLOIDES.

By Willard N. Clute

When we speak of the common polypody we seldom stop to think that this name can be applied to our familiar species in but a comparatively small part of the world. It is true that this species, or forms that closely resemble it, is widely distributed, but in many localities it is anything but common and from others it is absent entirely. So great is the *Polypodium* genus, however, that there is usually a common polypody for every clime though the species may vary with the latitude, longitude or altitude.

One of the common polypodies of the West Indies is the little *Polypodium piloselloides* illustrated herewith. From sea-level to altitudes of a mile or more it is likely to be a familiar feature of the wayside growing on rocks, earth, old logs and living trees. Like our little gray polypody of the South, which inhabits similar situations, it seems to prefer the trunks of trees up which it climbs for long distances by means of its slender cord-like rootstocks. In the forests it often gets well up into the treetops. The thick and dark green fronds are usually not as long as one's finger and are entire with an ovate, oblong or lanceolate outline quite unlike the polypodies of northern regions though similar to many allied species in the tropics. They are scattered along the freely branching rootstock on short stipes and at first glance the plant might be mistaken for some flowering vine.

As in many other ferns, the work of spore-bearing has produced a reduction of leaf surface that causes a marked difference between the fertile and sterile fronds. The whole plant is scaly. Upon the fronds are many shield-shaped scales and the rootstock which appears as thick as cord is found to be scarcely heavier than strong thread when the scales that clothe it are removed.

EDITORIAL.

The present issue of this magazine is intended to be on time—at least it was practically all in type by the first of March. At this writing also, part of the July number is in type, and all the principal articles are ready. We have no intention of allowing this magazine to be late again and think we have perfected plans to prevent such occurrences in future. The great trouble has been that the magazine is printed by one of the big printing houses, and just at the time when it ought to be printed, some bigger job crowds it out. We now expect to send copy to the printer somewhat earlier. Contributors will kindly note this and send communications intended for any special number in ample time.

* *
*

As usual, the editor expects to spend part of his summer directing the Nature Study work at the Connecticut State Chautauqua. It is too early in the season to present all the details of the courses for this year, but it may be said that a course in the structure of plants will be given which is intended expressly for teachers of nature study and other lovers of outdoors. In these courses technical terms are reduced to the minimum. There will also be lectures on how to identify the trees, birds, ferns, etc. The locality in which the meeetings are held is one that abounds in wild plants, containing, among others, nearly forty species and varieties of ferns. In addition to the lectures, daily walks to attractive points are taken for the purpose of studying the wildlings. The Chautauqua begins the second week in July. Those who are looking for a good place to spend their vacation should investigate this. Some fifty lectures on other subjects by eminent men are included in the Chautauqua course. Further information may be had by addressing Dr. D. W. Howell, 400 Windsor Ave., Hartford, Conn.

The new Treasurer of the American Fern Society, and the third person to assume the duties of that office since its organization, is Miss Nellie Mirick of Oneida N. Y., who has been a member of the Society since 1896. It is a bit curious that no less than five officers of the Society have been drawn from the ranks of members admitted in that year, two of these having acted as President, and two as Vice President. Under these circumstances, we have no doubt Miss Mirick will make a most capable Treasurer, and we suggest that if there are any members of the Society who have not yet paid their dues, they will help the new Treasurer to get accustomed to the office by sending them in at once.

* * *

As this issue goes to press, the American Fern Society has a larger membership than ever before in its history. Deducting all resignations to date, it nearly reaches the 150 mark, and there is no doubt that that point will be passed during the present year. Eighteen new members have joined the Society within a year without a special effort being made to increase our numbers.

The new folder that may be sent to fern-loving friends will certainly help greatly in adding to our rolls. The present is likely to be a record year for the Society.

* * *

In response to the requests of several subscribers who would like to read the early numbers of this publication, but cannot because they are out of print, we shall begin the publication in subsequent numbers of occasional articles taken from the first five volumes. We shall only select what, in our judgment are articles that merit a reprinting, and we trust the writers of these will not rise up and complain at our bringing their early efforts before the public. This is one of the few botanical magazines that has existed long enough to assist at the beginnings of several botanical reputations. Several of

those who are now foremost among fern students were just beginning to be able to distinguish the Christmas fern from the cinnamon fern and the maidenhair when the FERN BULLETIN put forth its first tiny leaves. Some of these youthful efforts, however, are still worth a reading, and we hope to give the first in a short time.

* * *

Notwithstanding the wisdom of the couplet which exclaims

"O how wondrously you vary
Polypodium vulgare!"

it is probable that few of us realized the extent of the variations of this common fern within our territory until the publication of Mr. Gilbert's article. A close study of any widely distributed fern, however, is likely to give equally surprising results. This being so, it may strike the thoughtful student that it is possible to make too much of the forms in certain groups, especially in those that exhibit a natural tendency to vary.

* * *

Although a meeting of Fern Students was announced to take place at New Orleans during the holidays in conjunction with the meetings of the American Association for the Advancement of Science, the scarcity of fern students in the Gulf States and the distance of the meeting from the centers where such students are most numerous decided the promoters of the meeting to cancel it and to help swell the audience at the general botanical meetings of the Association. Three papers intended for presentation at the meeting are therefore given to the public through the FERN BULLETIN. Their titles are: "*Dryopteris filix-mas* in Vermont," "An Alabama Station for *Botrychium biternatum*" and "Tropical Ferns in the Southern States."

NOTES.

A new station for *Lygodium palmatum* in the vicinity of Hendersonville, N. C., is recorded by W. C. Dukes.

It is of interest to note that British fern culturists invariably speak of young ferns as "seedlings," though the merest novice among them ought to know that ferns do not produce seeds. The fact that the word, sporeling is avoided, may possibly be set down to British conservatism.

In the catalogue of a German dealer we notice that the common polypody is called spotted fern. This will probably be a new one to most of our readers, though when one considers the distinctness with which the sori stand out on the frond, the name must be admitted to be quite as appropriate as many of the common names of ferns.

We regret to note that Miss Elizabeth Whittlesey, a well-known student of ferns and flowering plants, died at her home in Litchfield, Conn., Dec. 26, 1905. Miss Whittlesey was one of the early members of the Fern Chapter, but of late years had devoted her time to bird studies.

Two more sets of THE FERN BULLETIN have been located. The Lloyd Library, Cincinnati, O., has a full set, and Mr. J. H. Ten-Eyck Burr, Cazenovia, N. Y., by offering $1.00 a number has at last filled his set. Several sets lack only the January, 1896, number. If ten orders at 75 cents can be secured, it will be reprinted.

The second finding of *Asplenium trichomanes f. incisum* is reported from Brattleboro, Vt., by Mrs. Frances B. Horton. The first specimens were found some years ago by Miss Annie L. Grout, and none have been located since until the find of Mrs. Horton. The crested dicksonia and *Nephrodium marginale* × *cristatum* have also been found.

THE AMERICAN FERN SOCIETY.

Formerly Linnæan Fern Chapter.

The membership folder that is now ready to send out is a new departure for the Society. The front page is devoted to an invitation to membership, and succeeding pages give an account of the Society, the Officers for the year, the Advisory Council, and various additional paragraphs containing information that members will find useful. One of the back pages is a printed receipt for dues, which is signed by the Treasurer when dues are sent, and thus remains a permanent part of the folder. Copies of this folder will be sent to every member. Those who have paid dues will find their receipt included. Extra copies of this folder may be had by addressing either the Secretary or the Treasurer. If you have any fern-loving friends that are not members of the Society, by all means send them a copy.

The Woodsia Chapter.

The new Chapter of the Society, located at Muscatine, Ia., has been in existence as a fern club for nearly a year. Monthly meetings are held for the discussion of subjects pertaining to ferns, and, in suitable weather, botanizing excursions to the haunts of the rarer ferns are planned. Such excursions include picnics and other similar pleasures. The Chapter has most of the American works on ferns, and obtains both pleasure and profit from the study. The membership consists of five congenial spirits, no effort being made for a larger number because of the devastation that might ensue if a larger party visited a rare species. We trust that the chapter will have a long and pleasant existence.

At a recent meeting of the Linnæan Society Mr. Charles T. Druery recorded a case of apospory in the common polypody and of apogamic buds in *Cystopteris montana.*

ABOUT THE FERN BULLETIN

In offering back numbers of *The Fern Bulletin* for sale, we are not attempting to get rid of some surplus stock. We print hundreds of extra copies of each number for the express purpose of supplying new subscribers with the numbers issued before they became acquainted with the magazine. The great demand for these is shown by the fact that the first five volumes are out of print, volume 6 nearly so, and other volumes are becoming scarce. The illustrations and articles in these numbers are not only still of interest, but *they are becoming more valuable with age.* The price of each volume is 75c. except volume 6, which is $1.00. Volume 6 is not sold separately except to complete files of our subscribers.

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These works scarcely need description. A folder describing them will be sent, however, upon application.

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Vol. XIV No. 3

The Fern Bulletin

A Quarterly Devoted to Ferns

Binghamton, N. Y.
Willard N. Clute & Company
1906

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, Editor

Willard N. Clute & Co., Publishers, Binghamton, N. Y.

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(Formerly Linnæan Fern Chapter)

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Secretary, Willard N. Clute, Joliet, Ill.

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BOTRYCHIUM LUNARIA ONONDAGENSE

THE FERN BULLETIN

VOL. XIV. JULY, 1906. No 3

THE FERN-FLORA OF ONTARIO.

BY A. B. KLUGH.

The Province of Ontario lies between the 42° and 52° of N. Latitude, and has an area of 220,000 square miles. The altitude varies from 165 feet at the Quebec boundary on the St. Lawrence to 1706 feet at Dundalk, Grey County, the average altitude being about 950 feet. The mean yearly temperature at Stoney Creek, Wentworth County, is 49.1°F.; at Chatham, Kent County, 47°; at London, Middlesex County, 45.8°; at Toronto, York County, 44.2°; at Kingston, Frontenac County, 43.8°; at Guelph, Wellington County, 43.7°; at Owen Sound, Grey County, 42.8°; at Gravenhurst, Muskoka District, 41.5°; Ottawa, Carleton County, 41.1°; at North Bay, Nipessing District, 39.8°; at Rat Portage, Rainy River District, 36.2°; at Port Arthur, Thunder Bay District, 34.9°; at White River, Algoma District, 32.6°; and at Moose Factory, Nipessing District, 31.1°.

While temperature has an influence over the distribution of the boreal species, the principal factor in determining the distribution of our Pteridophytes appears to be the outcropping of the different rock formations. In a broad way we may say that in the counties which border on Lake Erie and in the adjacent counties of Middlesex and Oxford, there are few or no outcrops of rock, and consequently an almost total absence of rock species. North of a line drawn from the southern border of Muskoka to Kingston the outcrops are Laurentian, with the exception of the counties of Russel, Prescott, Dundas, Stormont, and Glengarry, in which limestone appears.

The remaining portion of Ontario is characterized by the frequency and extent of the outcrops of various limestone formations, and here we find the richest fern-flora.

The Catalogue of Canadian Plants, Part V., by Prof. John Macoun, has been of great service to me in the preparation of this list, and I wish here to thank the following botanists who have kindly contributed notes: Drs. J. Fletcher, John Macoun, N. Scott, P. J. Scott, J. Dearness, Rev. Dr. Campbell, Rev. C. J. Young, Messrs. J. M. Macoun, W. Herriot, J. White, W. C. McCalla, F. Mitchell, W. E. Saunders, D. W. Beadle, J. Morrison, E. E. C. Kilmer, G. L. Fisher, F. P. Gavin, and Miss A. Saunders.

OPHIOGLOSSACEÆ.

Ophioglossum vulgatum L. Low meadows. Rare, but distributed throughout the province.

Botrychium simplex E. Hitch. Meadows, damp woods and hillsides. Rare. Reported from a small island east of St. Joseph's Island, Georgian Bay, by J. Bell, as common; near Fort William, north shore of Lake Superior, by Macoun, and from Galt, Waterloo County, by Herriot.

Botrychium lunaria Sw. Damp meadows and thickets. Very rare. Reported from the vicinity of Lake Nipigon, Thunder Bay District, by Macoun, and Stiltsville, Carleton County, by J. M. Macoun.

Botrychium lanceolatum Angs. Low pastures and rich woods. Very rare. Reported from Martentown, Glengarry County, by Campbell, and from Niagara Falls by Cameron.

Botrychium matricaræfolium A. Br. Damp hillsides, pine woods, gravelly cliffs and thickets. Rare. Reported from Casselman, Russel County, by Fletcher, and from Belleville, Hastings County; Campbellford, Northumberland County; Nipigon River and Lake Nipigon, Thunder Bay District, by Macoun.

Botrychium ternatum obliquum D. C. Eaton. Fields and dry woodlands. Scarce, but widely distributed. Ranges north to Hudson Bay.

Botrychium virginianum Sw. Woodlands. Common throughout the province.

OSMUNDACEÆ.

Osmunda regalis L. Swamps and swales. Scarce in northern Ontario, common throughout the rest of the province.

Osmunda claytoniana L. Low ground. Frequent throughout the province.

Osmunda cinnamomea L. Swamps and swales. Apparently absent from northern Ontario, but common throughout the rest of the province. The form known as *frondosa* occurs at Belleville, Hastings County; Bismark, Elgin County, and Guelph, Wellington County. The writer has found two phases of this form, in one of which the fertile portion was terminal, and in the other basal and having some of the lower pinnæ half fertile and half sterile. In both cases they appeared on otherwise normal plants, which had not been cut or apparently injured in any way.

POLYPODIACEÆ.

Polypodium vulgare L. Rocks, in shade. Rare in southern Ontario, but common throughout the rest of the province.

Adiantum pedatum L. Moist woodlands. Common throughout the province.

Pteris aquilina L. Dry thickets and borders of woods. Common throughout the province. The writer collected, in a cedar swamp, a fern of this species, which was not at all ternate but merely bi-pinnate.

Cryptogramma acrostichoides R. Br. Rocks. Very rare. Reported from Shrieber, Thunder Bay District, by Campbell, and McLeod's Harbour, Manitoulin Island, by J. Bell.

Pellaea gracilis Hook. Moist, shady rocks. Frequent throughout the Limestone region. Found on Laurentian

rock, in Frontenac County, by C. J. Young, and on Huronian slates, near Michipicotin, Algoman District, by Macoun.

Pellaea atropurpurea Link. Dry limestone cliffs. Frequent throughout the Limestone region and common locally.

Pellaea densa Hook. Limestone rocks. Reported only from Durham, Grey County, by H. M. Ami.

Woodwardia virginica J. E. Sm. Swamps. Scarce, but widely distributed over the province as far north as Muskoka.

Asplenium viride Huds. Moist, mossy, shady limestone rocks. Rare. Reported from Tabermory, Bruce County, by P. J. Scott; Inglis Falls, Grey County, by Macoun; Crecht Forks, Peel County, by White; and found by the writer on Flower Pot Island, at the head of the Bruce Penninsula, and at Rockwood, Wellington County.

Asplenium trichomanes L. Rocks. Frequent throughout the province.

Asplenium ruta-muraria L. Only known from Flower Pot Island, at the head of the Bruce Peninsula, where it was found by P. J. Scott. In August, 1905, the writer visited the island and found the fern growing in moss on dryish limestone rocks, but very scarce.

Asplenium ebeneum Ait. Rocks and rocky woods. Rare. Reported from Charleston Lake, Leeds County, by C. J. Young; Brockville, Leeds County, by Billings; Jones Falls, Leeds County, by P. J. Scott; Belleville, Hastings County, by Macoun; Niagara Falls, and Kingston, Frontenac County, by Fowler, and Port Abino, Welland County, by Day.

Asplenium angustifolium Michx. Woods. Widely distributed throughout the province as far north as Ottawa, and common locally.

Athyrium thelypteroides Desv. Woods. Frequent throughout the province.

Athyrium filix-fœmina Roth. Common throughout the province.

Scolopendrium vulgare J. E. Smith. Found only in woods on limestone ridges in Grey County and the Bruce Peninsula. Common in these situations at Inglis Falls, near Owen Sound, at Woodford, north of Woodford, at Kemble and McLean's Mountain, east of Kemble in Grey County, and north of Colpoy's Bay to two miles south of Lion's Head in the Bruce Peninsula. Found also at Durham, Grey County, by H. M. Ami.

Camptosorus rhizophyllus Link. Mossy, shady rocks. Frequent throughout the province as far north as Ottawa.

Phegopteris polypodioides Fée. Woods. Frequent throughout the province, with the exception of the Lake Erie Counties. Commonest northward and eastward.

Phegopteris hexagonoptera Fée. Woods. Frequent throughout the province as far north as Muskoka, but commonest southward and westward.

Phegopteris dryopteris Fée. Woods. Common throughout the province.

Phegopteris dryopteris robertianum Dav. Reported only from Lac Seul, Rainy River District, by R. Bell.

Nephrodium noveboracense Desv. Frequent in woods throughout the province.

Nephrodium thelypteris Desv. Abundant in swamps and swales throughout the province.

Nephrodium fragrans Rich. Rocks. Rare. Reported from Green Lake, Renfrew County, by C. J. Young; Moon River, Muskoka District, by Burgess, and as the commonest fern in the region about Lake Nipigon, by Macoun.

Nephrodium marginale Michx. Woods, cedar swamps and among limestone talus. Abundant throughout the province.

Nephrodium filix-mas Shott. Limestone rocks. Rare Reported from Royton Park, near Owen Sound, by Mrs. Roy, and from Niagara Falls, by Campbell. Found by the writer on McLean's Mountain, near Kemble, Grey County, where plants with sterile fronds were frequent but fertile fronds very rare, and at Cape Croker, Bruce County, where it was common in a limited area.

Nephrodium goldieanum Hook. Woods. Widely distributed and frequent locally. Extends as far north as Ottawa and Owen Sound.

Nephrodium cristatum Michx. Swales and wet woods. Widely distributed and abundant locally throughout the province.

Nephrodium cristatum clintonianum Gilbert. Swales and wet woods. Scarce but widely distributed.

Nephrodium boottii Dav. Swamps, swales and damp woods. Rare. Reported from Kemptville, Grenville County, by Porter; Belleville, Hastings County, by Macoun; Hamilton, Wentworth County, by Logis; London, Middlesex County, by Burgess; Snellgrove, Peel County, by White, and Innerkip, Oxford County, by Mitchell. Found by the writer at Arkell, Puslinch Lake and Pike Lake, near Mount Forest, all in Wellington County. At Belleville it was growing with *N. cristatum clintonianum* and *N. spinulosum,* and in every case where found by the writer it was growing with *N. cristatum* and *N. spinulosum.* While the Puslinch Lake specimen must for the present be included under the so-called species *N. boottii,* it is without doubt a hybrid between *N. cristatum* and *N. spinulosum,* as fronds of these two and of *N. boottii* all grew from the same root. The Snellgrove, Pike Lake and Arkell records are all for single plants. So far all the evidence obtained by the writer point to the hybrid origin of *N. boottii.*

Nephrodium spinulosum Desv. Woods. The type which includes the unstable ferns known as varieties *intermedium* and *dilatatum* is abundant throughout the province.

Polystichum acrostichoides Shott. Woods. Common throughout the province as far north as Owen Sound. The form *incisum* is reported from London and Hamilton by Burgess, and Owen Sound by Macoun, and it and the form *crispum* found at Guelph by the writer.

Polystichum lonchitis Roth. Limestone rocks. Common on the limestone ridges from Woodford west through

the northern portion of Grey County, and throughout the Bruce Peninsula. Reported from Foster's Flats, Niagara Falls, by Macoun.

Cystopteris bulbifera Bernh. Moist woods and on rocks. Abundant throughout the province, with the exception of northern Ontario, where it is frequent.

Cystopteris fragilis Bernh. Rocks and woods. Common throughout the province.

Cystopteris montana Bernh. Very rare. Reported as growing in a cedar swamp north of Current River, Lake Superior, by Macoun.

Onoclea sensibilis L. Wet woods and swales. Abundant throughout the province. The form *obtusilobata* is reported from Murray, Northumberland County, by Macoun; Sangeen, Bruce County, by P. J. Scott, and Ottawa by Fletcher.

Struthiopteris germanica Willd. Damp woods, swales and stony streams. Common throughout the province, except in northern Ontario, where it is frequent.

Woodsia glabella R. Br. Moist, shaded rocks. Rare. Reported from Red Rock, Algoma District, and Kaministiquia River and Nipigon River, Thunder Bay District, by Macoun.

Woodsia hyperborea R. Br. Moist, shaded rocks. Rare. Reported from Michipicotin, Algoma District, and along north shore of Lake Superior, west of Nipigon Bay, and Jack Fish Island, Lake Nipigon, Thunder Bay District, by Macoun.

Woodsia ilvenis R. Br. Dry rocks. Common in the Laurentian region, but not reported from the limestone region. Very abundant in northern Ontario.

Woodsia oregana D. C. Eaton. Very rare. Reported as growing on rocks at Lake Nipigon, Thunder Bay District, by Macoun.

Dicksonia pilosiuscula Willd. Open woods and rocky hillsides. Common locally as far north as Parry Sound District.

EQUISETACEÆ.

Equisetum arvense L. Common throughout the province. The form *campestre* has been found at Puslinch Lake, Wellington County, by the writer.

Equisetum pratense Ehrl. Damp thickets. Rare. Reported from Owen Sound, Grey County, and Sangeen Bruce County, by Burgess; shores of Lakes Superior and Nipigon, by Macoun, and Cornwall, Stormont County, by Campbell.

Equisetum sylvaticum L. Damp woods and thickets. Frequent throughout the province.

Equisetum palustre L. Swamps and springy ground. Rare. Reported from North Hastings County and Lake Nipigon, Thunder Bay District, by Macoun, and White Lake, Renfrew County, by Campbell. Found by the writer in a swamp at Oliphant, Bruce County.

Equisetum littorale Kuhl. Bogs. Rare. Reported from Belleville, Hastings County, and Lake Nipigon, Thunder Bay District, by Macoun.

Equisetum fluviatile L. Margins of rivers and lakes and in swamps. Common throughout the province.

Equisetum hiemale L. Common throughout the province.

Equisetum variegatum Schleich. Sandy shores. Scarce. Reported from Niagara Falls by Burgess; shore of Lake Ontario, near Brighton, Northumberland County, and shore of Lake Nipigon, Thunder Bay District, by Macoun; Galt, Waterloo County, by Herriot; Toronto by Beadle; and found on Flower Pot Island at the head of the Bruce Peninsula, by the writer.

Equisetum scirpoides Michx. Wet woods and cedar swamps. Frequent throughout the province.

LYCOPODIACEÆ.

Lycopodium selago. L. Exposed rocks. Very rare. Reported from Otter Head, north of Lake Superior, by Macoun.

Lycopodium lucidulum Michx. Swamps and wet woods. Common throughout the province.

Lycopodium inundatum L. Bogs. Rare. Reported from North Hastings County by Macoun; Port Colborne, Muskoka, by Burgess, and north shore of Lake Superior by Agassiz.

Lycopodium annotinum L. Woods. Common in northern Ontario. The only stations known south of Ottawa are Snellgrove, Peel County, from where it is reported by White, and Aberfoyle and Killean, Wellington County, where it has been found by the writer.

Lycopodium clavatum L. Moist woods. Common in northern Ontario, frequent throughout the rest of the province.

Lycopodium obscurum L. Woods. Frequent throughout the province.

Lycopodium stichense Rupr. Reported only from Magpie River, north of Lake Superior, by Macoun.

Lycopodium sabinæfolium Willd. Reported only from Crane Lake, Muskoka, by Burgess, and Magpie River, north of Lake Superior, by Macoun.

Lycopodium complanatum L. Woods. Common in northern Ontario, scarce throughout the rest of the province. The status of *flabelliforme* in the province has not yet been worked out.

Lycopodium complanatum tristachyon Fernald. Reported only from Dalhousie, Lanark County, by Campbell.

SALVINIACEÆ.

Azolla caroliniana Willd. Reported only from Burlington Beach, Hamilton, by Buchan.

Selaginella spinosa Beauv. Marshes and spring places. Rare. Reported as common along the north shore of Lake Superior and shores of Lake Nipigon, by Macoun. Reported from Sangeen, Bruce County, by Burgess; shore of Bruce Peninsula, at the Fishing Lakes, by Macoun, and found in a sandy marsh at Oliphant, between the two above-mentioned points, by the writer.

Selaginella rupestris Spring. Rocks. Widely distributed and common locally in the Laurentian region.

Selaginella apus Spring. Springy places. Scarce. Widely distributed throughout the province, with the exception of northern Ontario.

ISOETACEÆ.

Isoetes macrospora Dur. Reported only from River St. Marie, at the head of the Canal, by Macoun.

Isoetes echinospora braunii Englem. Reported only from Partridge Lake, Addington County, by Macoun.

Isoetes canadensis A. A. Eaton. Reported from Crow River, above dam of Marmosa Iron Works, Hastings County, and Salt River, at head of Mud Turtle Lake, Victoria County, by Macoun.

Guelph, Ontario.

BOTRYCHIUM BITERNATUM

By L. H. McNeill.

In the late seventies and early eighties, while yet a boy, I had the extreme good fortune to be a personal friend of the late Dr. Chas. Mohr, and in his delightful company strolled through the woods in this neighborhood numberless times, gathering an education in, and a love for, the flora of our State, that has never left me. It was not until the spring of 1904, however, that the notion seized me that I should take up the study of ferns, for pastime more than anything else, but the interest grew to such an extent that at this date I find myself almost in the " Pteridomaniac " class.

After gathering our common varieties and scouring the woods for miles around for new ones, with indifferent success, I remembered the doctor had called my attention to a particular variety of *Botrychium* that he said was quite rare, it having been found in only a few isolated localities, Mobile being one of them. I also remem-

bered the field where we found them, but alas, the inroads of civilization had turned that field into city lots and flower gardens. The character of soil, etc., was still clear in my mind, and I soon found such a place, and after a careful search, discovered, in a few scattered bunches of yellow, semi-disintegrated leaves, the *Botrychium* I was after; this was in April. Attributing its condition to an unprecedented drouth, which had been killing hardier plants, and fearing its effect might be permanent, I carefully transplanted half a dozen roots, giving them what I considered to be the proper amount of water, but they failed to revive and were, for the time, forgotten.

Late in July, the *B. obliquum,* in its various interesting but bewildering varieties, began to appear. They stayed with us until October, then came frost, and after arranging the specimens gathered that season, I started on the wait until spring should come again. Some days later (October 20), almost by accident and much to my surprise, I found my neglected roots, planted the April before, were putting out leaves. I went to the place where I had gotten them, and the same life was visible there, and within a week I had spotted more than a dozen colonies of this same fern, some of them miles from the original location. For weeks they showed no change, merely the little triangular, delicately compound leaf clinging close to the ground. On November 20, and almost suddenly, the healthier plants all showed a tightly curled but perfectly formed fertile frond in the axil of the leaf and barely above ground. They remained in this condition until late in January, when a touch of warm weather unfolded them, and in some places the ground was literally covered with them.

Hardly had this fertile frond begun to mature, in the older and more fully developed plants, than a secondary sterile frond started on the opposite side of the fertile stipe, and in an incredibly short space of time had grown alongside the primary one, having come from the same rootstock but from a separate bud. Frequently, how-

ever, primary and secondary fronds had come up at so nearly the same time that both were in fit condition for specimens. The only perceptible difference between these two growths was in the sterile fronds, the later one being less inclined to be sessile or lay flat, and owing to the more rapid development was lighter in color, straggling in shape and more delicate generally.

The age of a plant does not seem to affect its size, but tends to make it stockier, and in some cases the segments or pinnules become so crowded as to force each other on edge. It is a hopeless task to attempt to press such specimens, as they appear only a dense mass of crushed leaflets, it being impossible to arrange them with any degree of satisfaction.

In five or six weeks everything had withered and commenced to turn yellow, and by April, a little bunch of yellow chaff here and there was all that was left, and that entirely disappeared with the first heavy rains, not to show itself again until the following autumn. I have, however, seen sterile fronds appear in midsummer, but these were rare exceptions, and they soon died of the heat.

I will not attempt to describe this plant, as Professor Underwood, in his pamphlet on "The Ternate Varieties of *Botrychium*," has done so exhaustively. I can advise you as to its habitat, though, as the Professor has probably never seen one growing. It prefers a light, well-drained, sandy soil, sparsely covered with grass, usually in company with various low-growing mosses and lichens. I have found them on the shores of Mobile Bay, at an elevation of but a few feet above tidewater, and also at Spring Hill, seven miles west of the city, at an elevation of 210 feet, all showing the same habits and characteristics.

There are several authorities who are unwilling to entirely admit that this is a distinct species, but after having watched and examined dozens of living specimens of *B. biternatum* and *B. obliquum* I find differences not noted

by even the Professor. The season of maturing, sessility of sterile frond and size, he has called attention to, but these further differences are also noticeable. The primary and secondary growth, before mentioned, does not occur at any time with the *obliquum* in this locality, though I may add it does with *Ophioglossum bulbosum,* which grows and blooms on exactly the same lines and in the same locations as *biternatum.* The roots of *biternatum* form a large, succulent mass, seldom more than an inch below the surface, and in the older plants are sometimes bulkier than the plant above ground, being often enclosed in a bunch of chaff, the unrotted accumulation of old stipes, from the root almost to the surface of the ground. The root of *obliquum* is generally six to eight inches below the surface, and is disposed to be straggling, the chaff hardly appearing. *Biternatum* prefers open ground in the full glare of the sun, and it is in such places it attains its typical form. *Obliquum* invariably seeks the shade of some evergreen bush or tree or dense grass. Often, however, *biternatum* is found in shady places on the edges of the open spots. Under such circumstances the growth is considerably changed, the color is a lighter green, the sterile frond loses largely its sessility, having a tendency to reach up and rarely has the secondary growth. In the open, the sterile frond is a dark reddish green, adhering closely to the ground, and under such conditions I have seen the same plant frozen until it was brittle and also undergoing the hot, dry winter sun we sometimes have, in apparent unconcern. Furthermore, *biternatum* is inclined to sport, double fronds, fertile or sterile, being quite common, and I have one specimen where three fertile heads come from a single stipe, the division taking place above where the leaf joins.

The above notes represent the careful examination and inspection of quite a number of plants and in several locations, for a period extending from April, 1904, to the present date, and so far the behavior of this odd little fern, for the two seasons, has been identical.

Mobile, Ala.

GREEN AND RED STIPED LADY FERNS.

By William Palmer.

Some dozen or more *varieties* (*?*) of the Lady fern have been recognized or named from eastern North America. Nearly all these variations, in my judgment, have been produced as a result of man's interference with the environment of the species, by changing the water content of the soil, by reducing the shade, by allowing the wind to greatly influence the growing plant, and generally by affecting the nutrition. Except, possibly, in the case of one or two, these variants have no taxonomic values. Though much has been written about this common species, very much more remains to investigate, and I have a few suggestions to make regarding two of the forms which are quite different in color, but grow together *in the same environment.* One of these has a green stipe and rachis, and I here assume that it is *A. filix-fœmina;* the other has a red stipe and rachis, which I also assume to be *A. filix-fœmina rubellum.* Gilbert, List of North American Pteridophytes, 1901, page 35.

About Washington, D. C., both in Maryland and Virginia, these two forms are common, sometimes growing in colonies close together, and in many cases clearly distinct on account of the entirely pale green of the one and the darkness of the other. Scattered about in the same wood, often near the others, are usually single plants, variously intergrading in appearance and undoubtedly filling up the gap between the two variants, besides manifesting side tendencies, especially when growing in slightly different environments. The red stiped form is usually the larger and more vigorous, and the fronds are darker with broader, often larger pinnules, but not always. The green plant is without a trace of reddish, is a pale green, is a less vigorous grower, not as apt to be found in the open as the other, is very tender and readily influ-

enced by dryness, and the pinnules are smaller and narrower, but not always. The intergrades are common, especially in recently changed woods, but in old woods, where the forest has not been injured and one or both of the forms is common, intergrades are, I believe, absent, except where the local environment is different or influenced by man. Small green or pink stiped plants are not here considered, as they are evidently immature plants, readily affected by position, drainage, light, absence or abundance of humus. Names have been given with facility to these plants, but with little if any knowledge or care as to the age or habitat of the individual plants composing such an extremely adaptive species, and which undoubtedly has an easy habit of morphological adjustment to a varying or uneven local environment.

In Newfoundland I have never seen plants with red stipes. In South Carolina, in the vicinity of Charleston, I have only been able to collect the red-stiped form. Is it possible that all the far northern (boreal) plants are green-stiped, and all of the southern lowland coastal plain habitat (austral) are red-stiped? In the intervening area (Carolinian and Transition) we know that both occur.

The members of the Fern Society, scattered so widely in so many localities, could during the coming summer study the question. Specimens had best be examined in woods where there has been no recent interference with the forest and where the drainage has not been affected. I have replanted typical plants of each form in my garden, and am watching their behavior, hoping to catch one or the other lapsing. Why, under precisely the same environment, one should be red and the other green, is what I want to know. No plant should be considered in this connection which is growing where the sun can reach it, for its influence is effective in producing other variations. With some flowering plants age produces a deepening of the reddish stems, with which sun exposure seems to have something to do, but this is evidently not so with our woodland ferns.

Washington, D. C.

THE MOONWORT

Botrychium Lunaria.

By Willard N. Clute.

The moonwort, though rare in the settled parts of North America, is a most cosmopolitan species. It is recorded from Greenland and Alaska, and probably occurs throughout most of British America, since it extends into southern Canada. It is pretty well distributed in Europe and western Asia, as well as in the Himalayas, and according to the latest authorities occurs in Patagonia, Australia and New Zealand. In the United States the plant is one of the rarest. It was formerly reported from Connecticut, but this is now said to be due to a wrong identification. A single specimen has been reported from Vermont, and others have been found in northern Michigan, Montana, and Minnesota. In the Rockies it extends to Colorado and Utah.

In central New York, in the same general region that contains the hart's-tongue (*Scolopendrium*), plants have been found that until recently were considered identical with this species, but which are now called *Botrychium Onondagense* by a few botanists. If *Botrychium Lunaria* was not known from other parts of our country, I could look with more complacency upon the proposal to consider the New York plant a distinct species, but when we reflect how widely *B. Lunaria* is distributed and make allowances for the variation in the plant that this great range of latitude, longitude, and altitude must entail, it seems more logical to call all the plants by the name of *Lunaria.* If these plants must have a name to distinguish them, then it certainly should be *Botrychium Lunaria Onondagense.* I doubt if botanists a hundred years hence will consider the plants worth even a varietal name.

Among the characters by which the so-called *B. Onondagense* is to be known is the very short axis from which the roots spring. In our illustration, which is natural size and was drawn from a fresh specimen which is still preserved, the axis appears to be fully as long as the average for *B. Lunaria.* Another point is made of the fact that the pinnæ are farther apart, though of the same number and shape as in *B. Lunaria.* This difference is explained at once when we learn that *Onondagense* grows in woods and *Lunaria* prefers open fields and moors. It is the natural thing for plants in the sun to be more compact than when in the shade. It will not do to say that the difference in habitat makes this a different species. That any plant may have as great a variation in habitat is shown by the moonwort's rare ally, the hart's tongue, which in central New York grows in deep, moist ravines only, while in Britain it is found on walls, in hedges, and other exposed places.

The illustration is from specimens sent through the kindness of Mr. H. E. Ransier from the New York station for the plant. It is of special interest from the fact that the fertile portion bears near the fruit a sterile pinnule of the usual size, showing unmistakably that the fruiting part is morphologically closely related to the sterile portion. At the date of collection (late in May), the fruit was still green, and the apex of the panicle still slightly coiled, or rather bent over, as its habit is. It is hoped that collectors on our northern border, especially in the New England States, may have the fern in mind this year, and see if it cannot be recorded at other stations.

I wish to correct a misprint in my note on "*Scolopendrium vulgare* in Ontario" in the October (1905) FERN BULLETIN. On page 105, instead of "The largest fronds I found were 13 inches long," it should read, "The largest fronds I found were 18 inches long."—*A. B. Klugh, Guelph, Ont.*

THE HART'S-TONGUE IN TENNESSEE

By Dr. E. L. Lee.

Recently I visited the station for *Scolopendrium* near South Pittsburg, Tennessee—the only reported station for the fern in the South. Whether the surroundings and peculiar locality were described at the time the fern was reported is unknown to me, but a little of its history may be interesting to fern lovers. This fern was located by Mr. Cheatham (a brother of General Cheatham), who at the time had charge of a branch of the state prison of Tennessee at the Battle Creek mines, near South Pittsburg. He was a fern lover, and was making a collection for himself and friend, when he found the *Scolopendrium* in the most unlooked for place. He believed he had discovered a new fern, and named it the Bune fern, in honor of O. R. Bune, on whose place he found it. There was no one else enthused at the time except Mr. Cheatham. Had it been *sang*, our people would have recognized it. Later, when South Pittsburg sprang into some prominence, there came to that place a Mr. Middleton, an educated Englishman and an enthusiastic botanist, who had a mania for snakes and ferns. Since they grew together in the Cumberland Mountains, he could kill two birds with one stone. He was shown the station, and we suppose the fern was reported by him.

South Pittsburg is on the Tennessee River, where it first touches the Cumberland Mountains, after its mad escape through the mountains below Chattanooga. It is two miles from the Alabama State line—five miles from Bridgeport, Ala., on the Nashville and Chattanooga Railroad, and on a branch of the above road leading to Pikeville. The flora of the Cumberland is rich and varied, especially so just at this place, or beginning at this place.

At the State line the mountain begins to lose that bold, smooth front that has characterized it for seventy-five miles north of the Alabama line—a solid wall, as it were—but here it begins to break up into innumerable spurs that jut out toward the Tennessee River, with deep, long gorges between them—a veritable paradise for the botanist. These narrow defiles are from one to six miles long, from a mile wide to as narrow as a hog trough. It is up one of these narrow defiles we will go. This particular one is very narrow, leading up into the mountain in a northwest direction, as all of them do. After following a timber road along the winter run for about a mile, we have reached a point where the bed of the ravine is our road. From this we turn to our left up a steep, and reach a little plateau, about 100 feet long and thirty or forty feet wide, that is nearly level. Looking to the west and up the steep, you see a bold stream meeting you that is pouring over the rocks, ten and twenty feet at a jump. Advance across this little plateau and you are on the edge of a chasm, fault, or rift in the rock, of a triangular shape, the sides of which are about 25 yards long and the depth about 40 feet. The walls on the three sides are perpendicular, except the little wear of the stream as it approches the chasm. There you have the *Scolopendrium* in the hole where few intruders dare to go. This place is wild and weird, even to a mountain man. The water pouring down in this abyss and disappearing is common in these mountain gorges, but this rift is a little unusual. The flow of it inclines to the northwest and grows deeper as it approaches the little pool made by the falling stream. In this hole, shut out from the sun, grows the fern. I think there must be 100 plants. Instead of standing upright, they are inclined to spread out, on the ground particularly, the outside leaves. On the left is a shelf, some three or four feet from the floor and three or four feet wide, with numerous plants on it. A majority of the plants are small, many of their fronds not more than four or five inches long. The largest I estimated

at 10 inches. This possibly is due to want of light. The wonder comes as to how they got there. It is true they have a way of isolating themselves, but when I looked down in that hole it seemed that the seeds were sown there by the Creator himself, at the time "the morning stars sang together." This is surrounded by a fringe of as rich and luxuriant *Woodsias,* Christmas ferns, and *Aspidiums* as can be found in any place, and on top we saw arums, sedum, Solomon's seal, lead-plant, and many others that grew on those rich benches. The location of this fern at such a place may be a hint to those looking for *Scolopendrium.* Look in the ground for it.

