# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

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AMERICAN FERN SOCIETY



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# American Fern Journal

VOL. 27 JANUARY–MARCH, 1937 NO. 1

## Southern Occurrences of Dryopteris Clintoniana

EDGAR T. WHERRY[1]

On June 1, 1927, Mr. Harry W. Trudell and the writer, out on a camping trip, stopped to shave at a limpid, purling brook in the woods 1½ miles east of Forney, Cherokee County, Alabama. Most unexpectedly we found that just back of the spot we had selected there was growing a *Dryopteris* of the general aspect of *D. clintoniana*, though differing from the more northern material of this fern in certain respects. The photograph of it taken at the time is here reproduced in Plate one; plants growing near-by in more open situations showed more erect fronds.

Subsequent herbarium study showed that a similar plant had already been collected in the state: it was discovered about 1895 by the late Professor S. M. Tracy, in a needle-palm swamp said to be 4 miles south of Auburn in Lee County, and was referred by Mohr[2] to *D. floridana;* from this it differs, however, in numerous respects, notably in having the frond widest well below the middle, without any conspicuous, sudden change in degree of cutting where sterile pinnae give way to fertile ones, and in having the lower pinnae acuminate with a sharp tip

[1] Contribution from the Botanical Laboratory and Morris Arboretum of the University of Pennsylvania.

[2] Plant Life of Alabama: 317. 1901.

[Volume 26, No. 4 of the JOURNAL, pages 113–148, plates 12–15, was issued Dec. 16, 1936.]

and the marginal teeth sharp-pointed. I have been unable to relocate this colony, but collections made there by Pollard and Maxon in 1900 are widely distributed in herbaria. More recently, ferns of more or less the same features have been found in Arkansas, Louisiana, and North Carolina.

At intervals during the subsequent ten years I have repeatedly tried to find some feature which would separate this fern sharply from *Dryopteris clintoniana,* but have never succeeded. Only varietal status seems possible for it, as follows:

*Dryopteris clintoniana* (Eaton) Dowell, var. **australis,** var. nov. A varietate boreali differt soris plusminusve medialibus. Differing from the northern plant in having the sori more or less medial, instead of rather near the midvein. Sometimes, though by no means consistently, tending to develop fertile pinnae only above the middle of the blade, and sinuses in the upper ones nearly as wide as the adjacent segments; the northern variety often showing fertile pinnae near the blade-base, and sinuses at most $\frac{1}{3}$ as wide as segments.

Type in herbarium Academy Natural Sciences Philadelphia, collected by Edgar T. Wherry July 15, 1932, in humus-rich subacid woodland soil $1\frac{1}{2}$ miles east of Forney, Cherokee Co., Alabama.

The northern plant, which now requires a varietal name, may become:

*Dryopteris clintoniana* (Eaton) Dowell, var. **genuina,** nomen novum.

Records of the southern variety known to date are:

ALABAMA.—The plants of both colonies above referred to show marked variation in rhizome scales, from pale brown and dull to nearly as dark brown and lustrous as in *D. goldiana;* the specimen selected as type exhibits the latter extreme, but a cotype sheet, bringing out the rootstock features (with attached sterile fronds), has

Dryopteris clintoniana var. australis at Forney, Ala.

pale scales. Pinnae may lie close together, as in the frond shown at the right of Plate 1, or again may be spaced as widely as is normal in var. *genuina*. The sinuses between fertile segments are usually very narrow, as in the frond pictured, and also the type specimen, but on occasional vigorous plants may be wider.

ARKANSAS.—Specimens from rocky woods just north of Shirley, Van Buren Co., have been distributed by the discoverer, E. J. Palmer, and also by Demaree and Moore. Some of these have much the aspect of the Alabama material, and the sori lie well out, being at least medial or even slightly supra-medial. Here too the scales vary from the pale brown of *D. clintoniana* to the dark and shining ones of *D. goldiana*. The latter is approached also in one other respect—the basal pinnae may have their lowermost segments shortened, so that their outline is somewhat lanceolate. Sinuses between lobes vary from narrow to wide, the fronds in extreme cases becoming bipinnate.

LOUISIANA.—Early in 1936 Dr. Clair A. Brown discovered a colony 6 miles southeast of Baton Rouge, which I visited in September. Here the plants approach var. *genuina* in having sori beginning to appear not far above the base of the blade, and occupying a slightly inframedial position. The sinuses between fertile lobes show, however, a marked tendency to widen, so the occurrence is classed as var. *australis*.

NORTH CAROLINA.—Material collected by Rev. Fred W. Gray 9 miles north of Charlotte, Mecklenburg Co., has been figured by Blomquist.[3] This shows an approach to *D. floridana* in elliptic frond-outline, the lower 4 pairs of pinnae being progressively shortened, but is *clintoniana* in every other respect. In the narrow sinuses

[3] Ferns of N. C.: 65. 1934.

between fertile lobes it is like var. *genuina*, but the medial sori shown in the figure cited place it in var. *australis*. Variation occurs in the latter feature, however, for in fronds recently sent by Mr. Gray to the Philadelphia Academy the sori are distinctly infra-medial.[4]

Two possible explanations of the remarkable variability shown by the plants under discussion suggest themselves. One is that they represent the result of hybridization between several species. The occasional dark scales and lanceolate basal pinnae would indicate *D. goldiana* to have been one of these. Tendencies toward basally narrowed blade, development of fertile pinnae only terminally, and widening of sinuses between fertile segments all point to *D. floridana* having been another. Movement of the sori out from the midvein suggests the entry into the complex of *D. marginalis*. Finally, the outlines and cutting of the pinnae correspond most often to *D. clintoniana genuina*.

The alternative explanation, which is favored here, is that we are dealing with a stock which has already given rise to several descendants, and is still undergoing evolution. *D. clintoniana genuina* and *D. goldiana* represent, then, offshoots which migrated northeastward, while *D. floridana* is one which moved coastward. In these, features which appear in the ancestral stock as mere uncorrelated tendencies became so definitely combined and stabilized that we can recognize one distinct variety and two independent species.

PHILADELPHIA, PA.

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[4] Although full discussion of more northern variants is beyond the scope of the present article, record should be made of the fact that material of *D. clintoniana* from as far north as Dauphin and Berks counties, Pennsylvania, shows an approach to var. *australis* in sorus-position. On the other hand, var. *genuina* is known down to Dade Co., Georgia (Pyron and McVaugh, 1936).

# All in a Day's Trip—Tennessee[1]

D. R. BARTOO

We began our study five miles east of Monterey, just off U. S. highway 70. Here on the Cumberland Plateau (elevation 2,000 feet) in a small swampy area and associated with Sagittaria and Sphagnum, we observed *Osmunda regalis* var. *spectabilis, Osmunda cinnamomea* and *Woodwardia areolata;* the latter growing in great abundance. Near the margin of the swamp which was rather densely shaded by oaks, tulip poplars, and maples were numerous plants of *Thelypteris noveboracensis.*

As we continued our journey eastward, we halted some four miles nearer Monterey to note the several rather mediocre plants of *Lygodium palmatum* clinging to a crevice of a northward exposure of sandstone outcropping. They were a contrast, indeed, to the luxuriant growth of this fern a few miles farther east where it may be found along the sandy banks of shaded brooks.

It was ten o'clock on July 20th before our party of 20 had reached Bee Rock, a high sandstone bluff one mile southeast of Monterey. This vantage point gave us a commanding view of the headwaters of the Calf-killer River some 600 feet below. Here our study proper was to begin. As we viewed this rugged expanse of wooded hillsides, with here and there an outcropping of sandstone, little did the party realize the difficulty of the course ahead. We would first descend rapidly from cliff to cliff and through crevices, then a more gradual descent would lead us down a two-mile valley westward. We would follow the course of a small stream-bed. At the lower end of the two-mile valley, we would cross the

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[1] Read before the Botany Section of the Tennessee Academy of Science November 29, 1935.

main valley of Stamp's Hollow and follow up a southwest branch for about two miles to the head, where the water flows from a cave in the mountain side and falls to a depth of 151 feet. This falls area (known locally as the cave falls) offers one of the most interesting studies that I have ever known. This was to constitute the climax of our work for the day.

As we descended from Bee Rock, we observed fine plants of *Asplenium montanum* growing from the crevices of the weathered sandstone cliffs above us. Just below the bluff in the soil of the upper wooded area a few plants of *Pteridium latiusculum*, var. *pseudocaudatum*, *Pellaea atropurpurea* and *Dennstaedtia punctilobula* were seen. Then as we descended into the deeper, richer woodland, we saw *Polystichum acrostichoides*, *Asplenium platyneuron* and *Botrychium virginianum*, none of which were in great abundance. *Polypodium virginianum* and *Polypodium polypodioides* took on their characteristic poses atop large sandstone boulders which almost overshadowed the stream. *Thelypteris marginalis* was nearer the brook but only a few plants were observed at this place.