Bridgeport, Ala.

THE FORMS OF BOTRYCHIUM SIMPLEX

By George E. Davenport.

I read Mr. Gilbert's note on the forms of *Botrychium simplex* in the Fern Bulletin for July, 1905, with much interest, but the forms are by no means so uncommon at the present time as his note indicates. When in 1877 my monograph on *B. simplex* was published, the species was considered as one of the rarest of all our ferns, yet even at that time my monograph contained citations for, and figures of, several specimens of *compositum* from Macoun, Dr. Parry, John Muir, Rev. J. Hermann Wibbe, Miss Pelton and Mrs. Charles Barnes. Since then I have examined many collections, quite a number of which contained one or more specimens of *compositum,* which, as I showed in my monograph, is the fully *matured form* of the species itself, and, therefore, not a true variety. Lasch originally described two forms of his variety *compositum,* one being *binate* with two divisions each corresponding to variety *incisum* (Milde), and the other *ternate* with three divisions, their common stalk being lengthened, and the fertile panicle starting from well down near the base of the whole plant, exactly as in *B. ternatum.*

Both of these forms are well represented in the Davenport Herbarium, and to my positive knowledge are to be found in some other herbaria as well. Walter Deane has a very fine example of *compositum* from Mt. Tobey in his herbarium, and it has been collected with nearly all of the other forms during the past season by Miss Rooney of St. Johnsbury, Vermont, who has favored me with some fine duplicate specimens of the same. She has also sent to me a fine tracing of a double specimen of *incisum,* the two fronds being united at the rootstock.

As to Milde's var. *fallax,* it clearly rests upon a single character, and, according to my view of it, has not been so very unusual in collections of late years. This so-called variety was established by Milde on a form of var. *incisum* with the lamina above the middle of the frond, and nothing can be clearer than the fact of the lamina happening to be incised in his plants, having nothing whatever to do with the establishment of the variety, which rests wholly on the position of the lamina in its relations to the common stipe. This being so, it follows that any specimen having the lamina above the middle of the frond constitutes the var. *fallax,* whether the lamina is simple or compound; it is, however, most likely to occur in the simpler forms, such as *simplicissimum* and *incisum.* In no instance coming under my own observation, or within my knowledge, has the lamina ever occurred elsewhere than low down near the base of the frond in the *sub-compositum* and *compositum* forms.

Medford, Mass.

With reference to Mr. B. D. Gilbert's note on the very curious variety, *Churchiæ* of *Polypodium vulgare,* it would be of interest to know whether the plant is still living, Mr. Gilbert's concluding notes leaving a doubt as to whether it failed to survive removal, or merely to produce fertile fronds. Stalked pinnæ in this genus, to say nothing of the particular species, are quite anomalous. The " corymbiense " form noted should be *Cornubiense,* it being a Cornish find.—Chas. T. Druery.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

45. **Asplenium ebeneum** Ait. Ebony Spleenwort; Screw Fern. Common; in dry, or moist, rocky soils. Maine and Ontario to Florida, Texas and Colorado; also in the West Indies, Equador and Cape Colony.—*A. platyneuron* (L).

The form **serratum** Miller is an incised form occurring with the type; **f. Hortonae** Dav. more deeply cut is reported from Vermont, Maryland and Arkansas; **f. proliferum** D. C. Eaton is a proliferous form from Florida.

46. **Asplenium ebenoides** R. R. Scott. Rare and local; on dryish rocks. Vermont to Virginia, Alabama and Illinois. Regarded as a hybrid between *Camptosorus rhizophyllus* and *Asplenium ebeneum.*

47. **Asplenium firmum** Kunze. Rare; in moist shades, Florida and Arizona; also in the West Indies. Guatemala to Brazil and Peru.

48. **Asplenium Glenniei** Baker. Very rare. Huachuca Mountains, Arizona.

49. **Asplenium monanthemum** L. Rare. Huachuca Mountains, Arizona; also in the West Indies and Africa.—*A. Monanthes* L.

50. **Asplenium montanum** Willd. Mountain Spleenwort. Rare; on dryish rocks. Connecticut and New York to Georgia, Alabama and Arkansas.

51. **Asplenium muticum** Gilbert. Rare; on moist rocks. Southern Florida; also in Bermuda. Often confused with forms of *A. trichomanes* and *A. parvulum*, and occasionally referred to *A. Anceps* Solander.

52. **Asplenium myriophyllum** Mett. In moist shades. Florida; also in the West Indies.—*A. rhizophyllum myriophyllum* Mett. The forms of this species in the United States have recently been named *A. verecundum* and *A. Curtissii* by Underwood.

53. **Asplenium myriophyllum Biscaynianum** D. C. Eaton. Rare. Southern Florida. Regarded as a species by some botanists.—*A. Biscaynianum* A. A. Eaton.

54. **Asplenium parvulum** Mart. & Gal. Small Spleenwort; Little Ebony Spleenwort. Tolerably common; in dryish rocky soil. Virginia to Florida, Kansas and Texas; also in Jamaica.—*A. resiliens* Kunze.

55. **Asplenium pinnatifidum** Nutt. Pinnatifid Spleenwort. Rare and local; on dryish rocks. New York to Georgia, Alabama, Kansas and Missouri.

56. **Asplenium ruta-muraria** L. Wall rue. Rue Spleenwort. Tolerably common; on dry rocks. Southern Canada to Alabama, Missouri and Michigan; also in Europe and Asia to the Himalayas.

57. **Asplenium septentrionale** (L.). Forked Spleenwort. Rare; on rocks. Colorado to New Mexico and Arizona; South Dakota; also in Europe, northern Asia and the Himalayas.

58. **Asplenium serratum** L. Rare; on the trunks of trees. Southern Florida; also in the West Indies and Africa.

59. **Asplenium trichomanes** L. Maidenhair Spleenwort. Common; on shaded rocks, wet or dry. Nearly throughout North America; also in northern Europe and Asia and in the mountain tops in the tropics. The form **incisum** Moore has

been reported from Vermont and may be looked for with the type.

60. **Asplenium vespertinum** Maxon. Southern California. Has the appearance and habitat of *A. trichomanes* with which it was formerly included under the form *incisum*.

61. **Asplenium viride** Huds. Green Spleenwort. Rare and local; on rocks. Arctic Circle to Vermont, Colorado and Oregon; also in Northern Europe, Japan and the Himalayas.

Athyrium Roth.

62. **Athyrium cyclosorum** Rupr. Western Lady Fern. Common; in moist shades. Alaska to California, Arizona and Nebraska.—*Asplenium filix-foemina cyclosorum* Rupr.

63. **Athyrium filix-foemina** (L.). Lady Fern; Female Fern; abundant; in woods, thickets, roadsides and the borders of swamps. North America generally, giving place in the west to *A. cyclosorum;* also nearly throughout the world. A most variable species.—*Asplenium filix-foemina* Bernh.

More than twenty forms have been reported from America, the most noticeable being **angustum, furcatum, incisum, laciniatum, molle, ovatum** and **rubellum.** Less important are **confluens, elegans, exile, interruptum, latifolium, laxum, multifidum, pectinatum, plano-rhoeticum, polyclados, rectangulare, rhoeticum** and **stenodon.**

64. **Athyrium thelypteroides** (Michx.). Silvery Spleenwort. Not uncommon; in moist shades. New Brunswick and Nova Scotia to Minnesota and south to the Gulf States; also in Eastern Asia.—*Asplenium thelypteroides* Michx.; *Asplenium acrostichoides* Sw. A form distinguished as *acrostichoides* Gilbert, has been reported from New York.

BLECHNUM L.

65. **Blechnum serrulatum** Richard. Rare; in moist shades. Southern Florida.

CAMPTOSORUS Link.

66. **Camptosorus rhizophyllus** (L.). WALKING FERN; WALKING-LEAF. Not uncommon; on calcareous rocks. Maine and Quebec to Minnesota, Kansas and the Gulf States. Has also been found on sandstone, shale, gneiss, quartzite and granite. There is much diversity in the shape of the base of the fronds, some fronds being rounded and some eared. The form **intermedius** Arthur with fronds tapering at base has been reported from Iowa.

CHEILANTHES Sw.

67. **Cheilanthes Alabamensis** (Buckl.). Not uncommon; on shaded rocks Virginia to Florida, Illinois, Arkansas and Arizona; also in Mexico.

68. **Cheilanthes argentea** (Gmel.). Very rare. Alaska; also in Siberia.

69. **Cheilanthes Californica** (Nutt.). LACE FERN. Common; at the base of shaded cliffs in moist soil California. The form **amoena** A. A. Eaton with acute tips to the pinnules is reported from Fresno County. (*C. amoena* A. A. Eaton.)

70. **Cheilanthes Clevelandii** D. C. Eaton. Tolerably common; at the base of cliffs. California.

71. **Cheilanthes Cooperae** D. C. Eaton. Rare; in crevices of rocks and in canyons. California.

72. **Cheilanthes Eatoni** Baker. Tolerably common; at the base of rooks in moist soil. Western Texas and Arizona. Closely related to *C. tomentosa*.

73. **Cheilanthes Fendleri** Hook. Rare; in crevices of the rocks. Colorado to Texas and California; also in Mexico.

74. **Cheilanthes fibrillosa** Dav. Very rare. San Jacinto Mountains, California.

75. **Cheilanthes gracillima** D. C. Eaton. Mountain Lace Fern. Tolerably common; in clefts of rocks. California to British Columbia and Idaho; also in Guatemala.

76. **Cheilanthes lanuginosa** Nutt. Not uncommon; on exposed rocks. Minnesota to British Columbia, Illinois, Texas, Arizona and New Mexico.—*Cheilanthes gracilis* Mett.; *C. Feei* Moore.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

Brodie, W. *A New Station for a Northern Fern.* Ontario Natural Science Bulletin, May, 1906. *Woodsia hyperborea* in Ontario.

Clute, W. N. *A Check List of North American Fernworts.* Fern Bulletin, April, 1906. A continuation.

Clute, W. N. *Polypodium piloselloides,* illust. Fern Bulletin, April, 1906.

Clute, W. N. *The Author Citation.* Fern Bulletin, April, 1906.

Clute, W. N. *The Forms of the Cinnamon Fern.* Fern Bulletin, April, 1906. Suggests the name of *Osmunda cinnamomea bipinnatifida* for a dissected form.

Dukes, W. C. *An Alabama Station for Botrychium biternatum.* Fern Bulletin, April, 1906. Notes on the habitat, growth, and fruiting of this plant.

Gilbert, B. D. *Polypodium vulgare and Its Varieties in America.* Fern Bulletin, April, 1906. Description of fifteen varieties, four of which are new.

Maxon, W. R. *A New Name for a Jamaican Fern.* Proceedings of the Biological Society of Washington. Oct. 17, 1905. Proposes *Acrostichum excelsum* for *A. lomarioides.*

Rooney, B. M. *The Resting of Botrychium..* Fern Bul-

letin, April, 1906. Observations which point to the abortion of the fruiting parts as the cause of the "resting" in *Botrychium.*

SCHAFFNER, J. H. *The Life Cycle of a Homosporous Pteridophyte.* Illust. Ohio Naturalist, March, 1906.

SMITH, A. W. *A New Station for Asplenium ebenoides.* Rhodora, March, 1906. A Vermont station.

UNDERWOOD, L. M. *American Ferns—VI.* Torrey Bulletin, March, 1906. Species added to the Flora of the United States from 1900 to 1905.

WINSLOW, E. J. *Distribution of Botrychia.* Fern Bulletin, April, 1906.

LOMARIA SPICANT BIPINNATUM IN AMERICA

I have recently received fronds of a thoroughly bipinnate form of *Blechnum* [*Lomaria*] *spicant bipinnatum* found in Vancouver Island by Mr. Geo. Frazer of Ucluelet, Canada. The normally simple pinnæ are divided into pinnules cut to the midrib, thus entirely surpassing previous wild sports in this direction, which have never got beyond a marked serration, though in one case the offspring of one of these forms has given an almost tripinnate form, but with shortened lobes.—*Chas. T. Druery, F. L. S., 11 Shaa Road, Acton, London W., England.*

The third annual meeting of the Botanical Symposium will be held from July 2d to 9th, 1906, at Mountain Lodge, Little Moose Lake, Old Forge, New York. Through the courtesy of the members of the Adirondack League Club, the privilege of occupying the Club House for one week is extended to the members of the Conference. Tickets should be bought to Fulton Chain Station on the Adirondack Division of the N. Y. C. & H. R. R. Single fare from New York City, $6.46. Board, $2.00 to $3.00 a day. Stages will meet the party at Fulton Chain Station. Botanists are requested to notify Mr. Joseph Crawford, Secretary, 2824 Frankford Avenue, Philadelphia, if they intend to attend the Symposium.

EDITORIAL.

After this issue is mailed, the business office of this magazine will be removed to Joliet, Illinois, whither our other publication, the *American Botanist,* preceded it six months ago. This change is a change of office only, and will have no effect upon the contents or size of the magazine; in fact, it is quite likely that it will continue to be printed at Binghamton. Letters relating to the magazine may continue to be addressed to Binghamton until the end of July, and if mailed later will be promptly forwarded, though in that case they will be better addressed direct to Joilet. In this connection we would again call attention to the fact that we are always willing to supply any missing or defective numbers free of charge. We want subscribers to have complete sets from the time their subscriptions began. Look over your files, and if any numbers are lacking let us know at once. We have very few copies of some issues remaining, and shall soon have to withdraw this offer regarding them.

* * *

A prominent fern student has recently taken the ground that since species are regarded as the units of classification no attention need be given to varietal or form names, and with this pretext has substituted *Isoetes occidentalis* for A. A. Eaton's *Isoetes paupercula.* This species was first described as *Isoetes lacustris paupercula,* and when Eaton considered it to have specific characters, he rightly, in our opinion, used the varietal name for the species. It makes no difference in this case that Henderson found the plant and mistaking its identity called it *I. occidentalis.* A plant once named is *named,* whether first named as a species, variety or form. If not, then the rule should work both ways, and we should be entitled to give new names to every species reduced to a variety. This latter

procedure would scarcely be more absurd than the one advocated in displacing *paupercula* with *occidentalis.*

* * *

Mr. Charles T. Druery is inclined to defend the word seedling as applied to ferns, and writes in reference to the note in the April issue as follows: "Please permit me to point out that the British Fern Culturist is entirely justified in terming the young ferns raised from spores 'seedlings,' and that it is only the 'merest novice' among them that is ignorant of the reason. The student of fern biology here is acquainted with the fact that prior to the emergence of the young fern from the prothallium an embedded embryo seed is formed at the base of each archegonium, and that this seed, being subsequently fertilized by an antherozoid or pollen-grain equivalent, then acts precisely as ordinary seeds do, by producing roots and fronds, so that the resulting plant is after all a seedling. The only case where the term sporeling is alone permissible is where the young fern is asexually, *i. e.,* apogamously, produced by simple budding from the prothallium, in which case, of course, the seed is eliminated; but these are the rare exceptions and not the rule. That the word sporeling is avoided is not so much a matter of British conservatism as of British knowledge." So long as there are so many more important conflicts in names to attend to, we shall not quarrel with Mr. Druery over the name he applied to the young fern, but while the subject is up it may not be amiss to point out exactly what takes place in the fern's development from spore to spore. It may be news to many to hear that every fern produces two kinds of spores: one the kind we usually think of when a fresh spore is mentioned and which produces the prothallium; the other rarely seen, inclosed, as Mr. Druery states, in the archegonium. This cell in the archegonium, however, does not even become a spore, much less a seed, until another cell called a sperm, produced in the antheridium, has met and fused with it. Until then it is merely an egg-cell incapable of further development.

After the fusing of sperm and egg, the spore thus formed, which is termed the sexual spore, begins to grow and forms what we commonly call the fern. In no stage of its development does the fern form a seed, for the seed is a ripened ovule and consists of one or more integuments and a nucellus enclosing an embryo. If ferns really produced seeds they would be placed with the flowering plants, and it may be noted that the flowering plants are classed together, not so much because they bear flowers as because every one of them bears true seeds. As a matter of fact, some of the fernworts come much nearer producing flowers than seeds. It really looks as if the British will have to reduce their fern "seedling" to synonomy!

BOOK NEWS.

Although a very short time has elapsed since the beginning of the present century, a most unusual number of species have been added to the fern flora of the United States. Most of these have been added as the result of explorations in southern Florida, a much smaller number having been discovered in various other parts of the country. In the Torrey Bulletin for March Dr. L. M. Underwood has listed the species which he considers have been added to our flora since 1900, and figures that they number about forty-two. It is hardly to be expected in this day of species-making that the opinion of any radical botanist will find implicit acceptance by others, and many so-called species in this list will likely be ruled out as new, while others are certain to be denied specific rank. Of the new ones that are not actually new we note *Asplenium Biscaynianum, Gymnogramma viscosa,* and a dwarf form of *Aspidium trifoliatum* called *Tectaria minima,* but which should be *Aspidium minima* if anything. A wide form of the well-known *Polypodium phyllitidis* is listed as *Campyloneuron latum,* while two forms of the variable *Asplenium myriophyllum* are named *A. verecundum* and *A. curtissii.* These and others having been known before as forms, and are scarcely to be listed as

new species. Again, several mere forms are included as good species, such as the forms of *Botrychium* named *Alabamense, tenuifolium, Californicum* and *Onondagense,* and the forms of *Nephrodium* named *Aquilonare* and *Pittsfordense.* In passing, the curious fact may be mentioned that Dr. Underwood, while listing at different times a great number of variants of *Botrychium ternatum,* has omitted entirely the variety *Oneidense* described by Mr. Gilbert, though it is far more characteristic than others that could be mentioned, and was described since 1900. Among the species actually new to our flora, those not previously listed in this journal are *Lomaria procera* (listed as *Stenochlæna kunzeana*), *Aspidium cicutarium* (listed as *Tectaria coriandrifolia*), *Schizæa pennula,* and *Asplenium muticum. Meniscium reticulatum* is reported on the authority of A. A. Eaton, though first reported in this magazine by the editor and J. H. Ferriss a year before Mr. Eaton ever collected it. From the list is omitted *Cheilanthes moritziana,* though this is more easily distinguished than any form of *Botrychium* described in this century! The plant reported by A. A. Eaton as *Acrostichum sorbifolium* is also omitted. In this paper we also note a curious clinging to the term macrospore, although all morphological botanists have long ago abandoned it for the more proper megaspore. The *Selaginella* mentioned in "The Fern Allies" as collected in California by Mr. Saunders is named *S. Parishii.* Six other mere forms of *Selaginella* previously described are listed.

In an old number of *Meehan's Monthly* we find a correspondent calling *Equisetum hiemale* the "dry rush." Certainly few other living plants are as dry to the touch as this one.

According to the *Gardening World,* The Country Press, 19 Ball St., Kensington, W., London, has issued a set of seven post-cards illustrating forty-two species of British ferns. The illustrations are taken from Heath's "Fern Paradise," and the set of seven cards are sold for a sixpence, though this probably does not include postage.

AMERICAN FERN SOCIETY

A postal recently received from Jamaica apprises us of the fact that Mr. W. R. Maxon is again in the Tropics.

The annual dues have been paid with commendable promptness this year. It is hoped that the few who have not yet paid will find time to attend to the matter at once.

The Society continues to increase in membership. We welcome the following new members to our ranks: Miss M. DeLongue, Trudeau, N. Y.; Miss Margaret H. Grant, 187 Bowen Street, Providence, R. I.; Miss Dorothy Furman, 58 Clark Street, Glen Ridge, N. J.; Mrs. H. D. Carter, 18 Bradford Place, Montclair, N. J.; Mrs. L. H. Green, Oakwood, Ill.; Prof. Philip Dowell, Port Richmond, N. Y.; Mr. Geo. L. Fisher, St. Thomas, Ontario; Mr. Harold G. Rugg, Hanover, N. H. The 150 mark has now been passed!

In the early years of the Society, one of the most delightful features of the work was the offering of ferns to members. This feature we have now taken up again, and it is expected that it will be continued. Prof. L. S. Hopkins, Massilon, Ohio, offers specimens of *Asplenium ruta-muraria,* and Mr. H. E. Ransier, Manlius, N. Y., offers specimens of *Pellæa gracilis.* These specimens are offered to members of the Society only, for the cost of postage. It is hoped that others will be moved to offer other specimens. It should be remembered that the Society contains both beginners and advanced students, and that species common in one locality may be rare in another. Many species not ordinarily considered rare will therefore be desirable for distribution. It is best to select the smaller species, since the large ferns cost more to mail, though there is no reason why the largest ferns should not be sent if desirable. It would facilitate matters if each person offering specimens would indicate the amount of postage necessary to be sent for them.

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In offering back numbers of *The Fern Bulletin* for sale, we are not attempting to get rid of some surplus stock. We print hundreds of extra copies of each number for the express purpose of supplying new subscribers with the numbers issued before they became acquainted with the magazine. The great demand for these is shown by the fact that the first five volumes are out of print, volume 6 nearly so, and other volumes are becoming scarce. The illustrations and articles in these numbers are not only still of interest, but *they are becoming more valuable with age.* The price of each volume is 75c. except volume 6, which is $1.00. Volume 6 is not sold separately except to complete files of our subscribers.

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These works scarcely need description. A folder describing them will be sent, however, upon application.

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Vol. XIV No. 4

The Fern Bulletin

A Quarterly Devoted to Ferns

October

Joliet, Ill.
Willard N. Clute & Company
1906

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

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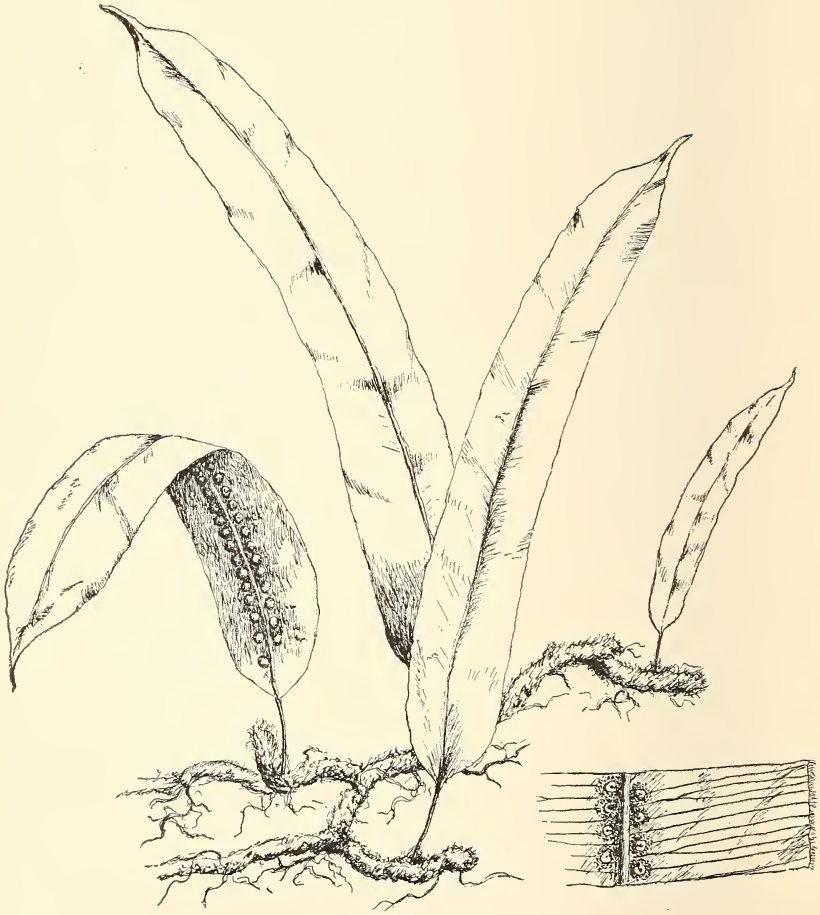

OLEANDRA WALLICHII

THE FERN BULLETIN

VOL. XIV. OCTOBER, 1906. No. 4

THE FERN FLORA OF MAINE

BY DANA W. FELLOWS.

The State of Maine, which forms the northeastern extremity of the United States, lies between 43 and 47½ degrees north latitude, and contains 33,000 square miles. Three important rivers flow through the southern section of the State to the Atlantic, while the northern portion, comprising about one-fifth of the entire area, is drained by tributaries of the St. John. The lakes are innumerable, Moosehead, which is thirty-five miles in length, being the largest. The Appalachian system of mountains extends across the State from southwest to northeast, reaching the highest elevation in Mt. Katahdin, 5,215 feet. Nearly the entire surface of the State is hilly.

The climatic conditions of the southwestern half of the State are similar to those of the other New England States, but the eastern coast region and the extreme northern parts show a flora containing many boreal and alpine species. A large section in the northwestern part of the State has been explored only for its timber of pine and spruce, and its flora is practically unknown. This is true also of a smaller area in the eastern part of the State away from the coast.

A division of the State on the parallel of 45° 30′ into a southern and a northern section, though quite arbitrary, will be, in most cases, sufficient for the present purpose. The southern section contains the entire coast region and the valleys of the Penobscot, the Kennebec and the

Androscoggin rivers. The northern section consists, for the most part, of Aroostook County with an area more than three-fourths as great as that of the State of Massachusetts.

Maine produces nearly all the common ferns and fern allies of the Eastern States, but lacks a few that are found on calcareous rocks in western New England. Distinct and well-recognized varieties only have been enumerated in connection with species, and the list, thus constituted, comprises thirty-eight species and ten varieties of ferns, and twenty-seven species and six varieties of the allies, with reports, which cannot be confirmed, of two or three other species.

I wish here to acknowledge my obligations to Mr. C. H. Knowlton, Mr. E. B. Chamberlain, Miss Kate Furbish, Miss Lillian O. Eaton and numerous other correspondents whose notes have greatly assisted me in the preparation of this list of Maine ferns. Acknowledgements are also due to Mr. M. L. Fernald of the Gray Herbarium for notes and suggestions, but especially for his work in connection with the genus *Isoetes*. This portion of the list was written by him from collections by himself and others in the Herbarium of the New England Botanical Club, the Gray Herbarium and notes of Mr. A. A. Eaton.

OPHIOGLOSSACEÆ.

Ophioglossum vulgatum L. Adder's-tongue. In all portions of the southern section and not rare. Not known in the northern section.

Botrychium simplex Hitchcock. In various parts of the State in both northern and southern sections, but apparently not common.

Botrychium matricariæfolium A. Br. Matricary Grape Fern. Generally distributed and not rare.

Botrychium obliquum Muhl. Common Grape Fern.

Rather common in the southern section. Not seen from the northern.

Botrychium obliquum dissectum Clute. Frequent in the southern section.

Botrychium obliquum intermedium Underw. Occasional.

Botrychium lanceolatum Angs. LANCE-LEAVED GRAPE FERN. Found throughout the State, but not common.

Botrychium Virginianum Swartz. RATTLESNAKE FERN. Throughout the State, and common especially in the northern portion.

OSMUNDACEÆ.

Osmunda regalis L. ROYAL FERN. Common throughout.

Osmunda cinnamomea L. CINNAMON FERN. Very common.

Osmunda Claytoniana L. INTERRUPTED FERN. Throughout the State, but not as abundant as the two other species.

POLYPODIACEÆ.

Onoclea sensibilis L. SENSITIVE FERN. Common in all parts of the State.

Onoclea struthiopteris Hoffm. OSTRICH FERN. Throughout the State. Frequent.

Woodsia Ilvensis R Br. RUSTY WOODSIA. Frequent throughout the State on rocky hills and cliffs.

Woodsia glabella R Br. Moxie Falls, Township No. 1 East of the Kennebec, Fifth range of Bingham's Purchase, Somerset Co. (J. F. Collins). The only station.

Woodsia obtusa Torr. COMMON WOODSIA. About Mt. Pisgah, Winthrop. (H. Metcalf).

Dicksonia pilosiuscula Willd. BOULDER FERN. Abun-

dant in the southern section, not reported from the northern.

Cystopteris bulbifera Bernh. Rather common in the northern parts of the State, less so in the western and central.

Cystopteris fragilis Bernh. Common Bladder Fern. Generally distributed in the State but nowhere abundant.

Cystopteris fragilis Bernh. var. *dentata* Davenp. Wells (Kate Furbish).

Polystichum achrostichoides Schott. Christmas Fern. Very common throughout the southern section, but not known north of forty-seven degrees.

Polystichum achrostichoides f. *incisum* Gray. Frequent with the species.

Polystichum Braunii Lawson. Rather common in the northern part of the State. Found also at high elevations in the western portion.

Nephrodium Noveboracense Desv. New York Fern. Found in all parts of the State and common in most.

Nephrodium Thelypteris Desv. Marsh Fern. In all portions of the State and quite common.

Nephrodium simulatum Davenp. Not common as far as known. Georgetown (G. E. Davenport), Southport (M. L. Fernald).

Nephrodium fragrans Richards. Fragrant Fern. In the extreme northern part of the State (M. L. Fernald), Mt. Kineo (C. E. Smith), Winthrop (H. Metcalf), Andover (J. A. Allen).

Nephrodium cristatum Michx. Crested Fern. Common in swamps throughout.

Nephrodium cristatum Clintonianum D. C. Eaton. Apparently rare. Farmington (H. W. Jewell), South Portland.

Nephrodium Goldieanum Hook. Goldie's Fern. Not rare in the western and central parts of the State, but not known near the coast nor in the northern section.

Nephrodium marginale Michx. Marginal Shield Fern. Common on rocky hillsides throughout the State.

Nephrodium spinulosum Desv. Spinulose Wood Fern. Frequent in the southern section.

Nephrodium spinulosum var. *intermedium* Davenp. Common everywhere.

Nephrodium spinulosum var. *dilatatum* Baker. Common in the hills of the western and northern parts, and on Eagle Island, Casco Bay.

Nephrodium Boottii Davenp. Frequent in all sections.

Phegopteris polypodioides Fee. Narrow Beech Fern. Throughout the State. Common.

Phegopteris hexagonoptera Fee. Broad Beech Fern. Scarce. Found in the central and western parts of the State. Monhegan Island (M. P. Cook).

Phegopteris Dryopteris Fee. Oak Fern. Common throughout the State, especially in the north.

Woodwardia Virginica Smith. Common Chain Fern. Quite frequent in the southern section. Not known in the northern.

Camptosorus rhizophyllus Link. Walking Fern. Winthrop (H. Metcalf). The only station. Said to have been collected in Shapleigh but this was an error.

Asplenium ebeneum Ait. Ebony Spleenwort. Not common, but found at various stations in the southern section.

Asplenium Trichomanes L. Maidenhair Spleenwort. Widely scattered in the southern section, but rather scarce. Not known in the northern.

Asplenium thelypteroides Desv. Silvery Spleenwort. Fairly common throughout the State except near the coast.

Asplenium Filix-fœmina Roth. Lady Fern. Abundant everywhere with numerous varieties and forms.

Adiantum pedatum L. Maidenhair. Widely distributed but not common.

Pteris aquilina L. Bracken. Abundant everywhere.

Polypodium vulgare L. Polypody. On rocks throughout the State. The variety *auritum* Willd. is reported

from Farmington (H. W. Jewell), and the variety *cambricum* Willd. from Mount Desert Island (Miss E. S. Shaw).

EQUISETACEÆ.

Equisetum arvense L. Field Horsetail. Common in numerous forms.

Equisetum pratense Ehrh. In the valley of the Kennebec and rather abundant along the St. John in northern Maine.

Equisetum sylvaticum L. Wood Horsetail. Common.

Equisetum palustre L. Livermore Falls, Androscoggin Co. (C. H. Knowlton). Abundant on the shores of the St. John, Aroostook Co.

Equisetum fluviatile L. Water Horsetail. Common throughout.

Equisetum littorale Kuehlw. Collected in one or more of its many forms at several stations in the valley of the Penobscot and in Aroostook Co., especially along the northern border of the State. (M. L. Fernald, O. W. Knight).

Equisetum hyemale L. Common Scouring Rush. Rather common in the southern section.

Equisetum variegatum Schleich. Kennebec River at Skowhegan and common along the St. John.

Equisetum scirpoides Michx. Quite generally distributed in the State and abundant in the extreme north.

LYCOPODIACEÆ.

Lycopodium selago L. Fir Club-Moss. On mountains. Mt. Katahdin (M. L. Fernald), Mt. Desert (Rand & Redfield, Fl., Mt. Desert), Mt. Bigelow.

Lycopodium lucidulum Michx. Shining Club-Moss. Frequent throughout.

Lycopodium inundatum L. Marsh Club-Moss. Not rare in the southern section.

Lycopodium obscurum L. Tree Club-Moss. Common.

Lycopodium annotinum L. Common.

Lycopodium annotinum pungens Spring. Mountains of the western part of the State (E. B. Chamberlain), Mt. Katahdin (M. L. Fernald), St. Francis, Van Buren, Orono and Cutler, in bogs or cold woods. (Herb. New Eng. Bot. Club).

Lycopodium sabinæfolium Willd. Common in the extreme north (M. L. Fernald). Found also at Farmington (C. H. Knowlton), and Dover.

Lycopodium clavatum L. Common Club-Moss. Abundant everywhere.

Lycopodium clavatum monostachyon Hook. Very frequent in various parts of the State.

Lycopodium complanatum L. Ground Pine. Fort Kent. Island Falls and Haystack Mountain (M. L. Fernald); Pleasant Pond (E. B. Chamberlain).

Lycopodium complanatum flabelliforme Fernald. Common.

Lycopodium Chamæcyparissus A Br. In nearly all parts of the State, and common in the central and northern portions.

Lycopodium Sitchense Rupr. Mt. Katahdin (M. L. Fernald), and along the northern border of the State.

SELAGINELLACEÆ.

Selaginella rupestris Spring. Rock Selaginella. Frequent in the southern section, rare in the northern.

Selaginella spinosa Beauv. Fort Kent. (A. A. Eaton).

Selaginella apus Spring. Creeping Selaginella. Kittery. (G. L. Goodale, 1861).

ISOETACEÆ.

Isoetes heterospora A. A. Eaton. Jordan Pond, Mt. Desert Island (E. L. Rand).

Isoetes Tuckermani A. Braun. Ship Pond, Elliottsville and Great Pond, Mt. Desert Island (M. L. Fernald); Oldtown (F. L. Harvey).

Isoetes Tuckermani, borealis A. A. Eaton. Pushaw Lake, Oldtown (F. L. Harvey); Somes Stream and Great Pond, Mt. Desert Island (Rand, Kennedy, Fernald); Kennebago Lake (F. V. Coville).

Isoetes Harveyi A. A. Eaton. Pushaw Lake, Oldtown (F. L. Harvey); Mt. Desert Island (M. L. Fernald).

Isoetes hieroglyphica A. A. Eaton. Lakes of the St. Francis River (C. G. Pringle; St. John River at St. Francis (M. L. Fernald); Moosehead Lake (F. L. Harvey); Rangeley Lakes (F. V. Coville).

Isoetes echinospora Braunii Engelm. Of general distribution.

Isoetes echinospora muricata Engelm. St. John River at Madawaska, St. Croix River at Masardis, Penobscot River at Orono, Dead River, Somerset Co., Great Works River at North Berwick (M. L. Fernald), Moosehead Lake (F. L. Harvey), Androscoggin River at Mechanic Falls (J. A. Allen).

Isoetes Dodgei A. A. Eaton. Pease Pond, East Wilton (M. L. Fernald), Cornish (J. W. Chickering), Kennebunk (Gray Herb.)

——— *Botrychium Lunaria* Sw. This has been reported from several stations, but plants seen are not satisfactory, and it is doubtful if the species has been collected in the State.

——— *Woodwardia angustifolia* Smith. This species has been reported from Acton, Brownfield and Wells, all in the southern part of the State, but no herbarium specimens are known and the plant has not been collected recently.

Portland, Me.

POLYPODIUM VULGARE VAR. ALATO-MULTIFIDUM, VAR. NOV.

By B. D. Gilbert.

After my monograph of the varieties of *Polypodium vulgare* in this country was in print for the April Fern Bulletin, I received specimens of a variety which I had never seen before, and which is as peculiar and striking as anything in this list. The fronds measure from 20 to 33 cm. in length and are all beautifully multifid and fruited at the tips. The pinnæ are acute, hardly acuminate, much as in the variety *angustum,* but at the base expand on each side so as to form a wing to the rachis. The expansions of the lower side however are much larger than those of the upper. Those of the lower side extend downward in triangular shape about 1 cm. and meet the short extension from the upper side very near the rachis, thus forming a continuous wing. In the larger auricles a vein springs from the rachis instead of the costa, and sends a branch both upward and downward, but I have not detected any anastomosing.

The plants were discovered by Mr. Edward R. Heacock at Mauch Chunk, Pa., Oct. 15, 1905. They were growing in a clump on red sandstone. Mr. Heacock says: "I brought a part of the original clump home, divided it, and planted one part in the green house, and one outside. The situation was a big rock slide, and every ledge of the upheaved red sandstone, wherever there was room for leaf-mold to collect, was covered with this handsome fern." In another letter he says: "I judge it is a fairly constant variety, for a part of the original clump which I brought home to the greenhouse, has sent up similar fronds for this season."

Clayville, N. Y.

THE GENUS OLEANDRA.

By Willard N. Clute

As relationships go in the fern world, a few families contain a majority of the species. Such genera as *Polypodium, Pteris, Asplenium, Trichomanes,* and *Nephrodium,* represented in our region by from one to half a dozen species, in other climes include many hundreds. Clustered about these great genera are various smaller ones which resemble the leaders in many particulars, but differ enough to have generic names of their own. Related to *Pteris* we find *Pellæa, Cheilanthes, Adiantum,* and others whose species often so closely resemble that genus that they are mistaken for members of it. Similarly about *Nephrodium,* we find *Aspidium, Sagenia, Polystichum, Nephrolepis* and the subject of this note. Like its near ally, *Nephrolepis,* the genus *Oleandra* is what is called a "natural genus," that is, the species are all so much alike that they would be recognized as members of the genus whether found in fruit or not. Except for this peculiarity of habit, there is little to warrant their separation from *Nephrodium.* The sori and indusia are practically alike and fixed to the fronds in the same manner, thought their location on the fronds is quite characteristic. In all the species the fruit-dots are found in a single or double row not far from the midrib and parallel to it, as shown in our illustration. The rootstock is usually scandent or creeping, and covered with silky scales. Along this rootstock at intervals the fronds appear, being jointed to it by an articulation near the base of the stipes.

There are about half a dozen species of *Oleandra* in the world, but these are widely distributed. There are two in the American tropics, one in India, one in Africa, and two in Ceylon, Assam, and the East Indies. The species figured is *O. Wallichii,* from Northern India, collected by C. W. Hope, author of a work on the ferns of that region.

WHERE FLORIDA FERNS GROW.

By Henry H. Negley.

The rarest and most difficult ferns to procure in Florida are only to be found about 31 miles from Miami, down the coast and inland about 6 miles, so that to get them you have to drive from Miami. The road from Miami to Cutler (15 miles) is a beautiful drive, a good smooth, solid roadway all the distance. It runs through a series of dense jungle hammock for about three-quarters of the distance, but frequently striking salt marsh prairies which lay between the road and Biscayne Bay. It is an ideal drive in every respect. Quite a number of large grape fruit groves are to be seen in all stages of advancement, from those but recently planted to those 6 years old, bearing golden fruit. These groves were all originally hammock land. The town of Cutler is but a scattered village of some dozen houses and a fairly good hotel. It is situated on a slope overlooking the bay. The section of country in which the greatest number of ferns grows lies about 16 miles southwest from Cutler, and the only way to reach it at present * is by the newly made homestead trails, for that is all they can be called. One trip over this road in a buggy will certainly cure the most stubborn case of liver complaint. It is the roughest section of Florida that I have yet visited. It alternately traverses very rocky pine timber and scrub palmetto land and swamp prairie, the latter the natural drainage of the everglades to the bay. As they approach the bay they decrease in width and become creeks (here called rivers). These prairies vary in width from one-quarter to one mile, and in the rainy season are covered by water from two to four feet in depth. Roads across these places are

* Since this was written the railroad has been extended to within a few miles of the place described.

what are called corduroy, and you can imagine how smooth they are. The drive from Cutler to our destination was a decidedly rough one, but still not devoid of interest, as we occasionally explored some small hammocks on the way, but found nothing of special interest. Our destination was the last new homestead in Southeast Florida, north of Cape Sable. Our plan was to get to our grounds the first day, and be prepared to make an early start the next morning. I was very fortunate in securing the services of a gentleman in Miami, a nurseryman, and who, by the way, is a man after my own heart; not a botanist, but an enthusiast like myself. He had been over the ground in December or January previous, with Mr. Oakes Ames and a Mr. Eaton.

To those not familiar with these regions, it might be well to explain what hammocks are. They vary so much in character that a general description must suffice. Most of them seem to be spots where nature in past ages has been more lavish in depositing soil, and as a result of climatic conditions vegetation has taken hold and from year to year has added to this deposit of virgin soil, resulting finally in a dense jungle growth of live oaks, gumbo-limbo, immense lianas, vines and shrubbery, the ground generally being covered with ferns, *Tillandsia,* etc. The larger trees are also covered with *Tillandsias,* ferns, and orchids, mostly *Epidendrums.* Most of these jungles are so dense that it was necessary to cut our way through with a Cuban machette, which my friend Mr. J. Soar used most skillfully. The southermost hammocks we visited are exceedingly rocky, and will hardly ever pay for their clearing out. The rock is a carbonate of lime formation, and taken as one large mass, very much resembles an immense flat sponge. The rock is perforated with what are called pot holes, in size from six inches in diameter to ten or fifteen feet, mostly about four to six feet, varying in depth from four to fifteen feet. The larger ones very much resemble a nicely built up well, whose walls are quite perpendicular. Some are

of an oval shape, some few being quite irregular. The hammocks that we visited are exceedingly dangerous to walk over, and one has to be very careful, using a cane to prevent his stepping into one of these pitfalls, as from time to time limbs, leaves, and fern fronds conceal their openings. As an evidence of their dangerous character I am now limping about with an exceedingly badly sprined knee and limb, which the doctor says may continue for some time. It was quite unfortunate but as I was getting over a large fallen tree I slid into one of these traps and thought I had broken my leg.

The whole trip was truly a revelation to me, and I feel well paid for all the trouble experienced. In as few words as possible I will describe how and where most of these ferns grow. It is quite an interesting study to note the selection of location (shady or open light), nearness to or on the surface of the ground, or depth in these wells, in which these ferns thrive. A few feet in depth either way seems to mean their destruction, or at least the conditions for their reproduction are not favorable. In describing some of these conditions I will do so generally, except to indicate the depth in these wells in which some of the smaller ferns grow.

Asplenium myriophyllum. Hammocks in pot holes not lower than four feet below the surface; quite abundant. Think this fern would make quite a fine one for fern dishes and baskets. It certainly is a beauty, covering as it does the walls of some of these holes.

Tectaria ———. New, quite dwarf in habit, pot holes, same relative position as No. 1. Abundant.

Tectaria trifoliata. Hammocks; rather scarce. Grows only on the upper edge of pot holes, sometimes forming a beautiful fringe around the holes.

Phegopteris ———. Hammocks in pot holes, not nearer to the surface than five to eight feet; very rare and exceedingly scarce. Mr. Eaton claims to have found it in December, 1903, for the first time in the United States.

Phegopteris reptans. In hammocks; quite rare. Grows a few feet nearer surface than the preceding. Has not only upright growing fronds, but also those that creep and root, as shown by specimens.

Trichomanes Kraussii, sheet fern. In hammocks. Grows on walls anywhere below the surface, either on wood or rock; quite abundant and exceedingly pretty, often covering entire walls.

Nephrodium patens. Hammocks, in rich, moist places; tall; quite common in Florida; very beautiful, growing very much like the tree ferns of Jamaica.

Polypodium phyllitidis. Common. Grows all over the southern part of the State in shady situations, on the ground as well as on rotted logs, stumps, and even on live trees along with *Tillandsias;* often grows to the height of four feet.

Polypodium incanum. Common. Grows on trees, particularly on live oaks. Often called resurrection fern in Florida. I had difficulty in getting live fronds this time of the year.

Polypodium swartzii. Very rare; only found in two places in the State. Grows on the ground and climbs trees to a height of 12 feet. Exceedingly beautiful (I send pressed specimens). Where we found it was a dense jungle extending over about half an acre.

Adiantum tenerum. Common in southern Florida, in very moist and well-shaded hammocks. Grows to the height of two and half feet. In one place we found it exceedingly abundant and a beautiful sight it was. It is largely used in the hotels belonging to the Florida East Coast Railroad as a table (and exchange) decoration.

Pteris longifolia. Quite common in extreme southern Florida on rocky land.

Vittaria lineata. With long grass-like fronds. It grows in dense hammocks on cabbage palmetto trees. Often covering the trunk with its beautiful fringe-like foliage; quite common.

Nephrodium unitum glabrum. Common in the State. Grows in wet places along rivers.

ASPLENIUM EBENOIDES IN CHESTER VALLEY, PA.

By T. Chalkley Palmer.

The infrequency of this species will, perhaps, warrant a short notice of its appearance once more within a few miles of its original station. These plants were found on September 8th of the present year growing on a mossy ledge of the Chester Valley limestone seven miles west of the Schuylkill and within the limits of Chester County. The situation is shaded and the exposure is to the north. The ledge is not exactly damp—it is only not dry.

One of the plants has long spore-bearing fronds and has evidently survived more than one cold season. The other two were younger. All were vigorous and healthy. The fronds were altogether typical and the lower pinnæ distinctly resembled those of *Asplenium platyneuron* as did, quite uniformly, the lower half of the rachis. The plants grew within a foot or two of each other. There is no intention to discuss, here, the question of hydridity. However, the companion plants to these were preëminently *Asplenium platyneuron* and *Camptosorus*.

Media, Pa.

Dr. R. J. Smith, Milpitas, Santa Clara County, California, notes that *Selaginella Bigelovii* is not confined entirely to Southern California. It grows quite freely in Alum Rock Canyon, Santa Clara County, about seven miles east of San José, at the foot of Mt. Hamilton. On a very steep bank with northeast exposure are many little clumps of bright green, some a yard or more across. After the first rains in the fall they are very noticeable while other plants are still brown.

ON CULTIVATING OUR FERNS

By James H. Ferriss.

Ambitious to grow all the American ferns in the Joliet park I have made a summer trip to Colorado and two winter excursions to western Texas, New Mexico and Arizona, and I am going again. Members of our society have given me generous assistance and the nurserymen, pay or no pay, have been very kind. I have a soft spot in my heart for a lot of these people I never have seen and when ferns die or park commissioners grumble I am cheered on by an assurance that I will meet all of these good people over on that shore where the ferns grow everlasting and so big the heathen cannot pull them up.

All but a very few of our American ferns, and a great many others have seen the park alive. Alas, some are now dead. The Canadian ferns give me as much trouble to grow as the curiosities of the rocks and desert. I have experienced help in the greenhouse, but other business preventing my giving daily attention to the ferns is a large factor in our failures. But there is something in our soil, water or air, I fear, that makes trouble. At least some kinds always remain stubborn; others have a constant habit of petering out little by little, while others never die. There always remains the hope however of discovering a situation that will pull these failures through the next time. *Lygodium palmatum* will not grow at all but *L. Japonicum* thrives like a weed. *Ceratopteris* does fairly well at the Missouri Botanical Garden in rain water, but in our creek or well water it declines to the end in six months. *Schizaea, Polypodium Swartzii, Cheilanthes Lindheimeri, Asplenium serratum, A. pinnatifidium, A. septentrionale, A. montanum,* and *Woodsia alpina* have never put out new fronds.

Many others put out one or two fronds and die with the effort. Among these are *Gymnopteris triangularis* and *G. hispida, Notholaena Schaffneri, N. Hookeri, Vittaria lineata, Cheilanthes Californica, C. Wrightii, Pellaea aspera, P. densa,* all the *Woodwardias, Asplenium vespertinum, A. viride, A. dentatum, A. fontanum, A. Bradleyi, Nephrodium fragrans, N. patula, Polystichum lonchitis, P. scopulinum,* and *P. aculeatum lobatum, Woodsia ilvenis,* and *W. glabella.*

This is not a very good record for the president of the greatest fern society in the world, and I have not told you all either, for *Polypodium Scouleri* continues year after year a mere runt, and *Psilotum nudum* is dead. These are mere samples. *Equisetum telmateia* never starts, though *E. Funstoni,* of San Bernardino, California, lives out of doors and thrives. The *Lycopodiums* are a discouraging lot.

In the Southwest I found all the ferns catalogued for the territory visited except *Asplenium Glenniei, Cheilanthes leucopoda, Notholaena Parryi, N. Aschenborniana* and *N. tenera.* In southern Texas I found *Cheilanthes Moritziana,* a South American species, and *Adiantum tricholepis f. glabrum,* Clute, and *Pellæa aspera f. compacta,* the two latter new. In Arizona, *Polystichum aculeatum lobatum* and *Polypodium falcatum,* new to the territory. The latter grew on the roof of a dry cave twenty or thirty feet from the sunlight in company with *Asplenium parvulum* and *Pellæa ternifolia. Polypodium hesperium* grew on the hot side of a cliff 8,000 feet above the sea. *Polypodium thysanolepis* has the habit of *P. vulgare,* abiding upon a shady, dry rocky shelf.

In a well-drained spot and the warmest in the greenhouse *Cheilanthes tomentosa* and *C. Eatoni* are as thrifty as in their wild state. It is the same with *Notholaena sinuata, N. ferruginea, N. nivea, N. dealbata,* and *N. candida, Pellæa ternifolia, P. flexuosa, P. intermedia,* and *P. pulchella* and *Asplenium monanthemum. Phaner-*

ophlebia auriculata (*Aspidium juglandifolia*) is not far behind.

The ferns are finicky in their choice of abode. A limestone gulch was built for *Scolependium vulgare* and *Pellæa gracilis.* They are pleased with it, and many youngsters now nestle in the limestone niches. Other ferns mildew and damp off here, but thrive in the dry rocks. One corner of the greenhouse will grow a species that will not thrive in any other spot. Fern life is much of a chance. In Arizona a species that poisoned sheep was reported by the ranchmen, and also one or two used for a beverage, steeped as tea, but from the description given I could not determine what species was referred to in either case.

While the flora of mountain and desert is large in the aggregate, the colonies are so scattered and in such inaccessible places I felt that these trips were exceedingly feeble efforts. The ground was scarcely scratched. Besides I am interested in snails, land snails in particular. In the Florida, Chiricahua and Huachuca mountains I found twenty-three species and varieties, one of these a new genus—*Infundibularia tuba,* Pilsbry. Some had whiskers and wool, some were like cornets, and bugles, and they had all sorts of stripes and colors. The snails are interesting and the ferns hang high in Arizona.

Joliet, Ill.

In the October Fern Bulletin, Mr. A. B. Klugh says "*Scolopendrium vulgare* has been recorded in Ontario only from Owen Sound and Durham, both in Grey County." Durham is about 30 miles *south* of Owen Sound. In 1903 I found the fern in abundance, with the other ferns mentioned by Mr. Klugh, on the limestone ridge near Collingwood, at a point 22 miles directly *east* of Owen Sound, and this was recorded by Mr. House in The Fern Bulletin for October, 1903. The limestone ridge is on the border line between Grey and Simcoe Counties, Ontario.—*W. A. Bastedo, M. D.,* 120 *W.* 58*th St., New York City.*

RARE FORMS OF FERNS.—I.

A ROUND-LEAVED ROYAL FERN.

We illustrate, herewith, a curious form of the royal fern (*Osmunda regalis*) from Hartland, Vt., collected by Harold G. Rugg. The figure shows the two middle pairs of pinnæ and a part of what appears to be the normal fruiting apex. Specimens are at hand, however, in which the apex of the frond is leafy and the sori borne on reduced pinnæ lower down. An examination of these latter, however, discovers that they are but incompletely fertile, most of the sori being scattered along the margins of leaf-like expansions. Because of this latter characteristic, some fern students, who have seen the specimens are inclined to call the species *Osmunda Claytoniana*, and others have suggested a hybrid between this and *O. regalis*. The veining and texture of the pinnules is so evidently that of *O. regalis*, however, that the aberrant fruiting may be disregarded, since it is not uncommon for abnormal fronds of any of the *Osmundas* to deviate from the usual in this respect. In the present specimens it is interesting to note that the imperfectly fertile pinnæ have veins tipped with spore-cases that spring from the surface of the pinnæ instead of from the edges.

The fern illustrated has been growing on the farm of B. P. Ruggles for the past twenty years and therefore seems worthy of a name to designate it. I would accordingly call it *Osmunda regalis* f. *orbiculata*. It may be described as follows: Rootstock as in the type;

fronds 6-15 inches high, 2-3 inches wide; pinnules 5-7 to each pinna, orbicular or cordate crowded and overlapping; pinnæ about ten pairs. Type in my herbarium. A form of this fern found in Ireland by Phillips has been named f. *rotundata,* but judging from the rather meager description it is not identical with the specimens here described.—*Willard N. Clute.*

A NEW STATION FOR SELAGINELLA DOUGLASII

By Walter Albion Squires.

Selaginella Douglasii is said to be one of the rarest of the fern allies in collections. Maxon in his List of the Ferns and Fern Allies of North America says that it is found from northern California to British Columbia. So far as I have been able to learn, it has never been reported from Idaho or eastern Washington and Oregon.

In the autumn of 1904 I first noticed the delicately beautiful foliage of this plant on mossy shaded banks in the Bitter Root Forest Reserve of Northern Idaho. Since then I have found it at many places along the Middle Fork of the Clearwater river from the point where I first discovered it to the junction of the middle and south forks of the Clearwater at Kooskia. In cool shady spots at the foot of the precipitous hills, which form the southern wall of the Clearwater canyon it is often abundant. Its long creeping stems often spread over rocks and banks of earth with a delicate lace-like covering of beautiful green.

Whether or not its range crosses the Bitter Root Mountains into Montana I was unable to ascertain. I hope to make further investigations next summer and would be glad to collect specimens of this plant for readers of the Fern Bulletin who wish them. It seems to me that more of our fern students should become acquainted with this delicate little plant, perhaps the most beautiful of our *Selaginellas.*

Kooskia, Idaho.

THE RUSTY WOODSIA IN CULTIVATION.

By Mrs. J. J. Puffer.

I was much interested in the article about the fernworts on Mt. Tom, Massachusetts, in the October Bulletin of 1905. Several years ago I visited Mts. Tom and Holyoke, and saw those same fernworts, the rusty *woodsia* and rock *selaginella,* growing—no, just barely existing—on the seemingly bare rocks, trampled upon and exposed to the full heat of the summer sun till they were dried to a crisp, and out of pity for them I loosened one tuft from its hold with my fingers and brought it home, and now you ought to see it!

I was told then that they would not grow unless on a mountain, but, with woman's natural persistency, I vowed I would make them grow if I had to build a little mountain for them. On arriving home, I looked over the situation and chose a stone wall which was banked to the top with earth on one side. There I set them as close to the stones as possible, and covered their roots with flat stones, leaving only a crevice for them to grow up through.

They are now large, thick tufts of fronds six inches and more high, and fully equal to any I have ever seen in their natural haunts, and I have taken specimens from Mts. Wauchusett, Greylock and Holyoke, where they had more soil and partial shade, which they seem to prefer. My plants increase in size of tufts, and also new plants from spores are often found.

Along with them, on the same wall, I have the rock-fern (*Woodsia obtusa*), *Cystopteris fragilis,* and the little maiden-hair spleenwort. At the foot of the wall on the face side are the ebony spleenwort and *Asplenium thelypteris,* all thriving on the same soil.

Sudbury, Mass.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

77. **Cheilanthes lendigera** (Cav.). Rare; on rocks. Huachuca Mountains, Arizona; also southward to Equador.

78. **Cheilanthes leucopoda** Link. Very rare; on shaded rocks. Western Texas; also in Mexico.

79. **Cheilanthes Lindheimeri** Hook. Rare; on shaded rocks. Western Texas and Arizona; also in Mexico.

80. **Cheilanthes microphylla** Sw. Not uncommon; on rocks in sun or shade. Florida, Western Texas, Arizona and New Mexico; also in Mexico and the West Indies. The form **elegans** Baker is reported from Arizona and California.

81. **Cheilanthes Moritziana** Kunze. Not uncommon; on moist rocks in sun or shade. Texas and tropical America. Resembles the preceding but the fronds are broadest at base.—*C. microphylla Moritziana* (Kunze).

82. **Cheilanthes myriophylla** Desv. Rare; on rocks. Texas and Arizona; also from Mexico to Chili.

83. **Cheilanthes Parishii** Dav. Very rare; San Jacinto Mountains, California.

84. **Cheilanthes Pringlei** Dav. Rare; at the base of rocks. Arizona.

85. **Cheilanthes tomentosa** Link. Not uncommon; on dry rocks in sun or shade. Virginia to Missouri, Georgia, Texas and Arizona; also in Mexico and the West Indies.

86. **Cheilanthes vestita** Sw. Rather common; on gneiss rocks. Connecticut to Missouri, Georgia and Texas, more common in the south.—*C. lanosa* (Michx.).

87. **Cheilanthes viscida** Dav. Not common; in dry soil in shade. California.

88. **Cheilanthes Wrightii** Hook. Somewhat rare; on open grassy knolls. Western Texas, Arizona and New Mexico.

Cryptogramma R. Br.

89. **Cryptogramma acrostichoides** R. Br. Rock Brake; Parsley Fern; Pea Fern. Not uncommon; on dryish cliffs and talus slopes. Labrador, north shore of Lake Huron, Colorado and California to the Arctic Circle. A closely allied species, of which this is often considered a variety, is common in northern Europe and Asia. The form **foveolata** Ruprecht is reported from British Columbia and Alaska.

90. **Cryptogramma gracilis** (Michx.). Slender Cliff-brake. Common; on moist limestone cliffs, rarely found elsewhere. Pennsylvania, Illinois, Iowa and Colorado northward; also in northern Asia. This species is as well placed in the genus *Pellæa* as here. The dimorphic fronds are regarded as characteristic of *Cryptogramma* — *Cryptogramme Stelleri* (Gmel.); *Pellæa gracilis* (Michx.).

Cystopteris Bernh.

91. **Cystopteris bulbifera** (L.). Bladder Fern. Abundant; on moist, shaded rocks, especially limestone. Georgia and Arkansas to Canada.—*Filix bulbifera* (L.).

92. **Cystopteris fragilis** (L.). Brittle Bladder Fern; Common Bladder Fern. Abundant; on rocks wet or dry and occasionally in alluvial soil. Throughout North America and in most parts of the earth from the tropics to the Arctic Circle. —*Filix fragilis* (L.).

The form **angustata** Link is a narrow form from Vermont; **f. dentata** Hook. is a dentate form reported from New York and California; **f. laciniata** Dav. is a more deeply cut form from New England; **f. Mackayi** Lawson is from Nova Scotia; **f. magnasora** Clute is a form with very large sori, found on dry rocks in New England, New York and Pennsylvania.

93. **Cystopteris montana** (Lam.). Mountain Bladder Fern. Rare; on shaded rocks. Labrador, north shore of Lake Superior and Colorado to Alaska; also in northern Europe and Asia.—*Filix montana* (Lam.).

Davallia Smith.

94. **Davallia clavata** Sm. Rare; on moist rocks. Southern Florida; also in the West Indies.—*Odontosoria clavata* (Sm.).

Dicksonia L'Her.

95. **Dicksonia punctilobula** (Michx.). Boulder Fern; Hay-scented Fern; Fine-haired Mountain Fern; Pasture Fern; Sweet Fern. Abundant; in pastures, thickets and along roadsides, especially in upland regions. Georgia and Alabama to Michigan and Canada —*Dicksonia pilosiuscula* Willd.; *Dennstædtia punctilobula* (Michx.).

The form **cristata** (Maxon) is a crested form from Massachusetts (*Dennstædtia punctilobula cristata* Maxon); **f. schizophylla** Clute is a narrow incised form from Connecticut.

GYMNOGRAMMA Desv.

96. **Gymnogramma hispida** Mett. Rare; on exposed rocks in elevated regions. Western Texas, New Mexico and Arizona; also in Mexico —*Gymnopteris hispida* (Mett.); *Bommeria hispida* (Mett.); *Gymnogramma Ehrenbergiana* Underw.

97. **Gymnogramma triangularis** Kaulf. GOLDEN-BACK FERN; GOLD FERN. Common; in exposed situations. California to Alaska near the coast; also southward to Equador.—*Gymnopteris triangularis* (Kaulf.); *Ceropteris triangularis* (Kaulf.).

98. **Gymnogramma triangularis viscosa** D. C. Eaton. Rare; in exposed situations. Mountains of San Diego county, California, and Santa Catalina Island.—*Ceropteris viscosa* (D. C. Eaton).

MISCELLANEOUS NOTES

A few years ago Jenman described a species of *Acrostichum* which had previously been confused with *Acrostichum aureum*. To this species he gave the name of *A. lomarioides*. There is still a disposition among some writers to regard these two species as but forms of a single species, but nobody who has ever seen them in the field would so regard them. Seventy-three years ago Bory de St. Vincent gave the name *Acrostichum lomarioides* to another plant. This name, however, has not continued in use, notwithstanding which, W. R. Maxon proposes that the plant we now call *A. lomarioides* be renamed *A. excelsum*.

The December (1905) number of the Japanese *Botanical Magazine* reports that the wood horsetail (*Equisetum sylvaticum*) has recently been found for the first time in Japan.

It is a pity the BULLETIN cannot see its way to ignore the name *Dryopteris* as a synonym for *Nephrodium* or *Lastrea.* I have pointed out more than once the ill-founded nature of it, and the consequent absurdity of adding to the synonymic confusion by its adoption. On page 55 in the "Index to Recent Literature" this confusion is exemplified by reference to *Nephrodium filix-mas* in Vermont (Brainerd), and *Dryopteris filix-mas* in Vermont (Hazen), both obviously relating to the same thing. —*Chas. T. Druery, London, England.* [Mr. Druery should remember that we have in this country a party of radicals who take themselves quite seriously and use *Dryopteris* on all occasions. Ever since they went off on this tangent we and others have labored to show them the error of their ways, but some of them have replied, "What do we care about the Old World? We cannot let the rest of the world interfere in an American nomenclature." If they insisted on *Dryopteris* only, we should not so seriously object, but think of *Filix* and *Matteuccia* and *Ornithopteris!* Last year the Vienna Congress spoiled their nonsensical doubling of the generic name, such as *Phegopteris Phegopteris,* but it would take an Act of our National Congress to make them desist from changing names entirely. It is not likely that the radical names will ever become common in America, and for the same reason that a dog wags his tail. The dog wags his tail because the tail cannot wag the dog!—ED.]

CAUSE OF RUSTED FRONDS.—The cultivated ferns in the Joliet and the Chicago parks are browned or rusted in the early spring. The cold rainy nights seem to do this. The sensitive fern (*Onoclea sensibilis*) is the first to be attacked for the last half dozen seasons at least. The native ferns suffer most. Following *Onoclea* will be both species of *Cystopteris, Adiantum pedatum, Asplenium thelypteroides* and *A. filix-fœmina* in their order. The fronds attacked die down and new fronds usually take their places later. Can any suggest a cure? —*James H. Ferriss, Joliet, Ill.*

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

CLUTE, W. N. *A Check-List of North American Fern-worts.* Fern Bulletin, July, 1906. A continuation.

CLUTE, W. N. *The Moonwort,* illust. Fern Bulletin, July, 1906.

DAVENPORT, G. E. *The Forms of Botrychium simplex.* Fern Bulletin, July, 1906. Distinction of the variety *fallax.*

DOWELL, P. *Distribution of Ferns on Staten Island.* Proceedings Staten Island Association of Arts and Sciences, January and May, 1906. A list of species with notes.

DRUERY, C. T. *Lomaria spicant bipinnatum in America.* Fern Bulletin, July, 1906. From Vancouver Island.

HANS, A. *About Abnormal Ferns,* illust. Horticulture, May 12, 1906. Illustrations of aberrant *Athyrium filix-fœmina.*

KLUGH, A. B. *The Fern Flora of Ontario.* Fern Bulletin, July, 1906.

LEE, DR. E. L. *The Hart's-tongue Fern in Tennessee.* Fern Bulletin, July, 1906. Description of the station near South Pittsburg.

MCNEILL, L. H. *Botrychium Biternatum.* Fern Bulletin, July, 1906. Habits of growth in this species.

PALMER, W. *Green and Red Stiped Lady Ferns.* Fern Bulletin, July, 1906. An inquiry as to the cause of the difference in color with suggestions for study.

SANFORD, MRS. J. R. *A Station for Asplenium ebenoides in Massachusetts.* Rhodora, June, 1906.

EDITORIAL.

The removal of this magazine to its new home in Joliet, Ill., was a bit larger undertaking than we had anticipated and it is quite likely that this number may be somewhat delayed. For the first time in some years the editor and the magazine are now in the same town, and we expect everything to work better in consequence. Delayed numbers should be out of the question in future. The next volume of this magazine is expected to be of unusual excellence, in fact to be by far the best volume we have ever issued. We trust that all our subscribers will promptly renew and that they will induce their friends to do likewise. We are sending a bill with this number to all whose subscriptions have expired and if any do not care to receive the magazine longer we request that notice be sent to us at once. It is a rare thing, however, for a person interested in ferns to stop his magazine. Many of our subscribers have been with us from the beginning, fourteen years ago, and many others expect to be with us for some time longer, at least, for there are subscriptions on our books that are paid up to 1910.

* *
*

In July this magazine was packed for shipment to Joliet, and a great share of the back numbers are still in the packing cases. This has prevented us from sending sample copies as requested during the past few months, but a sample of this issue is sent to all who applied and we earnestly solicit their subscriptions.

* *
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While we have always felt that too much may be made of the forms of ferns from the standpoint of the systema-

tist, we are not blind to the fact that such forms occur in nature and as such are well worth attention. Fern illustrations, however, have usually depicted the normal fronds and for this reason we have begun in this number a series of illustrations of the rare forms which we purpose continuing through the next volume. We wish especially to illustrate those named forms which have never been figured and invite our readers to send us specimens of such forms, from which drawings can be made. As a general thing the crested and forked forms are so much alike that we do not care to figure them, but any other curious forms we shall be glad to receive.

* *
*

No title-pages and table of contents have yet been printed to volumes 12, 13 and 14 of this magazine, but these are ready for the printer and as soon as issued will be mailed to all subscribers. At the end of next year we also plan to issue a five-year index exactly like the ten-year index to the earlier volumes which has achieved a deserved popularity. If our readers have not seen this ten-year index we shall be glad to send them a copy for twenty-five cents, and this cost may be deducted from any order for back numbers that they may later send us. The index is practically a reference list to all that was published about ferns in America from 1893 to 1903. A word may also be said about the back numbers. Volume six is practically out of print. We still have a few volumes left, but they will probably be gone within the year. The increasing value of these back numbers is beginning to be properly appreciated for we have sold more during the past year than in any two years previous. Those who are specially interested in ferns should get a set while they can. The literature of ferns is so limited that anyone can afford to have a complete collection. It is not merely to sell the back numbers that we urge the purchase of full files; we are also interested in the spread of a knowl-

edge of ferns. Nor do we like subscribers to have incomplete volumes. If your set lacks a number here and there, let us know what numbers are missing before too late and we will replace them free. All who have recently asked for missing numbers should receive them with this issue of the magazine.

* *
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From the viewpoint of the radical botanist these are the days in which history is being made. On all sides we see evidences of the desire to change the names of plants merely for the sake of change. The only excuse for giving a new name to a well-known plant that should be considered valid is that it will aid the scientist in studying it. And yet we constantly find botanists struggling for mere change; some raising sections to generic rank, some making so-called species out of varieties or forms, others digging up forgotten generic and specific names, and still others subdividing genera into new genera of their own. When business gets dull, a few botanists get together, make some rules useful to their purpose, and begin the game all over again. We are forcibly reminded of this by some recent publications, in one of which we find that the genus *Agaricus* no longer includes the familiar mushroom, but is now used for a shelf-fungus! Among ferns, *Didymoglossum* has tried to crowd out *Trichomanes,* and *Actinostachys* has designs upon *Schizæa.* Less than ten years ago, *Aspidium trifoliatum* went unchallenged in every book. Later it was introduced into the society of those who favor a "stable" nomenclature and baptized *Tectaria trifoliata.* But the motto of the "stable" nomenclaturists is change, and the plant is at this writing to be known as *Tectaria heracleifolia,* the name *Tectaria trifoliata* having departed attached to some overlooked form in the West Indies. Its orbit has not yet been calculated, and therefore it is not known whether it will return to again perch upon our species; but if it does, we need not look for it under the

name of *heracleifolia.* Some other name will undoubtedly be found for it soon. For ourselves, we purpose waiting about one hundred years before we take up any more of this nomenclature nonsense, and in the meantime shall call the species by the good old names in use when every fern student could recognize them at sight, and when new facts and not new names were the objects of a fern student's attention.

BOOK NEWS.

The title "How Ferns Grow," * selected for a new book by Margaret Slosson, is a bit misleading. This is not a treatise on the life processes of the ferns, but a series of forty-six plates illustrating the forms assumed by eighteen ferns from the sporeling stage to maturity, with more or less explanatory text. All who are interested in the development of fern fronds will find this a most attractive book, though they will doubtless regret that all the ferns of our region were not selected for treatment. The illustrations are by far the best part of the work, however. The rootstock, leaves, venation, sori, spores and habitat of each species are described with great prolixity and in the less technical parts, the author's style is so obscure or involved as not to be readily understood. A fondness is exhibited for the possessive plural in such terms as Species', Plants', Segments', etc. *Asplenium ruta-muraria,* one of the best-known species on both sides of the Atlantic is re-named *Belvisia ruta-muraria* because Neuman separated it from the other *Aspleniums* more than sixty years ago. The publishers have done their part well, though the excellence of the illustrations is marred by the evident fact that the originals were cut out of herbarium sheets in irregular pieces and photographed. The nomenclature is "in accordance with the American Code," whatever that may be.

* "How Ferns Grow," by Margaret Slosson, New York; Henry Holt & Co., 1906. 8vo. Pp. 156. $4.00.

There comes to us annually from Dr. C. Brick, St. Georgskirchhof 61, Hamburg, Germany, a separate from the *Botanischen Jahresbericht,* containing the title and a summary of the contents of every article on the Pteridophytes published anywhere during the year. While a great part of the summary is in German and therefore not available to some fern students, we regard it as one of the most desirable publications for those interested in the literature of the fernworts. We do not know whether this part of the work can be purchased separately, but if so, we are of the opinion that many of our readers will find it a desirable possession.

Dr. E. B. Copeland has published in a report of the Government Laboratories of the Philippines, a list of "The Polypodiaceæ of the Philippine Islands," which will form a most valuable handbook for all who may have occasion to collect ferns in the islands. The author has sensibly concluded not to unnecessarily hamper fern students by new and strange names and has used a conservative nomenclature. The price of the Bulletin is fifty cents and it may be had from the Superintendent of Government Laboratories, Manila, P. I.

AMERICAN FERN SOCIETY

Mr. Henry W. Merrill, Hiram, Maine, has joined the Society since the last report.

President Ferriss left Joliet on October 8 for a two months' trip for ferns and land snails, to the Grand Canyon of the Colorado. He is accompanied by H. A. Pilsbry of the Philadelphia Academy of Sciences.

Dr. Dana W. Fellows, Portland, Maine, offers fronds of *Nephrodium fragrans* and *Polystichum Braunii,* collected in Maine to such members of the Society as desire them. Postage on either specimen will be three cents or both for five cents.

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In offering back numbers of *The Fern Bulletin* for sale, we are not attempting to get rid of some surplus stock. We print hundreds of extra copies of each number for the express purpose of supplying new subscribers with the numbers issued before they became acquainted with the magazine. The great demand for these is shown by the fact that the first five volumes are out of print, volume 6 nearly so, and other volumes are becoming scarce. The illustrations and articles in these numbers are not only still of interest, but *they are becoming more valuable with age.* The price of each volume is 75c. except volume 6, which is $1.00. Volume 6 is not sold separately except to complete files of our subscribers.

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THE

FERN BULLETIN

A Quarterly Devoted to Ferns

EDITED BY WILLARD N. CLUTE

VOLUME XV

JOLIET, ILL.
WILLARD N. CLUTE & CO.
1907

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Vol. XV No. 1

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January

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WILLARD N. CLUTE, EDITOR

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TRICHOMANES RENIFORME

THE FERN BULLETIN

VOL. XV. JANUARY, 1907. No. 1

THE FERN FLORA OF OHIO.

BY LEWIS S. HOPKINS.

From an ecological standpoint, Ohio represents what might be termed average conditions. The forty inches of rainfall is usually fairly well distributed, the summers are warm but not excessively so, while the winters are not unusually severe. There are no real mountains in the State, the average elevation being 760 feet above sea level. At the same time there are over forty points in the State whose elevation is over 1000 feet, the highest being Hogue's Hill, near Bellefontaine, which is 1549 feet high. The main features of relief are due to erosion and not to anticlinal or snyclinal folds. The river valleys formed by the erosive action of the streams extend north and south. The main water-shed, about 1100 feet high, extends across the State from its northeastern corner to near the middle of the western boundary. Glacial drift covers the northwestern three-fourths of the State. There are no real lakes in Ohio, yet there are numerous ponds bearing the name on the northern slope, as well as peat in various stages of formation. The soil in these regions affords ideal conditions for the raising of celery, onions, etc., and many acres are annually being reclaimed for this purpose, to the destruction of the native flora of these most interesting regions.

Generally speaking, the rock-loving ferns are more abundant in that part of the State which lies south of the fortieth parallel; the marsh-loving ferns in that part included in the St. Lawrence basin; while the wood ferns are likely to be found anywhere. It might be added also that the rock-loving ferns, owing to the nature of their

habitat, have been less disturbed by the inroads of civilization than any other group and will continue longer for the same reason.

The Fern Allies of Ohio are a very much neglected group of plants. Familiarity has bred contempt for two or three of the most common ones, while a lack of attractive features has probably caused others to be passed by for their more showy fellows. More investigation is needed in order to complete a thoroughly reliable list of the Fern Allies of Ohio. In all seventeen species are included in Dr. Kellerman's State Catalogue, but of this number, four are not referred to any locality, leaving one in doubt as to their occurrence. It is highly probable that most of them occur in greater abundance than is indicated in the following list, and also that a careful search will reveal still other species not now recorded as occurring in this State.

The student of Ohio ferns who has never visited the sandstone rocks at Dundee, Tuscarawas County, has a rich treat in store for him, and should spend at least two days in this vicinity, for it abounds in things full of interest to the general botanist as well as to the fern student.

In the summer of 1905, in the course of a two hours' exploration of a wet, hilly woodland of 12 acres in Wayne County, I found 14 species of ferns—the most I had ever seen up to this time in a single afternoon's walk—including the very rare (for Ohio at least) *Nephrodium cristatum clintonianum*. In the early part of September, 1905, in the "Garden of the Gods," three miles north of Massillon, sixteen of the commoner species were found within a radius of half a mile. Induced by and in company with some friends who are fond of outdoor life, a visit was paid to Sigrist's Rocks at Dundee on August 28th, 1906. My skepticism soon gave way to the greatest delight, for growing within half a mile of each other, were found no less than twenty species of ferns, proper, varying in number from the common polypody which covers the sandstone rocks by the thousand, to a single fruiting

specimen of the ternate grape fern, and including the *Dicksonia punctilobula* and *Phegopteris polypodioides,* both of which are not common in Ohio—in fact I had never seen either growing but once before, and at widely separated stations. This, too, is the only place I have ever seen the cinnamon fern growing high and almost dry upon rocks and apparently in a very prosperous condition, although not exposed to the direct rays of the sun.

. . . . .

The list which follows includes two species excluded from the latest catalogue published under the direction of Dr. Kellerman, chief botanist at the State University, but in each case I have collected the specimens myself and my own analysis has been verified by competent authority.