Farther down and some 300 feet below Bee Rock were *Adiantum pedatum*, *Cystopteris fragilis* and *Cystopteris bulbifera* while our approach to the bottom of the valley gave us a few plants of *Thelypteris spinulosa* var. *intermedia*. In the higher altitudes of this valley the predominating trees were oaks, but as we approached the lower levels, the beeches and tulip poplars became as abundant as the oaks.

We now followed up the cave-falls branch of Stamp's Hollow. The ascent was gradual and we kept close to the stream-bed. The narrow flood plain (a few feet in width) was densely wooded while steep wooded slopes on either side aided in maintaining a constantly high

humidity. The predominating trees were oaks with sprinklings of tulip poplars, beeches, and maples. It was upon these wooded slopes and plains that we found *Athyrium angustifolium*, *Athyrium asplenioides* and *Thelypteris spinulosa* var. *intermedia* at their best. Two or three plants of *Botrychium dissectum* var. *obliquum* were also observed. Near-by were a few small plants of *Onoclea sensibilis* and *Thelypteris Goldiana*. *Thelypteris hexagonoptera* was in abundance in areas which were less densely wooded, while here and there *Asplenium resiliens* greeted our eyes. The valley had now become narrowed to a V-shape with no flood plain. *Camptosorus rhizophyllus* covered huge sandstone boulders which had fallen down to block the stream's course.

We were now approaching the falls area and the temperature had suddenly dropped. The valley had suddenly widened to some 200 feet, and we became conscious of the fact that we were descending instead of ascending. About 200 feet before us was a semicircular precipice of solid rock rising to a height of 151 feet which terminated the upper limit of our valley. This falls area consists of a plain plot of ground about 200 feet square which slopes rather abruptly towards the precipice. The whole area receives a cool mist from the falls as the water streaks down through the central portion of the precipice and disappears into the sink beneath. Readings on two different dates at three different stations showed the temperature to be almost constant at 71 degrees Fahrenheit. These readings were taken in the summer time when the roadside temperatures were 75 and 96 degrees Fahrenheit. This constantly low temperature, no doubt, is due to the fact that water flowing from the cave above had an almost constant temperature of 61 degrees (Summer). The soil underneath is a black, rich leafmold, the result of ages

of decay of accumulated leaves and wood which have fallen to the depths from above. It is very pliable to a depth of six inches or more and is constantly wet. The few trees within the area consist of birches, hickories and tulip poplars. None of them are large.

It was in this rather invariable environment that the following ferns seemed at their best: *Thelypteris Goldiana,* comprising more than 100 large thrifty plants; *Thelypteris spinulosa* var. *intermedia,* by the scores; and *Cystopteris bulbifera* hanging from the limestone layers of the rocky wall near the waterfalls. *Cystopteris fragilis* and *Thelypteris marginalis* were abundant near the margin of the falls area.

No less luxuriant are the mosses of this area. Decaying logs are completely covered with thick mats of moss through which ferns are growing. Boulders and rocks, except those directly underneath the falls, are hidden beneath a complex of fern-moss vegetation.

Upon our return we followed down Stamp's Hollow a distance of some four miles. About three miles from the falls we observed *Woodsia obtusa* and *Pellaea atropurpurea* growing in abundance on exposed limestone cliffs in sunny situations.

It is interesting to note that this six or seven mile trip included an observation of 30 of the 31 ferns previously found in Putnam County. *Asplenium cryptolepis* had previously been observed about one mile southwest and some 400 feet above the falls area growing upon limestone bluffs. Two of the Lycopodia had also been observed about two miles southwest of the falls upon the Cumberland Plateau. *Lycopodium porophilum* was in a stream underneath a dripping waterfall while *Lycopodium dendroideum* occurs abundantly just north of Monterey lake near the highway. The following list of ferns in Putnam County includes *Asplenium crypto-*

*lepis* and the two Lycopodia named above, none of which were observed on this trip.

FERNS OF PUTNAM COUNTY—TENNESSEE

*Woodsia obtusa* (Sprengel) Torr.
*Cystopteris bulbifera* (L.) Bernh.
*Cystopteris fragilis* (L.) Bernh.
*Onoclea sensibilis* L.
*Thelypteris noveboracensis* (L.) Nieuwland.
*Thelypteris marginalis* (L.) Nieuwland.
*Thelypteris Goldiana* (Hooker) Nieuwland.
*Thelypteris spinulosa* (O. F. Muell.) Nieuwland.
var. *intermedia* (Muhl.) Nieuwland.
*Thelypteris hexagonoptera* (Michx.) Weatherby.
*Polystichum acrostichoides* (Michx.) Schott.
*Dennstaedtia punctilobula* (Michx.) Moore.
*Athyrium angustifolium* (Michx.) Milde.
*Athyrium acrostichoides* (Swartz) Diels.
*Athyrium asplenioides* (Michx.) Desv.
*Camptosorus rhizophyllus* (L.) Link.
*Asplenium Trichomanes* L.
*Asplenium resiliens* Kze.
*Asplenium platyneuron* (L.) Oakes.
*Asplenium montanum* Willd.
*Asplenium cryptolepis* Fernald.
*Woodwardia areolata* (L.) Moore.
*Pellaea atropurpurea* (L.) Link.
*Adiantum pedatum* L.
*Polypodium virginianum* L.
*Polypodium polypodioides* (L.) Watt.
*Pteridium latiusculum* (Desv.) Hieron.
var. *pseudocaudatum* (Clute) Maxon.
*Lygodium palmatum* (Bernh.) Swartz.
*Osmunda regalis* L. var. *spectabilis* (Willd.) Gray.
*Osmunda cinnamomea* L.
*Botrychium dissectum* Spreng. var. *obliquum* (Muhl.) Clute.
*Botrychium virginianum* (L.) Swartz.
*Lycopodium porophilum* Lloyd and Underwood.
*Lycopodium dendroideum* Michx.

TENNESSEE POLYTECHNIC INSTITUTE,
COOKEVILLE, TENN.

# Fern Notes III. Ferns and Fern Allies of the Keweenaw Peninsula, Michigan

OLIVER A. FARWELL, SC.D.

I believe a list of these plants for this region has never been compiled. I give one herewith which is as complete as I can make it. Of the ferns there are 3 families, 18 genera and 70 species and their subdivisions; of the fern allies, 3 families, 4 genera and 65 species and their subdivisions. All except one or two have been found in Keweenaw County and were collected chiefly at or near the old Cliff Mine location, in the old township of Clifton. All are probably common to Keweenaw, Houghton and Baraga counties, which comprise the Peninsula.

As originally submitted, this paper contained some generic names that have been outlawed by recent International Congresses. As I have not the proceedings and no list of conserved names, Mr. C. A. Weatherby kindly consented to re-edit these parts and bring the nomenclature into accordance with the rules. I am under deep obligations to him and wish to express my heartfelt appreciation of his kindness and invaluable assistance, not only as to nomenclatural matters, but also in regard to Latin diagnoses, which I had failed to provide.

## POLYPODIACEAE

### POLYPODIUM Linn. Polypody

P. VULGARE Linn., var. VIRGINIANUM (Linn.) Eaton. This fern is very abundant amongst the greenstone trap rocks at the base of the Mineral Range. The fronds are used as a medicine.

### PHEGOPTERIS (Presl) Fée (1850–1852). (*Gymnocarpium* Newm. (1851)). Beech Fern. Oak Fern

I do not know which name has actual priority, so I use

the old familiar *Phegopteris;* also because "1850" of "1850–1852" antedates "1851."

P. POLYPODIOIDES Fée. (*G. Phegopteris* (Linn.) Newm.)

P. HEXAGONOPTERA (Michx.) Fée.

P. DRYOPTERIS (Linn.) Fée. (*G. Dryopteris* (Linn.) Newm.)

### ADIANTUM Linn. Maidenhair Fern

A. PEDATUM Linn., var. ALEUTICUM Rupr. I have not seen the typical form of the species from the Keweenaw Peninsula.

Var. **tripartitum,** n. var., frondibus aequaliter ternatis. The frond is composed of three equal divisions at the apex of the stipe, *i.e.*, is ternate instead of the usual dichotomy. Found at Hazel, Houghton Co., Oct. 7, 1934, no. 10612.

### PTERIDIUM Gleditsch ex Scopoli; Kuhn. Bracken; Brake

P. AQUILINUM (Linn.) Kuhn, var. LANUGINOSUM (Bong.) Fern. Low plants under three feet in height are usually ternate and are found on more or less dry, sterile hills, etc. In low, more or less moist and rich ground the plants are pinnate; the lower pinnae are stalked, the stalk being less than half the length of the internode above; these stalks are gradually reduced until the upper pinnae are sessile. Such plants often reach a length of 12 or more feet.