OPHIOGLOSSACEÆ.

Ophioglossum vulgatum L. Adder's Tongue. Represented in the State herbarium by specimens from eight counties in different parts of the State. I have never seen it growing, but have specimens secured from Mr. Roscoe J. Webb of Portage County. It is probably more widely distributed, but less often recognized, than some of the other ferns which are not considered so rare.

Botrychium Obliquum Muhl. Grape-fern. This species with all its different forms and intermediate varieties, is widespread in its distribution over the State, but not abundant anywhere. A single station in Miami County, from which I have collected many specimens, contains about fifty plants. I have had no trouble in transplanting it, and from my own experience, have reason to believe it reproduces from a short, thick root-stock as well as the usual way. However, this last statement needs to be verified before being accepted as final.

Botrychium lanceolatum S. G. Gmel. Lance-leaved Grape-fern. First collected by the writer in Geauga County in 1900, when a diminutive specimen was found by the roadside near Thompson. In 1904 another speci-

men was found in an open woods near Middlefield in the same county.

Botrychium Lunaria L. Moonwort. This is reported from Lake County.

Botrychium matricariæfolium A. Br. Matricary Grape-fern. Know only by specimens from Cuyahoga County. It is unquestionably one of the rarest ferns of the State. The reader unacquainted with the local geography of Ohio, would do well to note that this and the two preceding species are found in four counties only (Lake, Portage, Cuyahoga, and Geauga), either bordering on or closely adjacent to Lake Erie, in the extreme northeastern corner of the State.

Botrychium Virginianum L. Rattlesnake Fern. Common in rich woods everywhere. It could probably be found in every county in the State if one were to search for it. It varies greatly in size from diminutive plants to those over two feet high in more favored localities.

OSMUNDACEÆ.

Osmunda regalis L. Royal Fern. Abundant; found with the following species:

Osmunda cinnamomea L. Cinnamon Fern. Of great size and abundance in the small marshes and bogs which abound in the northern part of the State, but rather rare south of the fortieth parallel, owing to the lack of proper ecological conditions. The same might be said of *O. Claytoniana.*

Osmunda Claytoniana L. Clayton's Fern. My experience has been that this plant fruits most abundantly in open fields and roadside thickets, rather than in rich woods where the larger plants are usually sterile. In such places it is a beautiful plant, and often transplated to yards in the north where it thrives, and becomes fertile. I have seen open fields near Thompson, Geauga County, containing hundreds of plants of this fern.

POLYPODIACEÆ.

POLYPODIUM VULGARE L. Polypody. Not rare, but rather local in its distribution. Where it does occur, it is likely to be abundant, although two stations are known to the writer which contain fewer than fifty plants.

POLYPODIUM POLYPODIODES (L.) Gray Polypody. Rare; only two counties, Adams and Hamilton, in the extreme southwestern corner of the State, are honored by its presence. I have never collected it.

ADIANTUM PEDATUM L. Maidenhair. The one fern known by everybody everywhere, and it is as common as it is well known.

PTERIS AQUILINA L. Brake or Bracken. Abundant in northern Ohio, but rather rare in the south. It attains great size compared with other Ohio ferns, and it is no uncommon thing to find specimens over forty inches in length and width. These specimens, however, would seem diminutive by the side of those from Oregon, Maine, or the Andes. The bracken is the subject of attack by some parasite, so that good fruiting specimens are rather difficult to obtain at all times.

PELLÆA ATROPURPUREA (L.) Purple Cliff-brake. Occurs in profusion, but is local in its distribution. To see it at its best, one must visit the Niagara Limestone exposures in Highland, Green, Clark, and Miami Counties, where it literally occurs by the mile and is numbered by the tens of thousands. It is very rare in the north, being known at present only in Stark and Ottawa Counties.

WOODWARDIA VIRGINICA (L.) Virginia Chain Fern. Occurs in and around some of the small lakes in Williams, Summit, Defiance, Wayne, and Ashtabula Counties, all in the northern part of the State. It is not seen in many private herbariums.

ASPLENIUM PINNATIFIDUM Nutt. Pinnatifid Spleenwort. Not common; it has been collected in Fairfield, Hocking, Lawrence, and Logan Counties.

Asplenium ebonoides R. R. Scott. Very rare; the only authentic specimens known are those from Hocking County, in the State Herbarium.

Asplenium parvulum Mart. & Gal. Small Spleenwort. Represented by specimens collected only recently by Dr. Kellerman in Adams County (on the Ohio River), which is perhaps the most northern station known for this species.

Asplenium platyneuron (L.) Ebony Spleenwort. Fairly abundant on shaly hillsides all over the State, yet specimens cannot always be secured for the herbarium when wanted. Its former abundance is testified to by the frequent occurrence of isolated plants in localities favorable to their preservation.

Asplenium Trichomanes L. Maidenhair Spleenwort. Abundant in suitable localities. Since it is limited to limestone and sandstone formations, it is somewhat local in its occurrence.

Asplenium angustifolium Mich. Narrow-leaved spleenwort. This is to me one of our most beautiful ferns. It is not scarce and is to be found in shady, damp woods throughout the State, but does not stay long after the underbrush has been cleared out. I have had no trouble in securing plenty of fertile fronds with an occasional intermediate one, though some collectors report otherwise.

Asplenium ruta-muraria L. Wall Rue. This ranks with the rare ferns of the State. The single station known for it is in Greene County, and at the present time numbers approximately one hundred plants whose short stiff rootstocks find solid footing in the cracks and crevices of a western exposure of Niagara Limestone. No other fern with which I am acquainted is so exacting in its choice of a home. This station has been under my observation for several years, and quite a number of plants have been collected from it. Just around a corner and not over five feet from the place where strong, vigorous plants grow, not a single plant has been found on a

southern exposure of the same material and ecological conditions.

ASPLENIUM MONTANUM Willd. Mountain Spleenwort. This is perhaps as rare as the wall rue, being represented in the State herbarium by specimens from Summit County, while Mr. Scott Harry, from whom I obtained some excellent specimens, collected it at Graber's Rocks, Tuscarawas County.

ASPLENIUM ACHROSTICHOIDES Sw. Silvery Spleenwort. This is common and to be found in almost any wet woods. Some species of insects prey upon it to such an extent that fine, whole fruiting specimens are sometimes difficult to find.

ASPLENIUM FILIX-FOEMINA (L.) Lady Fern. Of frequent occurrence and wide distribution over the entire State. It is commonly transplanted in the south and makes a beautiful and attractive fern for the yard. The varieties *ovatum, incisum, laxum, distans,* and *angustum* have all been collected by the writer.

CAMPTOSORUM RHIZOPHYLLUS (L.) Walking Fern. This is always interesting to the fern student who finds it for the first time. It is widely distributed over the southern half of the State, where large limestone rocks are often fairly carpeted with it. I believe it no exaggeration to say that I have seen ten thousand plants in the course of a single day's walk in Greene County. Strong and vigorous, it curls up to withstand drought. Forking fronds are not uncommon.

NEPHRODIUM ACHROSTICHOIDES (Michx.) Christmas Fern. Occurs everywhere, although more common in the north. In Ohio it is distinctively a hillside fern. Its varieties *incisum* and *crispum,* with their intermediate forms, are of frequent occurrence. The conclusion may be premature, but from observations of the same plants extending over a period of three years, I venture the assertion that the variety *incisum* is only a later form of the type as I have repeatedly found them both when the type form would be old and unfit for pressing, while the

variety would be just right. It seems almost as if the plant, desirous of insuring its propagation, rushes to maturity, the first form fertile at its apex only, and then takes its time for the later fronds fertile their entire length.

Nephrodium Noveboracense (L.) New York Fern. More abundant than indicated by State herbarium specimens, as I, alone, have found it in four other counties than those given the State catalogue. It may be found in narrow wooded valleys and wet woods of the north, but is rare in the south. When found at all, it is likely to be plentiful.

Nephrodium cristatum (L.) Crested Fern. Not rare, yet not as common as some other species of a similar habitat. It is likely to be found anywhere in swampy or wet lowland thickets.

Nephrodium cristatum Clintonianum (D. C. Eaton.) Crested Fern. First collected in 1903 in Wayne County, a few miles east of Wooster. There were fewer than ten plants at the single station found. As they were in a place likely to be cleared away at any time, I felt justified in taking up four of the smaller plants and transplanting them to the school yard at Troy, where they prospered better than many other species which grew in my little fernery there. Two of these plants were afterwards taken up and sent to the Ohio State University. Of their subsequent fate I am uninformed. The single station in Wayne County is the only place in the State where it has ever been collected so far as present records show. It fruits from four to six weeks earlier than the preceding species which may be found a short distance away.

Nephrodium Boottii (Tuckerm.) Boott's Shield-Fern. This species was collected about one mile east of Middlefield, Geauga County, June 17, 1905, in an open wet woods. A single plant was all that was seen and from it four passably good specimens were secured. This interesting fern ought to be found in other localities, for

there are many places favorable to its growth. Of the four fronds secured, one was sent to Dr. Britton, through whose courtesy Prof. Underwood confirmed my analysis of the plant; one will be sent to Columbus for the State herbarium; while the other two will be kept in the writer's private herbarium until additional specimens are secured.

Nephrodium Goldieanum (Hook.) Goldie's Fern. A magnificent plant not rare in Ohio, and yet not always easy to find, as those will testify who have searched in vain for it. It usually occurs in abundance wherever there is a station for it. I have found it in only one county—Geauga.

Nephrodium marginale (L.) Marginal Shield-fern. Plentiful everywhere on shelving wooded hillsides where it reaches its greatest perfection both as to size and characteristic green color. I have collected it in five counties.

Nephrodium spinulosum (Retz.) Spinulose Shield-fern. Fairly common in Ohio, but not so abundant as the following species which is the best known and to which the common name is most often applied.

Nephrodium spinulosum intermedium (Muhl.) Occurs in wet woods in great profusion over the entire State. Within the last five years I have examined many hundreds of plants in futile endeavor to find *Nephrodium spinulosum dilatatum* which was reported in the first State catalogue, but omitted from later ones. The two preceding forms vary greatly in size, form and manner of cutting, and are very beautiful. They are easily transplanted and thrive if given ordinary care.

Nephrodium Thelyteris (L.) Marsh Fern. This can be had in almost any swamp or marsh, in company with its favorite companions, the wild rose and the cat-tail.

Phegopteris polypodioides Fee. Long Beech-fern. Could hardly be considered rare, since it is known to occur in eight counties, yet few have seen it growing. My first and only specimens were collected in Parkman Township, Geauga County, June 18, 1905. I shall forever "asso-

ciate it mentally with the drip and splash of falling water, and the gurgle of small streams." There is no trouble in separating it from the following.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Broad Beech-fern. Quite common in rich woods and thickets. A number of plants are usually found together at each station. I have often seen it growing in somewhat protected locations after the first heavy frosts had killed most of the surrounding vegetation.

PHEGOPTERIS DRYOPTERIS (L.) Oak Fern. Rather rare in Ohio as it is limited to three northern counties, Ashtabula, Lake, and Wayne. At Funk's Hollow in the latter county, the only place where I have ever seen it growing, there are quite a good many plants on a steep moss-covered hillside of sandstone where it finds a congenial companion in the shining club-moss.

CYSTOPTERIS BULBIFERA (L.) Bulblet Bladder-fern. Rather local, but found in great profusion at its various stations. It is easily transplanted and readily adapts itself to the ordinary fernery. The Niagara limestone cliffs along the upper course of the Little Miami River bear thousands of specimens of this fern, but it is only rarely met with in the northern part of the State. It also grows readily on the talus at the foot of the cliffs. It varies considerably in size, frequently reaching a length of four feet in the more favorable locations.

CYSTOPTERIS FRAGILIS (L.) Fragile Bladder-fern. Found everywhere and not a bit fragile, if I may speak from personal experience, since I have given particular attention to this fern and have collected approximately two thousand specimens, the most interesting of which, including all sorts of freaks and variations, were retained. An old unused well within the city limits of Wooster, and not over four hundred yards from the University of Wooster, has furnished me with my most interesting specimens. The variety *magnasora* Clute was found in Wayne County, July 15, 1905.

DICKSONIA PUNCTILOBULA (Michx.) Boulder Fern.

This was one of the first ferns collected by the writer, several years ago in Geauga County. Since that time he has not seen it growing anywhere. It is reported from five other counties than the one named, but is not plentiful in Ohio.

Onoclea sensibilis (L.) Sensitive Fern. Common everywhere in wet woods, marshes, thickets, and borders of woods. I have experienced no trouble in finding fertile fronds. A single specimen of the so-called variety *obtusiloba* was collected in Wayne County in 1904.

Onoclea struthiopteris (Hoff.) This enjoys the distinction of being included in the first catalogue of Ohio's flora, then excluded and included in one and the same bulletin. I have seen this species exposed for sale in the streets of Cleveland, almost by the wagon load, under the name of "southern palm fern." I have reason to believe it has been offered in the market at Springfield, but of this I am not quite certain. Near Middlefield there is a station for this plant, which contains over forty strong, vigorous plants. The yards of Wooster contain many really magnificent specimens of the ostrich fern, and I believe a careful search of all available territory would reveal its presence in Wayne County.

Woodsia obtusa (Spreng.) Obtuse Woodsia. Limited to the southern part of the State where it is fairly abundant wherever there are out-croppings of limestone. It is to be looked for in company with the bladder ferns and the purple cliff-brake. However, it differs from them in that it seems to prefer detached boulders rather than the face of the cliff for its home.

Asplenium fontanum (L.) Sometimes credited to Ohio, but at the present is not authenticated by any herbarium specimens. All told I have spent several weeks searching for this fern at Springfield, it reputed home. It is needless to say I did not find it, but then not near all of the available territory was gone over, and that by one pair of eyes only. For the present at least, it should be excluded from the list Ohio ferns.

SALVINIACÆ.

AZOLLA CAROLINIANA (Willd.) Reported from Hamilton and Lake Counties.

EQUISETACEÆ.

EQUISETUM ARVENSE (L.) Field Horsetail. Common everywhere, and in some localities is a bad weed, difficult to eradicate, owing to its long rootstock. It fruits very early, and in the popular mind there is no connection between the fertile fronds and the later appearing sterile ones.

EQUISETUM PRATENSE (Ehrb.) Thicket Horsetail. Reported from Auglaize, Erie, Clarke, and Summit Counties; probably more common.

EQUISETUM SYLVATICUM (L.) Wood Horsetail. Reported from Wood and Auglaize Counties.

EQUISETUM FLUVIATILE (L.) Swamp Horsetail. Reported from Clermont and Cuyahoga Counties.

EQUISETUM ROBUSTUM (A. Br.) Stout Scouring-rush. Reported from Cuyahoga County.

EQUISETUM HYEMALE L. Common Scouring-rush. Common throughout the entire State and an obnoxious weed in many localities.

EQUISETUM LAEVIGATUM A. Br. Smooth Scouring-rush. Reported from Erie, Cuyahoga and Summit Counties.

EQUISETUM VARIEGATUM Schlch. Variagated Equisetum. Reported from Lake County.

EQUISETUM SCIRPOIDES Mx. Sedge Equisetum. This is reported in the State Catalogue, but referred to no locality.

LYCOPODIACEÆ.

LYCOPODIUM LUCIDULUM L. Shining Club-moss. Reported from Licking, Perry and Stark Counties. I

have also collected it in Wayne County where there are several stations for it.

Lycopodium inundatum L. Bog Club-moss. Referred to no locality, but included in the State Catalogue. It probably will be found in the northern part of the State, as there are many suitable localities for it there.

Lycopodium obscurum L. Ground Pine. Reported from Ashtabula and Defiance Counties.

Lycopodium annotinum L. Stiff Club-moss and Lycopodium clavatum L. Running-pine are reported from the State, but referred to no locality.

Lycopodium complanatum L. Trailing Christmas-Green. Reported from Cuyahoga County. I have collected it at "Pewee Hollow," Wayne County, where it grows plentifully on the summits of the ridges.

SELAGINELLACEÆ.

Selaginella rupestris (L.) Rock Selaginella. Reported from the State, but not referred to any station. It will probably be found and verified.

Hardiness of Florida Crest Fern.—*Nephrodium Floridanum* is fairly hardy at Joliet. A small percentage only have been killed in the outside ground by the freezing and heaving. When well established and with a little protection it will do as well as any. It is also an excellent house fern. The fertile fronds do not fall down as with its near relative, *N. cristatum,* but remain erect and glossy until far over into the next season and the clumps increase in size rapidly. It is one of the best in cultivation whether in a pot, in a moist situation, or upon a stump pile. In the shade it is as dark in color as *N. Goldieanum,* more polished and richer in color than *N. cristatum* or *N. Braunii* in their wild state.—*James H. Ferriss. Joliet, Ill.*

THE ROUND-LEAVED FILMY FERN.

Trichomanes reniforme.

By Williard N. Clute.

The family Hymenophyllaceæ to which the filmy ferns belong, is one of the most interesting of fern families. In its ranks are to be found the very smallest ferns in the world, some of them, as in the case of our own *Trichomanes Petersii* of the southern States, so small that the mature plant, or several of them, may be concealed under one's finger. There are a few forms that occur in temperate regions, but the majority are to be found in moist places in the tropics. Given a warm region with plenty of moisture, and the filmy ferns are likely to be present in abundance. The writer well remembers taking shelter from the rain under a leaning tree trunk in the forests of Jamaica, and watching the rain-drops trickle down from no less than eleven different species of filmy ferns, while the shower continued. The cause of the great dependence of these ferns upon moisture, is that their fronds are usually but a single cell in thickness, and being unprotected by a thick epidermis, as the ferns of dry regions are, would dry out very quickly in places where the air is not constantly moist. They are thus well named filmy ferns.

There are two great genera in the filmy fern family named respectively, *Hymenophyllum* and *Trichomanes*. The members of both are very much alike in appearance. The principal distinguishing feature being found in the form of the fruiting parts. The sporangia are not found in sori on the backs of the fronds, as the ordinary ferns fruit. Instead, some of the marginal veins project from the edges of the fronds as slender bristles, and the sporangia are clustered around this. The indusium is a cup-like structure surrounding the base of the bristle, and this is often spoken of as the involucre. If the involucre is

two-lipped the specimens belong to *Hymenophyllum;* if not, they are to be referred to *Trichomanes.*

The illustration represents a curious round-leaved *Trichomanes* from New Zealand, which is remarkable for being the only species of filmy fern with fronds four cells thick. In the herbarium it is quite stiff and firm in comparison with the others of its kin. One has only to compare this illustration with the one of the round-leaved maidenhair published in this magazine for April, 1905, to see how easily nature is able to vary the species with slight changes in the fruiting parts of the frond.

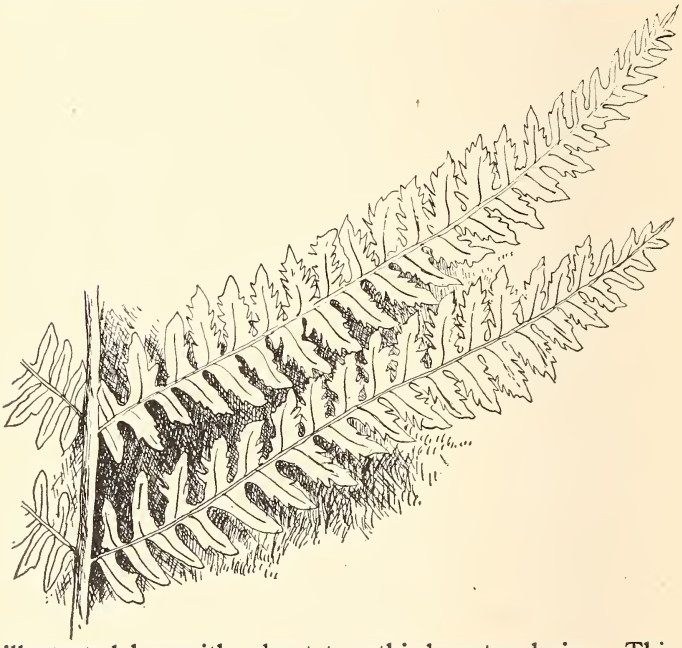
In the two genena of the Hymenophyllaceæ there are no less than four hundred and fifty species, but very few of them stray far beyond tropical regions. Four species are found in the United States, and a few others reach Great Britain. On the other side of the equator some forms extend to New Zealand as we have intimated.

Asplenium pinnatifidum in Connecticut.—So far as known *Asplenium pinnatifidum* is of rare occurrence in New England; in fact its sole claim to being an inhabitant of that part of the world rests upon a single specimen from Sharon, Connecticut, reported by F. W. Kobbe. During the past summer, however, Mr. H. C. Bigelow of New Britain, Connecticut, was fortunate enough to find two specimens of this species near New Britain. This second record for New England extends the range northeastward some fifty miles. The fern was collected on the ridge of trap rock that runs parallel to the valley of the Connecticut river, and it is quite likely that further search will disclose other stations for it. The note regarding this find published in *Rhodora* in anticipation of the present note was incorrect in several particulars, possibly due to haste in getting into print.

RARE FORMS OF FERNS.—II.

A CUT-LEAVED CINNAMON FERN.

Shortly after the description of *Osmunda cinnamomea bipinnatifida* was published in the April number of this Magazine specimens of a cut-leaved cinnamon fern were received for name from Mrs. J. B. Clapp, who collected it near Barnard, Vermont. Two of the middle pinnæ are



illustrated herewith, about two-thirds natural size. This specimen is much like the form *bipinnatifida* but the cutting is somewhat sharper than in that form. It is probably more nearly related to the form *incisum*. This latter form was described in THE FERN BULLETIN, Vol. 7, page 12, as follows: "If these peculiar forms are to be termed

varieties, why may not the same peculiarity in *Osmunda cinnamomea* be entitled to the same dignity. I have found a large quantity of fronds of the last named fern very beautifully incised, as much so as any fern I ever saw. I think they may properly be labelled *O. cinnamomea incisa.*" It may be added that this form and the form *bipinnatifida* may likely be found in any deep-shaded half bog, in which the species is plentiful. Of the two, *bipinnatifida* seems the more common. It may be distinguished by its even, rounded, basal, segments and by the fact that the pinnules thus lobed are likely to be much longer than the other pinnules of the pinna. As may be seen from the illustration the form is much handsomer for cultivation than the ordinary plant. If the variation is permanent it would no doubt have a commercial value. Experiments made in transplanting it, however, have not been successful, the fronds of subsequent years reverting to the type.—*Willard N. Clute.*

Southern Station for Botrychium Simplex.—Last summer in the San Bernardino Mountains I made the discovery of a new station for *Botrychium Simplex.* I found, in a far out-of-the-way cañon, a single specimen of this fern, which I submitted to Mr. S. B. Parish, of San Bernardino, whom you probably know as a botanical authority. He says the plant has never before been seen in this extreme southwest in all his thirty years' botanical experience; a fact quite worthy of note. The plant was found at nearly 8000 feet altitude—but a few score of yards, in fact, from the spot where Mr. Parish established the first Southern California station for *Polypodium vulgare* some years ago. It grew amid precipitous rocks almost side by side with summer mountain snow banks.—*G. Ross Robertson, Mentone, Cal.*

ISOETES SACCHARATA IN THE DELAWARE RIVER.

By W. A. Poyser.

Last July we collected at Delair, New Jersey, a few miles above Camden, three species of *Isoetes*, one of which was *Isoetes Dodgei*. The remaining two were rather puzzling. We had expected to collect *Isoetes riparia*, but could not reconcile the descriptions of this latter species with the material gathered, without leaving a doubt as to the absolute correctness of the determination. Mr. Alvah A. Eaton having kindly consented to give his opinion as to their identity, I sent him a batch of living plants from two colonies. They proved to be *Isoetes riparia* and *I. Dodgei* from one and *Isoetes saccharata* from the other—all typical plants.

Isoetes saccharata grows among the tall river-shore vegetation in very shady soil. *Isoetes Dodgei* occurs sparingly with a colony of *I. riparia* extending along the stony beach about eighty paces, forming an irregular belt, averaging about five paces wide. The plants are as plentiful as grass upon a lawn, not sharing the space with other species. All the colonies about Delair are immersed at high tide and exposed at low water, at least during the summer.

Mr. Eaton having expressed a desire to have me look for possible intermediates between *Isoetes riparia* and *I. saccharata*, I sent him plants from still another colony, that appeared after a field examination, probable. The results fully justified expectations. In the lot was *Isoetes Dodgei* (a single plant), a number of *I. echinospora Braunii* and *I. riparia* and *I. saccharata*. The series of specimens collected appear to justify Mr. Eaton's suspicion that *Isoetes riparia* is a polymorphic species and includes *Isotes saccharata*. He has them under cultivation and hopes to be able to settle this question with the material now on hand.

Philadelphia, Pa.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

HYPOLEPIS Bernh.

99. **Hypolepis repens** (L.). A single plant reported from Oakland, Fla., by L. M. Underwood; also in tropical America and southward to Brazil and Peru.

LOMARIA Desv.

100. **Lomaria spicant** (L.). DEER FERN; HARD FERN. Not uncommon on rocky slopes; California to Alaska; also in Europe, northern Asia and Japan. This is as properly placed in the genus *Blechnum.—Blechnum spicant* (L.); *Struthiopteris spicant* (L.).

The form **serratum** Wollaston is reported from Oregon; **f. bipinnatum** is a twice pinnate form from Vancouver Island.

MENISCIUM Schreb.

101. **Meniscium reticulatum** (L.). Rare; in wet shades. Southern Florida; also from Mexico and the West Indies to Brazil and Peru.

NEPHRODIUM Rich.

102. **Nephrodium amplum** (H. & B.). Rare; in moist shades. Southern Florida; also in the West Indies and south to Ecuador. — *Dryopteris ampla* (H. & B.).

103. **Nephrodium Boottii** (Tuckerm.). Not uncommon; in wet shades. Nova Scotia, Ontario and Minnesota to Virginia. Often regarded

as a hybrid between *N. spinulosum* and *N. cristatum*. Forma **multiflorum** Gilbert is a larger, more heavily fruited form occurring with the type.—*Dryopteris Boottii* (Tuckerm.); *Aspidium Boottii* Tuckerm.

104. **Nephrodium conterminum strigosum** (Fee). Rare; in woods. Ft. Meade, Florida. The type is common in the West Indies.—*Dryopteris contermina strigosa* (Fee); *Aspidium conterminum strigosum* D. C. Eaton.

105. **Nephrodium cristatum** (L.). CRESTED FERN. Common; in swamps, especially in shade. Newfoundland to Virginia, Arkansas, Nebraska, Idaho and the Northwest Territory; also in central and northern Europe and western Siberia.—*Dryopteris cristata* (L.); *Aspidium cristatum* (L.).

The form **marginale** Dav. is reported from New England and New York; **f. Lancastriense** (Spreng.) from the same region has the lobes of the pinnæ shorter and approaching triangular. Two hybrid forms are credited to this species—*N. cristatum* × *marginale* Dav. from New England, New York and New Jersey, and *N. cristatum* × *spinulosum* (Milde), the latter better known in America as *N. Boottii*.

106. **Nephrodium cristatum Clintonianum** (D. C. Eaton). Somewhat rare; in moist shades. Maine and Ontario to Wisconsin and Virginia. A much larger form than the type and found with it.—*Dryopteris cristata Clintoniana* (D. C. Eaton); *Aspidium cristatum Clintonianum* (D. C. Eaton).

107. **Nephrodium Filix-mas** (L.). MALE FERN. Somewhat rare; in woodlands. Newfoundland, Nova Scotia and Alaska to Vermont, Michigan, South

Dakota, Arizona and California; also in elevated regions nearly throughout the world. The form **incisum** Mett. is an incised form from Colorado and Ontario.—*Dryopteris Filix-mas* (L.); *Aspidium Filix-mas* (L.).

108. **Nephrodium Floridanum** Hook. Florida Crested Fern. Not uncommon; in wet shades. Florida, southern Georgia and along the Gulf coast to Texas.—*Dryopteris Floridana* (Hook.); *Aspidium Floridanum* (Hook.).

109. **Nephrodium fragrans** (L.). Fragrant Fern. Rare; on dryish rocks. Maine to New York, Wisconsin and far northward; also in Greenland, northern Europe and Asia, Japan and the Caucasus. The form **aquilonare** (*Dryopteris aquilonaris* Maxon) is a large fruited form from Alaska.—*Dryopteris fragrans* (L.); *Aspidium fragrans* (L.).

110. **Nephrodium Goldieanum** (Hook.). Goldie's Fern. Not common; in wet woodlands. Canada to North Carolina, Tennessee and Iowa. The form **celsum** (*Dryopteris Goldieana celsa* Palmer) with smaller fronds is reported from the Dismal Swamp, Virginia.—*Dryopteris Goldieana* (Hook.); *Aspidium Goldieanum* Hook.

111. **Nephrodium marginale** (L.). Marginal Shield Fern; Wood Fern. Common or abundant; in rocky woodlands. Nova Scotia to Georgia, Alabama, Indian Territory and British Columbia.—*Dryopteris marginalis* (L.); *Aspidium marginale* (L.).

The forms **elegans** Robinson, **Traillae** Lawson and **tripinnatifidum** Clute are ecological forms found with the type.

112. **Nephrodium molle** Desv. Rare; in moist wood

lands. Florida, Georgia and Alabama; also widely distributed in the tropics. The earliest specific name of this species is *parasiticum*, but *molle* has the sanction of universal usage.

113. **Nephrodium Nevadense** (D. C. Eaton). Not common; in wet meadows. California and Oregon. The name of **Nephrodium Oreganum** (*Dryopteris Oregana* C. Chr.) has recently been given to this species.—*Dryopteris Nevadensis* (D. C. Eaton); *Aspidium Nevadense* D. C. Eaton.

114. **Nephrodium noveboracense** (L.). New York Fern. Abundant; in dryish woodlands. Newfoundland to Georgia, Arkansas and Minnesota. The form **suavolens** (D. C. Eaton) is an unusually fragrant form reported from New York. —*Dryopteris noveboracensis* (L.); *Aspidium noveboracense* (L.).

114. **Nephrodium oreopteris** (Ehrh.). Heath Fern. Rare; in meadows. Washington to Alaska; also in Europe, Madeira and Japan.—*Dryopteris oreopteris* (Ehrh.); *Dryopteris Montana* (Vogl.); *Aspidium oreopteris* (Ehrh.).

115. **Nephrodium patens** (Sw.). Common; in partial shade. South Carolina and the Gulf States to California; also in the West Indies and nearly around the world in the tropics. Forma **glandulosum** (*N. patens glandulosa* A. A. Eaton) is a glandular pubescent form found with the type.—*Dryopteris patens* (Sw); *Aspidium patens* Sw.

116. **Nephrodium patulum** (Sw.). Rare. Huachuca Mts., Arizona; also in the American tropics — *Dryopteris patula* (Sw.); *Aspidium patulum* Sw.

117. **Nephrodium reptans** (Gmel.). Rare; on moist sunny banks. Southern Florida; also in the

West Indies and southward to Brazil. This species is as well placed in the genus *Phegopteris.*—*Dryopteris reptans* (Gmel.); *Aspidium reptans* (Gmel.); *Phegopteris reptans* (Gmel.).

118. **Nephrodium rigidum argutum** (Kaulf.). Not common. Arizona and California to Alaska, mostly near the coast. The type is found from Great Britain to the Mediterranean region.—*Dryopteris rigida arguta* (Kaulf.); *Aspidium rigidum argutum* (Kaulf.).

119. **Nephrodium setigerum** (Bl.). Rare; in swampy woods. Southern Florida; also throughout the tropics.—*Dryopteris setigera* (Bl.).

120. **Nephrodium simulatum** Dav. Rare; in shaded bogs. Maine to New York and Maryland.—*Dryopteris simulata* Dav.; *Aspidium simulatum* Dav.

121. **Nephrodium spinulosum** (Mull.). Spinulose Wood Fern. Common; in rocky woodlands, especially if moist. Newfoundland to Virginia, Kentucky, Nebraska, Washington and Alaska; also in Europe and Asia.—*Dryopteris spinulosa* (Mull.); *Aspidium spinulosum* (Mull.).

The form **concordianum** Dav. is a finely divided form possibly referred to the sub-species *intermedium;* **f. fructuosum** Gilbert is a heavily fruited form from New York and New England, also referred to the sub-species; **f. Pittsfordense** is an ecological form from New York and New England.

122. **Nephrodium spinulosum intermedium** (Muhl.). Common Wood Fern. Abundant; in moist, usually rocky, woods. The common form within the limits given for the type.—*Dryopteris spinulosa intermedia* (Muhl.); *Aspidium spinulosum intermedium* (Muhl.).

123. **Nephrodium spinulosum dilatatum** (Hoffm.) Broad Wood Fern. Tolerably common; in. rocky soil. An upland or mountain form found at sea-level in the far north, but limited to the mountain tops in the southern part of its range. —*Dryopteris spinulosa dilatata* (Hoffm.); *Aspidium spinulosum dilatatum* (Hoffm.)

124. **Nephrodium stipulare** (Willd.). Rare. Southern Florida. Regarded by many as a form of *N. patens* and more properly named **Nephrodium patens stipulare.** Has the same range as *N. patens.*—*Dryopteris stipularis* (Willd.).

125. **Nephrodium thelypteris** (L.). Marsh Fern. Abundant; in swamps and wet woods. North America east of the Rocky Mountains in suitable situations; also Europe, Asia, Africa and Australia. The form **Pufferae** A. A. Eaton is a forking form from Massachusetts.—*Dryopteris thelypteris* (L.); *Aspidium thelypteris* (L.).

126. **Nephrodium unitum glabrum** (Mett.). Not rare; in open swamps. Florida and Texas; also in the West Indies and nearly throughout the world in the tropics. This has recently been named *Dryopteris gongylodes* (Schkuhr), but is more properly **Nephrodium gongylodes** (Schkuhr).—*Dryopteris unita glabra* (Mett.); *Aspidium unitum glabrum* (Mett.).

PTERIDOGRAPHIA

Marsilia Leaves and Light.—The curious fact that *Marsilia,* like the clover and oxalis, closes its leaves at night, has long been known, but Robert F. Griggs has recently noted what appears to be a new motion of the leaves to enable them to face the sun. Thus far the habit has been noticed in but one species, *M. vestita,* but it is

likely that other species may be found to act in the same way. Acording to the writer quoted, the leaves at evening squarely face the West, while shortly after sunrise they will be found to face the East. The movement seems to be produced by the petiolules of the individual leaflets, rather than by the petiole of the leaf. The motion which causes the closing of the leaves at night is also located in the petiolules. One striking difference between the night position of marsilia and oxalis leaves is that in the former the leaflets are erect and in the latter the leaflets droop. The explanation for this seems to be a physiological one. In the oxalis the stomata or openings through the epidermis are mostly on the under surface, and the drooping position of the leaflets protects them through the night. The stomata of marsilia, on the other hand, are mostly on the upper surface, and the leaflets naturally bring their upper surfaces together in the night position.

Reproduction of Resurrection Fern.—One of the distinguishing marks of the group of *Selaginellas* to which the resurrection fern (*Selaginella lepidophylla*) belongs is the fact that it produces roots from the base of the fronds only. In most *Selaginellas* the fronds root from any part that happens to come in contact with the soil. But while the resurrection fern remains true to this principle when intact it readily casts it aside when injured for if bits of the fronds are broken off and fall in a suitable place, they at once take root as other *Selaginellas* normally do, and soon form new plants. The resurrection fern takes its name from its habit of drying up when moisture is scarce and reviving when rains come again. During drouths it becomes very dry and brittle and is then likely to be more or less shattered by the passing of animals or the force of the wind. Whether the pieces thus broken from the fronds later revive and re-

produce the plant as those broken from the fronds in the greenhouse do, is not yet known. Readers in the region where this plant grows would do a service to science by investigating.

Bracken Protected by Law.—In America the bracken (*Pteris aquilina*) receives scant attention from the land-owner, who probably never thinks of it unless he is devising a way of eradicating it from his fields. In England, however, the case is different, as indicated by the following communication recently published in *Gardening World:* "I have read with considerable surprise a letter in your issue to-day on the subject of utilizing the young shoots of bracken as food. Your correspondent does not mention the locality in which she resides, which may differ materially from others, but here in Banstead, and for many miles around, the young bracken shoots are protected by very stringent laws, inflicting a heavy fine on any person cutting or mutilating the bracken before notice allowing them to do so is issued. This generally appears about the middle of September. The bracken is then dry and of a beautiful golden brown and then any person can cut any quantity he pleases." The usual fine is $25.00 and costs. The correspondent does not indicate the uses to which the bracken is put, but it is probably used in packing vegetables and protecting tender plants outdoors, much as straw is used in America.

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omissions from this list.

Bissell, C. H. *A New Station for Asplenium pinnatifidum.* Rhodora. D. 1906.—Second finding of this species in New England.

Clute, W. N. *A Check-list of the North American Fernworts.* Fern Bulletin. O. 1906.—A continuation. tion.

Clute, W. N. *Rare Forms of Ferns.—I. A. Round-leaved Royal Fern,* illust. Fern Bulletin. O. 1906.—A new form from Vermont named *orbiculata.*

Clute, W. N. *The Genus Oleandra,* illust. Fern Bulletin. O. 1906.

Dowell, P. *Observations on the Occurence of Boott's Fern.* Torreya. O. 1906.

Eaton, A. A. *Pteridophytes Observed During Three Excursions into Southern Florida.* Torrey Bulletin, 1906.

Fellows, D. W. *The Fern Flora of Maine.* Fern Bulletin. O. 1906.

Ferriss, J. H. *Cause of Rusted Fronds.* Fern Bulletin. O. 1906.

Ferriss, J. H. *On Cultivating Our Ferns.* Fern Bulletin. O. 1906.—Note on the behavior of various rare species in cultivation.

Gilbert, B. D. *Polypodium vulgare var. alato-multifidum.* Fern Bulletin. O. 1906.—Description of a new variety from Mauch Chunk, Pa.

Griggs, R. F. *A Diurnal Rotation in the Leaves of Marsilia.* Ohio Naturalist. Je. 1906.—Records the rotation of the leaflet in *M. vestita* in order to face the sun.

Hans, A. *Acrostichum and Platycerium,* illust. Horticulture. Ap. 14, 1906.

Hans, A. *Filmy Ferns,* illust. Horticulture. Je. 10, 1906.

Negley, H. H. *Where Florida Ferns Grow.* Fern Bulletin. O. 1906.

Palmer, T. C. *Asplenium ebenoides in Chester Valley, Pa.* Fern Bulletin. O. 1906.—Record of its occurrence in Chester County.

Puffer, Mrs. J. J. *The Rusty Woodsia in Cultivation.* Fern Bulletin. O. 1906.

Squires, W. A. *A New Station for Selaginella Douglasii.* Fern Bulletin. O. 1906.—First report of this species from Idaho.

EDITORIAL.

The delay in this issue is due to the fact that the application for the transfer of our mailing permit from Binghamton, N. Y. to Joliet, Ill., has been pending for more than three months. This seems to be the last obstacle to our appearing on time and in future we expect to issue the numbers promptly. A great part of the April issue is ready as this is written. Copy intended for that issue should be sent at once.

* *
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It would doubtless be impossible for any body of scientists to make a set of rules for naming plants that would be acceptable to everybody else. The Vienna Botanical Congress made several rules that will likely find acceptance, but there were occasional outcrops of assininity that ought to be attended to at the earliest possible moment. After all this howl about priority of specific names, it is surely a delectable sight to find these eminent scientists solemnly agreeing that what is sauce for the botanical goose is *not* sauce for the gander. By the Vienna rules, we are still to have priority in specific names, but in varietal names, never! Take the case of *Isoetes Canadensis.* The earliest valid name given this particular quillwort is *Isoetes riparia Canadensis.* When it was later regarded as a species distinct from *I. riparia,* it was properly described as *I. Canadensis.* But while its position was still in question, Eaton described plants as *I. Dodgei,* and now by the new rules, we are asked to forget that the plant's real name is *Canadensis* and take up with *Dodgei* again because " species and not varieties are the units of classification." Can anyone believe that this idiotic rule was not made in the interests of a few botanists who rely upon its use to get their names into print? If American botanists want to earn a reputation for wisdom, they should promptly repudiate such nonsense.

Was it not Henry Ward Beecher who said that if a man owned a fine diamond with a flaw in it so small as to be perceived by nobody else, yet he would not thoroughly enjoy its possession because of the flaw that he knew was there? Anyway, none of us want possessions with flaws in them if it can be helped, and most of us are willing when we can to remove the flaws from the possessions of others when it does not cost us too much. The opportunity to be benevolent in this way we now offer to our readers, for we know of three sets of THE FERN BULLETIN, each of which lacks but a single number to be flawless, and which might easily be made complete if the holders of these numbers will only part with them. The set of Mr. Chas. W. Jenks, Bedford, Mass., lacks No. 3 of the first volume, Miss Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y., lacks No. 1 of volume 4, and Mr. B. D. Gilbert lacks No. 1 of volume 4. The owners of these sets will gladly pay a good price for these numbers, but if your own set is complete, do not break it, for a full set of FERN BULLETIN is so rare that its value is increasing very rapidly. And we shall never impair it by reprinting the early numbers. There are or were, three hundred copies of each of these early numbers about, and it is not too much to hope that some of them may yet come on the market. With many, the case may be as we found it with a subscriber for the early numbers who finally dropped his subscription. Thinking he might be willing to part with the numbers, we made a cash offer for them and received the reply that he had a full set, but would not sell them to anybody. In addition to the numbers wanted which we have noted above, Prof. W. A. Setchell, of the University of California, Berkeley, California, wants Vol. 5, No. 1, and many of the earlier numbers, for which he is willing to pay a liberal price, and Prof. George F. Atkinson, Cornell University, Ithaca, N. Y., needs many of the numbers previous to Vol. 5. Two other wants in this line are to be noted among the advertisements. The trouble is that when those first small numbers appeared, nobody thought THE FERN

BULLETIN would live to grow up, and they were, in consequence, neglected. Some of those three-cent numbers are now worth a dollar or even more! And yet, when we saw those last full sets disappearing, we tried to get people to buy before it was too late. We are now doing the same thing with the few remaining sets containing Vol. 6. We have only to wait a year or so longer to see these in as great demand as the earlier numbers now are. The time to invest is now.

* *
*

We recently had cause to appreciate the truth of the old adage, that it is better to be born lucky than handsome, and as the circumstance is of interest to fern students, we purpose mentioning it. The first book devoted to American ferns was Williamson's "Ferns of Kentucky," issued in 1878 and, of course, out of print for many years. Single copies when they were obtainable, which was not often, sold for $5.00 each. The editor of this magazine has long wanted a copy, but even the second-hand dealers could not locate one. Several who listed the book had just sold it when we ordered it. When a new catalogue appeared in 1905 with the book listed, we did not write for it, being sure of disappointment again, but when a second edition of the catalogue appeared a year later with the book still in it, we took the chance, and much to our surprise got the book, which is apparently a fine copy of the first edition. And the cost was just $3.50. The editor knows of a dozen or more fern students that would have jumped at the chance to get that book at twice the price we paid, but as we said in the beginning, it is better to be born lucky than handsome.

BOOK NEWS.

Three different collecting trips have been made to Southern Florida by Mr. A. A. Eaton, in the course of which a large number of ferns new to the United States were collected. These trips and the ferns collected have

been recently described in *Torrey Bulletin,* and subsequently reprinted as contributions from the Ames Botanical Laboratory No. 4. The title is "Pteridophytes Observed During Three Excusions into Southern Florida." The new species recorded and not previously noted in this journal are *Polypodium costatum, Nephrodium setigerum* and *N. stipulare.* The broad form of *Polypodium phyllitidis* is given specific rank as *Campyloneuron latum,* a glandular form of *Nephrodium patens* is named *glandulosum,* and a lobed form of *Acrostichum lomarioides* is called *lobatum. "Tectaria Amesiana,"* a form of the variable *Aspidium trifoliatum* is named, and its hybrid origin suggested, the fact that it may be an intergrading form between two extremes apparently overlooked. The *Selaginella* previously identified as *S. Caribensis,* is now believed to be *S. rhodospora.* The account is an excellent one and will do much to assist other collectors in locating and identifying the ferns of our sub-tropical regions. It is with regret, however, that we note several imperfections in the work, such as the adoption of *Dryopteris* for *Nephrodium,* and the segregation of forms as species. The proof-reading also has been most slovenly done. *Asplenium Biscaynianum* has been described as if it were new, and *Meniscium reticulatum* is reported as new to the flora of the United States, when it was reported from Florida in The Fern Bulletin some months before Mr. Eaton first set foot upon Florida soil. Who the first person was to report the fern from the United States is not of much moment, but since this is the second time this erroneous statement has been made in *Torrey Bulletin,* it may be just as well to have the statement again denied.

AMERICAN FERN SOCIETY

The annual dues to the Society are now due. Members are requested to note that by paying their dues promptly, the officers will be enabled to plan the year's work to much better advantage and thus all will be

benefited. Do not wait for a notice from the treasurer. Should any member contemplate resigning from the Society, he should send such resignation to the treasurer and not to the publishers of THE FERN BULLETIN. The magazine is sent to each member by the Society, and members who resign are expected to pay for any copies received during the time between their resignation and the time paid for by their dues.

Mr. H. E. Ransier, who acted as judge in the recent election, reports the following officers elected for 1907: President, J. H. Ferriss, Joliet, Ill; vice-pesident, Dr. D. W. Fellows, Portland, Maine; secretary, Willard N. Clute, Joliet, Ill.; treasurer, Miss Nellie Mirick, Oneida, N. Y. A full account of the election will appear in the Annual Report, which will be issued much earlier in the year than usual.

The following persons have recently joined the Society: Miss Frances H. Newton, Ooltewah, Tenn.; Mrs. Alida Kimbell, 410 Church St., Adams, Mass.; Mrs. C. A. Pearson, 45 Suffolk St., Holyoke, Mass.; Mrs. Chas. E. Young, 1706 Oregon Ave., N. W., Washington, D. C.; Miss Ella S. Ruland, Trudeau, N. Y.; Mr. Louis Axt, 116 Richmond Ave., Port Richmond, N. Y.; Mr. Rett E. Olmstead, Decorah, Iowa. We are glad to add their names to our rolls.

In order that the new list of members in the Annual Report may be up-to-date, we request all who have recently changed their place of residence to notify the secretary or treasurer at once, if they have not already done so. The new list will contain the names of those who have paid dues since January 1, 1906, only. Although dropping all who have resigned during the year, we expect to still have more than one hundred and fifty members.

Do not forget the invitations to membership that the officers of the Society are glad to send to all who are interested in ferns, if you will send the addresses. If you are pleased with membership in the Society, pass it along to your friends.

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, Editor

Willard N. Clute & Co., Publishers, Joliet, Ill.

20 Cents a Copy ; 75 Cents a Year.

Entered at the Post Office, Joliet, Ill., as second-class mail matter.

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The American Fern Society

(Formerly Linnæan Fern Chapter)

President, James H. Ferriss, Joliet, Ill.

Secretary, Willard N. Clute, Joliet, Ill.

Fern students are cordially invited to join the Society. 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, Oneida, N. Y.

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WANTS AND EXCHANGES

WANTED—Linnæan Fern Bulletin Nos. 2, 3, 4, 6 and 12. Any reasonable price will be paid for these numbers. Address, stating price, Miss E. W. Fisher, 1502 Pine Street, Philadelphia, Pa.

WANTED—Fern Bulletin, Nos. 2, 3, 4, 5, 10 and 11 of Vols. I-III, and No. 1 of Vol. V. A liberal price will be paid. Address, stating price, S. W. Fletcher, Pepperell, Mass.

WANTED—Fern Bulletin, Vol. V, No. 1. $1.50 will be paid. Address H. E. Ransier, Manlius, N. Y.

FORMS OF LOMARIA SPICANT

THE FERN BULLETIN

VOL. XV APRIL, 1907. No. 2

VARIABLE SPORELINGS OF LOMARIA SPICANT

By AMEDEE HANS.

If raising ferns from spores to produce abnormal or hybrid forms is surrounded with much disappointment, sometimes very curious results are obtained which repay for the trouble and persistent labor. While it is not the habit of THE FERN BULLETIN to care much about abnormalities, it may be of interest to its readers to hear something about what can be obtained by sporelings from abnormal forms of ferns.

Lomaria (or *Blechnum*) *Spicant* is found in nature growing in cool and damp situations and is very hard to grow out of doors in the Eastern States and especially near the seashore, and in such situations seldom makes fertile fronds. One form which has often been found in England and is known there under the name of *L. s. contractum* (II.) grew a little fertile frond in our collection. From the spores we raised 65 plants. Among them the type is represented by only a few plants and there are many varied forms. The form *contractum* dominates with a tendency to gradually decline in the length of the pinnæ, shortening to the English form *lineare,* going through several forms of broad or narrow *concinnum* of the same origin (IV.). A few are contracted at the top as well as the base of the frond (III.) and could nearly be called *caudatum* (IV.), and some, the most curious of all since there were no spores from any other form of *Lomaria* present, are bi- to multi-

furcate at the tip with shorter or longer narrow pinnæ resembling the English form *multifurcatum* (VI.). One of these *concinnum* forms has fertile fronds that are not different from the others. The sori are in short strips on each side of the rachis, one on each little pinnæ, while in the English form the pinnæ of the fertile frond are contracted around the rib of the frond. I have raised many abnormal forms from spores but never have had such a percentage of variations from so few plants.

I have also some plants raised from spores of Mr. Clute's *Polystichum acrostichoides recurvatum* and some *P. acrostichum X P. angulare* forms which I expect to have characterized this season and will publish the results later.

The interest in growing hardy fern species and forms in out-of-door ferneries is taking greater hold every day. There is no doubt that there are many abnormal forms of ferns to be found in the United States, and it is a pity that they are passed by as of little worth or simply preserved in herbariums and that nobody has a chance to handle them as living plants and to propagate them for the benefit of the lover and cultivator of these most interesting plants.

Stamford, Conn.

Explanation of Plate.—I. *Lomaria spicant* (type). II. L. S. *contractum* (the spore-bearer). III. A form. IV. Three forms from English *concinnum to lineare.* V. A form. VI. Furcate forms.

THE FERN'S STRUGGLE FOR EXISTENCE IN THE TROPICS.

By Willard N. Clute.

In the Tropics, where the conditions for the existence of fern life are most favorable, fern species are greatly multiplied and the struggle for existence is waged with greater fierceness than it is among the denizens of our own fields and woods. The great number of species as

well as individuals makes it more difficult for a species to flourish than in a section where the stress is less. The young fern finds that the ground is literally all taken with no signs of "standing room only" to be seen. It must, therefore, find a foothold elsewhere or perish. Thus it happens that many respectable fern families have been obliged to take to the "upper story of the woods" for refuge.

It is interesting to note the ways in which various species have attempted to secure advantages not possessed by their neighbors. The lack of space for all on the ground has resulted in numerous curious forms being evolved. In some parts the trees are ferns, the climbing vines are ferns, the thorns that pierce and the brambles that scratch are ferns, the epiphytes are ferns, and the very moss on the trunks seem turned to ferns.

With the exception of some mountain tops covered with *Dicksonia* in Eastern Pennsylvania, I do not remember any such vast areas covered with a single fern as I saw in Jamaica. The bracken and various species of *Gleichenia* claim whole hillsides for their own and grow in perfect thickets. This, I hasten to add, is the exception and not the rule. These two species live in localities so dry that no other species want them—at least no other species that are strong enough to take them—but in the forest one is at once impressed with the large number of species in proportion to the number of individuals. I believe that in a three-mile walk in the vicinity of Morce's Gap I could collect nearly a hundred species without going out of the path more than six feet. Nature has filled up the forest as a man would fill up a trench with gravel—using all sizes. Just as the small stones fill the chinks between the larger ones, so do the small ferns find an existence upon and between their larger relatives.

When we speak of the climbing fern in the Northern States, we have a very definite species in mind, but not so in the Tropics. It is true that the *Lygodiums,* faithful

to family tradition, are climbers still, often reaching heights of thirty feet or more, but there are other genera, such as *Davallia, Blechnum, Hypolepis, Polypodium, Acrostichum* and others that have climbing species, the hope that actuates them all being that by this means they will be able to get up in the world and obtain light and air. Some of these merely trail over bushes and trees, having hooked prickles upon the rachis to assist in holding, but nevertheless often reaching considerable heights and forming impassable thickets. Others are true twiners and, though born on the earth, soon scramble up to the top of its shelter. One *Acrostichum* with brown, scaly rootstock as thick as one's thumb, sends it straight up the trunks to heights of twenty feet or more precisely as our poison ivy does. Then it sends out its great fronds a yard across.

This hints at the possible origin of the tree ferns, for if the trunk were but a little thicker and inclined to stand upon its own resources, we should have a tree fern. The tree-ferns proper are frequently as tall as small trees with magnificent crowns of fronds. To get a good idea of what a tree-fern is like, take a pole, perch a big plant of the ostrich fern at top, wrap the pole thickly with barbed wire and small rootlets and you have it. There is no climbing fern trees unless one is insensible to thorns an inch long; and after one has once slipped in the forest and stayed himself by clutching at a tree-fern's trunk he will resolve to fall a long way in the future before trying to stop a second time in that way.

Climbing other trees for ferns, however, is quite the thing. I have a lively recollection of balancing upon a slender branch and trying to reach some specimens of *Polypodium gramineum* that were sitting in a row on a limb fully twenty feet from the ground. Many grow at greater heights and quite out of reach. In regions where a daily bath in the clouds keeps their rootstocks and roots moist, numerous species escape the crush below

by this means of living. In fact, without stopping to count I am inclined to say that as many species live above the earth as upon it. The tiny, filmy ferns, of the genera *Trichomanes* and *Hymenophyllum* are sometimes called brothers to the mosses; and in Jamaica they really deserve the title, crowding the mosses so much for room on all the moist trunks that in sort of revenge some species of mosses find a home on their fronds. The filmies also grow on wet rocks, old logs, and other places where their stronger competitors among the ferns can find no foothold.

But the struggle for existence has produced other types, among them—

"Those who fight and run away."

Apparently not liking the struggle, or perhaps getting the worst of it, they have taken to locations where the others dare not follow them. The hard, sunbaked, exposed hillsides, upon which rain often does not fall for months, has its own fern flora, albeit much scantier than in more favored regions. The ordinary fern leaf could not endure, unprotected, the steady downpour of heat, day after day, to which these are subjected. The dry ground species have, accordingly, various devices to prevent complete dessication. The species of *Gymnogramma,* many of which frequent such places, have the underside of the frond thickly powdered with farina of various colors which give them the name of silver and gold ferns. This farina is of a waterproof nature and effectually conserves such water as the plants are able to suck up from the soil. One species, *G. rufa,* lacks the powdery covering but is thickly clothed with brown hairs which answer the same purpose. To sight and touch, the frond appears as if it might have been cut out of greenish-brown velvet. Of similar appearance are the fronds of *Asplenium pumilum* and *Hemionitis palmata* to be found with it.

The *Notholœnas,* most of them, have both hair and

powder on their fronds, but even this seems not enough and the fronds curl tightly up in dry weather. The little resurrection fern, *Polypodium incanum,* also grows in such places although it abounds in localities where there is more moisture. It grows both upon trunks and limbs of trees and upon bare rocks, but at the first sign of dry weather, it goes into a comatose condition, wrapping its scale-covered fronds around it, and so waits for rain.

CONCERNING NOMENCLATURE.

By S. B. Parish.

The editor of The Fern Bulletin indulges, in the January number, in condemnation, a trifle over vigorous, of the 53rd article of the code of nomenclature set forth by the recent Vienna Botanical Congress. Certainly it is annoying that this rule makes it necessary to exchange the familiar name of a certain quillwort for a neglected one. Yet it must be remembered that a contrary rule has occasioned some of the most confusing substitutions with which the nomenclature of the spermatophytes has in recent years been afflicted.

The fact is that systematists long exercised a liberty, sanctioned by custom, of disregarding varietal names when raising plants to specific rank. It was not a commendable practice, and the Vienna code recommends its discontinuance. Nevertheless, many names thus given were established and well known. Now there are not a few botanists who have never learned what nature teaches, that exceptions are the most natural things in the world. To them anything but the most rigid and searching application of the law of priority is an unendurable sacrilege. Yet the logical outcome of this doctrine is pre-Linnæanism, and those who make one fundamental exception to strict priority, by assenting to an initial date, would seem to be estopped from objecting to other exceptions.

The editor well says that "it is impossible for any body of scientists to make a set of rules that would be acceptable to everybody." Quite impossible, indeed; every attempt has demonstrated it. Yet we must have rules. The editor recommends American botanists to "repudiate such nonsense"; that is, I take it, for each to repudiate any law that appears to him objectionable. That is anarchy. Another course is for the Botanical Clubs, or similar associations, in different countries to formulate codes independently—that is provincialism. On the other hand, we may accept a code set forth by a body wherein the botanists of the whole world are, or may be, represented. Only in this way can we hope to obtain a catholic system of nomenclature. Individually we are certain to find in it something not in accordance with our ideas. Yet let us accept it, comforting ourselves with the thought that the laws of botanical nomenclature are not unlike those of the Medes and Persians, and that we may be able to bring future congresses to our wiser way of thinking.

San Bernardino, Calif.

FALL FRUITING OF THE CINNAMON FERN

By Willard N. Clute.

Although the cinnamon fern (*Osmunda cinnamomea*) is one of our most abundant species, it is quite apparent that we do not know all about it. It has an interesting trait of fruiting in the autumn in the southern States, and as yet no explanation of this peculiar habit has been given. That it normally fruits in spring there can be little doubt. In southern Louisiana I have thus found it in March, and Mr. W. C. Dukes writes me that in the vicinity of Mobile, Ala., he finds it in full fruit by the last of February, and occasionally some fronds by the middle of that month. In the same line the observations of Mr. W. C. Steele for Florida (Fern Bull. 10:19, 1902) indicate that the plant fruits there in spring. It

is among the earliest of our ferns to fruit, and in its farthest southern haunts begins to grow shortly after the new year begins. In February, 1900, I collected it in fruit near Guava Ridge in the Island of Jamaica at an altitude of about 3500 feet. The difference in altitude between this station, which, by the way, is the only one in Jamaica, and the Florida station would equalize the difference in latitude between the two. Thus the fruiting impulse may be said to begin in the West Indies and the Gulf Coast in February, passing over the southern States during March, reaching the northern States late in April and going on into Canada in May.

The second fruiting season appears rarely, if ever, to reach very far north. Mr. Steele has noted it in Florida, and in a recent publication (*Torrey Bulletin* 33:462, 1906) Mr. A. A. Eaton says (doubtless incorrectly) that "Its common time of fruiting appears to be early November, as it was in full fruit in the middle of the State at that date, and bore no indication of fruit in March, save in the case of one plant." Mr. W. C. Dukes found them fruiting about Mobile, Ala., at least three weeks earlier. He, too, found the fruiting general, and says, "I have run across colonies where scarcely any failed to develop a fertile frond. In one place I counted over fifty plants fruiting, but noticed that the fronds were not so robust as those found in spring and not as tall."

As to the cause of the fall fruiting the suggestion made by Mr. Dukes seems to offer the best explanation. He observes that the fall fruiting seems to be most prevalent in those years when summer extends far into autumn. The rains that follow form a second spring-like season, beguiling the ferns to fruit. It would be interesting to know just how general the fall fruiting of this species is, and how far it extends northward. Do the ferns fruit every year in autumn? Do the same ferns fruit again in spring? Do all, or nearly all, the ferns fruit in autumn? Are there more fruiting fronds produced in autumn than in spring? If our readers can give answers to any of these questions, we shall be glad to have them.

THE COMMON BRAKE AS A FOOD.

Almost everyone knows the common brake on bracken, (*Pteridium aquilinum*), found in woods throughout the greater part of the world. Excepting possibly Australia, it is in Western Oregon, Washington and British Columbia that it reaches its highest development. In this American area it is not only the most common fern, but the largest as well. In the damp woods it grows up through the evergreen shrubbery of salal, Oregon grape, and huckleberry so densely as to make the woods almost impassable. In the drier regions it reaches a height of three to eight feet, and in hollows where the ground is specially rich it reaches a height of fourteen feet. Occasionally there are four or five to the square foot, but when they are so dense as this, they interfere with each other and do not reach the maximum growth. The tallest are in woods where there is shade, for this makes stems and leaf-stalks grow longer. In cleared fields, however, they come up as densely as in woods, but rarely reach a height of over six feet, usually two to four. In new lands they are bad weeds, coming up year after year. The farmer considers them a pest since they are tough and hard to destroy; and the horizontal, subterranean stems, which are an inch or less in diameter, and as much as ten feet long, are hard to cut. The large amount of starch found in the stems produces numerous shoots and is their source of supply during their rapid growth.

Like all common ferns (Filicales), the leaves of this fern, when they appear above ground, are rolled up circinately, like a very much inverted capital J. The food in the subterranean stems causes such rapid growth that in the shade they reach a height of two to four feet before they unroll the leafy portion to any considerable

extent. In tenderness and thickness these leafy-shoots are very like asparagus. Tender as these young shoots are, neither horse now cow will eat them. But the reason for this is evident when one finds the whole leaf-stalk, the younger parts in particular, densely covered with hairs, which are bitter to the taste. From the view point of the fern this is a splendid arrangement, for the large, succulent young shoots would certainly be much eaten by animals if they were not protected in some way.

It was conceived that these succulent shoots might be valuable as food, so in the spring of 1906 material was gathered for experimental purposes. The upper portion of the shoots was used. It will be observed that the tender part is longest just before the leaf-blade is unrolled. The extreme tips are so rolled up and covered with hairs that it takes too long to clean them, hence they were cut off. The tender part is much longer than that in asparagus, but the bases are woody, as in asparagus, so they were not used. In stalks three feet long as much as one foot is tender. The hairs or scales are loosely attached, and may therefore easily be removed by an ordinary vegetable brush. The stalks were then cooked by various recipes.

To test their palatableness, the dishes were prepared in quantity and offered to classes of fifteen to twenty for judgment. Perhaps three-fourths of these pronounced them good. The taste is not exactly like that of anything else, and like tastes in general, cannot be described except in terms of others. However, to many it suggests the almond. The fern cooks up readily, being softer than asparagus; and it has less woody tissue than asparagus as bought in the market, for the wood is not so near the tip as it is in asparagus. The epidermis is, however, somewhat tougher.

In food values, it compares well with other vegetables of the kind, its nutritive value being near that of cabbage. In comparison with asparagus, which it most resembles, it proves to be superior, containing .87 as

much protein, 1.7 as much fat, and 1.6 as much carbohydrates.

It has been shown that it is a good food, and it has been found palatable by most of those who have tested it. But whether it will become a considerable article of diet or not remains to be seen. The love-apple which was once raised in the flower-garden as a plant of beauty is now highly prized as our vegetable, the tomato. Ignorance of tastes, habit, and a hesitancy in trying anything new, often prevents one from enjoying some of the best of foods.

The brake was used by the Indians of the Northwest coast before the introduction of wheat flour, but the part used was the subterranean stem. This was dug up, washed, dried, pounded fine, and the coarse shreddy parts removed by sifting. The starchy powder was used as flour. Its use has been discontinued since the introduction of wheat flour. The writer has also been told that the young shoots of the brake are eaten in parts of France.

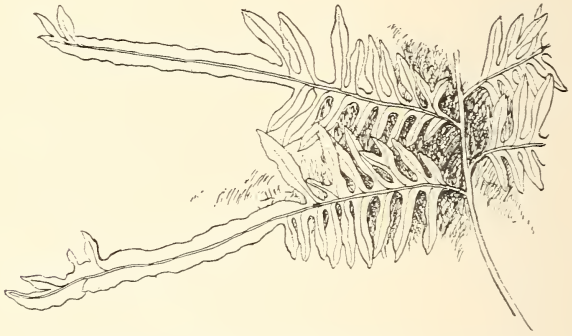
Commercially it is possible that the brake might be canned and sold like asparagus. Should it become a commercial product, the farmer would no longer need to consider it a pest. The season is short, lasting only about three weeks; but the supply is unlimited, and the product may be had for the collecting.—*From an article by Anna C. Dalgity in American Botanist.*

RARE FORMS OF FERNS.—III.

AN ABERRANT PTERIS AQUILINA PSEUDOCAUDATA.

Not many years ago *Pteris caudata,* a West Indian species, was listed as a native of various parts of the United States, but it is not now believed to grow within our limits unless it may occur in the southern part of Florida. The plant that has caused these various reports to be made is a form of our common bracken which I

have named *Pteris aquilina pseudocaudata.* It is simply a form with elongated narrow pinnules, the terminal one being unusually lengthened. It may occur wherever the insolation and small water supply make a reduced leaf surface desirable. For this reason it is most common in



PTERIS AQUILINA PSEUDOCAUDATA

the southern states, where it is often the dominant fern, though it may occur northward in the sandy wastes near the coast as far as Massachusetts. The specimen illustrated was sent me by W. C. Dukes of Mobile, Ala., and represents a not unusual form of the frond in which the terminal pinnule may have a few projections or lobes upon it. The illustration is of two pinnæ from the base of the frond.—*Willard N. Clute.*

The Water Clover.—There never can be rules for the making of common names. The common people will call the plants what they please. In the *Garden Magazine* we find *Marsilia quadrifolia* called water clover, a name that is quite descriptive, although *Marsilia* does not belong to the same grand division of the plant world that clovers do.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(*Continued.*)

NEPHROLEPIS Schott.

127. **Nephrolepis biserrata** (Sw.). SWORD FERN. Common; in swampy grounds. Southern Florida; also in the West Indies and throughout the tropics.—*N. acuta* (Sw.).

128. **Nephrolepis exaltata** (L.). SWORD FERN. Not uncommon; on palmettoes or sometimes on the ground. Southern Florida; also around the world in the tropics.

NOTHOLAENA R. Br.

129. **Notholaena Aschenborniana** Klotz. Rare; on dry rocks. Texas and Arizona; also in Mexico.

130. **Notholaena candida** (M. & G.). Rare; on dryish ledges. Southern Texas and New Mexico; also in Mexico.

131. **Notholaena cretacea** Liebm. Rare and local; in dry places at the base of rocks. Southern California and Arizona; also in Mexico.

132. **Notholaena dealbata** (Pursh). Not uncommon; on dryish calcareous rocks in light shade. Nebraska and Missouri to Texas and Arizona. —*Pellæa dealbata* (Pursh).

133. **Notholaena Fendleri** Kze. Not uncommon; at the base of rocky ledges. Wyoming to New Mexico and Arizona.—*Pellæa Fendleri* (Kze).

134. **Notholaena ferruginea** (Willd.). Somewhat rare; at the base of rocks. Texas and Arizona.

135. **Notholaena Grayi** Dav. Not rare; on grassy knolls in sun. Texas and Arizona.

136. **Notholaena Hookeri** D. C. Eaton. Rare; in talus at the base of cliffs. Texas to Arizona.

137. **Notholaena Lemmoni** D. C. Eaton. Rare; in dry places. Arizona.

138. **Notholaena Newberryi** D. C. Eaton. Cotton Fern. Abundant in crevices of dry rocks. Southern California; also in Mexico.

139. **Notholaena nivea** Desv. Rare; on dryish rocks. Arizona and New Mexico.—*Pellæa nivea* (Poir).

140. **Notholaena Parryi** D. C. Eaton. Rare; in dry, rocky soil. Utah to Arizona and California.

141. **Notholaena Shaffneri** (Fourn.). Rare; at the base of rocks. Western Texas.

142. **Notholaena sinuata** (Sw.). Not uncommon; on dry rocks often in sun. Texas to Arizona; also in the West Indies and southward to Chili. The form **crenata** Lemmon is reported from Arizona.

143. **Notholaena tenera** Gillies. Very rare and local; in dry soil. Southern Utah, Arizona and California; also in Chili. By many regarded as a form of *N. nivea*.—*Pellæa tenera* (Gillies).

Onoclea L.

144. **Onoclea sensibilis** L. Sensitive Fern. Abundant; in swamps and wet woodlands. Newfoundland and Saskatchewan to Nebraska, Texas and Florida. The form **obtusilobata** Torrey occurs with the type, and is probably caused by an injury to the sterile fronds.

Pellæa L.

145. **Pellaea andromedaefolia** (Kaulf.). Coffee Fern. Common; in stony soil. California and Arizona. The form **rubens** D. C. Eaton is a bronzed variety occurring with the type.

146. **Pellaea aspera** (Hook.). Not uncommon; on

rocks in sun or shade. Western Texas and New Mexico. The form **compacta** Clute is a form with close-set pinnules found with the type.

147. **Pellaea atropurpurea** (L). PURPLE-STEMMED CLIFF-BRAKE. Common or abundant; on calcareous rocks. Vermont, Ontario and British Columbia to Georgia, Arizona and California; also in Mexico. The form **cristata** Trelease is a crested form from Nevada.

148. **Pellaea brachyptera** (Moore). Not uncommon; on rocks. California and Oregon.

149. **Pellaea Breweri** D. C. Eaton. Rare; on exposed rocks. Montana to Arizona, California and Oregon.

150. **Pellaea Bridgesii** (Hook.). Very rare; on exposed rocks at high altitudes. California.

151. **Pellaea densa** (Brack.). Common; in the crevices of rocks. British Columbia to Montana, Wyoming, Utah and California, and on Mt. Albert, Quebec, and in Grey county, Ontario; also southward to Costa Rica.

152. **Pellaea flexuosa** (Kaulf.). Not uncommon on shaded rocks or in thickets. Western Texas and New Mexico; also from Mexico to Peru and in Santo Domingo.

153. **Pellaea intermedia** Mett. Tolerably common; at the base of dryish rocks. Texas and Arizona.

154. **Pellaea marginata** (H. B. K.). Rare; in crevices of rocks. Huachuca Mountains, Arizona; also southward to Chili. — *Cheilanthes marginata* H. B. K.

155. **Pellaea occidentalis** (E. Nelson). Not uncommon; in crevices of rocks. South Dakota to Wyoming and Washington.

156. **Pellaea ornithopus** Hook. Bird-foot Fern. Common; in sterile half-shaded soil. California.

157. **Pellaea pulchella** (M. & G.). Not common; at the base of dryish rocks. Western Texas and New Mexico; also southward to Peru.

158. **Pellaea ternifolia** (Cav.). Not common; in crevices of rocks. Western Texas; also southward to Chili, in Santo Domingo and the Hawaiian Islands.

159. **Pellaea Wrightiana** Hook. Common; in dry, sterile soil. Kansas to Texas and California. The form **compacta** is found with the type, which is quite variable.—*P. mucronata* D. C. Eaton.

Phegopteris Fee.

160. **Phegopteris alpestris** (Hoppe). Alpine Polypody. Not common; on elevated rocky slopes. Montana and British Columbia to California; also in Europe.—*Athyrium alpestre* (Hoppe).

161. **Phegopteris dryopteris** (L.). Oak Fern. Tolerably common; in moist woodlands. Alaska to Newfoundland, Virginia, Kansas, Colorado and Oregon; also in Greenland, Europe, Northern Asia, Japan and China.—*Dryopteris Linnæana* C. Chr.

162. **Phegopteris hexagonoptera** (Michx.). Broad Beech Fern. Common; in shades, moist or dry. New England to Quebec, Minnesota, Kansas, Louisiana and Florida; also in India.

163. **Phegopteris polypodioides** Fee. Long Beech Fern. Common; on wet rocks in sun or shade. Alaska to Newfoundland, Virginia and Iowa; also in Greenland, Europe, Northern Asia, Japan and the Himalayas.—*Dryopteris phegopteris* (L).

164. **Phegopteris Robertiana** (Hoffm.). Limestone Polypody. Rare; in rich woods. Labrador to Quebec, Minnesota, Iowa and Manitoba; also in Europe and Afghanistan.—*P. calcarea* Fee.; *P. Dryopteris Robertiana* Dav.

165. **Phegopteris reptans** (Sw.). Somewhat rare; on moist calcareous rocks. Southern Florida; also in the West Indies and southward to Brazil. This is as well entitled to be placed in the genus *Nephrodium* as here.—*Dryopteris reptans* (Sw.).

166. **Phegopteris tetragona** (Sw.). Not uncommon; in moist shades. Southern Florida; also in the West Indies and southward to Brazil and Peru.—*Dryopteris tetragona* (Sw.).

PTERIDOGRAPHIA

Additional Dorset Ferns.—I have two additions to make to my list of Dorset (Vt.) ferns: *Botrychium simplex,* and *Pellaea atropurpurea,* both of which I had the pleasure of finding last summer. It is a curious fact that one may go to the same spot, year after year, in search of the same fern and yet fail, year after year, to find it. But my persistence has been rewarded in this instance. My list now numbers fifty-five species and varieties from this locality.—*Mrs. Emily Hitchcock Terry, Northampton, Mass.*

Three Fertile Panicles.—Mr. H. E. Ransier, Manlius, N. Y., sends us an excellent photograph of a plant of the dissected form of the grape fern (*Botrychium ternatum*) possessing three fertile panicles. Such specimens are usually the result of unusual vigor in the plant, and this one is of especial interest from the fact that it is the dissected form which we are often assured, incorrectly, does not grow far from the sea-coast.

Onoclea Sensibilis in the South.—It is well known that the sensitive fern (*Onoclea sensibilis*), so common in northern swamps, does not extend far toward the tropics. Its nearest relative, the ostrich fern, is of the same disposition, and but rarely extends to Virginia. The sensitive fern is found in most of the southern States, but it is rare long before the Gulf is reached. It has been reported from Florida, but evidently through an error. Harper reports it as confined to the upper third of the State of Georgia, Professor Cocks found it near New Orleans, and Reverchon notes it from eastern Texas. In Alabama Dr. Mohr's southernmost station was at Stockton, in Baldwin County. Mr. W. C. Dukes writes that this station is no longer the fern's southern limit, since three colonies of about a dozen plants each were located at Spring Hill, near Mobile, in 1906, by L. H. McNeill. This practically extends the range of the plant to the Gulf. As to the range of the plant in Mississippi not much seems to be known. We hope the publication of the fern flora of that State will throw more light on the subject.

Edible Ferns.—The bracken is doubtless the species of fern most often used as food. Not only is it occasionally thus used in America, but in Japan it is a regular article of commerce and may be found in the markets tied up in small bundles like asparagus. The royal fern (*Osmunda regalis*) is used like the bracken and is often dried for winter use. In the green state many other ferns are used as pot-herbs, being collected just as the young fronds are unrolling. Only the thick and succulent species are selected, such as the cinnamon fern (*Osmunda cinnamomea*), the interrupted fern (*O. claytoniana*), and the ostrich fern (*Struthiopteris Germanica*). The use of the undeveloped fronds in the center of the crown of all ferns of the genus *Osmunda* is well known to children, who in other days at least, ate it under the name of "the heart of Osmund." It is white and tender with a starchy flavor not unlike raw chestnuts.

It is obtained by grasping all the green fronds of a plant and giving them a steady pull. When they break loose, the heart comes with them, but this of course destroys the plant. All these uses, however, are insignificant in comparison with the uses of some of the tropical tree ferns, such as *Cyathea dealbata, C. medullaris, Alsophila excelsa* and *A. australis.* The interior of the trunk or caudex of these ferns consists of a white farinaceous matter that is highly esteemed by the natives and formerly formed no inconsiderable part of their diet.

The Fern Garden.—The best time of the year for transplanting ferns is without doubt the spring of the year, just as the fronds are unrolling, but this has the disadvantage of being done when the ferns are identified with the greatest difficulty. It would be a hard matter for any but a fern student to get a complete collection of the ferns in the nearest woodland by this means. Fortunately for us, the ferns may be safely moved in full leaf if a few simple conditions are observed. The most important of these conditions is that the roots be kept moist. They should not be allowed to become dry at any time and this may be prevented by wrapping each plant in a damp cloth as soon as dug. The fronds of many species may well be cut off and used as packing material, but some discretion must be used in this for much depends upon the species. The ferns may be divided into two groups as regards the way in which the fronds are produced. In one, the fronds for the year all come up in the spring and unless the plant is injured no more are produced. A good example of this group is the cinnamon fern, or the marginal shield fern (*Nephrodium marginale*). The other group, represented by such ferns as the bracken, the sensitive fern and the marsh fern have slender creeping root-stocks that put up fronds all summer. In this second group the removal of the fronds works no injury to the plant since they readily produce new ones, but in the first group the fronds are much more sparingly produced and if the plants are wanted to make

a show as soon as possible an effort to retain the old fronds should be made. In digging the ferns, as many of the roots as possible should be taken as any shortage in the root-system will prevent the fronds from getting sufficient moisture. If any fronds are injured in digging they may be removed as this will also lessen the demands upon the roots for moisture, and when for any reason but few roots can be obtained, all the fronds should be removed. By such treatment the most unpromising specimens may be induced to survive. By proper care in digging and packing, ferns may be kept out of the earth for weeks and transported thousands of miles without harm. There are no ferns that cannot be grown in our gardens if proper attention to their wants is given. To have them thrive best, give them situations as nearly like the originals as possible or improve upon them if you can. Some ferns are more easily grown than others and it may be said in a general way that the common ferns are least fastidious as to requirements and that the care necessary to make a rare fern live is in direct proportion to its rarity. The beginner by taking up the common ferns first will soon learn how to care for the rarities.