### PELLAEA Link. Cliff Brake

P. ATROPURPUREA (Linn.) Link. Dr. Fernald collected this on West Bluff in 1934.

[P. GLABELLA Mett. Dr. Fernald is uncertain if the collection at Norway, Dickinson Co., belongs here or to *P. atropurpurea.* Specimens of this collection by C. F. Wheeler in Aug., 1892, are in the herbaria of the Uni-

versity of Michigan, Michigan State College and of O. A. Farwell. They are *P. glabella.*]

### ASPLENIUM Linn. Spleenwort

A. TRICHOMANES Linn.

A. MONTANUM Willd.

A. RUTA-MURARIA Linn.

The last two species I found mixed in with an old collection of *Woodsia ilvensis,* not knowing at the time that I was getting other than the *Woodsia.* I have not found them since.

### ATHYRIUM Roth. Female Fern. Lady Fern

A. FILIX-FEMINA (Linn.) Roth. The typical form is not found here. The following varieties occur:

var. COMMUNE (D. C. E.) O. A. F.

var. MICHAUXII (Spreng.) S. H. Burnham (*Athyrium angustum* [Willd.] Presl).

subvar. ELATIUS (Link) O. A. F.

var. DENTATUM Doell. (*A. angustum,* var. *laurentianum* Butters). The pinnules of this are oblong, broadly obtuse and crenate-serrate.

var. MULTIDENTATUM Doell.

var. SITCHENSE Rupr. This is another far western plant found in the Lake Superior district. In the last three varieties the rhizome is erect while in the others it is horizontal.

### CAMPTOSORUS Link. Walking Fern

C. RHIZOPHYLLUS (Linn.) Link.

### POLYSTICHUM Roth

P. ACROSTICHOIDES (Michx.) Schott. Christmas Fern.

P. LONCHITIS (Linn.) Roth.

P. ACULEATUM (Linn.) Schott, var. BRAUNII (Spenn.) Davenp., subvar. **Purshii** (Fern.), n. comb. (*P. Braunii,* var. *Purshii* Fern.).

### DRYOPTERIS Adans. Shield Fern

D. FILIX-MAS (Linn.) Schott. The rhizome and stipe-bases are used as a medicine and are official in the U. S. Pharmacopoeia.

D. FRAGRANS (Linn.) Schott, var. HOOKERIANA (Fern.) A. R. Prince.

D. GOLDIANA (Hook.) A. Gray.

D. BOOTTII (Tuckerm.) Underw.

D. CRISTATA (Linn.) A. Gray.

D. SPINULOSA (O. F. Muell.) Ktze.

var. AMERICANA (Fisch.) Fern.

" INTERMEDIA (Muhl.) Underw.

### CYSTOPTERIS Bernh. Bladder Fern

C. FILIX-FRAGILIS (Linn.) Chiovenda.

var. **Mackayii** (Lawson), n. comb. (*C. fragilis*, var. *Mackayii* Lawson, Fern Fl. Canad. 233. 1889).

var. ANGUSTATA (Hoffm.) O. A. F.

var. LOBULATO-DENTATA (Koch) O. A. F.

### WOODSIA R. Br.

W. ILVENSIS (Linn.) R. Br. This is very abundant amongst the greenstone trap rocks.

W. ALPINA (Bolton) S. F. Gray. In Rhodora **37**: 219 (1935) Dr. Fernald remarks that he does not know if his Eagle Harbor station for this species is identical with mine or not. It is not; my station was in similar situations but about 10 or 12 miles to the southwest on the Manhattan Bluff.

W. OBTUSA (Spreng.) Torr.

W. OREGANA D. C. E. West Bluff. Dr. Fernald (1934).

### DENNSTAEDTIA Bernh.

D. PUNCTILOBULA (Michx.) Moore.

### ONOCLEA Linn. Sensitive Fern

O. SENSIBILIS Linn.

### PTERETIS Raf. Ostrich Fern

P. STRUTHIOPTERIS (Linn.) Nieuwl., var. PENSYLVANICA (Willd.) O. A. F.

subvar. **foliacea**, n. subvar., lamina superne fertili, inferne sterili. The fertile frond in its lower parts is a normal sterile frond, thence gradually passing into the normal fertile frond, which gives some pinnae sterile below and fertile above and others sterile above and below and fertile in the middle; the fertile parts are of the normal character. Lake Linden, Houghton County, July 19, 1934, no. 10072.

subvar. **obtusilobata** (Clute), n. comb. (*Onoclea Struthiopteris*, f. *obtusilobata* Clute, Fern Bull. 18: 111. 1910).

subvar. **pubescens** (Terry), n. comb. (*Struthiopteris germanica* f. *pubescens* Terry, Fern Bull. **16**: 5 and 49. 1908).

## OSMUNDACEAE

### OSMUNDA Linn.

O. CINNAMOMEA Linn. Cinnamon Fern.

O. CLAYTONIANA Linn.

O. REGALIS Linn., var. SPECTABILIS (Willd.) A. Gray. Royal or Flowering Fern. The rhizomes are used as a substitute for the official Male Fern.

## OPHIOGLOSSACEAE

O. VULGATUM Linn., with the vars. MINUS Moore and PSEUDOPODUM (S. F. Blake) O. A. F.

### BOTRYCHIUM Swartz. Grape Fern

B. LANCEOLATUM (Gmel.) Angstr. and var. ANGUSTISEGMENTUM Pease & Moore.

B. LUNARIA (Linn.) Swz., Moonwort, and var. ONONDAGENSE (Underw.) Clute.

B. MATRICARIAEFOLIUM A. Br. The following variants occur: var. COMPOSITUM Milde; var. PALMATUM Milde; var. RHOMBEUM (Angstr.) O. A. F., and f. GRACILE (House) Weatherby.

B. MULTIFIDUM (Gmel.) Rupr. (*B. Matricariae* Spreng.). The following varieties occur: var. DICHOTOMUM O. A. F.; var. **Habereri** (Gilbert), n. comb. (*B. obliquum,* var. *Habereri* Gilbert, Fern Bull. **11**: 88. 1903); var. INTERMEDIUM (D. C. E.) O. A. F.; var. ONEIDENSE (Gilbert) O. A. F.

B. SIMPLEX E. Hitchc. The following varieties have been found: var. ANGUSTUM Milde (*B. tenebrosum* A. A. E.); var. FALLAX Milde; var. SIMPLICISSIMUM (Lasch) Milde; var. SUBCOMPOSITUM (Lasch) Milde.

B. VIRGINIANUM (Linn.) Swz., with var. GRACILE (Pursh) D. C. E.

## EQUISETACEAE

### EQUISETUM Linn. Horsetail

E. ARVENSE Linn. Used as a medicine. The following varieties occur: var. BOREALE Bong.; var. CAMPESTRE Schultz; var. DECUMBENS Meyer; var. NEMOROSUM A. Br.; var. **proliferum** (Luerss.), n. comb. (*E. arvense,* monstr. *proliferum* Luerss. Farnpflanz. 701. 1889); var. RIPARIUM Milde.

E. FLUVIATILE Linn., with the following varieties: var. LINNAEANUM (Doell) A. A. E.; var. POLYSTACHYUM (Bruckn.) A. A. E.; var. ULIGINOSUM (Muhl.) A. A. E.; var. **verticillatum** (Doell), n. comb. (*E. limosum,* f. *verticillatum* Doell, Fl. Baden **1**: 64. 1857).

E. LITORALE Kuehl.

E. PALUSTRE Linn., with var. NANUM Milde.

E. PRATENSE Ehrh.

E. SYLVATICUM Linn.

E. TELMATEIA Ehrh. This species was included under one name or another in the early editions of Gray's Manual, but excluded from the last two editions. I found it many years ago on the Keweenaw Peninsula and so reported it. I have not been to the station since and do not know if it is still there.

HIPPOCHAETE Milde. Scouring Rush

H. HYEMALIS (Linn.) O. A. F., var. JESUPI (A. A. E.) O. A. F.

H. LAEVIGATA (A. Br.) O. A. F.

var. **caespitosa** (A. A. E.), n. comb. (*Equisetum laevigatum* f. *caespitosum* A. A. E. Fern Bull. **11**: 43. 1903).

var. **ramosa** (A. A. E.), n. comb. (*Equisetum laevigatum* var. *ramosum* A. A. E. l. c.).

var. **variegatoides** (A. A. E.), n. comb. (*Equisetum laevigatum* var. *variegatoides* A. A. E. l. c.).

var. EATONII O. A. F.

var. **caespitica,** n. var., var. *caespitosae* similis caulibus autem scabris ut in var. *Eatonii.* Like var. *caespitosa,* but the stems are rough as in var. *Eatonii.*

H. PREALTA (Raf.) O. A. F. Used as a medicine.

subvar. **neopolystachya,** n. subvar., nodis superioribus ramos fructiferos gerentibus. The fertile stem normally bears slender, fertile branches from the upper nodes. Clifton, Aug. 29, 1887, no. 572.

var. PSEUDOHYEMALIS O. A. F.

subvar. **polystachya** (Prager), n. comb. (*Equisetum hyemale* var. *affine* f. *polystachyum* Prager ex A. A. E. Fern Bull. **11**: 112. 1903).

var. SCABRELLA (Engelm.) O. A. F.