Packing Fresh Fronds.—The following methods of sending fresh specimens of fern fronds, for long distances, have proved to be excellent. Professor House, while in Washington, sent to me for quite a quantity of *Scolopendriums,* upon which he had run short after offering it. I could not take the time to press them for him and so concluded to ship green by express. I took large heavy sheets of paper, thoroughly paraffined them, cut so that one sheet went down one side of a wooden box, across the bottom, up the opposite side, the ends long enough to cover the top when folded over. Another piece was laid in the box the opposite way, then the ferns were closely packed in, the paraffined papers folded over them and the wood cover nailed on. Mr. House reported their arrival by express in perfect condition. Again last

August I wished to send Dr. Lee, of Bridgeport, Alabama, some *Scolopendriums* to compare with those he was investigating at the nearby Tennessee station. I had a tinker at Jamesville make a tin box 1 x 2 x 20 inches, cover as deep as the box and corners not soldered. Cost me 10c! I packed it full of *Scolopendriums,* moonworts, *Ophioglossum* and walking ferns. Put in some moist moss also. Dr. Lee wrote: "I did not think it possible to deliver specimens in such perfect condition." I planned to start the above box out of Jamesville, N. Y., Saturday evening. After having mailed it I learned that the last mail had gone for the day and that it would not start out till Monday morning. I left it and yet in spite of a day and a half there, besides its long journey, the ferns were delivered in "perfect condition."—*H. E. Ransier, Manlius, N. Y.*

Nephrodium Boottii a Hybrid.—Much has been said and written on both sides of the question as to the hybrid origin of *Nephrodium Boottii.* It is interesting to note that Christiansen's "Index Filicum," recently issued, lists the plant as a hybrid between *N. cristatum* and *N. spinulosum.*

Lygodium as a Decoration.—The Japanese climbing fern (*Lygodium Japonicum*) unlike many other ferns grows with unusual luxuriance in cultivation and some florists are beginning to use its fronds in place of smilax in decorations. It has been found that the fruited pinnæ remain fresh as long or longer than the sprigs of smilax and are no more difficult to grow.

Habitats of Cystopteris Fragilis.—There are few ferns in the world more widely distributed than the common bladder fern (*Cystopteris fragilis*). It has been reported from Alaska, the West Indies, Cape of Good Hope, New Zealand, China, and Europe. Its predilection for moist rocks is well-known and in regions where such habitats are to be found, the fern is rarely found else-

where, but in the woodlands that border the streams through the prairie regions of our Middle West, where no rocks are to be found, the fern grows in the soil like the lady fern usually does. In such woods this fern is usually the most abundant species, and frequently is the only fern to be found.

Fossil Ferns are Rare.—At the autumn meeting of biology teachers at the University of Chicago, Dr. J. M. Coulter discussed the discoveries that have recently been made among the so-called fossil ferns. Botanists generally have long believed that the flowering plants originated from the ferns through some such forms as the fern-like cycads, but there has always been more or less of a break between the two groups. The assumption has usually been made that the connecting links have died out, and if they are ever found at all they will be found among the fossil ferns. The great difficulty in testing this theory heretofore has been that most of our fossil fern remains are not the ferns themselves, but are, instead, the impressions, or casts, which they left in the soft mud that later became the rocks of the coal measures. Recently, however, many silicified fern remains have been found in which the substance of the ferns has been replaced by mineral matter. Such remains show the structure clearly, and may be sectioned and studied like fresh material. One of the first surprises in this study has been the discovery that the great majority of what we have been calling fossil-ferns are in reality seed-plants and not ferns. The ovules have been found to arise directly from the sori and the stamens have been discovered in other sori. The fruits are usually borne in a husk that appears to be derived from the indusium. Possibly this husk is the prototype of the bract that so often encloses the flowers in the lower seed-plants. In any event, these discoveries make clearer the origin of flowers. After all, a stamen is not so far removed from a sporangium. Pollen grains, as is well known, are but spores that grow when brought

in contact with the stigmatic surface of the pistil. The new light that these recent investigations have thrown on the fossil fern-like plants, shows that only about twenty per cent. of the plants known as fossil ferns really are such. The rest are seed-bearing plants, related to the cycads, and forming a group intermediate between them and the ferns, to which the name of Pteridosperms has been given.—*Willard N. Clute.*

Ferns and Lime.—It is often assumed that all ferns love limestone and that certain species will not thrive unless in a soil of this nature. This was once said of the walking fern and it is still the custom to mix limestone, old plaster, etc., with the soil in that part of the fern garden where these ferns are to be placed. But since this idea became current the walking fern has been found on a large number of rocks that contain no trace of lime, and at present not a few believe that the reason for the occurrence of some ferns on limestone is the same as the reason for certain plants growing in alkaline soils or in deserts, namely, that they cannot hold their own against the tenants of other soils. Not only is it true that many ferns are not lovers of lime, but there are some species that cannot endure it. *Lomaria Spicant* and *Cryptogramma crispa* are reported as unable to survive if watered with water containing much lime.

Ferns and Drouth.—It is well known to botanists that drouth is very effectual in causing plants to flower and fruit, and the same thing seems applicable to the fern-worts. The behavior of the various species of *Marsilia* are quite in accordance with the rule. When growing in plenty of water they rarely fruit at all. Fruiting specimens must be looked for among the dilapidated specimens in drier ground. The same is true of *Pilularia* and the species of *Isoetes.* Some of the so-called "terrestrial" species of the latter fruit at the beginning of the dry season, and then drop their leaves, but if supplied with water throughout the year do not drop their leaves and

rarely produce spores. Other species fruit late in summer when most likely to be exposed to drouth. The fact thus illustrated is of wide application among the ferns, and may have an influence upon the production of such forms as *Onocea sensibilis obtusilobata* and *Osmunda cinnamomea frondosa*. Many have conjectured that the last mentioned form is due to a fire sweeping through the locality, while others claim to have found specimens where there were no signs of a forest fire. Drouth at the proper season, however, might account for both occurrences.

Prof Atkinson has held that the *obtusilobata* forms of *Onoclea* and *Struthiopteris* can be produced at will by removing the early sterile fronds, but some of those who have tried to duplicate his results have been unable to do so. It may turn out, after all, that dry weather must be taken into account in producing such forms. Many other habits of ferns point to this theory. Practically all tropical ferns fruit at the beginning of the dry season, and our own ferns, with few exceptions, fruit when their habitat is the driest. Everybody is familiar with the fact that specimens growing in dry ground or in sunlight will be more fruitful than specimens of the same species in shade and moisture. The whole subject is worth a careful investigation.

Fern Genera and Species.—The completion of Christiansen's "Index Filicum" gives us new data upon which to base our calculations of the number of fern species. According to this there are 149 good genera and 5940 species. Of course the majority of these are in the Polypodiaceæ which is regarded as containing 114 of the genera and 4527 of the species. The next two largest genera are Hymenophyllaceæ and Cyatheaceæ, containing 459 and 456 species, respectively. That the industrious name-tinkerer has been ever with us is shown by no less than 670 generic names that are synonyms, and 15,787 specific names that are no longer in use. It is

almost certain that a large number of these synonyms were made prior to the movement for a " stable " nomenclature in America. The number of valid species as given in Christiansen's work will in all probability have to be reduced somewhat, as owing to the circumstances many of the " new species " recently published have been taken upon the authority of their authors.

Absurdity in Nomenclature.—In 1850 a botanist named Unger described a species of *Isoetes* as *I. Braunii.* Fourteen years later this name did not seem to have gained acceptance and Durieu then gave the same name to our well-known quillwort. Somewhat later Engelmann considering this plant but a variety of *I. echinospora* made it *Isoetes echinospora Braunii* and under this name it has been going up to the present. Prof. T. D. A. Cockerell, however, is one of those individuals who cannot let well enough alone and on the strength of that earlier *I. Braunii* of Unger has proposed the name of *I. echinospora Brittoni* for our plant. The absurdity of naming this plant for a botanist who was not born when the plant was first discovered seems not to have occurred to the maker of the new name. We are the last persons to object to honoring a man by naming a plant for him, when the man has been associated with the plant in any way, but this deliberate taking away from one to enrich another, as in this case and others than we can mention (such as *Porteranthus*), is a little too strong for us. There is no likelihood that the two *I. Braunii* will ever be confused. As between Braun and Britton we choose the first.

The Boulder Fern and Water.—Most ferns are so adjusted to moisture and shade that they soon wither when gathered for decorations, but the boulder fern (*Dicksonia pilosiuscula*) which delights in sunny hillside pastures is not one of the number. Although at first glance its finely dissected and delicate fronds would seem

but poorly adapted to withstand drying, it will be found upon experiment that no ferns in our flora are better able to do so. The thick-skinned polypody and the Christmas fern are no match for it. At present florists make great use of the spinulose wood fern (*Nephrodium spinulosum*) for bouquets, but this fern wilts very rapidly. They could apparently gain much by changing to the boulder fern, which has beauty, fragrance, abundance and lasting qualities to recommend it.

Botrychium Lunaria Onondagense.—Mr. H. E. Ransier, Manlius, N. Y., writes: "I have a quantity of moonwort ferns, gathered this fall after the spores were shed. The ferns at this time are usually flat upon the ground and losing their color. I found that the frond could be pulled up without disturbing the bud in the base, the tissue just above the bud being shriveled and weak. Specimens which approach the *B. Lunaria* in size or appearance are rare and this partly leads me to believe that *B. Lunaria Onondagense* is a deserving designation. Ordinarily, I should hesitate to offer such specimens, but knowing their scarcity I offer specimens to members of the American Fern Society for the cost of postage, which is three cents."

INDEX TO RECENT LITERATURE.

Readers are requested to call our attention to any omission from the list.

Campbell, D. H. *Studies on the Ophioglossaceæ.* American Naturalist, March, 1907.—Discusses the morphology of the fruiting part.

Clute, W. N. *Asplenium piannatifidum in Connecticut.* Fern Bulletin, January, 1907.

Clute, W. N. *Check-list of North American Fernworts.* Fern Bulletin, January, 1907.—A continuation.

Clute, W. N. *Rare forms of Ferns.* II. *A cut-leaved cinnamon Fern.* illust. Fern Bulletin, January, 1907.

Clute, W. N. *Reproduction in the Resurrection Fern.* Fern Bulletin, January, 1907.—Reproduction from parts of the fronds noted.

Clute, W. N. *The Round-leaved Filmy Fern.* Illust. Fern Bulletin, January, 1907.

Dalgity, A. C. *The Common Bracken as Food.* Illust. American Botanist, March, 1907.—Describes methods of cooking, etc.

Ferriss, J. H. *Hardiness of Florida Crest Fern.* Fern Bulletin, January, 1907.—Reported hardy in Illinois.

Harrison, A. K. and others. *Flora of the Boston District*—1. Rhodora, May, 1907.—List of the Ferns.

Hawkins, L. A. *The Development of the Sporangia of Equisetum hyemale.* Illust. Ohio Naturalist, April, 1907.

Hopkins, L. S. *The Fern-flora of Ohio.* Fern Bulletin, January, 1907.

Nehrling, H. *Ferns in Florida.* Florida Agriculturist, May 15, May 22, 1907.

Palmer, T. C. *Rare Local Ferns.* Proceedings of Delaware County Institute of Science. October, 1906.

Pease, A. S. and Moore, A. H. *Botrychium lanceolatum in America.* Rhodora, December, 1906.—*B. lanceolatum angustisegmentum* described as new.

Poyser, W. A. *Isoetes saccharata in the Delaware River.* Fern Bulletin, January, 1907.

Robertson, R. R. *Southern Station for Botrychium simplex.* Fern Bulletin, January, 1907.—Reported from San Bernardino Mts., California.

Strong, M. A. *Regarding Dryopteris filix-mas in Vermont.* Rhodora, February, 1907.

Underwood, L. M. *Concerning Wordwardia paradoxa, a supposedly new fern from British Columbia.* Torrey, April, 1907.—Asserts that *W. paradoxa* is a synonym for *W. radicans* (*W. spinulosa*) of the West Coast.

EDITORIAL.

Readers of this magazine have not yet heard all the reasons for the delay of the January number. When the magazine came from the printer we found it had been printed by mistake on a cheap bluish-white paper, not at all like the paper we use. The issue was then nearly three months late and we were greatly tempted to send it out and trust to luck that our subscribers would not discover the difference. The magazine is still printed at Binghamton, N. Y., and sent to us for mailing and the time consumed in transportation meant more delay, but the editor, who gets more pay from the appearance of the magazine than he does from its income, decided that it must be reprinted, and reprinted it was. The most singular part of the matter was the fact that not more than a dozen subscribers complained of the delay, and these were mostly big public libraries. We wish to say, however, that we thoroughly appreciate the patience of our readers and hope we shall not be called upon to try them in this way again. If anyone would like a copy of that spoiled edition we will be glad to send it, with our compliments. It will serve to show what vigilance is necessary to keep the magazine up to the high standard we have set for it.

* *
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To our way of thinking, the article on nomenclature by Mr. Parish in this issue does not clear the Vienna Congress from making a very foolish rule regarding varietal names. When a plant is named it is *named,* and no amount of juggling will change the facts. It makes no difference what the namer thought of the plant's rank

with regard to other species. He gave it a name. Now comes the Congress and rules that if the one who named the specimen did not guess correctly the position the next generation of name-tinkers would give it, his name is to be turned down and anybody else may guess at it. This is nonsense and not worthy of those gentlemen who laud "priority." In this connection, referring to the remark that an independent code in each country is provincialism, we take pleasure in pointing out that the so-called "American code" is just this very thing, and yet a lot of our prominent botanists appear to be following it. If they can repudiate other wiser rules, why not also include in the repudiation this absurd one that a plant is not named unless the namer is fortunate enough to guess the specific value that others will put upon it.

* *
*

For nearly fifteen years this magazine has steadily objected to tinkering with the names of ferns. Our persistence has behind it no desire to belittle the energy of the gentlemen engaged in mixing up plant names, but to insist that this energy would be of greater usefulness if directed into other channels. What we need is more information about ferns and less information about what some dead-and-gone author called them. It has become all too common for individuals with a meagre knowledge of ferns in the field to locate in a library and imagine they are contributing to the sum of our knowledge by rearranging plants and plant-names in systems that will give their own names much prominence.

* *
*

Just as this issue is being made up word comes of the death of Mr. B. D. Gilbert, which occurred at his home in Clayville, N. Y., on June 3rd. Mr. Gilbert was for many years a prominent business man in the city of Utica, N. Y., was an authority on dairying and wrote

extensively for the press. He took up fern-study as a recreation, and carrying into it the same thoroughness that characterized his other work, soon became an authority in the subject. He made many expeditions in search of ferns and described numerous species and varieties. It is to his painstaking work that we owe the excellent monographs on the varieties of *Asplenium filix-foemina* and *Polypodium vulgare* in America. Mr. Gilbert was a pleasant and agreeable companion and made friends wherever he was known. He will be greatly missed by the readers of this magazine, but by no one more than the editor. Mr. Gilbert was for a time president of the American Fern Society and a more extended notice will appear in the Annual Report.

* *
*

Some years ago the little gray polypody (*P. incanum*) was threatened with a change of name, and in fact a few fern students did adopt the specific name of *polypodioides*. Now the same species is threatened from another quarter. Ivar Tidestrom suggests that the generic name of *Marginaria* be taken up, and *Marginaria polypodioides* it is likely to become in future. Not so many years ago the genus *Polypodium* had quite a respectable showing in the United States, but its ranks have been sadly depleted by the defection of *Phlebodium, Campyloneuron, Phymatodes* and *Marginaria*. It would not be surprising if somebody figured out a way of getting *Eupolypodium* out of the genus.

BOOK NEWS.

We have to thank Dr. E. Rosenstock of Gotha, Germany, for a reprint from *Hedwigia* of his paper on the ferns of Southern Brazil. The paper covers upward of 100 pages and includes descriptions of a large number of new species as well as notes on the other ferns and fern allies of the region. The nomenclature is that of

Christiansen's "Index," and therefore a bit more radical than we are accustomed to in the greater part of America. It is interesting to note that many of the Brazilian species are also represented in the West Indies and some extend as far north as our own regions. We note *Botrychium Virginianum, Osmunda regalis, O. cinnamomea, frondosa,* and several common *Lycopodiums.*

The *Philippine Journal of Science* continues to reflect the activity that characterizes the study of the ferns of the Philippines. In the January number for this year, E. B. Copeland gives an account of the "Comparative Ecology of San Ramon Polypodiaceæ" that is an excellent example of a real contribution to our knowledge of ferns. We shall later make extracts of some of the more interesting portions for this magazine. In the April number an extended account of the Pteridophytes (206 in number) of Mt. Halcon, the third highest of Philippine mountains, is given.

OWNERS OF COMPLETE FILES OF THE FERN BULLETIN.

As a matter of history it is desirable that the location of the twenty-six complete files of THE FERN BULLETIN be put on record, and we print the list below. If our readers know of any other complete sets we shall consider it a favor if they will send us this information. The fortunate owners of the twenty-six known sets are as follows:

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The magazine was begun as the LINNÆAN FERN BULLETIN, and the first three volumes were numbered consecutively, but each issue was paged independently. Volume IV. was increased in size and paged through the volume. With the beginning of Volume V. the title was changed to the present one and the present size of page adopted. THE FERN BULLETIN, therefore, may be said really to begin with Volume V. This volume has been out of print for many years, and sets containing it are constantly increasing in value. We contemplate printing a list of those owning sets complete from the beginning of this volume, and will appreciate it if the owners will inform us by postal card. It may interest our subscribers to know that more back volumes have been sold during the past year than have been sold in any other three years together. This speaks well for the continued interest in fern study.

Vol. XV No. 3

The Fern Bulletin

A Quarterly Devoted to Ferns

July

Joliet, Ill.
Willard N. Clute & Company
1907

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

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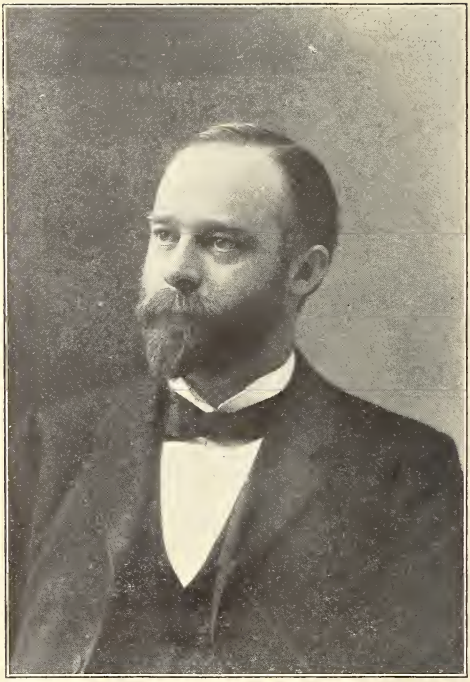


LUCIEN MARCUS UNDERWOOD

THE FERN BULLETIN

VOL. XV JULY, 1907. No. 3

IN MEMORIUM

In the death of three of its most eminent men within a year, American fern study has sustained a loss that will cause the year 1907 to be long remembered. In their demise we lose not only three leaders and authorities but the last of a group of men in which were included D. C. Eaton, John Williamson, Thomas Meehan, and others famous for their researches among the fern worts. The men now most active in fern study were all born since this group began their labors, or at least they began their study of ferns long after these had achieved distinction in the science. To these pioneers, therefore, fell the task of laying the foundations for our present knowledge of ferns and welding the scattered facts and descriptions into one complete whole. They found the study devoid of literature; they left it with many books for its work. They began their work alone and widely removed from one another; they ended with fern students in every town of any size.

First of the recent deaths was that of Benjamin Davis Gilbert, which occurred at his home in Clayville, N. Y., on June 3rd, 1907, after a protracted illness. Following this came that of Lucien Marcus Underwood, who died by his own hand in a fit of temporary insanity Nov. 16, 1907. Last to leave us was George Edward Davenport, who expired suddenly Nov. 29, 1907, while walking with his grandchildren in the Middlesex Fells reservation. A short account of the life and work of each may be a fitting memorial with which this page in fern study closes.

Benjamin Davis Gilbert was born at Albany, N. Y., Nov. 21, 1835, and graduated from Hamilton College in the class of 1857. His father died before he was

born and his mother died six months afterward, thus leaving him to make his own way in the world. That he attained eminence in several walks of life may be taken as some indication of the energy he possessed. At the end of his college course Mr. Gilbert became in succession

BENJAMIN DAVIS GILBERT

broker, book-seller and editor. He was connected with the Utica *Morning Herald* for eleven years and continued to write for it for many years afterward. Leaving the paper he became interested in the manufacture of steel goods, which he continued to the time of his death. For nearly 30 years he served as secretary of the New York State Dairyman's Association, and was author of

a book on cheese-making, issued by the National government.

Mr. Gilbert's interest in ferns began shortly after leaving college. His herbarium, begun then, is one of the largest of private fern herbariums, and includes more than a quarter of all the known species. In the interests of this herbarium he twice visited the West Indies, and also collected in Bermuda, Florida, California, and in the Old World. He was a frequent contributor to the scientific press, most of his work on ferns appearing in the *Torrey Bulletin* and *Fern Bulletin*. Among his more important papers are "A Revision of the Bermuda Ferns," "Polypodium Vulgare in America," "Asplenium filix-foemina and its Varieties," and "A Study of the Tribe Aspidie." He also issued "North American Pteridophytes," a list of the fernworts.

Mr. Gilbert was a member of the Torrey Botanical Club and of the American Fern Society, and served one term as president of the latter society.

Lucien Marcus Underwood was born at New Woodstock, N. Y., Oct. 26, 1853. He began life on a farm. Entering Syracuse University, he was graduated in 1877. The next four years were spent in teaching in small colleges in the middle west. In 1883 he returned to Syracuse University, where he taught for nearly ten years. From 1891 to 1895 he taught in De Pauw University, and the next year went to the Alabama Polytechnic Institute, which he left after a stay of a year, to accept the position of professor of botany in Columbia University. This position he held until his death.

Dr. Underwood's fame as a fern student began with the publication in 1881 of "Our Native Ferns." This was the first American attempt at a manual for naming the ferns, and met with such success that a second edition was required within a year. This has since been followed by four other editions and remains to-day our only manual of the North American fernworts. Another book, "Moulds, Mildews and Mushrooms," has been

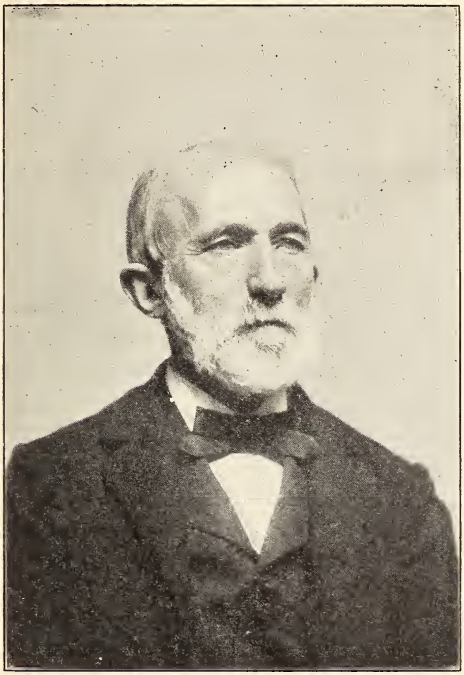
almost as successful. Dr. Underwood was a voluminous writer on his chosen subjects, and his intimate knowledge of critical groups gave his opinion much weight. In his later years he became somewhat radical in his views on nomenclature and species making, but never lost the good opinion of his opponents, however much they differed from him. Among his other published works are "North American Hepaticæ," "Review of the Genera of Ferns," and a multitude of shorter papers, mostly descriptive of new species or revisions of older genera of ferns. Numerous species of fernworts fungi and flowering plants have been named in his honor.

Dr. Underwood was a member of the Torrey Botanical Club and for eight years editor of its *Bulletin* in the pages of which much of his later work appeared. He also published many notes in *The Fern Bulletin.* He was a member of the American Fern Society and chairman of the Board of Scientific Directors of the New York Botanical Garden. Although for more than twenty-five years he has been among the first fern students of the world, he was only in the prime of life, with the prospect of many years of usefulness before him. His untimely end is cause for deep and sincere regret.

George Edward Davenport was born in Boston Aug. 3, 1833, and all his life was spent in or near that city. In his younger days he became acquainted with Wendell Phillips and William Lloyd Garrison and thereafter was counted among their friends. He was always interested in plants and was well known for his contributions to the botany of his State, but it was not until after his marriage that he turned his attention to the ferns.

In 1872 he joined the Massachusetts Horticultural Society and a few years later presented this society with his splendid fern herbarium, to which he continued to add during his life. In acknowledgment of this he was made a life member of the Society and voted the Appleton Gold Medal. He was one of the founders of the Middlesex

Field Club and a leading spirit in the work of preserving the beautiful tract of land and water known as the Middlesex Fells. Many other socities claimed him as a member, among which may be mentioned the New England Botanical Club, Academy of Arts and Sciences, and American Fern Society. He served one term as president of the last named society.



GEORGE EDWARD DAVENPORT

Probably no other American has contributed more to our knowledge of ferns. For more than a quarter of a century his notes and longer papers have been appearing. The earliest papers apeared in *Torrey Bulletin* and *Botanical Gazette,* while most of his recent work has ap-

peared in *Rhodora* and *Fern Bulletin*. Among his more important publications may be mentioned "Monograph of Botrychium Simplex," "Vernation in Botrychium," and "Aspidium Spinulosum and its Varieties." During his lifetime much of the development of the West occurred, and in consequence the naming of many of the western and Mexican ferns fell to his lot. For many years his opinion was sought by Harvard University and the National Government in fern matters. He left unfinished a manual of the ferns of the United States, which he regarded as his most important contribution to fern literature. W. N. C.

FAIRY RINGS OF LYCOPODIUM SABINÆFOLIUM IN MAINE

By Alvin H. Trundy.

In the southern section of Maine, *Lycopodium sabinæfolium* is not of common occurrance but its manner of growth is most interesting. When found at all it occurs in open and rocky pasture-land and grows in large circles or belts. These belts of green are beautiful reminding one strongly of an enormous Christmas wreath of evergreen. One which we visited late in August measured one hundred and forty-five feet in circumference and formed a hollow circle, the space within being filled with the grayish crust-like mass of the reindeer "moss." (*Cladonia rangiferina*). The dark green of the *Lycopodium* contrasted beautifully with the gray of the *Cladonia* and could be easily distinguished at a distance of one half mile. In a series of stations, extending along a range of hills from north to south, it assumes this trait of growing in hollow circles. These are re-enforced annually on the outside margin until the ring is sometimes three feet deep. The fruiting plants are found on the inside margin of the ring, they being the older. The younger plants are always found on the outside margin. This formation of circles seems to be due to the creeping

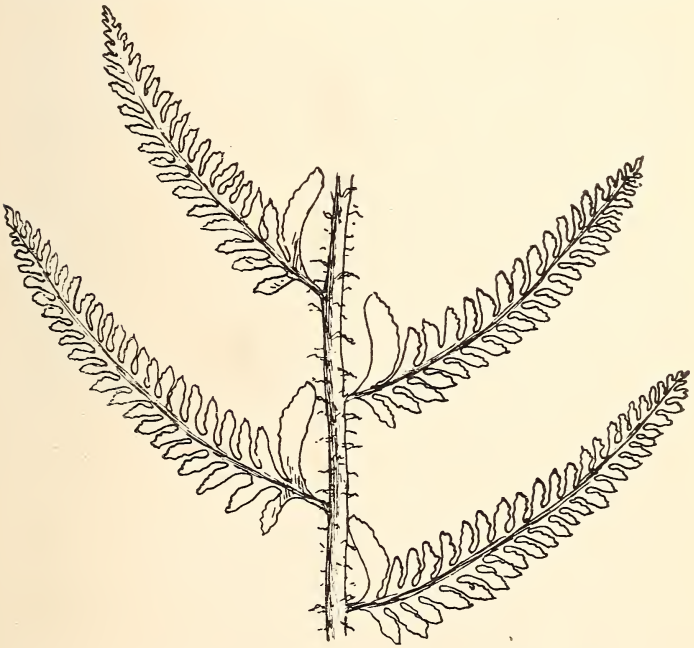
nature of the plant which carries the young tips outward from the centre. The centre is left vacant by the dying of the older plants. The rings enlarge gradually year by year. The habit is not confined to *Lycopodium sabinæfolium* alone, but is also noticeable in *Lycopodium inundatum*.

Farmington, Maine.

RARE FORMS OF FERNS—IV

A Bipinnatifid Christmas Fern.

It is probable that if one searched long enough he could find bipinnate forms of any of our pinnate ferns,



and corresponding forms for those that are naturally more than pinnate. The numerous sports of *Nephrolepis exaltata* now coming on the market well illustrate the

extremes to which the tendency to become finely divided may be pushed by taking advantage of the most aberrant forms produced. In nature these forms are likely to die out in competition with the type, but by selection they may be continued or even improved. In the bipinnatifid form of the Christmas fern, shown herewith, we have a type that has appeared again and again, but apparently has never been named. As it is well to have terms to designate these variations I here suggest that it be called *Polystichum acrostichoides f. multifida.* As early as 1867 it was reported from New Jersey and a pinnule of this find is illustrated in Eaton's "Ferns of North America." I have also seen specimens from Long Island and still more recently from Connecticut. It is likely to occur wherever the type is found, however. Our illustration was made from specimens from Bristol, Conn., discovered by Mr. W. A. Terry, who now has the plant under cultivation and to whose kindness in sending specimens I am greatly indebted.

The plant possessed by Mr. Terry is much more regularly cut than is usual in the finds of this form and no doubt would find a ready sale if carefully propagated since it is as hardy as the ordinary Christmas fern and far handsomer, standing in this respect in much the same relation to the type as the variations of the so-called Boston fern do to that well-known plant. The illustration is from the middle pinnae of a frond in my herbarium.—*Willard N. Clute.*

THE BOSTON FERN AND ITS SPORTS

By Willard N. Clute.

In Southern Florida, the West Indies and almost around the world in the tropics grows a species of sword fern called *Nephrolepis exaltata.* It has handsome, long, slender drooping fronds and was soon regarded as a fine fern for cultivation in the conservatories of cooler lands. Brought to Massachusetts, the fern or a form of it so nearly like it as to be indistinguishable was sent out as the Boston fern. This form is often called *Nephrolepis exaltata Bostoniensis,* and until recently was one of the most abundant of cultivated ferns. In most places, however, it is now being rapidly supplanted by a numerous progeny that is considered far handsomer. These latter forms have arisen as sports from the original plant and have doubtless been called forth in response to the variations in culture to which it has been subjected for these many years. Only the head of a large establishment for the growing of fern specialties could hope to keep track of all the newly named varieties, but it is proposed here to make a start at it and to add to the list as new forms come under notice. Our country is affected at present by several cults devoted to single species as the dahlia, the sweet pea and the peony. In time we may have a sword fern cult that deals only with the forms of this one species and considers all else as dross. A peculiarity of the gardening fraternity is their fondness for specific values and so we have most of these forms named as if they were distinct species. All of them properly belong to the single species *Nephrolepis exaltata* and will be so listed in this note. Most, if not all of the forms are due to variations in the cutting of the pinnae, such as may be found in the incised forms of the nearly related *Polystichum acrostichoides,* only in these forms the cutting has been carried much

further. One of the first of these forms to make its appearance was Pierson's fern, *Nephrolepis exaltata Piersoni* (*N. Piersoni*). It has finely pinnatifid pinnae and is connected with the type by *N. e. cristata* or perhaps more properly the latter points the way in which the former was produced. The Tarrytown fern *N. exaltata elegantissima* (*N. Piersoni elegantissima*) is like Pierson's fern, but more deeply and finely pinnate with broader fronds. The fact that these are mere sports of *N. exaltata* is shown by the occasional reversion to the type. The very latest in this line is the Superb Boston fern, *N. exaltata superbissima* (*N. superbissima*). To give it the place it deserves according to its lineage it should be named *N. exaltata Bostoniensis elegantissima superbissima,* but it is a mere sport no matter how it was derived. It is of compact growth and heavy texture, and is without question the finest of these plants. Scott's Boston fern, *N. exaltata Scottii* (*N. Scottii*), is a short compact form of the type with nothing in common with the preceding. The Philadelphia lace fern *N. exaltata Amerpohlii* (*N. Amerpohlii*) and *N. exaltata Whitmanii* (*N. Whitmanii*) are somewhat on the type of the *elegantissima* forms and belong to a class of named sports which is likely to be greatly augmented by additions from every big grower's place. A few of these have already claimed attention. *N. exaltata Genyi* (*N. Genyi*) appeared in the collection of Geny Brothers of Nashville and was promptly given a specific name and *N. exaltata todeaoides* (*N. todeaoides*) is a British introduction. It is practically certain that the successes attained with the Boston fern can be duplicated with almost any other fern in cultivation. The characteristics of these varieties seem latent in the type and may be called out by the manipulations of the grower.

DECIDUOUS BRITISH FERNS

Ferns which are natives of cold and temperate climates, in which the conditions of the winter are so rigorous that the frondage is practically destroyed, have developed in large measure the same deciduous or leaf-shedding character as is possessed by the majority of trees. Comparatively few, however, have developed the same capacity of throwing off their fronds at a basal joint, and among our native Ferns only one, Polypodium vulgare, or the common Polypody, has this faculty, which, moreover, does not show itself at the usual leaf-shedding season, the autumn, but only in the spring, when the new fronds are rising to replace the old, and consequently monopolize the root action. In the other species, which are deciduous, the fronds in October or November, or even earlier in some cases, commence without any obvious reason to lose their fresh green tints and become first yellow and finally brown, shrivelling eventually to feather-weight *débris*, owing to the retraction of their sap and any contained nourishment into the crown or root-stock. To many people who do not understand this provision of Nature for a thorough rest, the change is imputed to bad health, and the final disappearance or death of the fronds is thought to mean the death of the fern, the result being subsequent neglect, which makes worse the error. It has so frequently happened in our own experience, especially with lady friends to whom we have given some of our seedlings, that their subsequent loss has been owing to a mysterious disease in the autumn, though every care was taken, that we deem a word of warning not to be out of place in this connection at this season. Losses occur, however, even with those who understand this phenomenon, for where ferns are grown in pots in conservatories the absence of any obvious plant for some months is all too apt to lead to those pots being placed out of sight in

favour of more presentable occupants, the result being that they are forgotten, left altogether unwatered, and thus either perish outright or are greatly weakened by the drought to which they have been unnaturally subjected.

In their natural habitats the sleeping ferns are saturated through the winter beneath a thick blanket of fallen leaves, and there is no doubt that, as with bulbs, the roots are at work preparing for the spring growth long before the centres of growth show any signs of activity. Hence one essential to the well-being of ferns is that they be kept moist throughout the winter, and a good plan is either to pack the pots in a frame with cocoanut fibre or to bury them to their edges in the garden, and mulch them well with dead leaves, thus imitating as far as possible the natural conditions of existence in the dormant period. Our native ferns belong really to three categories, due probably to our comparatively mild winter climate. Thus in the lady ferns, bladder ferns, oak and beech ferns, mountain lastrea, marsh fern, and royal fern we have a class which, however we may treat them, die down altogether in the autumn. Then we have an intermediate section, represented by the soft male fern and broad buckler fern, which only drop their fronds to the ground, but under shelter retain their greenness. Finally, in the hard male fern, the spleenworts, the hart's-tongue, the shield ferns, and blechnum we have thorough evergreens, the fronds of which are retained well into the subsequent season. In making and arranging fern collections it is therefore well to bear these peculiarities in mind, especially with planted out ferns, but of course when grown in pots readjustment in the winter is possible, so as to give good effect even in the dead season. The moral of this note is, however, that dying fronds do not necessarily mean dying ferns, at this period of the year, but that due precautions must be taken as regards watering to ensure that sleep does not culminate in death.—CHAS. T. DRUERY, F. L. S., in *The Garden.*

CASH FOR EVERGREENS

By Willard N. Clute.

Some time ago, I noticed in the columns of a paper, obviously designed for circulation among the less enlightened members of society, the advertisement of a man who wanted people to collect ferns. Scenting something new in the wording of the notice, I sent for particulars and drew some information that I am sure is not generally diffused among readers of The Fern Bulletin. The circular slightly abridged, is as follows:

Dear Friend;

In answer to yours of recent date would say I advertised for people to gather evergreens. Read this letter carefully and you will profit thereby. Sixteen years ago I started in fruit farming, but there was some spare time from October until spring, so I cast about for some way to draw an extra dollar. Having some knowledge of botany and love for the woods I began gathering Christmas Greens. After I had looked up the trade, wholesale and retail, visiting many dealers, getting prices and the different ways of manufacturing, I found there was a large and growing demand for the goods that a farmer could gather in the woods in spare time or one could devote his whole time to it, as there is a market the year around for these goods at a larger profit than can be made on most farms.

The first year I only retailed, my wife, little girl and boy helping make them up. We sold $50 worth. Since then I have learned the Christmas Green business from A to Z, but I cannot supply one thousandth part of the demand, so have decided to let others learn of the chance there is in this line and do the same as myself if they wish. For the last two or three years I have had orders that I could not fill, for a number of tons of pine.

Very few people have any idea of the amount of ferns, oak foliage, bronze and green galax, sphagnum moss, holly, etc., used in the large cities. Chicago alone uses 20,000,000 ferns each year for which $1 a thousand is paid.

There are several kinds of ferns that grow in nearly all parts of the U. S., for which there is a market the whole year. I will tell you how to keep them six months, and where to sell them. How to keep all kinds of greens fresh for three months; how to manufacture wreaths, crosses, festooning and cemetery blankets which bring $5 each. I will direct you how to get good prices and orders for other evergreens for cemeteries.

Thousands of ferns are sold each year on the root stock also there is a large demand for 18 in. to 2½ ft. evergreen trees on the root stock. I will tell you how to sell both of these at good prices.

I will send all of this information complete, samples of different kinds of wire, cord and all material used, sample of ferns, princess pine, laurel, oak, etc. In fact everything used and how to use it so that you can do the same as myself."

I doubt whether any of our readers " with some knowledge of botany and love for the woods " can be induced to root out their ferns and ground pines for the small return to be derived from it, and therefore, have no hesitation in saying that all the valuable information hinted at in the foregoing may be had in exchange for a two-dollar bill from F. P. Barton, Durham, Conn. Reluctantly I put away these visions of wealth, only to have them recalled to me later by a second letter in which our friend Barton observed that he believed me to be an honest, intelligent person and would therefore knock off a dollar of his price if I would go into the business and send him the other dollar as soon as I had made $25 for myself. Alas, he probably thinks I haven't a dollar, for I have not yet gone into the business he so attractively sets forth.

Seriously, it is a question whether the collection and

sale of evergreens is a legitimate industry. Several States have so far discountenanced it as to make laws forbidding the collection of ferns and evergreens from the lands of another without permission, but on the other hand, even the legislators themselves are likely to prove good purchasers of evergreens at the holiday season. Personally I would not sell the evergreens on any land of mine for many times the current price, but so long as the owners of our forests are willing to sweep them away at the command of the highest bidder the lesser products of the woods will doubtless vanish with them.

NOTES ON ASPIDIUM CRISTATUM

This is one of the most interesting species, showing as it does the effects of light and surroundings upon its growth. In its natural habitat it is usually surrounded by a dense low growth of other plants that, like itself, luxuriate in rich, damp woods and swamps. The fertile fronds grow almost vertically and are two or three times as long as the sterile ones which are simply ascending. The fertile fronds no doubt grow this way because it is more important for the preservation and increase of the species that the spore-bearing part of the plant should receive every advantage due to better light, more air, etc., than that the sterile parts should avail themselves of such advantages. It must also be noted that the sterile fronds are a shade lighter in color than the sterile ones on the same plant. But most interesting of all, the pinnules on the fertile fronds are turned so as to lie in a horizontal plane. Reading of this in a book gave me a clue to the following observations: I planted some of the ferns in my yard in the city near a board fence so that they had only a northern exposure. This spring the ferns came up luxuriantly and bore many sori. The ferns nearest the fence had the upper surface of the pinnae turned almost directly outward so that the pinnea were nearly in the plane of the stipe. On the fronds farthest from the fence,

yet not over a foot from it, the pinnae were nearly horizontal. One frond was somewhat inclined and the rachis was twisted but all along the frond the pinnae were set at different angles so that the upper side faced the direction of the brightest light. The most interesting of all was a frond so growing that the back of the frond faced outward. Here the pinnae were inclined at an angle of forty-five degrees and facing the back of the stipe or toward the brightest light. So plain is this evidence that it seems certain that the fern makes every effort to obtain the greatest possible amount of light upon the surface of the fertile fronds, these being the most important. The size and position of the fronds, their darker color and, above all, the peculiarities of their pinnae go to prove this.—C. E. Waters. (Reprinted from *Linnaean Fern Bulletin* No. 1, pages 1 and 2).

ASPIDIUM SPINULOSUM AND ITS VARIETIES

Beginners, as well as more experienced fern collectors, often find it difficult to distinguish *Aspidium spinulosum* from its varieties *intermedium* and *dilatatum* and call them all *spinulosums* as the easiest way to dispose of them. *A. Boottii,* which is about two-thirds *spinulosum* and one-third *cristatum,* generally goes into the same batch as a modified *spinulosum.* No genuine fern lover will feel satisfied with this lumping off process. It makes the study of ferns far more interesting and profitable to be able to recognize the fine points that distinguish species and varieties. Ferns are exceedingly variable in their forms, mainly owing to the kinds and conditions of soil in which they are found, but cases in which they seem to run into each other may be the results of hybridization. In selecting specimens for the herbarium, the typical form, as nearly, as possible, should be chosen and when laid side by side the differences can readily be seen and there need be no confusion. I will briefly enumerate a few of the

distinguishing points which will be helpful to some beginner. If your fern is lance-ovate in outline and twice pinnatifid, the pinnae oblique to the rachis frequently nearly forty-five degrees, with two or three of the lower pairs broadly triangular, those above more elongated, the pinnules also set oblique to the midrib and connected with each other by a narrow wing rather coarsely serrate or lobed each ending in a spinulose tooth the margin of the indusium entire and smooth, you may safely call your specimen *A. spinulosum.* It is generally found in moist, shady woods in the Northern States. If your frond has a longer and broader ovate outline and often thrice pinnate, the pinnae rather distant on the rachis, the lower triangular but unequally so, pinnules crowded, more finely toothed and lobed than above, the margin of the indusium jagged and beset with very small stalked glands (to see them plainly required a glass magnifying twenty or thirty diameters; the sori that protrude from the edges of the indusium must not be mistaken for the glands), it is very probable that your fern is the variety *intermedium.* It is very common in damp woods. If your specimen frond is broader at the base than either of the above approaching triangular ovate and nearly always thrice pinnatifid, the pinnules lance-oblong, the indusium entirely smooth and naked, it is pretty certain you have found the variety *dilatatum.* This form is not so frequently met with as the two above and is generally found on mountains and elevated ground. *A. Boottii* has elongated, lanceolate fronds inclining to oblong in outline. It is thrice pinnatifid, the pinnules broad-oblong, rounded on the ends, somewhat pinnatifid below and serrated above. The indusium is covered with minute glands which give it a rough appearance under the microscope. It is a northern fern and found about ponds and wet places.—James A. Graves. (Reprinted from *Linnaean Fern Bulletin* No. 4, pages 1, 2 and 3.)

EQUISETUM HYEMALE

Summer does not reach us until June 21, although *Equisetum hyemale* seems to think the solstice is on March 23 if we can judge from its fruit. Or perhaps Gray's Manual and Our Native Ferns do not know how to name the seasons when they say of this species "fruiting in summer." I have always found the fertile knobs all through the winter. In the early spring the spores are discharged quite as early, if not earlier than those of E. arvense which "fruits in spring." The spores were perfect, for I have already some young prothallia from them (April 2) simply by sowing them on moist sand in a covered tumbler. At my favorite colony of *E. hyemale* the plant seems to have a great tendency to develop slender branches usually near the top of the stems. Many of these branches bear fertile spikes which are rarely as large as peas.—C. E. Waters. (Reprinted from *Linnaean Fern Bulletin,* No. 6, page 1.)

PTERIDOGRAPHIA

Botrychiums in Sand.—It has been held by those who are most strenuous in insisting upon a special creation for American plants, that the fern we have for many years called *Botrychium matricariæfolium* cannot be the same as the European plant of the same name, because the European plant is often found in sand along the seashore. In a recent number of *Torreya,* C. B. Robinson reports finding this species in great abundance on sand dunes on the north coast of the Gulf of St. Lawrence, "only ten yards above the reach of ordinary tides. * * * In other terms, they were among the plants which formed the first fringe of veegtation along the coast." The usual habitat of this species is in moist, rich woods, and this new habitat is but another reminder

that we must not be too quick to conclude we have a new species just because it is not exactly like what we assume the nearest old species to be. We are still with Mr. Davenport in maintaining that *Botrychium matricariæfolium* is common to both Europe and America.

Florida Crest Fern.—There are many ways of recognizing a species that are not set down in the manuals. Often the mere habit or way in which a plant grows, whether upright or trailing, may be sufficient to identify it, even as one passes it swiftly on the railway. Coming down to smaller matters, a difference in veining may serve to distinguish two closely allied species. Mrs. A. P. Taylor notes that while the cinnamon fern has been known from its tufts of wool in the angles of the veins, the Florida crest fern (*Nephrodium Floridanum*) has these tufts much larger and may be distinguished by this feature.

Variable Nfphrodium Cristatum.—In recent years much—too much, some are inclined to think—has been made of the variations in the common wood fern (*Nephrodium spinulosum*) to the exclusion of variations quite as striking in allied species. This is brought to notice by the observation of Mr. A. A. Eaton in the recently issued 14th Annual Report of the Fern Society, that different localities are likely to present different forms of the crest fern (*N. Cristatum*) and that these varieties prove constant under cultivation. One difference often remarked in specimens of this fern from eastern localities is that they average broader than western forms. It will be worth while to be on the watch for unusual forms of any kind in this species. While upon this subject it may be well to reiterate the idea slowly gaining acceptance, that from the modern viewpoint the plant called *Nephrodium cristatum clintonianum* is entitled to specific rank and should be known as *Nephrodium Clintonianum* or *Aspidium Clintonianum.*

Polynomial Ferns.—Linnaeus conferred unending benefit upon all students of nature by firmly establishing the momenclature of plants and animals upon a binomial system. He found botanical names a medley of adjectives and nouns; he left them in an orderly arrangement of genus and species. Since his time, however, we have been distinguishing varieties, forms and subforms until the names of some of the latter strongly remind one of pre-Linnaean botany. We are again reminded of this by a notice that at a recent meeting of the Royal Horticultural Society of London a certificate was awarded to *Polystichum aculeatum pulcherrimum Dreuryi.* The note further says that " the fern bears no resemblance to any other British fern." It certainly ought not to, with a name like that. It may be added, however, that the British are not the only sinners in this direction. It seems possible that some way might be devised to avoid more than three words in the scientific name.

The Tubers of Nephrolepis.—Any one who has grown *Nephrolepis cordifolia* for any length of time must have noticed the potato-like objects to be found on the underground parts of the plant. According to Prof. J. W. Harshberger, who spoke of the matter some forms of the crest fern (*N. Cristatum*) and that these outgrowths are borne on underground branches and are properly tubers. Most, if not all, the tubers with which we are familiar are storehouses of food, but the tubers of *Nephrolepis* are composed of thin-walled cells filled with water and are therefore more in the nature of cisterns than storehouses. Water, however, is as much a plant food as is starch, so these tubers, after all, act as food storage organs. The reason they contain water instead of starch is probably due to the fact that *N. Cordifolia* is an epiphyte and therefore more subject to drouth than many other plants. The habit of producing these tubers is common to several species of the genus, notably *N. tuberosa, N. Philippinensis, N. pluma,*

N. undulata and *N. Bauseii.* Our common *N. exaltata* does not produce them.

Fragrant Cinnamon Fern.—Mrs. A. P. Taylor of Thomasville, Ga., writes that *Osmunda cinnamonea glandulosa* is decidedly aromatic. If bruised early in the day it is of a spicy fragrance. Mrs. Taylor suggests that this may be the origin of the name cinnamon fern, but the evidence appears to be against this. It is a case where the name might have been derived in two ways, just as in the ebony spleenwort, the name is usually considered as given in reference to the ebony-colored stipes, but eben means a stone in some languages, and as the plant prefers rocky or stony places, the name might easily be derived in another way. As to the glandular members of a species being fragrant, it may be noted that most glands on plants secrete a volatile oil and that nearly all such oils are odoriferous. A large number are pleasing to our sense of smell and these we call fragrant, but many are quite otherwise.

The Forms of Onoclea Sensibilis.—I was greatly interested in your article on the *obtusilobata* forms of *Onoclea,* and I was one who tried to produce them by removing the fronds, but it did not work, with me. Now last year was a rather wet season and I found one or two of them; this year has been very dry with us, and I find dozens of them. I found twenty in about a rod square, and can find them anywhere. I wondered at it and I think you hit it about right. Why is it sometimes in the shade it will fruit, and others near, out in the sun, are all sterile.—*H. C. Bigelow, New Britain, Conn.* [Prof. L. S. Hopkins recently submitted to us a series of these forms from Ohio, collected in a locality where there appeared to be little likelihood that the rootstocks had ever been injured in any way. It is not denied that mutilating or removing the early fronds may produce the *obtusilobata* forms, but it seems quite as likely that drouth often causes these forms.—Ed.]

Mailing Small Ferns.—Mr. H. E. Ransier suggests that a most convenient way to mail small ferns is by the use of the " Photo-mailer " envelopes, which may usually be obtained of the nearest stationer or photographer. They are strong and light and protect ferns as well as they do photographs.

Polypodium Vulgare Auritum.—Dr. Fellows in his list of Maine Ferns (Fern Bulletin, October, 1906) states that *Polypodium vulgare auritum* has been found only in one station in the State. This fall I have found it in quite abundance and from specimens I have from other stations I should judge that my find was a very fine one.—*Henry W. Merill, Hiram, Maine.* [We are indebted to Mr. Merrill for some excellent specimens of this but most of the fronds more properly belong to *P. Vulgare hastatum,* which has ears on both sides of the pinnae. Some, however, are eared only on the upper side. As there seems to be no name for this particular form Mr. Merrill's name may well stand for it. The form has been illustrated in *The American Botanist* for September, 1903.—Ed.]

The Eared Walking Fern.—It is not every day that one finds the walking fern (*Camptosorus rhizophyllus*) with the base of the frond prolonged into sharp-pointed " ears." It seems to occur only in the thriftiest plants, and is undoubtedly due to unusual vigor. It will be found upon examination of any leaf that veins and lobes bear a close relationship to each other. When the walking fern puts out these ears they will be found to be coincident with the formation of larger basal veins. The ears behave quite like the tip of the frond and may occasionally root and produce new plants, just as the tip of the frond does. Mr. H. C. Bigelow writes that he found an eared frond recently near New Britain, Conn., that was eighteen inches long. He has found several, always where the soil is moist and the colony shaded. The

lack of a name for the eared form is a most striking instance of how familiar things are overlooked. Had this form not been found until this year, it would immediately have been dubbed *forma hastata* or *auriculata.* It certainly differs as much from the type as many of the forms of *Nephrodium spinulosum* and more than many of the forms of *Botrychium,* whose chief points of specific value are that they grow in different states of our union.

Range of Pteris Serrulata.—The original habitat and range of *Pteris serrulata* is unknown and doubtless always will be. It is supposed on pretty good evidence to have originally come from China or Japan, but it has been cultivated for so long and reproduces so readily by spores that it is now to be found apparently wild at many widely separated points, including our own Southern States, and the West Indies. In regard to its occurrence in Florida, Mrs. A. P. Taylor writes: "On reliable authority I learn that as far back as 1890 it was to be seen in profusion in numerous lime sinks near Ocala, Fla. Many of these sinks were ten and fifteen miles from town or other habitation and at the time I doubt if anyone in the town cultivated a decorative plant. Wherever *Adiantum capillus-veneris* was found—which was in every lime sink— the *Pteris* was seen in much greater profusion. How could this fern have gotten there from China? Fern spores are so light, however, that it seems quite possible for a new colony to appear in any suitable part of the world without the aid of man.

More Complete Sets.—The publication of the list of those who own complete sets of this magazine has brought out information as to the whereabouts of two other sets, both completed since the list was issued. The fortunate owners are Mrs. Annie Morrill Smith, 78

Orange St., Brooklyn, N. Y., and Mr. Chas. W. Jenks, Bedford, Mass. The value of these sets may be estimated from the fact that but seven public libraries have been able to fill their sets, though we have a standing order for the missing numbers. Within the past month single volumes have sold for $3.00, and we know of two or three instances where single copies changed hands at $2.00. Not all the back numbers are worth this much, but these instances go to show the value that may be attached to them. If any of our readers have duplicates of any numbers earlier than volume VI. and will let us know, we will find them purchasers. Meanwhile we would say that if those who have nearly complete sets will send us a list of their lacking numbers on a postal we will do our best to fill their sets. Send on a postal so that your list will be filed with the rest and not overlooked. We have several notices of those whose sets are complete from Vol. V., No. 1. If you are among these let us know.

Hart's-tongue Rooting at the Tip.—Mr. H. E. Ransier, Manlius, N. Y., writes: "*Scolopendrium vulgare* is credited with rooting at the tip of its fronds, occasionally, but who has ever seen it so doing in America? Maxon and House reported *almost* having done so, but as I recall their account of it, it was not a well marked example. My personal observation of the fern has not disclosed a single instance of its occurrence among many thousands of specimens seen the past five years." In reply to this it may be said that any fern, or any other plant for that matter, that produces new plants on any part of itself, does so through the formation of adventitious buds. In flowering plants these adventitious buds are most frequent upon the roots and stems, but they also occur on leaves as in certain begonias. In some plants the adventitious buds are more easily produced than in others and so it happens that only a certain few of our ferns have this habit. The tip of the frond bend-

ing over to the earth is the most natural place for the buds to form, but they do not always form there. While we seem to have no record of the hart's-tongue forming new plants at the tip of the frond in America, Miss Mirick writes that a plant from Chittenango Falls after being grown in a flower-pot for several years finally produced two new plants from the crown.

Reported Find of Cyrtomium.—Mr. W. C. Dukes, Mobile, Ala., writes that he has recently seen fronds of *Cyrtomium falcatum* that are said to have been collected five or six years ago from plants growing wild in Alabama. The exact locality given was a shady ravine near "Montgomery Mill," in Autauga county, Ala., between Montgomery and Prattville, where he was told there is a thriving colony. The identification of the fronds is without doubt, but whether the colony really exists is still problematical. Mr. Dukes is making an investigation at long range and in time will doubtless settle the matter. There seems to be no reason why this fern should not thrive and increase in Alabama, should it once escape to the wild.

Nephrodium Patens.—In nearly all books California is included in the range of *Nephrodium patens,* but this is a rare fern on the Pacific Coast, though common enough in the same latitudes elsewhere. Until recently the only known California locality was at Santa Barbara. Now it is reported from Eaton canyon, near Los Angeles, having been collected there recently by Ernest Braunton, according to *Muhlenbergia.*

Equisetum for Decorations.—Some time ago I saw in a florist's shop, *Equisetum hiemale* used as a covering for flower boxes. The stems were laid on vertically and held in place by cross strips. The effect was decidedly novel and harmonious. It was the first time I have ever seen an Equisetum used for any purpose.—*W. A. Poyser, Philadelphia.*

INDEX TO RECENT LITERATURE.

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

BENEDICT, R, C *Notes on Some Ferns Collected Near Orange, N. J.* Torreya, July, 1907.

BURLINGAME, L. L. *The Sporangia of the Ophioglossales.* illust. Botanical Gazette, July, 1907.—A comparison of structure in the Sporangia of *Ophioglossium, Helminthostachys* and *Botrychium.*

CLUTE, W. N. *Absurdity in Nomenclature.* Fern Bulletin, April, 1907.

CLUTE, W. N. *A Check-List of the North American Fernworts.* Fern Bulletin, April, 1907. A Continuation.

CLUTE, W. N. *Edible Ferns.* Fern Bulletin, April, 1907.

CLUTE, W. N. *Fall Fruiting of the Cinnamon Fern.* Fern Bulletin, April, 1907.

CLUTE, W. N. *Ferns and Drouth.* Fern Bulletin, April, 1907.

CLUTE, W. N. *Ferns and Lime.* Fern Bulletin, April, 1907.

CLUTE, W. N. *Fossil Ferns are Rare.* Fern Bulletin, April, 1907.

CLUTE, W. N. *Habitats of Cystopteris Fragilis.* Fern Bulletin, April, 1907—Recorded as growing habitually on the ground in the Middle West.

CLUTE, W. N. *Onoclea Sensibilis in the South.* Fern Bulletin, April, 1907.—Range Extended to Mobile.

CLUTE, W. N. *Rare Forms of Ferns.—III. An Aberrant Pteris aquilina Pseudocaudata.* Illust. Fern Bulletin, April, 1907.

CLUTE, W. N. *The Boulder Fern and Water.* Fern Bulletin, April, 1907.

Clute, W. N. *The Fern Garden.* Fern Bulletin, April, 1907.

Clute, W. N. *The Fern's Struggle for Existence in the Tropics.* Fern Bulletin, April, 1907.

Dalgity, A. C. *The Common Brake as Food.* Fern Bulletin, April, 1907. Reprint from *American Botanist.*

Hans, A. *Variable Sporelings of Lomaria Spicant.* illust. Fern Bulletin, April, 1907.

Horton, F. B. *Fern Notes.* Bulletin No. 2; Vermont Botanical Club.—Crested *Dicksonia pilosiuscula* and incised *Asplenium trichomanes* in Vermont.

Parish, S. B. *Concerning Nomenclature.* Fern Bulletin, April, 1907.

Ransier, H. E. *Botrychium Lunaria Onondagense.* Fern Bulletin, April, 1907.

Ransier, H. E. *Packing Fresh Fronds.* Fern Bulletin, April, 1907.

Ransier, H. E. *Three Fertile Panicles.* Fern Bulletin, April, 1907.

Rugg, H. G. *Osmunda regalis orbiculata.* Bulletin No. 2; Vermont Botanical Club.—Further notes on this form.

Stokey, A. G. *The Roots of Lycopodium pithyoides.* illust. Botanical Gazette, July, 1907.

Strong, M. S. *The Finding of the Male Fern in Woodstock.* Bulletin No. 2; Vermont Botanical Club.—Account of the finding of this fern in Vermont.

Terry, E. H. *Additional Dorset Ferns.* Fern Bulletin, April, 1907.

Yamanouchi, S. *Apogamy in Nephrodium.* Botanical Gazette, April, 1907.

Owners of Complete Files. Fern Bulletin, April, 1907.

EDITORIAL.

In the fifteen years of its existence this magazine has made more records and in greater variety than any other in existence. At present we feel confident that we can claim the record for the longest interval between issues. There are two chief reasons for this. First, the editor is trying to handle more work than any two men ought to, and second, the magazine is still published at Binghamton and the distance is responsible for many delays. To remedy this the editor has already planned a great reduction in his work for 1908, and beginning with the new year the magazine will be moved to Joliet, thus saving much time. Meanwhile the dates of the various numbers will indicate not the time they were issued, but the time they ought to have been. A cheap way of catching up, when a magazine gets behind, is to issue two or three issues in one, but that is not our style. Every issue of this magazine contains 32 pages and a frontispiece and our subscribers will get all that is due them. We shall not ask for new subscriptions till the old ones are filled and hope our subscribers will continue to be indulgent to our shortcomings.

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The next number of this magazine will complete fifteen years of continuous publication and our readers may expect something out of the ordinary in consequence. Some of the features that will appear in this issue have never appeared in any other botanical magazine. It is also our wish to have as many of our old contributors represented in this issue as possible and we hereby invite all to send us at least a short note for the issue. Fifteen years in the study of ferns is a long time, measured by what has occurred since the first FERN BULLETIN appeared. We hope those who have all these years helped it on to success

will join with us in an anniversary number that will be second to none.

* *
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If any of the readers of this magazine are interested in wild-flowers as well as ferns it will be worth their while to get a copy of the *American Botanist.* For seven years it has been issued and every number is still of value to the botanist, the gardener and the student of nature. More than half of each issue is made up of notes similar to the Pteridographia of this magazine but dealing with every phase of botany. Nearly three thousand of these notes have been issued, giving an immense amount of information *about* plants. None of the articles are of a technical nature and both the common and scientific names of all plants mentioned are given. The editor of The Fern Bulletin is also editor of *The American Botanist,* and will be glad to send samples to all who are interested.

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Notwithstanding the Vienna Botanical Congress and the publication of Christiansen's "Index Filicum," or perhaps in consequence of them, the subject of nomenclature continues to be a bone of contention; in fact, the laws of nomenclature like laws in general, are capable of so many different interpretations that anything but stability and uniformity has resulted from their application. Judging from the many attempts to form a perfect set of rules that have ended in failure we doubt whether any body of scientists can make a set of rules that all their associates would subscribe to. The botanists, especially, are a bit too fond of considering their own interests first and the good of the science afterward. Although the Congress made a set of rules that ought to have produced approximate stability, the various "schools" are apparently as far apart as ever and the existence of an "American Code" is proof of the assertion. It may be asked, how-

ever, what is the use of a botanical congress at all if every member who does not like its rulings comes home more firmly resolved than ever to use his own private brand of nomenclature? We suspect that much of the opposition to the Vienna rules comes from those who have all to gain and nothing to lose by further experiments at rule-making. The *Sassafras Sassafras Sassafras* and *Lablab Lablab Lablab* crowd do not look with complacency upon any proposition to trim their absurd nomenclature. In the main, the Vienna rules should prove satisfactory. The greatest foolishness was the adoption of the rule that a varietal name does not hold when the plant to which it is applied is raised to specific rank. This means, simply, that if you think a named *variety* is more properly a *species* you can give it any new name you choose and have your own name placed after it if you will mention the fact in dog-latin in a botanical publication. This is offering a bonus for name changing and nothing more. Regarding the difference to be paid to forgotten botanizers, the Congress took the right stand in refusing to sacrifice about four hundred well-known genera for "prior" names. It is astonishing to note how botanists who have little respect for other botanists living, to judge from their writings, are ready to accord this respect to dead ones. And the longer they have been dead, the greater the respect. They are so concerned for fear the names of some plant-collector of the olden time will be overlooked that they quite fail to see the trouble their whimsical rules are causing us who are still alive and obliged to use the names daily. We shall ever maintain that if any old name did not get into current use it is not the fault of the present generation,—though paradoxical as it may seem, if it does not now get into common use it will not be the fault of this same generation—and having got used to a later name it does not benefit the science any to make a change. The whole world knows *Cystopteris fragilis* and cannot be fooled into believing that *Filix* is either necessary, advisable or

more ornamental. The same thing applies to *Pteridium, Matteuccia* and all the others. As to the name for the wood ferns, we stand willing to adopt even *Dryopteris* if the leaders will unite on one generic name for them.

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By a recent ruling of the Post Office Department, publishers are now forbidden to send their magazines to subscribers more than four months in arrears, unless they pay a higher rate of postage. This, of course, puts an end to our well-known custom of allowing subscribers to pay each year when they choose. We must, therefore, ask all subscribers now in arrears either to bring their subscriptions up to date or to send us a postal card explicitly ordering the magazine to be continued. One such notice will be sufficient for all time. Simply say please continue sending the magazine until ordered stopped. There are a great many reasons why the subscribers to any magazine should not all pay up to the minute their subscriptions end. Some, undoubtedly, cannot spare the money at the time; others simply neglect the matter because the sum involved is so small, while still others prefer to wait until they owe a considerable sum and make no objection to bills of two or three dollars. We have always been willing to await the pleasure of our subscribers, but now that the paternal government refuses to permit this any longer, we shall have to close up these accounts. With this issue, we include bills for all subscriptions in arrears and ask a prompt reply. Unless all these accounts are heard from within a reasonable time we must send them to a collecting agency. With the explanation we have made, we trust our subscribers will understand that such a course is no reflection upon their honesty or good intentions, in fact, so confident are we that the majority expect to continue to be subscribers that we have billed all of them for a year in advance also. This number, together with the January, 1908, number recently issued, will be construed as completing the sub-

scriptions of those who cease their subscriptions with 1907. The October issue for 1907 will be sent to all others as soon as out. Part of it is already in type as this is written.

AMERICAN FERN SOCIETY

President Ferriss returned from a trip to Arizona recently, bringing with him one fern new to the United States and some unusual forms of the rare species of the southwest.

Mr. Alvin H. Trundy, Farmington, Maine, offers specimens of *Lycopodium sabinæfolium* to members of the Society for the cost of postage—five cents. This club-moss is not a common one, and no doubt many will be glad to avail themselves of Mr. Trundy's offer. Our more fortunate members should not forget those less advantageously situated when collecting rare plants. Those who for various reasons cannot go far from home to collect plants will be very glad to pay the postage on the specimens collected by others.

The annual election of the Society was held in November and resulted in the following officers for 1908: President, James H. Ferriss, Joliet, Ill.; Vice-President, Dr. D. W. Fellows, Portland, Maine; Secretary, W. A. Poyser, 6028 DeLancey Street, Philadelphia; Treasurer, Miss Nellie Mirick, 28 East Walnut Street, Oneida, N. Y. A prosperous and profitable year is certain to be realized.

The annual dues of the Society should be sent to the Treasurer as soon after the first of the year as convenient. It is not customary to send notices that the dues are payable except to those in arrears and an early response to this notice will be appreciated by the officers who are planning the year's work.

This number was issued June, 1908.

Vol. XV No. 4

The Fern Bulletin

A Quarterly Devoted to Ferns

October

Joliet, Ill.
Willard N. Clute & Company
1907

The Fern Bulletin

A QUARTERLY DEVOTED TO FERNS

WILLARD N. CLUTE, EDITOR

WILLARD N. CLUTE & CO., PUBLISHERS, JOLIET, ILL.

20 Cents a Copy; 75 Cents a Year.

Entered at the Post Office, Joliet, Ill., as second-class mail matter.

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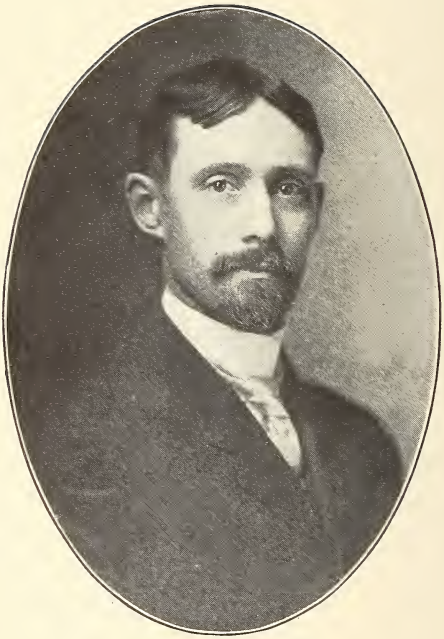

THE EDITOR

THE FERN BULLETIN

VOL. XV OCTOBER, 1907. No. 4

FIFTEEN YEARS OF FERN STUDY

By WILLARD N. CLUTE.

With the present number, THE FERN BULLETIN completes fifteen years of continuous publication. To the editor it seems but yesterday since the first tiny numbers of the *Linnæan Fern Bulletin*—with pages so much smaller than the current issues that they are often facetiously referred to as the prothallium stage of THE FERN BULLETIN—were issued; and yet, so much has been accomplished in fern study during this time that we begin to realize how inadequate as a standard of measurement any mere term of years is. When we began publication, practically all the authorities on American ferns were living. John Williamson had died less than ten years earlier, but we still had with us John Goldie, Daniel Cady Eaton, Thomas Meehan, John Redfield and Sadie F. Price. One by one these have passed away, to be joined more recently by Benjamin D. Gilbert, George E. Davenport and L. M. Underwood. All that remain to us of those whow ere writing on ferns when this magazine first appeared are S. B. Parish and Marcus E. Jones. Those whom we must now call authorities were then boys and girls at school. We are not, however, entirely without links connecting us with that earlier time, for the sons of John Goldie and R. B. Scott, the latter the discoverer of *Asplenium ebenoides,* are still on our subscription list. These are men in middle life, but we have several subscribers whose memory must outrun theirs, for several have passed the 85th milestone of life's journey and one, having passed ninety, has his eye set on the hundred mark.

When the first tiny issue of this magazine appeared we had no idea that it was to herald a great movement in the study of ferns. In those days the identification of ferns was not the simple task it is at present. Williamson's "Ferns of Kentucky" (1878) was rare and hard to get, Jones' "Ferns of the West" (1882) did not apply to the region in which most of the study of ferns was carried on and the cost of D. C. Eaton's "Ferns of North America" (1879) placed it beyond the reach of most students. Robinson's "Ferns in their Homes and Ours" (1879) though a manual for the cultivator did much to increase an interest in our favorites. It is true that the first edition of Underwood's "Our Native Ferns" appeared in 1880, but it was not until some time after THE FERN BULLETIN began to be issued that the popular handbooks, of which we now have so many, began to appear. First of these was the modest little volume of Raynal Dodge entitled "The Ferns and Fern Allies of New England" (1896) then came Sadie F. Price's "Fern Collector's Handbook" (1897) long since out of print. The well-known "How to Know the Ferns" by Mrs. Parsons appeared in 1899, the editor's "Our Ferns in Their Haunts" appeared two years later, and in the following year came his "Guide to the Ferns." Then followed Water's "Ferns" (1903), Eastman's "New England Ferns and Their Common Allies" (1904), Woolson's "Ferns, and How to Grow Them" (1905), Clute's "Fern Allies of North America" (1905), the latter the only popular work on this subject, and Miss Slosson's "How Ferns Grow" (1906). Mention should also be made of the fact that in 1900 appeared the sixth and last edition of Underwood's "Our Native Ferns." The student whose library is graced by a majority of the above-mentioned books may try to imagine what it meant to name the ferns without them. Those were the days when to be an authority on ferns meant more than it does at present, and beginners rejoiced when they

found some older student willing to give names to even the common things they sent him.

It would be unprofitable to repeat here various other facts that have arisen in connection with our magazine. They have for the most part been chronicled in our review of a decade of fern study, published in the tenth volume. Mention may be made, however, of the impetus which has been given to the study of the fern allies. In the early days, fern students seldom paid any attention to them; the early fern lists did not include them, and the first books did not even mention them. Now practically everyone interested in ferns is interested in the allies as well. To this magazine must also go part of the credit for the present activity in the study of mosses, for *The Bryologist,* now a strong independent journal, is a child of The Fern Bulletin, and for two years was published as part of it. That the ferns themselves have also gained by the spread of fern study may be seen from the fact that fifteen years ago the best list of ferns contained less than 250 names, while the latest contains more than double that number.

In the fifteen years of publication, this magazine has made several unique records. Starting with the field full of botanical publications, it has continued on its way unaided, until it is the third oldest of the strictly botanical publications in America. What this means in the way of good hard work only editors of similar publications can appreciate. This magazine is, so far as we are aware, the only one that for its entire existence has been in charge of a single editor and the only one that has not been subsidized in one way or another by club or society. It is also the only one that has never missed a number, nor doubled up two numbers in one. And, last but by no means least, it is the only publication of its kind in the world.

No one realizes better than the editor how much the success of the magazine is due to the steady encourage-

ment of its contributors. To name them all would be to list all the writers on ferns in America. We cannot refrain, however, from a mention of Messrs. Saunders, Maxon, A. A. Eaton, Graves, Bates, Dodge, Flett, Hill, House, Waters, Dukes Ransier, Ferriss, Hans, and Miss Slosson. To these, and to all the others who have helped *our* magazine to success, the sincere thanks of the editor are extended.

The study of the ferns and fern allies must continue to change with changing conditions. New species are no longer among the probabilities, though forms and varieties may still be found for many years to come. In the recording of these, with such additional facts about old species as may come to light, is work sufficient to keep the magazine busy for many years. That it may continue to engage in this work is the earnest hope of its editor.

Habitat of Polypodium Scouleri.—In the *Fern Bulletin* 9:40-42, 1901, Mr. S. B. Parish has a paper entitled "Southern Extension of the Range of Polypodium Scouleri." I chanced upon it recently, and note that in speaking of this species, he says: "Although this sometimes grows in the soil, its usual situation is the mossy trunks of trees." I have collected it on the San Bruno hills, San Francisco, and near the shore beyond Pacific Grove, Monterey County, and at both places it was growing on large granite boulders in crevices where a foothold could be obtained. Both of the localities cited are exposed to the cool ocean winds as well as to considerable fog, and are outside the line of arborescent growth.—*A. A. Heller in Muhlenbergia.*

RARE FORM OF FERNS—V

POLYSTICHUM ACROSTICHOIDES VAR. INCISUM INTERPRETED.

On October 19, 1907, near the edge of a swamp in the town of Lowman, N. Y., I found a clump of *Polystichum acrostichoides* var. *incisum*. The lower pinnæ were incised to an unusual degree, several fronds being cleft to the midrib, and one frond, which had been broken off one-third the way from the tip, by wind or cattle

perhaps, had its lower pinnæ fully divided into auricled pinnules so as to form miniature fronds with the tips fruited as in the ordinary form. As the second and third pairs of pinnæ were in all respects like the lower pinnæ of typical *incisum*, this was evidently a case of the incisum tendency carried to its logical conclusion.

I have often wondered why incising of the lower pinnæ is accompanied by fruiting at their tips, and had never been able to see any relation between the two modifications until this plant made it clear that they are two manifestations of an attempt of a pinna to grow into a frond. And since the resulting frond, as the illustration shows, is a typical frond, fruited at the tip, and not var. *incisum*, it seems evident that this is not a variety at all, but, as Mr. Hopkins suggests in the BULLETIN for January, 1907, a late growing form of the species, and should be called "forma *incisum*."—E. J. WINSLOW, *Elmira, N. Y.*

ECOLOGY OF SOME TROPICAL FERNS

The following account of the adaptations of ferns to their environment is condensed from an extended article on "The Comparative Ecology of San Ramon Polypodiaceæ," by Edward Bingham Copeland, published in the *Philippine Journal of Science* for January, 1907. The parts reprinted here are those which bear more directly upon the modifications which the ferns have evolved to fit them for their places in the plant world.

It has already been shown that large fronds are characteristic of habitats having a moist air, and that, on the other hand, large fronds, by virtue of their size, are more or less xerophytic in their finer structure. Very large fronds must have stout stipes and rhizomes which are well anchored. The caudex of the huge rain-forest variety of *Aspidium luzeanum* is ten centimeters in diameter. All our *Dennstaedtias* except *D. Erythrorachis* have very stout prostrate rhizomes. The enormous fronds of *Angiopteris* and *Marattia* spring from globose caudexes which are often thirty centimeters in diameter. Epiphytes have comparatively small fronds, the few exceptions being supported in an exceptional manner, namely, *Asplenium musaefolium, Polypodium heracleum* and *Platycerium,* by massive nests which, in large specimens, completely invest the supporting branch or trunk, as is sometimes the case with the stout rhizomes of *Polypodium musaefolium, Drynaria quercifolia* and *Thayeria.*

The margins of large fronds are always reinforced to give a protection against tearing. This protection may be by marginal anastomoses of the veins, as in the case of *Asplenium phyllitidis;* by walls merely thicker near the margin, as in *Cyclopeltis;* or by a more or less broad and rigid cartilaginous border, as in the case of *Hymenolepis* and *Acrostichum.* When the margin is deflexed, a very common occurrence, it is less likely to tear. If the frond is lobed or incised, the sinuses are the places

needing reinforcement. They are reinforced by the venation of *Goniopteris* and by a broader border of cartilage in *Polypodium affine* and other species. The special reinforcement of the sinuses can serve only as a protection against tearing, but the reinforcement of the margin as a whole is equally a protection against gnawing animals. It is probably of use in this way to many smaller ferns. Cartilaginous borders, if sharp or deflexed, also help to keep the nether surface dry.