H. SCIRPOIDES (Michx.) O. A. F.

H. VARIEGATUM (Schleich.) O. A. F.

## LYCOPODIACEAE

### LYCOPODIUM Linn. Club Moss, Ground Pine, Christmas Greens

L. ANNOTINUM Linn.

L. CLAVATUM Linn. The spores are medicinal, constitute Vegetable Sulphur and are official in the U. S. Pharmacopoeia under the name Lycopodium. They are used also for flash light to produce stage effects, etc.

var. BREVISPICATUM Peck.

var. MEGASTACHYON Fern. & Biss.

subvar. **trilobum,** n. subvar., spica apice trilobata vel tripartita. The summit of the spike is three-lobed or three-parted. Lake Linden, Oct. 11, 1934, no. 10629.

L. COMPLANATUM Linn.

var. FLABELLIFORME Fern.

subvar. **foliaceum,** n. subvar., pedunculi ramo frondem sterilem tridichotomum gerente. One branch of the peduncle bears a sterile frond three times dichotomously divided instead of the usual spikes. Lake Linden, Nov. 8, 1934, no. 10668.

var. WIBBEI Haberer.

var. CHAMAECYPARISSUS (A. Br.) Milde (*L. tristachyum* Pursh).

var. FLABELLATUM Doell. In this the branches are verticillate; the verticils are some distance apart and are arranged around the stem in the form of funnels. It bears the same relation to the preceding variety as var. *flabelliforme* does to the specific type.

subvar. **proliferum,** n. subvar., rachibus spicarum in frondes steriles productis. Axes of the spikes prolonged as sterile fronds. Lake Linden, Oct. 4, 1914, no. 3912.

var. SHARONENSE (S. F. Blake) O. A. F.

var. ALPINUM (Linn.) O. A. F.

var. SABINAEFOLIUM (Willd.) O. A. F.

L. INUNDATUM Linn.

var. BIGELOVII Tuckerm.

L. LUCIDULUM Michx.

var. POROPHILUM (L. & U.) Clute.

L. OBSCURUM Linn.

subvar. **parvispicatum,** n. subvar., spicis gracilibus, non plus quam 3.5 cm. longis. The spikes are under 1.33 inches and more slender, those of the specific type being stouter and over 1.5 inches. Lake Linden, Oct. 3, 1934, no. 10599.

subvar. **foliaceum,** n. subvar., spicis in frondes steriles productis. The axes of the spikes are prolonged as sterile fronds. Lake Linden, Oct. 14, 1934, no. 10635.

var. DENDROIDEUM (Michx.) D. C. E.

subvar. **proliferum** (Vict.), n. comb. (*L. obscurum,* var. *dendroideum,* f. *proliferum* Vict. Contr. Lab. Bot. Univ. Montreal 3: 32. 1925). The axes of the spikes are prolonged as sterile fronds.

subvar. **breve,** n. subvar., spicis brevioribus gracilioribusque ut in subvar. *parvispicato.* The spikes are shorter and more slender as in subvar. *parvispicatum.* Lake Linden, Oct. 23, 1934, no. 10648a.

var. HYBRIDUM O. A. F.

subvar. **brevispicatum,** n. subvar., spicis brevibus gracilibusque ut in subvar. *parvispicato.* Spikes short and slender as in subvar. *parvispicatum.* Bootjack, May 27, 1934, no. 9646; Lake Linden, Oct. 3, 1934, no. 10603.

L. SELAGO Linn. In recording the Robbins collection at the Dana Mine, Dr. Fernald puts a question mark before "Keweenaw Co." The question mark may be omitted, as the old Dana Mine is in Keweenaw County. It is now a part of the Central Mine; and just south of it is Mt. Horace Greeley, 932 feet above Lake Superior, the highest point on the Keweenaw Peninsula. The varieties APPRESSUM Desv. and PATENS (Beauv.) Desv. also occur.

SELAGINELLACEAE

SELAGINELLA Beauv.

S. RUPESTRIS (Linn.) Spring.
S. SELAGINOIDES (Linn.) Link.
S. DENSA Rydb.

LAKE LINDEN, MICHIGAN

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# A List of Varieties and Forms of the Ferns of Eastern North America

C. A. WEATHERBY

(*Continued from p. 136*)

ASPLENIUM TRICHOMANES Linnaeus, Species Plantarum 1080 (1753).—Pinnae merely toothed.

F. INCISUM (S. F. Gray) Clute, Fern Bulletin **14**: 87 (1906). *A. saxatile*, β *incisum* S. F. Gray, Natural Arrangement of British Plants **2**: 13 (1821).—Pinnae deeply cut into narrow lobes. Brattleboro, Vermont (*C. C. Frost*), the only American collection I have seen.

West-American specimens referred to this form belong with *A. vespertinum* Maxon. The name *incisum* is usually quoted from Moore, Nature-Printed Ferns of Great Britain and Ireland, but, as Moore's citations show, really goes back to S. F. Gray.

*Asplenium Trichomanes* β *delicatulum* Lawson, Edinburgh New Philosophical Journal, new series, **19**: 113 (reprint 14) (1864), described as having the pinnae "much smaller, thinner and wider apart than in the normal form" and as being the prevailing variety in Canada, seems to rest only on imperfectly developed plants. It is possible that some of the forms described in Europe, such as f. *auriculatum* Milde, with the pinnae lobed at the base on the upper side, may occur in America; but I have seen no specimens. Except for differences in size and some-

what in outline of the pinnae, the American specimens are very uniform.

ASPLENIUM PLATYNEURON (Linnaeus) Oakes ex D. C. Eaton, Ferns of North America **1**: 24 (1878). *Acrostichum p.* Linnaeus, op. cit. 1069 (1753).—Pinnae oblong, shallowly and finely toothed; sori confluent at maturity; no proliferous buds on the rachis or stipe.

F. PROLIFERUM (D. C. Eaton) Tanger, AMERICAN FERN JOURNAL **23**: 16 (1933). *A. ebeneum* var. *p.* D. C. Eaton, Bulletin Torrey Botanical Club **6**: 307 (1879).—Proliferous buds borne on the rachis or stipe at the base of the blade.

For a detailed account of this phenomenon see M. A. Marshall in AMERICAN FERN JOURNAL **13**: 7–13 (1923). The "form" is here included rather as a matter of record than because of any confidence that it deserves taxonomic recognition. Mr. F. G. Floyd, in the FERN JOURNAL **14**: 13–17 (1924) argues that the capacity for proliferation is inherent in the species and may be exercised under certain circumstances by any individual plant. Similarly, he says, any frond of walking fern may root at the tip, but not all do; yet we do not give different names to those which do and those which do not. The argument sounds reasonable; it suggests an inviting field for experiment by any one who has facilities for growing plants under different conditions and attempting to induce proliferation.

F. SERRATUM (E. S. Miller) R. Hoffmann, Proceedings Boston Society of Natural History **36**: 193 (1922). *A. ebeneum,* var. *incisum* E. C. Howe, Annual Report Regents University of New York **22**: 104 (1869). *A. ebeneum,* var. *serratum* E. S. Miller, Bulletin Torrey Botanical Club **4**: 41 (1873).—Pinnae rather narrow and elongate, coarsely toothed, the teeth broad-based and usually narrowed to a more or less pointed tip, or themselves finely toothed.

Present rules of nomenclature require the use of Miller's name in the category of form, though Howe's is the earlier. For the identity of Howe's plant, see the note by A. N. Leeds in the FERN JOURNAL **27**: 31 (1937).

F. FURCATUM Clute, Fern Bulletin **17**: 89 (1909).—Blade repeatedly branched at the tip.

F. HORTONAE (Davenport) L. B. Smith, Rhodora **30**: 14 (1928). *A. ebeneum* var. *H.* Davenport, Rhodora **3**: 1, pl. 22 (1901).—Pinnae rather broadly oblong, deeply pinnatifid, the lobes narrow-based, often broadest toward their obtuse tips and somewhat toothed.

One of the prettiest of our fern-forms. Although, so far as I know, it is always sterile, it keeps the dimorphic habit of the species, some of the fronds being long, upright and comparatively shallowly cut, others short, more spreading and with very deeply lobed pinnae.

Var. BACCULUM-RUBRUM (Featherman) Fernald, Rhodora **38**: 304 (1936). *A. ebeneum* var. *b.-r.* Featherman, Report of the Botanical Survey of South Central Louisiana for 1870: 75 (1871). *A. p.* var. *euroaustrinum* Fernald, Rhodora **37**: 382, pl. 384, figs. 1 & 2 (1935).—Pinnae elongate-linear, the sori separate at maturity.—Florida and Louisiana to Kentucky and Virginia and rarely northward.

A luxuriant form, sometimes occurring in the North, treated by Prof. Fernald as a variety because found mainly in the South.

ASPLENIUM CRYPTOLEPIS Fernald, Rhodora **30**: 41 (1928).—Pinnules wedge-shaped or diamond-shaped, coarsely toothed, blunt or somewhat pointed at tip.—Vermont and Michigan to North Carolina and Tennessee.

This is the American plant previously referred to the European *A. Ruta-muraria.* For a discussion of its characters, see Fernald's paper above cited.

Var. OHIONIS Fernald, op. cit. 43.—Pinnules lanceolate, deeply cleft, tapering to an acute tip.—Known only from Greene Co., Ohio.

ASPLENIUM SERRATUM Linnaeus, Species Plantarum 1079 (1753).—Margins of blade finely toothed.

F. INCISUM A. A. Eaton, Bulletin Torrey Botanical Club **33**: 475 (1906).—Margins of blade irregularly and deeply cleft.

*Asplenium viride* var. *robustum* Goode, Canadian Naturalist, series 2, **9**: 300 (1881) is apparently founded only on an individual with fronds somewhat larger and thicker in texture than usual.

PHYLLITIS SCOLOPENDRIUM (Linnaeus) Newman, History British Ferns, ed. 2, 10 (1844). *Asplenium S.* Linnaeus, Species Plantarum 1079 (1753).—Vein-tips close to the margin; some scales of the midrib broadly linear to lance-attenuate.—Eurasia.

Var. AMERICANA Fernald, Rhodora **37**: 220 (1935).—Vein-tips a little back from the margin; scales of the midrib all narrowly linear or thread-like.—New Brunswick (probably extinct); New York, Ontario and Tennessee. The characters are taken from Prof. Fernald's discussion.

CAMPTOSORUS RHIZOPHYLLUS (Linnaeus) Link, Hortus Regius Botanicus Berolinensis **2**: 69 (1833). *Asplenium r.* Linnaeus, Species Plantarum 1078 (1753).—Blade (excluding the long, slender tip) lanceolate with entire margins, cordate at base, the lobes rounded.

F. ANGUSTATUS F. W. Gray, AMERICAN FERN JOURNAL **14**: 11, pl. 1, figs. 7 & 8 (1924).—Blade narrowly linear.

F. BOYCEI C. L. Wilson, AMERICAN FERN JOURNAL **25**: 18, pl. 1 (1935).—Margins cut into narrow lobes.

F. AURICULATUS R. Hoffmann, Proceedings Boston Society of Natural History **36**: 195 (1922).—At least some fronds with basal lobes elongate, attenuate, sometimes rooting at tip.

F. INTERMEDIUS (Arthur) Clute, Fern Bulletin **14**: 89 (1906). *C. r.* var. *i.* Arthur, Botanical Gazette **8**: 200 (1883).—Blade wedge-shaped and pointed at base, not at all cordate.

An excellent series of photographs by H. E. Ransier illustrating variant leaf-forms in *Phyllitis* and *Camptosorus* may be found in the FERN JOURNAL **7**: 99–104 and **8**: 8–12.

*Woodwardia virginica,* f. *thelypterioides* (Pursh) Gilbert, List North American Pteridophytes 40 (1901), has remained a mystery ever since Pursh published it as *W. thelypterioides* in 1814. His description calls for a plant with the bases of the pinnae and the stipe pubescent and with triangular-acute fertile segments. So far as I am aware, no *Woodwardia* answering to this description has since been found. Hooker (Species Filicum **3**: 69) said he had the original specimens in his herbarium and that they were merely a weak state of *W. virginica;* but he did not explain the reference to pubescence. Gilbert, who alone (except as followed by Clute) has taken up Pursh's name, had seen no specimens, but thought the description indicated something which ought to be recognized. Until Hooker's material (if really the original) can be reexamined, the name had best not be used.

*W. virginica,* f. *fertilis* Farwell, Papers Michigan Academy of Sciences, **3**: 89 (1924) rests on blades with a few sori on their upper pinnae, otherwise sterile.

GRAY HERBARIUM.

(*To be continued*)

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## A Fern Collector's Notes

C. L. GRUBER

Although the Water Horsetail, *Equisetum fluviatile* L., is classed among the non-evergreen or deciduous species, my observations show that the stem is not always entirely winter-killed. Of three stations near the Sacony Creek, just below Kutztown, Pennsylvania, two are located on mud flats bordering swampy meadows from which prac-

tically all the water recedes in early spring while the third is located between an old unused railroad embankment and a public dump, in a hollow which contains water throughout the year. At this station, on May 15, 1936, I found a number of green stumps of the stems of the preceding year, in water about six inches deep, projecting a few inches above the water, and starting new growth or with a few new, thrifty branches two or more inches long. Probably these stumps had been entirely under water during the winter. On the mud flats further up the stream there were no such living stumps. At this same station I found two fine, freshly grown specimens on October 18, 1935, with long, heavy branches like secondary stems growing from near the base of the stem. At one station on the mud flats, with hundreds of plants, more than twenty-five per cent were fertile but at the other two stations there were very few fertile ones.

Apparently the first growth of *Equisetum arvense* L. is almost uniformly of the true *arvense* type; but later growth, especially if the earlier growth was destroyed, abounds in *E. arvense, f. pseudosilvaticum* Milde.

In studying the Lady Ferns according to Butters's classification, the shape of the fronds appears quite reliable in distinguishing between *Athyrium asplenioides* and *Athyrium angustum*, but the relative length of the stipes seems rather misleading, since I have specimens of *Athyrium angustum* with stipes more than one half to fully as long as the leafy portion of the frond.

In distinguishing between *Woodsia obtusa* and *Cystopteris fragilis* I find the color of the stipes a reliable characteristic. In *Woodsia obtusa* the stipes are straw-colored or yellowish green, with perhaps some dull brown at the base. In *Cystopteris fragilis* usually the entire stipe and

often the lower part of the rachis is shiny brown or blackish brown.

On June 10, 1936, I made a collecting trip on the northwest slope of the South Mountains, about five miles from Kutztown, Pa.

In an old woods trail winding up the slope of Guinther's Head I found a station of about one hundred plants of *Botrychium neglectum* Wood, ranging in height from three to twelve inches. The usual position of the sterile portion was above the middle of the stem, but in one specimen the sterile part was placed at the summit of the stem, close to the fertile part, as in *B. angustisegmentum*. However, the cutting of the frond and the fact that the sterile portion was stalked proved this plant to be a specimen of *B. neglectum*.

Further up this trail I found a station of about thirty plants of *Botrychium simplex* E. Hitch., ranging in height from two to six and one half inches. The usual position of the sterile part was about the middle of the stem, but on one specimen the sterile part was attached almost at the base of the stem, slightly below the surface of the ground. In one plant the sterile part was forked; and the sterile portion of all the fronds was of the pinnate or pinnatifid type with from one to four pairs of lobes below the rounded apex.

In an open spot along this same trail I made a highly satisfactory find—a *fragrant* Bracken, of the *Pteridium latiusculum* type. The fragrance is as strong as that of *Dennstaedtia* and is similar to it. There were two fronds, of which I took one and left the other for future study. A considerable amount of the fragrance is retained by the dried specimen. The pinnules are crowded, somewhat crisped, smaller, shorter, and more rounded at the ends than in typical *P. latiusculum*.

On this same date I found *Dryopteris spinulosa* and *Dryopteris intermedia* with beautifully developed and apparently ripe sporangia, although Gray and Britton and Brown give July and July and August as the time of fruiting. Possibly the fact that the black sporangia do not change to brown till in July is the reason for this later date.

On August 7, 1936, while exploring a mountain ravine known as Smoketown Hollow, about 5½ miles southeast of Kutztown, Pennsylvania, where in places I actually waded through ferns of several species, among which was *Athyrium thelypteroides* (Michx.) Desv., I came across some clumps of fronds which apparently also were Silvery Spleenworts yet looked decidedly different. After taking them home and studying them carefully, I found I had collected good *Athyrium thelypteroides* f. *acrostichoides* (Swartz) Gilbert and one plant proved to be an excellent specimen of *Asplenium thelypteroides serratum* Lawson, the deeply serrate extreme of *Athyrium thelypteroides* f. *acrostichoides* to which it seems no distinctive name has yet been applied to fit the revision of the species. For my own use on my herbarium label I am calling it *Athyrium thelypteroides* f. *serratum* (Lawson).[1] In my specimens of f. *acrostichoides* the stipe and the greater part of the rachis were tinged with deep dull red.