The ready removal of water from the frond is insured and facilitated in various ways. One of these is by a smooth, even waxy, unwettable surface, as in *Asplenium phyllitidis.* Caudate tips are very familiar structures serving this end, and, of course, acuminate tips in general are more common and less conspicuous structures of the same kind. The removal of water from an erect fern is brought about in the same way, by an attenuate base, like that of *Dipteris* and *Meniscium.* Essentially like these are plants such as *Odontosoria,* with cuneate, erect pinnules. Pinnæ drawn down at the base instead of attached horizontally will drain in the same way. The reduction of the basicopic half of the pinna has the same effect, the part of the lamina which is removed being that portion which could not readily drain down the rachis. This modification is begun in *Asplenium vulcanicum,* carried further in *A. tenerum* and its relatives and in *Polystichum;* farther still in *Asplenium resectum,* and completed in our dimidiate *Lindsayas* and *Adiantum.*

If detracted pinnæ are carried further they become decurrent, forming a wing on the rachis and stipe which serves at once as a drain for water, aside from any value it may have in increasing the leaf area. A broad wing is sometimes convex upward on both sides, effecting a depression along the axis, as in *Polypodium papillosum,* the pinnæ of *Pteris longifolia* and the whole frond of *Polypodium caudiforme.* The fine divisions of *Onychium* are concave above. Many ferns have very

narrow, erect wings, continuous along the rachis or along the rachis and stipe opening laterally at the insertions of the pinnæ. An effect similar to that of the winged stipe is produced by the auricles of the pinnæ of some species standing close to, or against, the rachis and each underlying the base of succeeding pinnæ. *Nephrolepis cordifolia* is an illustration. The convexity of the major areolæ of *Polypodium affine* and *P. heracleum* can conduct water along the main veins and costæ just as a wing, convex as a whole does, and the rows of close-set papillæ on the segments of *P. papillosum* must operate in the same way.

Irrespective of the ease or difficulty of becoming wet (as a matter of fact, for a reason which I shall presently develop, cut, incised and dissected fronds shed water), finely dissected fronds dry readily by evaporation. There are two reasons for this: the limited single surfaces preventing the holding of much water, and the ready agitation brought about by movements of air. Aside from these general adaptations to promote the facile escape of water from a frond, there are various other devices which prevent the passage of water to its nether surface. A very simple structure of this kind is the convexity of the ultimate divisions of the frond, such as that of the segments of *Blechnum egregium* and the ultimate pinnules of *Nephrodium setigerum.* To reach the nether surface of any of these structures, water would have to run up-hill from the margin. This is equally the case when the margin of an otherwise plane frond or division is deflexed, as in *Antrophium plantagineum, Polypodium punctatum* and *Acrostichum.* In the majority of these plants the margin is sharp as well as deflexed. A few species have a sharp margin which is not deflexed. The sharpness alone must prevent a *drop* of water from running to the nether surface. If the entire surface is wet, the water need not perhaps move in drops, but might move in a film around even a sharp edge, but so

long as the nether surface is not wet, or is imperfectly so, the surface tension of a drop would cause it to become spherical on an edge as sharp as the one under discussion, and it would therefore fall off.

Overfullness of the margin causes an effect like that produced by convexity of frond. Such margins are wavy or crisped, alternately raised and depressed. Water will, of course, run to the margin where it is lowest, and only to this point; these are the places where it would have to run upward to wet the nether surface. An example is *Polypodium macrophyllum*. Such fronds can hardly be torn, because the extra length of their margins allows them merely to straighten if the fronds are bent toward the other side. A ciliate margin is, as a rule, an obstacle to the passage of water; for if the hairs are not wet, a drop must pass over their ends, from which it will inevitably fall off, but if they are wet, they usually furnish an opportunity for water to run down far enough to fall, instead of allowing it to pass to the nether surface. As a matter of fact, neither the hairs nor the cuticle of plants in general are very readily wet.

If we suppose a frond to be horizontal, then the possibility of a drop passing from the upper to the nether surface depends upon the area of contact which it can preserve with the frond while rounding the margin. If the frond is in some other position, the area of contact is still a very important factor. Unless this area is sufficient to allow a drop to flatten into a broad enough oval markedly to reduce its relative surface over which it would be were the drop a sphere, and thus to overcome the force with which gravity can act to remove the drop from the leaf, it will inevitably assume the form of a sphere, and fall.

We have just seen that the surface tension of a drop must prevent it passing around a sharp edge; now, if drops run to a toothed margin they must run in part over the sinuses. If the sinus were a curve with a ra-

dius equal to or greater than that of the drop, or if the radius were not much less, the drop would have an area of contact greater than it would have in passing the entire margin, and so it would pass more readily. Such sinuses are found in *Dipteris,* but they are so placed that water to reach them would have to run up-hill. I have found such sinuses in no other fern. If a drop runs to a sharp sinus, or to one much narrower than the diameter of the drop, then the sides of the sinus will hold it up and make it run outward to where the sinus widens or the ends of the teeth are reached. If the sinus widens sufficiently to allow the drop to run through, then even though the frond is quiet enough so as not to cause it to be shaken off when its contact is limited, and although it might return to the body of the frond while still touching both sides of the sinus without its having to run up-hill, nevertheless it is more than likely to leave the frond because of its impetus in falling through the sinus; this condition is easily demonstrated. If a drop runs out *onto* a tooth it loses its opportunity to pass to the nether surface by diminishing its possible contact, just as it does if it runs on to a caudate tip. In general, water must run to the teeth rather than to the sinuses, because its surface tension prevents its starting over an edge if it can run along it. Thus a toothed or cut margin in all parts of its periphery is provided with a water-removing structure such as caudate leaves have at the apex. I have demonstrated the inability of water to pass around a narrowly or sharply cut margin by experiments on various ferns. A very much larger proportion of terrestrial than of epiphytic ferns have such margins; as epiphytes, by virtue of their position, will be injured for a comparatively short time by their wetness of the nether surface.

In a few ferns there are special adaptations to make the sinuses impassable to water. The sinus is elevated in *Nephrodium syrmaticum* and others. It is obstructed by local hairs, the rest of the margin being less ciliate,

or not at all so, in *Nephrodium diversilobum* and *Stenosemia.* In *Polypodium celebicum* and a number of its congeners the frond is cut so closely to a very hairy rachis that the hairs on the latter may obstruct the sinuses.

I am convinced that here we have the correct interpretation of serrate and otherwise inoffensively toothed margins. These structural peculiarities are among those most widespread, but hitherto they have been accepted as facts without an attempt at a general explanation being made. There are doubtless a sufficient number of instances in which this explanation will not apply, and many more in which its application is not evident, but among these must not be included the cause of the existence of those spiny margins, properly regarded as xerophytic characters, which are produced directly by strong insolation, dryness or exposure to wind, for these more often between the sharp teeth have rounded sinuses through which water might run more readily than it would around a straight or slightly convex margin.

Dryness of the nether surface in the ferns is doubly desirable, both for the sake of the fructification and also to avoid plugging the stomata. The protection of the fruit will be discussed later. The stomata are confined to the nether surface of every vegetative frond in the entire fern flora of San Ramon except in the single case of *Monogramma,* which has no differentiated ventral surface. Epiphytes dispense with incised margins more commonly than do terrestrial forms because, if their nether surface should be wet the water will be removed with relative promptness by evaporation; but among both groups, epiphytes and geophytes, it is almost invariably true that fronds which have margins entire in detail have other devices adapted for keeping their nether surfaces dry. Among these are sharp, deflexed or ruffled margins, convex or minute ultimate divisions of other forms adapted to the facile escape of water from the frond.

Besides the excretion of a cuticle sufficiently waxy to be more or less unwettable, many ferns have outer walls the convexity of which is a strong factor in the same direction. These convex walls are sometimes confined to the nether surface, sometimes they are more convex in such situations. Such an adaptation is naturally to be found chiefly in ferns growing in places where they are likely often to be wet; as a matter of fact, it is confined entirely to ferns growing in such places. It has already been remarked that half the depth of the cell in *Adiantum diaphanum* is made of the projections. Between walls which are convex to this extent and trichomes, no line can be drawn. Dry trichomes, unicellular or pluricellular, occur over the mesophyll of various species of *Nephrodium* and others. Very many species have them on the veins, the reason for this restriction being the mechanical one that their bases can be more firmly anchored in the more solid walls to be found there. A better protection against wetting than is produced by dry hairs is furnished by glandular ones such as are to be found in many species of *Nephrodium*. These are of characteristic form, size and color for each species.

Stomata occur on the upper surfaces of the fertile fronds of *Acrostichum* and *Cheiropleura* and on all four faces of those of *Monogramma;* otherwise they are entirely confined to the nether surfaces of all our ferns. Here they may be equally distributed or they may be in streaks or, to a limited measure, in groups. They occur only over the parenchyma. The number varies from 7 to 400 per square millimeter. As a general rule, the number and size vary in opposite directions. In most ferns, the outer walls of the guard cells are in the same plane as the outer walls of the epidermal cells.

The specialization of the epidermal cells of ferns is what the environment demands. In terrestrial species, with very few exceptions, they are not extremely differentiated from the parenchyma, but that this difference be-

tween the majority of the ferns and the majority of spermaphytes is adaptive, not a primitive character on the part of the ferns is amply proved by the exceptions. Some species in every tribe of Polypodiaceæ represented at San Ramon are without chlorophyll in the epidermis. The spicular cells of the Vittarieæ have already been mentioned, and in four tribes, Davallieæ, Asplenieæ, Polypodieæ and Acrosticheæ, are species which have carried protective specialization deeper than the epidermis, having a specialized hypodermis. In the majority of ferns it is more correct to describe the epidermis as specialized in other directions than for protection than to call it undifferentiated. In very numerous ferns it is, indeed, a highly specialized photosynthetic tissue which is not infrequently more specialized than any part of the parenchyma. In *Adiantum diaphanum* an especially large share of the photosynthesis falls to the epidermis, the upper and nether epidermis being in direct contact in a considerable part of the frond. It will be noticed that the ones which have been mentioned in this connection are nearly all terrestrial species, but some very large terrestrial species are like many epiphytes in the more or less complete suppression of chlorophyll in the epidermis, this being the case in *Nephrodium ferox, N. cyatheoides* and the huge variety of *Aspidium luzeanum.*

It is the mesophyll rather than the epidermis which shows less specialization in the ferns than in the seed plants. In the parenchyma the differentiation is especially backward. A complete and typically developed palisade parenchyma does not occur, but layers which are like it in compactness and more or less approaching it in form and arrangement of the cells are found in many species. According to its necessity, a hyaline epidermis has been differentiated in one or more genera of every tribe. This is usually found only beneath the upper epidermis, but underlies the nether as well in *Davallia solida, Asplenium musæfolium, Polypodium incurvum* and

others. This tissue is found only in xerophytes, and the notion has some time had vogue that its function is to act as a water-store. That this is not in general the case I have pointed out elsewhere. Among the ferns, the walls of the hypodermis are almost invariably so thick that any change in size or form, which is necessary if they are to give up any water, is quite impossible.

On the other hand, there are a very few species provided with an evidently available store of water. Thus *Polypodium caudiforme,* with two layers of non-collapsible cells under the upper epidermis, has one layer of collapsible ones next the nether one. The walls of the green parenchyma of *Loxogramma iridifolia, Antrophyum reticulatum* and *Polypodium accedens* are somewhat collapsible with loss of water, but not greatly so. In this direction again, it is *Niphobolus* of all our ferns in which specialization has gone farthest. *Niphobolus* is likewise the only genus having trichome-hydathodes. These hairs are different in form, those of each of our species being characteristic, our most xerophytic species, *N. adnascens,* being glabrescent; but they are all alike in insertion, each hair growing in a pit which is practically filled by the basal cell of the trichome. The basal cell is alive with considerable evident contents. When the leaf is damp, the contents fill the cell; it can then absorb water from the cells borne on it whether they are dead or alive, and give water to the cells within. Judging by the high turgor in *Niphobolus* leaves this movement must be fairly active. When the outside of the leaf becomes dry, the outer cells of these trichomes lose their water and promptly draw on the basal cell. If the connection were maintained, the basal cell would then supply itself from the interior of the leaf. But this does not happen, because its protoplasm instead of keeping in connection with the cells within and without shrink away from its wall and contracts into a lump touching but one end of the cell. A dead air space, or approximate vacuum, in

the basal cell then protects the interior of the leaf from evaporation. The protoplasm of the basal cell collapses instead of maintaining its turgidity, because it loses water outward faster than it can get it from within. This condition must be due both to the very high turgor of the mesophyll and to the unequal permeability of the end-walls of the basal cell, their outer ends being pitted.

Very many ferns have their vein tips hyaline and, as a rule, the clear spots are hydathodes, clear because of the absence of air-containing spaces. Such hydathodes are found among other ferns in *Meniscium, Arthropteris, Nephrolepis,* many *Aspleniums, Hymenolepis,* numerous *Polypodiums* and various others. White incrustations of lime are regularly found on these hydathodes on some species of *Nephrolepis,* and occasionally on various other ferns. There are other hyaline vein-tips, as in *Asplenium subnormale,* which are not active hydathodes, though perhaps potential ones.

Except as it is modified by correlation with other structural peculiarities, such as fineness of dissection of the frond, the venation in general is decidedly closer in species of arid than those of humid habitats. Anastomosis of the veins makes the venation closer in effect, and, as a general proposition, with many exceptions, ferns with anastomosing veins are more xerophytic in habitat than those with free veins. The frequent correlation between large size and ampleness of frond and reticulate venation is too obvious to need elaboration.

The articulation of the stipe to the rhizome and of the pinnæ or segments to the stipe facilitate the reduction or removal of the leaf surface whenever necessary. It is thus an adaptation to life where plants must sometimes endure a more or less prolonged want of water. Like other adaptive characters, but in greater measure than many, because it involves a deeper specialization, it has a taxonomic value, as species, genera and even larger groups have developed a constant adaptation to

certain conditions. Under the conditions at San Ramon (and under tropical conditions in general), then, the characteristically epiphytic groups have articulate stipes; the characteristically terrestrial ones, non-articulate stipes. Among our Asplenieæ a single genus exists which, when mature, is always epiphytic in exposure; namely, *Stenochlæna.* Its pinnæ under these circumstances are articulate, but young plants near the ground are without articulations. Our Pterideæ include no epiphytes and no plants with structural articulations. However, there are some species of *Adiantum,* notably *A. opacum,* the pinnules of which are deciduous in an emergency. The Vittarieæ as a group are non-articulate epiphytes. To endure this condition they have thick, rolling leaves with very heavy epidermal walls and very few stomata.

The stems of the Polypodieceæ are moderately modified in adaptation to a wide range of conditions—more modified and more variously so than one might imagine from text-book comparisons with Equisetum and Lycopodium. The most primitive form of fern stem is probably a short, erect one such as is observed in *Aspidium, Diplazium* and *Pteris.* This may be subterranean, or barely superficial, or in damp and darker places may rise into the air, as is the case with most of the larger *Diplazia.* On trunks deeply covered with vegetation some small ferns have stems standing out radially with a dense apical tuft of small fronds. A large number of ferns lift their fronds above competition with their terrestrial neighbors by assuming the scandent habit. The majority of these maintain their connection with the ground, but are still, if we classify all ferns as either terrestrial or epiphytic, rather to be regarded as belonging to the latter class, because of their exposure. Numerous other ferns keep to the ground or to their original aërial support, but remove their leaves from competition with one another by a creeping habit and by bearing them at considerable intervals. Neither the geo-

tropism of the stem, determining whether it shall be prostrate or erect, nor its symmetry, radial or bilateral, seems to be a very deep-seated or firmly fixed character, for both change in many instances within universally recognized generic or subgeneric limits.

Fleshy rhizomes serving as water reservoirs are found in *Drynaria* and its relatives, most notably in *Polypodium heracleum* and less developed in *Photinopteris* and *Polypodium affine*. All rhizomes are protected against loss of water at the apex and many throughout their length by scales which vary in form, size and texture. Exceedingly harsh palæ are found on *Dipteris* and *Dennstædtia Williamsi*, two ferns with notably stout rhizomes. It is very probable that these are protective against animals such as deer and hogs, which are very numerous, but which never, so far as I have observed, touch these species. Similar scales protect the fleshy crowns of various Cyatheaceæ. The muricate stems of *Stenochlæna* and muricate stipes of *Dennstædtia erythrorachis* and other species probably have the same function. Dead bases of stipes must provide other rhizomes with an unpalatable mantle, but most fern stems are too hard to need protection of this kind. Many stems contain chlorophyll when exposed to light. It is regularly present in those of *Polypodium accedens, P. dolichopterum, P. commutatum* and *P. Schneideri*.

The correlation between length of rhizome and length of stipe has just been mentioned. A similar correlation exists between length of one or the other of these and the development of the lowest pinnæ. Deltoid fronds—that is, fronds with elongate lowest pinnæ—would seriously interfere with each other's light if they were not borne on wide-creeping rhizomes or on very long ascending stipes or on comparatively short but more horizontal stipes. Fronds with short stipes, unless these are very remote, usually have the pinnæ reduced toward the base. Under the same conditions, entire fronds are narrowed

below. Among tufted fronds, such forms are the rule. All the lower pinnæ are sometimes equally and extremely reduced, the largest ones being immediately above these. Such fronds are physiologically like those with long stipes and large lowest pinnæ. Fronds with broad bases which are so placed as not to overlap might lose considerable light between the stipe, but in general this space is utilized. A long, broad wing on the stipe sometimes extends the assimilating area. In many species the lowest pinnæ are deflexed forward so that they practically fill the space between the frond bases. Deltoid fronds usually reach the same end by a strong basicopic development of the lowest pinnæ. Since half the margin of the frond is longer than its axis, most pinnæ being narrowed toward their apices lose considerable space between their distal ends. This form economizes the conduction of water and food and is mechanically good because it is compact, but it involves a waste of light which is saved in *Nephrodium diversilobum* and *N. Bordeni,* which broaden toward almost truncate apices. The pinnæ, as well as the fronds of ombrophilous plants, as is to be expected, are in general fitted together so as to utilize all possible light consistent with the disposible surface. Notably perfect mosaics are presented by *Davallia solida, Dennstædtia Williamsi* and all fronds with trapezoidal or lunulate pinnæ or pinnules. The pinnæ of *Lindsaya pulchella* would overlap wastefully were they not set at such an angle that they act like a grating.

Perhaps the most interesting specialization of the roots of ferns, but one which I have seen mentioned nowhere else, is the massing of very numerous roots, all densely covered by a felt of long, brownish, persistent root-hairs which form a structure for the storage of water. Appropriate to their function, these masses of hairy roots are commonly found on ferns growing on naked rocks or tree trunks, but never on ferns with abundant soil nor on trunks laden with moss. Persistent root-hairs as

organs of attachment are very common among ferns and other plants, and it is doubtless through roots clinging by such means that these water stores have been evolved. Obviously, too, the deepest roots in every mass of this kind still fasten the plant to its support, but that more than the deepest layer in the mass, which is sometimes two centimeters thick, can serve in this way, is, of course, impossible. There is every gradation from these thick pads down to those so thin that they may serve for attachment alone, as is the case with *Polypodium macrophyllum.*

Asplenium epiphyticum has roots of two kinds: those of unlimited length, positively geotropic, forming a jacket around the stem, diarch, flanked by sclerenchyma, unbranched, with hairs along the sheltered side, and roots two or three centimeters long, slightly negatively geotropic, freely branching, closely appressed to the support, clinging by copious hairs, of similar structure to the preceding, but with more sclerenchyma. These latter are the clinging roots. The former under favorable circumstances will reach the ground and branch. *A. scandens* likewise has roots of two kinds. The bracing roots of *Nephrolepis* are very familiar objects. Those of several species of *Diplazium* are very stiff and somewhat spreading above the ground.

The principles underlying the adaptations of the reproductive structures of ferns are very simple. The sporangia must be protected during their development against injury by dessication or otherwise; the mature spores must dry thoroughly enough to be easily and well scattered, and the drying of the spore must not involve too great a dessication of the frond. The structures found in ferns are a compromise between these rather antagonistic principles. Ferns almost always protect their sporangia at the same time that they avoid interference with the illumination of the assimilating organs by restricting the former to the nether surface of

the frond. Our physiological exceptions are *Psomiocarpa* and *Stenosemia,* the vegetative and reproductive fronds of which are distinct, and *Lecanopteris,* which may not be entirely dependent upon photosynthesis for its organic food. For the sake of facile nutrition and to preserve the normal exercise of its functions by the nether epidermis, the sporangia of practically all ferns whose vegetative and reproductive fronds are alike are collected into sori. Most ferns protect their sori by means of indusia. At San Ramon, sixty per cent. of all the Polypodiaceæ have indusia, the remaining forty per cent. including thirteen members of the old genus *Acrostichum* and a number formerly put in *Gymnogramme,* besides all those with well-defined nude sori. Any full discussion of the forms and origin of indusia would be superfluous here in view of the attention they have received as most important structures in taxonomy, but it is pertinent to the subject of this work to point out that their structure fits the local demands upon it. Thus, it is leathery in the two strongly marked xerophytic genera, *Davallia* and *Humata,* but not in their mesophytic relatives. In *Asplenium* it is the xerophytic section with fronds which has by far the firmest indusia.

A heavy coating of hairs protects the sori as well as the stomata against undue loss of water in *Niphobolus lingua* and various congeners. While the function of paraphyses in general is to protect against water rather than dessication, there are some ferns, the paraphases of which cover the sporangia so thoroughly that they must serve in their time in both ways. The protection of the sorus by the folding backward of the margin of the frond is familiar to all in the indusia of most Pteridеæ. The same effect is reached very thoroughly by two of our species of *Polypodium—P. cucullatum* and *P. gracillimum*—which have one-half of each pinna wholly or partly folded backward against the other half, covering the single sorus. In *Acrosorus* the folding is com-

plete and permanent, the edge being grown fast and the sorus opening toward the apex. Numerous ferns protect their young sori by more or less completely sinking them below the level of the frond's surface. According to the extent of the immersion and the thickness of the frond, the spots occupied by the sori may or may not be prominent on the upper surface of the frond. When they make moderately convex spots it strengthens the frond mechanically, so that the fertile part of the frond of *Nephrodium Foxii* retains its form for some time after the sterile part has begun to wilt. In *Monogramma* and *Vittaria* the sori are in deep slits, the effect being as in *Asplenium phyllitidis,* but the protection of the more open slits is perfected by capitate paraphyses. In *Polypodium incurvum,* and more prominently in *P. subauriculatum, P. nigrescens, P. schneideri* and *P. papillosum,* the sori are immersed for several times the thickness of the frond, forming very prominent projections from the upper surface.

The structures that serve to prevent the dessication of young sori serve also, without exception, to make their exposure to liquid water impossible, and there are a considerable number of ways in which they are adapted to perform this latter function well. In other cases, structures at first clearly protective are done away with or changed in such a way that as to make the mature sporangia as exposed as possible. Thus in a large part of our *Nephrodiums* and in many of their relatives the indusia partly or completely disappear as the sporangia mature. In *Asplenium scandens* and without doubt in many other species the indusia are motile, bending outward when dry, but closely appressed when wet. This movement deserves careful study both as to its commonness and its mechanism. I have noticed it to exist, but in a less pronounced manner, in *Onychium.* The indusia are beset with hairs which I interpret as water-repellent structures in various *Nephrodiums,* and are glandular hairy or glandular ciliate in others.

It has already been stated that paraphyses are in general water-repellent structures, in adaptation to which function they are provided with oily heads. The paraphyses are in part a substitute for indusia and often occur on ferns such as Acrosticheæ, which could not have indusia, but they are not rarely present in indusiate sori. They are notably developed on *Lomagramma* and *Acrostichum,* the brown color of the surface of the latter being due to them, while the sporangia are green. The branched form, like the oiliness, is evidence that they are specialized for protection against water rather than against dessication. Hairs on the end of the sporangia have the same effect. They are found in a number of species of *Nephrodium,* such as *N. setigerum* (glandular) and *N. diversilobum.* These hairs on the ends of the sporangia make the whole sorus incapable of being wet. Spores of ferns in general are not readily wet, because of their waxy and often rough or reticulate surfaces. Their resistance to wetting not merely facilitates their dispersal but insures them against germination under too temporarily favorable circumstances.

Very numerous ferns provide in a variety of ways that the dryness necessary for the dispersal of the spores shall involve the least possible dessication to the vegetative frond. One very simple means to this end is the location of the sori on the margin, or even on teeth. The marginal or apical position of the sori has been assumed independently by the plants in many different groups of ferns. As the primary purpose of this position of the sori is to insure the dryness of the sporangia and spores, it is characteristic of the plants growing in the most moisture-laden atmosphere, as in the rain- and mossy-forests. The tooth position is obviously drier than the merely marginal. The *Lindsayas* growing in the moistest places are deeply cut—even finely dissected in *L. Blumeana* of the mossy forest of Luzon. Yapp suggests that the peculiarly placed sori of *Lecanopteris* will let the spores escape only when there is wind enough to be

likely to scatter them into such places as the plant normally occupies, which are in the crowns of lofty trees.

It is probable that a considerable majority of all ferns have the fructification developed toward the apex rather than toward the base of the frond, obviously favoring the greater dryness of the fertile region. There are all grades of specialization in this respect from that in which the preference of the sori for the distal end is doubtful or not, emphasized as in the case of many species of *Nephrodium, Polypodium,* etc. The adequate drying of the mature reproductive structures without jeopardy to the proper performance of the vegetative functions is accomplished in many ferns by the specialization of entire fronds for one or the other end. In many ferns there is little or no specialization other than a difference in the length of the stipes, those of the fertile frond being the longer. In *Pteris* there is a difference in the margin, and in *P. ensifolia* the fertile frond is less compound than the sterile. The fertile fronds of *Polypodium sinuosum* yield to drought and fall off before the sterile.

There still remain a few ferns in which the differentiation has gone so far that the assimilating but not the spore-bearing surface of the frond has been practically obliterated. These are *Leptochilus* and *Cheiropleuria,* still with some expansion of green lamina, the nether surface of which is completely covered, when mature, with sporangia; *Blechnum egregium,* the fertile pinnæ of which are expanded at the base only, and *Psomiocarpa, Stenosemia, Stenochlæna* and *Lomagramma,* whose fertile fronds are almost completely without assimilating tissue. The two scandent genera have the pinnæ articulated to the rachis and the pinnæ of the fertile fronds of both are much more caducous than those of the sterile. This, with the further fact that only plants of a very considerable age are fertile, makes fertile fronds of both hard to find. The fertile frond of *Blechnum egregium* as well seems to be both rare and transitory, and on all these ferns they are to be found only in season.

A CHECKLIST OF THE NORTH AMERICAN FERNWORTS.

(Continued)

POLYPODIUM. L.

167. **Polypodium angustifolium** Sw. Rare; on the trunks of trees. Southern Florida; also in the American Tropics. The form **ensifolium** (Willd). (*Polypodium ensifolium* Willd) is a narrower form reported with the type.—*Campyloneuron angustifolium* (Sw.)

168. **Polypodium aureum** L. GOLDEN POLYPODY. HARE'S FOOT FERN. Common; on palmettoes, occasionally on the ground. Southern Florida; also in the American Tropics.—*Phlebodium aureum* (L.)

169. **Polypodium Californicum** Kaulf. Common; in the crevices of rocks. California; also in Mexico and Central America. The form **intermedia** H. & A. is found with the type and approches *P. vulgare* in appearance.

170. **Polypodium costatum** Kunze. Rare; in rocky shades. Southern Florida; also in Jamaica and Central America.—*Campyloneuron costatum* (Kuntze.)

171. **Polypodium falcatum** Kellogg. LIQUORICE FERN. Common; on old logs and the base of trees, occasionally in soil in damp, shady places. California to Alaska.—*P. Glycerrhiza* D. C. Eaton; *P. occidentale* (Hook.)

172. **Polypodium hesperium** Maxon. Not uncommon; in rocky shades. Arizona to Montana and British Columbia.

173. **Polypodium incanum** Sw. GRAY POLYPODY;

Resurrection Fern. Common; on the large branches of trees or in rocky soil. Virginia, Ohio, Iowa and Kansas, south to the Gulf; also in the West Indies, Central America and southward to Chili and Argentinia and in South Africa.—*Polypodium polypodioides* (L); *Marginaria polypodioides* (L.)

174. **Polypodium latum** (Moore) Rare; in woods. Southern Florida; also in the American Tropics.—*Campyloneuron latum* Moore.

175. **Polypodium pectinatum** L. Rare; in rocky shades. Southern Florida, also in the American Tropics.

176. **Polypodium phyllitidis** L. Not uncommon; in rocky woods. Florida; also in tropical America.—*Campyloneuron phyllitidis* (L.)

177. **Polypodium plumula** H. B. K. Rare; in woods. Southern Florida; also in tropical America.

178. **Polypodium Scouleri** H. & G. Rare; on trunks of trees or occasionally on rocks, near the coast. California to British Columbia.

179. **Polypodium Swartzii** Baker. Rare; on the branches of trees. Southern Florida; also in the West Indies and south to Brazil.—*Phymatodes Swartzii* (Baker); *Phymatodes exiguum* (Hew.)

180. **Polypodium thysanolepis** A. Br. Rare; in stony open ground Arizona; also in the West Indies and southward through Central America to Peru.

181. **Polypdium vulgare** L. Common Polypody. Abundant on shaded rocks. Throughout North America except in the coastal plain of

the Gulf States; also in Europe, Asia, China, Japan and South Africa.

Ecological and monstrous forms of this species have been named **alato-multifidum, attenuatum, bifido-multifidum, Cambricum, Churchiae, Columbianum, deltoideum, hastatum, marginale, multifidum, platylobum, ramosum, rotundatum, semi-lacerum,** and **sinuatum.** The form *Cambricum* is the Welsh polypody and forma *rotundatum* has round-ended pinnules. Any of these forms are likely to occur with the type. They are described in the Fern Bulletin XIV, 33, 1906.

182. **Polypodium vulgare angustum** Muell. Not common; on shaded rocks. In the Alleghenies from New York to Virginia.—*Polypodium vulgare deceptum* Maxon; *P. v. biserratum* Millspaugh; *P. v. acuminatum* Gilbert; *P. v. oreophilum* Maxon.

POLYSTICHUM Roth.

183. **Polystichum acrostichoides** Michx. CHRISTMAS FERN. SHIELD FERN. Abundant; especially in moist, rocky woodlands. Nova Scotia and New Brunswick to Wisconsin, Iowa and south to the Gulf States.—*Aspidium acrostichoides* Sw.; *Dryopteris acrostichoides* Kuntze.

The form **crispa,** Clute is a wavy-leaved form occurring with the type; **f. incisum** A Gray (*P. acrostichoides Schweinitzii* Beck) is an incised form also likely to occur. **f. multifida** Clute is a form with deeply divided pinnules reported from Connecticut, New York and New Jersey; **f. recurvatum** Clute has the pinnules recurved and the margins reflexed. It

has been reported from Connecticut and Virginia.

184. **Polystichum aculeatum** (L.) Prickly Shield Fern. Common; in rocky woods and slopes. California and Oregon to Washington; also nearly throughout the world in temperate and tropical regions. Extremely variable in the cutting of the fronds and thus giving rise to many varieties. More than forty have been catalogued.—*Aspidium aculeatum* Sw.; *Dryopteris aculeata* Kuntze.

The American forms **angulare** Presl; **Californica** D. C. Eaton, and **lobatum** Ait. are likely to be found with the type.

185. **Polystichum aculeatum Braunii** (Spenner) Not uncommon; in moist shaded woods. Maine, New Hampshire, Pennsylvania, Michigan and Washington northward; also in Europe, Asia and the Hawaiian Islands.—*Aspidium aculeatum Braunii* (Spenner); *Dryopteris aculeata* Kuntze. *Polystichum Braunii* (Spenner)

186. **Polystichum aculeatum scopulinum** (D. C. Eaton.) Not uncommon; in rocky places. California and Arizona northward to Washington and Idaho and in Quebec.—*Aspidium aculeatum scopulinum* D. C. Eaton.; *Polystichum scopulinum* (D. C. Eaton.)

187. **Polystichum Lemmoni** Underw. Rare; Northern California to Washington. Reported by D. C. Eaton to be identical with *Polystichum mohriodes* Bory from South America and until recently listed under this name.

188. **Polystichum lonchitis** (L.) Holly Fern. Common; in rocky woods. Nova Scotia, Wis-

consin and Washington northward and in the mountains of Utah, Colorado and California; also in Northern and central Europe, Asia and in the Himalyas.—*Aspidium lonchitis* Sw. *Dryopteris lonchitis* Kuntze.

189. **Polystichum munitum** (Kaulf.) Common; on stony slopes. California and Arizona to Alaska.—*Aspidium munitum* Kaulf; *Dryopteris munita* Kze.

The form **imbricans** D. C. Eaton with close-set pinnae, the form **inciso-serratum** D. C. Eaton with deeply cut pinnae and **f. flabellatum** A. A. Eaton with forked fronds may be expected with the type.

PTERIS L.

190. **Pteris aquilina** L. BRACKEN; BRAKE. EAGLE FERN. Abundant in woodlands, pastures and along roadsides. Throughout most of the known world. The form **crispa** Wollaston is reported from Massachusetts.—*Pteridium aquilinum* (L.)

191. **Pteris aquilina pseudocaudatu** Clute. SLENDER BRACKEN. Common or abundant; in sterile soil. Long Island to Texas mostly in the coastal plain. Until recently confused with *Pteris caudata* L.—*Pteridium aquilinum pseudocaudatum* Clute; *P. latisuscula* Desv.?

192. **Pteris aquilina pubescens** Underw. Common; in situations preferred by the type. Arizona to British Columbia.—*Pteris aquilina lanuginosa* Underw.

193. **Pteris caudata** L. Somewhat rare; in open places. Southern Florida; also nearly around the world in the tropics.

194. **Pteris cretica** L. Rare; on banks and walls. Georgia and Southern Florida; also around the world in the tropics.

195. **Pteris longifolia** L. Long-leaved Bracken. Common; on walls and rocky banks. Florida Alabama and Louisiana near the Gulf; also throughout the tropics.

196. **Pteris serrulata** L. f. Saw-leaved Bracken. Common on old walls. South Carolina to Louisiana and Florida, mostly near the coast; also in China and Japan. According to Christiansen, this is properly *Pteris multifida* Poir.

Scolopendrium J. E. Smith.

197. **Scolopendrium vulgare** J. E. Smith. Hart's-tongue Fern. Rare and local; in moist ravines and rocky woodlands. New Brunswick, Ontario, Central New York and Tennessee; also in Europe, Asia Minor, Persia, Japan and Mexico. *Phyllitis scolopendrium* (L.); *Scolopendrium scolopendrium* (L.)

Struthiopteris Willd.

198. **Struthiopteris Germanica** Willd. Ostrich Fern. Common or abundant; in moist shades, especially along streams. Nova Scotia to Virginia, Iowa and British Columbia; also in northern and central Europe and in Asia. The form **pubescens** Terry is reported from Connecticut. —*Onoclea Struthiopteris* Hoffm.; *Matteuccia struthiopteris* (L.)

Taenitis Sw.

199. **Taenitis lanceolata** (L.) Not common; on the trunks of trees. Florida; also in the West Indies, Guiana and Guatemala.—*Cheilogramma*

lanceolata (L.); *Paltonium lanceolatum* (L.)

VITTARIA Smith.

200. **Vittaria lineata** (L.) GRASS FERN. Not uncommon; on the trunks and branches of trees. Southern and central Florida; also in the West Indies and tropical America.

WOODSIA R. Br.

201. **Woodsia glabella** R. Br. Somewhat rare; on rocks. New Brunswick, Vermont, New York and British Columbia northward; also in northern Europe and Asia.

202. **Woodsia hyperborea** (R. Br.) Rare; on rocks. Maine, Vermont, New York and Ontario to Alaska and Greenland; also in northern Europe and Asia and in the Himalayas.—*Woodsia alpina* (Bolton.)

203. **Woodsia Ilvensis** (L.). RUSTY WOODSIA Common; on exposed trap rock. North Carolina, Kentucky and Iowa to the far north; also in Greenland and northern Europe and the mountains of Asia.

204. **Woodsia Mexicana** Fee. Rare; in rocky shades. Texas, New Mexico and Arizona; also in Mexico.

205. **Woodsia obtusa** (Spreng.) COMMON WOODSIA. Common or abundant; on shaded rocks and in woodlands. Georgia, Alabama and Texas to Alaska and Labrador; also in Peru. The form **angusta** Peck and **f. nana** Lemmon may be expected with the type.

206. **Woodsia obtusa glandulosa** D. C. Eaton. New Mexico and Arizona.—*Woodsia obtusa Plummerae* Lemmon.

207. **Woodsia Oregana** D. C. Eaton. Somewhat rare; in rocky soil. Northern Michigan, Wisconsin, Oklahoma, Arizona and California to British Columbia and Northward.

208. **Woodsia scopulina** D. C. Eaton. Rare; on rocks. Ontario and Michigan to British Columbia and Alaska; also in the mountains of Arizona and California.

The form found in Michigan and Minnesota has been described as *W. Cathcartiana* Robinson. It differs only in the form of pubescence and is more properly **Woodsia scopulina Cathcartiana.** (Robinson.)

WOODWARDIA Smith.

209. **Woodwardia angustifolia** J. E. Smith. NARROW-LEAVED CHAIN-FERN. Common in shaded marshes near the coast. Maine to Florida, Texas and Arkansas; also in Michigan.—*Lorinsera areolata* (L.); *Woodwardia areolata* (L.).

210. **Woodwardia spinulosa** Mart & Gal. Rare; in moist places. Arizona, California and Washington. The form **ramosa** A. A. Eaton is reported from California. This species is often considered a form of *W. radicans.*

211. **Woodwardia Virginica** (L.) COMMON CHAIN-FERN. Abundant in open swamps. Nova Scotia, Ontario and Michigan to Arkansas, Louisiana and Florida; also in Bermuda. A small form is reported from South Carolina as **f. thelyteroides** Pursh.—*Anchistea Virginica* (L.)

EDITORIAL

In honor of the completion of fifteen volumes of this magazine, and at the solicitation of numerous subscribers, the editor has been led to use his portrait as a frontispiece in this issue. Our critics may now observe how fifteen years of fighting for a sane nomenclature and a reasonable interpretation of the species concept has furrowed the editorial brow, silvered his raven locks, and put a general crimp into his ambition to make everybody interested in ferns. But even a careful look at the features presented will fail to discover any inclination to give up the fight. As an additional contribution, the editor has autographed the copies intended for subscribers. Anybody who prefers a plain copy may exchange his autographed copy for it, and those who do not get an autographed copy may have one by returning the regular copy, and requesting it.

* * *

In this issue we reprint an extended article on the ecology of some tropical ferns which we think our readers will find worth a careful reading. The ways in which ferns have adjusted themselves to their position in life must ever be of absorbing interest to all who are not mere fern collectors. Considerable pleasure may be gained by an investigation of our own ferns in the light which this article throws upon them. Touching this subject, however, it may be said in passing that the subject of plant ecology is still so new that it is quite possible that many of the deductions thus far made may not hold when further evidence is forthcoming. The article is one that should stimulate thought and experiment among our own fern students, with a view to proving or disproving the ideas held at present.

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.

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