## Shorter Notes

A FURTHER NOTE ON "POLYPODIUM FILIX-FRAGILE."—As a foot-note to Dr. Merrill's article "Cystopteris fragilis or C. Filix-fragilis?" (in this JOURNAL, **25**: 127–131. 1935), it may now be stated that there is direct

[1] ATHYRIUM THELYPTEROIDES (Michx.) Desv., **f. serratum** (Lawson), n. comb. ***A. thelypteroides*** β ***serratum*** Lawson, Edinb. New Phil. Journ. ser. 2, **7**: 115 (1864).

evidence that the "F. fragile" of the first edition of the Species Plantarum was an error which Linnaeus intended to correct. When I discussed the matter (Rhodora, **28**: 130–131. 1926) I did not know that there existed two interleaved copies of the first edition in which Linnaeus entered corrections and additions to be used in the second edition; but they do exist and are preserved in the library of the Linnean Society of London. Mr. Savage, Assistant Secretary of the Society, who has very kindly looked them up for me, reports that in one of them Linnaeus has crossed out the "F". Mr. Savage further states that in the original manuscript of the Species Plantarum the initial letters of generic names appeared in the margin before the specific epithets and that in this case the printer, having just set up "F. mas" and "F. femina" on the preceding page, may have mistaken a "P" before "fragile" for an "F".

Dr. Farwell, in a letter to me, argues that under present rules of nomenclature Linnaeus had no right to make any change—"F. fragile" got printed and must stand. This would be correct if Linnaeus had substituted an entirely new name, as he did in the case of *Oenothera perennis* and *Oe. pumila*. But the correction of an inadvertent error, such as this seems certainly to be, is quite another matter; as I read the rules, they set no limit, of time or otherwise, to such correction.—C. A. WEATHERBY, *Gray Herbarium.*

AN UNUSUAL BOTRYCHIUM STATION.—*Botrychium obliquum*, *Botrychium dissectum*,[1] and their varieties and forms appear to prefer an old unused woods road and its

[1] In this sketch I am using Mr. E. W. Graves's nomenclature, particularly because the naming of several varieties by him follows his treatment of the *obliquum* and *dissectum* types of *Botrychium* as separate species.

vicinity for a habitat. Fully half of the stations I have found are in and along old, rarely used woods roads, trails, or paths. Possibly the fact that in such locations a little more sunlight filters through the woodland cover makes them an acceptable habitat. Possibly also more moisture is conserved in and along these trails, most of them being slightly hollowed or having slight elevations along the sides which prevent the water of rains from being rapidly drained away.

In such a location is one of my most interesting Botrychium stations—interesting, first, because it has furnished me during 1935 and 1936 with three Botrychium varieties I had never before seen and, second, because of the unusual Botrychium associations found there.

Umbrella Hill lifts its conical outline about two miles west of the borough of Kutztown, Berks County, Pa. A field's breadth toward the southwest from this hill, a stony, wooded hillside, facing north, changes into a gentler slope near its base. Through this lower part, a trail used years ago as a wagon road through the woods, more or less easily discernible for seven or eight hundred feet, extends westwardly along the slope not far from the lower border of the woods. In and along this trail my Botrychiums grow, not so much in profusion as in remarkable variety. There are probably not more than fifty plants in the entire area, of which only a small number are of the multifidum varieties.

Near the eastern border of the woodland there are a few plants of *B. dissectum* Spreng., a few more of typical *B. obliquum* Muhl., one of *B. obliquum elongatum* Gilbert & Haberer [*B. dissectum* f. *elongatum* (Gilbert & Haberer) Weatherby], and one small plant that appears to be *B. multifidum oneidense* (Gilbert) Farwell. Farther out along the trail there are a few plants of *B. dissectum* and a larger number of *B. obliquum.* A short

distance beyond these, growing within fifty feet of each other, I found *B. obliquum oblongifolium* Graves, *B. multifidum oneidense* (Gilbert) Farwell, and two forms of *B. multifidum intermedium* (D. C. Eaton) Farwell. One of these, a beautiful spreading specimen, has the wide sinuses and oval segments as described by Graves (FERN JOURNAL **25**: 4, 113). The other, a sturdier, erect, more compact plant, has the ultimate segments ovate as characterized by Weatherby (FERN JOURNAL **25**: 3, 95). Both of them have the broadly triangular, blunt terminal segments. The multifidum varieties stood Graves's test of being green in winter while the obliquums and dissectums were bronzed.

*B. obliquum oblongifolium* was identified for me by Mr. Graves shortly before his death. This find extends its range into Pennsylvania. It had previously been reported only from Indiana and Iowa.

To make the obliquum-dissectum-multifidum family circle complete, as far as the specimens I have collected are concerned, I should have found there also *B. obliquum pennsylvanicum* Graves, but I failed to discover it at that place. In 1935, however, I found several specimens of the variety *pennsylvanicum* at stations nearer Kutztown. My pennsylvanicums also were identified for me by Mr. Graves.

Six species and varieties of Botrychium, growing in a comparatively small area, with the usual pairs (obliquum, dissectum; oneidense, intermedium) growing, here separately, there intermingled, present what is probably quite an unusual situation.—C. L. GRUBER, *Kutztown, Pa.*

AS TO "ASPLENIUM EBENEUM VAR. HORTONAE."—In 1908 Robinson (Rhodora X, 29) reduced the "attractive plumose variety" which Davenport (Rhodora III, **25**: 1901) had described as *Asplenium ebeneum* var. *Hortonae* to a synonym of var. *incisum* Howe, and this

treatment was promptly followed in the 7th Edition of Gray's Manual. Robinson based his knowledge of var. *incisum* not on an examination of the type specimen but on a description and a tracing of one of its fronds. Howe's type is preserved in the New York State Museum and, through the kindness of Dr. House, we received last February an excellent photograph of it.

The tracing Dr. Robinson had must have been misleading, for the photograph bears little resemblance to the fern described and well illustrated in Davenport's paper. Instead, it is one of the familiar forms with irregular, jagged pinnae.

Var. *Hortonae* has been collected only very occasionally. An addition to the few records of its occurrence was recently made when Dr. E. T. Wherry found it in York Co., Pennsylvania, in November, 1935. Specimens were taken for the herbarium and a living plant was removed to the Morris Arboretum, where it produced this year a luxuriant clump of crowded, beautiful fronds with their characteristic deeply pinnatifid and imbricated pinnae—all of them sterile. It is apparently a rare, sterile mutant, and should, perhaps, be classed as a forma rather than a variety.

Whatever the relation of var. *incisum* Howe[1] may be to the subsequently published var. *serratum* E. S. Miller,[2] var. *Hortonae* is evidently a thing apart, not to be confused with them.—ARTHUR N. LEEDS, *Academy of Natural Sciences of Philadelphia.*

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[1] Twenty-second Annual Report on State Cabinet, N. Y. Report of the Botanist, p. 104: 1869.

[2] Bull. Torrey Bot. Club IV, 41: 1873.

# American Fern Society

## Report of the President for 1936

Despite the hindrance placed in the way of amateur fern study by the wide sale of a largely spurious work on "American Ferns" through a leading publishing house, the membership list of our Society has shown during the year a gratifying increase. Our finances are now in satisfactory condition, and we hope soon to be able to publish the 25-year index, the manuscript of which is ready.

Early in the year Dr. R. C. Benedict, on account of the pressure of other work, asked to be relieved of the duties of Librarian, and Miss Hester M. Rusk, of the Brooklyn Botanic Garden, has been appointed in his place.

Mr. E. J. Winslow, who has been on the Editorial Board since 1913, attending particularly to the business of the JOURNAL, finds it necessary to withdraw at the close of the present year, and his resignation is accepted, with the heartiest thanks for all he has done to make our JOURNAL a success.

Early in October a committee was appointed for the incorporation of the Society, comprising the following members resident in or near Washington, D. C.: Paul Bartsch, J. E. Benedict, Jr., E. P. Killip, Mrs. T. M. Knappen, and W. R. Maxon. This group appeared before a notary and signed a certificate of incorporation, which was filed with the Recorder of Deeds of the District of Columbia by Dr. Maxon on October 10th, so our Society is now incorporated.

Respectfully submitted,

EDGAR T. WHERRY, *President*

## Report of the Secretary for 1936

The American Fern Society has passed another milestone, marking progress not only in length of existence but also in things accomplished. Two successful field trips were held during the year, both of which have been reported in detail in the JOURNAL. A report of the regular winter meeting will be found below.

One of the most important accomplishments of the year has been the incorporating of the Society under the laws of the District of Columbia. This makes it possible to receive and administer bequests and gifts such as the sum left to the Society by Mrs. Charles H. Bissell, widow of a former President of the Society.

This act of incorporation brings up the question of whether further changes may not be needed in the Constitution. During the last two years the membership has voted upon, and approved, certain amendments, bringing the procedure for the Society's business in line with newer conditions, and providing for safeguards to the treasury. The question now arises whether, as an incorporated society, it is not necessary to further amend the Constitution in regard to the method of setting up the Nominating Committee and filling vacant offices.

It is to be regretted that so few copies of the Constitution are in existence. There should be an early printing of this document, as soon as funds will allow, so that present members of the Society, and new ones as they come in, may each have a copy.

We regret to report the loss by death of Dr. Marshall A. Howe, who joined the Society in 1911, and was therefore a member for more than a quarter of a century. We also lost by death during the year, Dr. Paul Kestner, of Switzerland, whose work in experimenting with fern plants grown from spores brought requests through the JOURNAL for spore material of American species.

Twenty-eight new members were added during the year. This is a few more than the number lost through death, resignations and for other reasons, and finds the membership list at the end of the period with three hundred and twenty-three members.

We note the addition of several new members from North Carolina. Has this interest been stimulated by the appearance of Prof. Blomquist's book on the Ferns of North Carolina? If so, we should welcome a number of new books on the ferns of various local areas.

The annual election of officers returned for another term those who have guided your Society for the past year. Details of this election will be found elsewhere in this issue. Mr. Winslow has resigned from the Editorial Board, but happily not from the Society, while he represents his township in the State Legislature at Concord, New Hampshire.

Respectfully submitted,
ELSIE GIBSON WHITNEY, *Secretay.*

## Treasurer's Report

JANUARY 1, 1936, TO DECEMBER 31, 1936

| *Receipts* | *Amount* | *Sub-Total* | *Total* |
|---|---|---|---|
| Cash on hand, January 1, 1936 | | | $191.04 |
| 1935 Membership Payments | $ 21.00 | | |
| 1935 Subscription Payments | 2.60 | $ 23.60 | |
| 1936 Membership Renewals | 382.69 | | |
| 1936 New Members | 43.50 | 426.19 | |
| 1936 Subscription Renewals | 57.15 | | |
| 1936 New Subscribers | 17.70 | 74.85 | |
| 1937 Membership Renewals | 19.99 | | |
| 1937 New Members | 1.50 | 21.49 | |
| 1937 Subscription Renewals | 18.45 | | |
| 1937 New Subscribers | 1.25 | 19.70 | |
| Sale of back numbers | 68.05 | 68.05 | |
| Sale of Hart's Tongue Ferns | 9.75 | 9.75 | |
| Gifts | 16.25 | 16.25 | |
| Advertising in A. F. J. | 4.00 | 4.00 | |
| Windsor National Bank | 14.96 | 14.96 | |

| | | | |
|---|---|---|---|
| Reprints: | | | |
| Rogers McVaugh | 16.76 | | |
| Jos. Ewan | 6.57 | | |
| R. M. Tryon | 1.85 | | |
| Edward P. St. John | 8.38 | | |
| E. T. Wherry | 6.17 | | |
| Miss MacGilliard | 6.25 | 45.98 | 724.82 |
| | | | $915.86 |

*Disbursements*

| | | | |
|---|---|---|---|
| Science Press: | | | |
| A. F. J. Vol. 25, No. 4 | 124.51 | | |
| A. F. J. Vol. 26, No. 1 | 112.00 | | |
| A. F. J. Vol. 26, No. 2 | 107.35 | | |
| A. F. J. Vol. 26, No. 3 | 108.65 | | |
| New Membership list | 35.37 | | |
| Mailing envelopes | 7.87 | | |
| Reprints | 16.40 | 512.15 | |
| Sale of Hart's Tongue Ferns—Postage | .69 | .69 | |
| Bank Charges | .50 | .50 | |
| Returned checks | 5.64 | 5.64 | |
| Expense—Treasurer | 35.66 | | |
| Secretary | 12.48 | 48.14 | |
| Cuts for reprints | 10.23 | 10.23 | |
| Incorporation expenses | 1.40 | 1.40 | |
| Stamps for 1937 Membership bills | 10.17 | 10.17 | |
| Discount to members—sale A. F. J. | 4.25 | 4.25 | |
| Agency Commission | 5.18 | 5.18 | 598.35 |
| Cash on hand December 31, 1936 | | | $317.51 |

FINANCIAL STATEMENT, DECEMBER 31, 1936

*Assets*

| | | | |
|---|---|---|---|
| Cash | $ 317.51 | Capital account | $3,898.65 |
| Notes Receivable | 3,200.00 | Note Payable | 200.00 |
| Accounts Receivable | 12.85 | 1936 Suspense a/c | |
| Inventory A. F. J. | 711.87 | A. J. F. Vol. 26, No. 4 | 115.00 |
| Stamps for 1937 Membership bills | 10.17 | 1937 Subscriptions | 19.70 |
| Cash in closed bank | 7.05 | 1937 Membership Payments | 19.85 |
| | | Miss MacGilliard a/c | 6.25 |
| | $4,259.45 | | $4,259.45 |

HENRY K. SVENSON, *Treasurer*

## Report of the Judge of Elections

December 18, 1936.

Mrs. Elsie Gibson Whitney,
Secretary of the American Fern Society,
New York State Museum,
Albany, New York.

My Dear Mrs. Whitney:

Inclosed please find the election results for the American Fern Society. One hundred and seven ballots were returned. On two, the officers were unchecked, and on seven no vote on the amendment. One ballot substituted the name of C. A. Weatherby for President, and A. N. Leeds for Secretary. Otherwise all members voted the straight ticket.

The tabulation is as follows:

| | |
|---|---|
| For President—Dr. Edgar T. Wherry | 104 |
| For Vice-President—Mrs. Carlotta Hall | 105 |
| For Secretary—Mrs. Elsie Gibson Whitney | 104 |
| For Treasurer—Dr. Henry K. Svenson | 105 |
| Amendment to the Constitution, | |
| Article VI, Section 5 | 100 |

As Judge of Elections I decleare the regular ballot elected: Dr. Wherry for President, Mrs. Hall for Vice-President, Mrs. Whitney for Secretary, Dr. Svenson for Treasurer, and the Amendment adopted.

Respectfully submitted,
ELEANOR MCGILLIARD,
*Judge of Elections.*

## Report of the Auditing Committee

We have audited the books of the American Fern Society. They were found to be in excellent condition. Cash balance on hand December 31, 1936, was $317.51.

Receipts were $915.86, with disbursements to the amount of $598.35, giving the balance quoted above.

Respectfully submitted,

RALPH H. CHENEY,
ARTHUR H. GRAVES,
*Committee.*

The annual meeting of the society was held in the Auditorium, Atlantic City, New Jersey, in the morning of January 1st, 1937, the attendance being about 35. Professor M. A. Chrysler first showed lantern slides of maps of New Jersey, with dots marking where the various species of ferns are known to have been collected, bringing out many interesting details of distribution. Mr. Robert T. Clausen spoke on *Botrychium* and *Ophioglossum* in the state, not only as to geographic distribution, but also from the taxonomic standpoint. He announced the discovery of a new variety of *Botrychium simplex,* and discussed the status of heretofore doubtful plants such as *Botrychium angustisegmentum* and *Ophioglossum arenarium,* neither of these being now regarded as species.

Mr. James L. Edwards then spoke on his experiences on searching for the rarer New Jersey ferns, pointing out that there are many much harder to find than the famous *Schizaea pusilla.* Those so rare that no localities are now known for them comprise *Asplenium pinnatifidum* (or is it *A. trudelli?*) and *Equisetum pratense.* But a single station is known for *Cryptogramma stelleri,* here reaching its southern range-limit, and two for *Asplenium bradleyi.* Professor Edgar T. Wherry then showed habitat views and distribution maps for the more notable species of the state. Certain of these like *Botrychium simplex* var. *tenebrosum* reach their southern limits here, others like *Lycopodium alopecuroides* are at or near a

northern limit; one or two Equisetums have an eastern limit in the state, and two species, *Dryopteris simulata* and *Schizaea pusilla*, show a range indicating them to have lived during past geological periods on a former land-mass east of the present coast, and to have entered the state from the east.—EDGAR T. WHERRY, *Philadelphia, Pa.*

HAVE YOU A COMPLETE FILE OF THE AMERICAN FERN JOURNAL?—Several years ago, with the same question as the title, reference was made to the status of the AMERICAN FERN JOURNAL files at the end of the 20th volume. Now with the 26 volumes completed, it seems appropriate again to raise the same question and to bring the status of the FERN JOURNAL files up to date.

In connection with the building up of a college library, the writer had occasion recently to make inquiries as to the cost of the back files of various biological publications; some much younger than the FERN JOURNAL, and some older. The estimates for different journals ranged from $50.00 to $750.00. One reason for the high prices was of course the fact that the early volumes of most of these journals have long been out of print and have come to exist only as rare items to be supplied by dealers.

With the FERN JOURNAL, there is a very different story. It has been the policy of the Society to maintain complete stocks of all its back numbers. With this in mind, when the original supply of an early number becomes used up, it is reprinted. So far, there has been occasion to do this only once, but at the present time, the stocks of several back numbers have become so low that reprinting is necessary.

The basis for this policy is worth noting; namely, to make it possible for those who join the Society more recently to purchase back numbers at a moderate cost. It

may be noted that the early numbers of the JOURNAL contain many articles of considerable interest. The whole file of 26 volumes of the FERN JOURNAL constitute a library of fern literature of great interest and value to the fern lover.

There are 3488 pages in the AMERICAN FERN JOURNAL (up to and including Volume 26) and 230 illustrations.

The cost of 26 volumes is $35.55, figured at $1.50 per volume for all except volume 1, which is $2.00, and allowing 10% discount to members and institutions on orders of six volumes or more.

The following extract from a letter from one of the senior members of the Society should interest us all.

"... On my 79th birthday, last May 26, I made a tramp of ten miles or so over these ridges and hollows after flowers for the flower-book and to check upon the ferns. It was a glorious day of sunshine, blue sky and bird-songs.

"As to the ferns, they checked all right, though some are more rare owing to heavier stock-grazing and fires.

"The most interesting item is the wide-spread increase and the hardihood of *Ophioglossum Engelmanni* in spite of the intense drought and fires. It seems to flourish in any kind of soil, clay or gravel, loam or sand, anywhere—in damp ground near living springs, or high up on the top of ridges; in the shady woods or on the most exposed slopes! It seems to be as nonchalant as some of the plantains which it somewhat resembles at first glance.

"I have found some other ferns which were as bold and weedsome—one of the Aspidiums which grew under the wooden sidewalks in Tacoma, Washington, sending its clusters of fronds up through the cracks. And the royal fern and lady fern used to have to be reckoned with in the market gardens about Chicago, just as the buck-brush

and sassafras do here in southern Missouri.''—S. FRED PRINCE, *Galena, Missouri.*

Mr. Irving Knobloch, 64 Kent Blvd., Salamanca, N. Y., has the following surplus ferns as plants: *Ophioglossum vulgatum, Woodsia obtusa, Polystichum Braunii, Dryopteris Phegopteris, D. hexagonoptera, D. cristata, D. spinulosa, Woodwardia virginica, W. areolata, Camptosorus rhizophyllus, Asplenium platyneuron, A. Trichomanes, Athyrium pycnocarpon, A. thelypteroides,* and *Lycopodium tristachyum.* Any one interested in trading for any of the above will be answered.

New members:

Howard, Mrs. David G., 137 Monticello Ave., Annapolis, Md.
Lumis, Mrs. Harriet R., 28 Bedford Road, Springfield, Mass.
Miller, Mrs. Lawrence, 42 Brunswick St., Pittsfield, Mass.
Neidorf, Charles, 1719 Washington Ave., New York City.
Scamman, Miss Edith, 474 Portland Road, Saco, Maine.

Changes of address:

Bell, Mrs. John J., Winter Park, Fla.
Groff, Miss Mary E., R. F. D. 6, Lancaster, Pa.
Kamm, Mrs. Minnie W., 365 Lakeshore Road, Grosse Pointe Farms, Mich.
Lewis, Rev. Charles S., 3 Academy Road, Albany, N. Y.
Lewis, Rev. William F., 108 Bank St., Burlington, Vt.
Torrey, Raymond H., 99–28 193rd St., Hollis, Queens, N. Y.

Vol. 27 April-June, 1937 No. 2

# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY



## CONTENTS



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# The American Fern Society

## Council for 1937

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EDGAR T. WHERRY, University of Pennsylvania, Philadelphia, Pa. *President*
MRS. CARLOTTA C. HALL, Berkeley, Cal. ..... *Vice-President*
MRS. ELSIE GIBSON WHITNEY, New York State Museum, Albany, N. Y. ..... *Secretary*
HENRY K. SVENSON, Brooklyn Botanic Garden, Brooklyn, N. Y. *Treasurer*

### OFFICIAL ORGAN

## American Fern Journal

### EDITORS

C. A. WEATHERBY ..... 27 Raymond St., Cambridge, Mass.
R. C. BENEDICT ..... 1819 Dorchester Road, Brooklyn, N. Y.
W. R. MAXON ..... Smithsonian Institution, Washington, D. C.

An illustrated quarterly devoted to the general study of ferns.

Subscription, $1.25 per year, foreign, 10 cents extra; sent free to members of the AMERICAN FERN SOCIETY (annual dues, $1.50; life membership, $25.00). Extracted reprints, if ordered in advance, will be furnished authors at cost. They should be ordered when proof is returned.

Volume I, six numbers, $2.00; other volumes $1.25 each. Single back numbers 35 cents each. Vol. I, no. 1; vol. III, nos. 2, 3 and 4; and vol. IV, no. 1, cannot be supplied except with complete volumes. Ten per cent. discount to members and institutions on orders of six volumes or more.

Matter for publication should be addressed to C. A. WEATHERBY, at 27 Raymond St., Cambridge, Mass.

Orders for back numbers and other business communications should be addressed to the Treasurer of the Society.

### LIBRARIAN

MISS HESTER M. RUSK, Brooklyn Botanic Garden, Brooklyn, N. Y.

### CURATOR OF THE HERBARIUM

L. S. HOPKINS ..... Culver-Stockton College, Canton, Mo.

A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.

Philip Dowell

American Fern Journal

Vol. 27 April–June, 1937 No. 2

# Philip Dowell (Dec. 3, 1864—June 25, 1936)

R. C. Benedict

Philip Dowell was born at Attica, New York, the son of a Lutheran minister, John Franz Oscar Dowell, of Swedish descent. His collegiate education was gained in Augustana College, from which he was graduated in 1885 and from which he received his first graduate degree (A.M.) in 1886. From 1889 onward, he taught alternately with his collegiate and graduate work—in Augustana College, in Hope Academy, Moorhead, Minnesota, at Upsala College, at Muhlenberg College (from which he received the degree of Ph.D. in 1900), and at Yale University. In 1902 he served as assistant in the United States National Museum, and in the same year he began his long service (1902–1929) as teacher of biology in the Curtis and Port Richmond High Schools of the New York City system.

He was married Aug. 29, 1894, at Stanton, Iowa, to Anna Severina Albertina Dorothea Halland. They had four children, three of whom survive. Mrs. Dowell died in 1930.

It was during Dr. Dowell's residence on Staten Island that he worked most extensively with ferns. In the course of his botanical pursuits he often visited the New York Botanical Garden; on one of these visits, in 1906, I first met him. At that time he had already made very careful studies of such fern problems as the discrimina-

[Volume 27, No. 1 of the Journal, pages 1–40, plate 1, was issued March 27, 1937.]

tion of the spinulose types in *Dryopteris*, the differentiation of *D. Clintoniana*, and the identification and description of those puzzling dryopterid specimens which would not fit any species-classification and were then coming to be regarded as hybrids. Under his guidance I received a very valuable tutelage in these matters and in the general problems in the study of the ferns native to the vicinity of New York. He was a most careful collector and preparer of herbarium material, and the Herbarium of the New York Botanical Garden contains many fine sheets sent in by him. I did not then get to visit all of the stations from which he obtained his specimens of fern hybrids, but I have visited some of them since. Within the past two years the Fern Society and the Torrey Botanical Club have held joint meetings at the Springdale, New Jersey, station where *Dryopteris Goldiana* and at least one of its hybrids collected there by Dr. Dowell may still be found in relative abundance.

Dr. Dowell's botanical interests were broader than work with ferns; he carried on research in violets and in *Calceolaria*, among other things. He was a member of several scientific organizations; and associate editor of the Bulletin of the Torrey Botanical Club (1907–1911) and its editor-in-chief (1911–1913). He was particularly active in the Staten Island Academy of Sciences.

He was elected President of the American Fern Society in the fall of 1910 and served one year. He was the first regular editor of the American Fern Journal when this periodical became the official organ of the Fern Society, beginning with the third number of Volume I and he continued in this capacity for two years, through Volume 2. In this service he was responsible for establishing the Journal as a carefully edited, creditable botanical periodical, in practically the same format as at present.

BROOKLYN BOTANIC GARDEN

# Some Arizona Ferns Collected in Sonora, Mexico

JACK WHITEHEAD

It was the good fortune of the writer to spend the whole month of September, 1934, with Dr. Forrest Shreve and Dr. T. D. Mallery of the Carnegie Institution of Washington, D. C., and Dr. Ira L. Wiggins of Stanford University, California, on a trip of botanical exploration into the more remote regions of Sonora, Mexico. One of the most interesting features of this trip was the opportunity afforded to study some of the Arizona ferns as found growing in the Sonoran wilds.

One of the first ferns to be collected in Sonora was *Cheilanthes pringlei* Davenport. Specimens were gathered amid the scenic loveliness of the Rio Magdalena. This winding river flows through a rugged and rock-bound countryside, where its banks are lined deeply with many a tree and much luxuriant planting to beguile the nature lover. Wonderful specimens of Sycamore, *Platanus wrightii*, and Honey Mesquite, *Prosopis glandulosa*, were shade-bearers for myriads of annual and herbaceous plants. Above such groupings, among the rocks and boulders, were found numerous specimens of the Pringle Lip Fern. And, most assuredly, it was not alone as a fern species in such a habitat, as also collected hereabouts were *Notholaena sinuata, Notholaena sinuata integerrima, Notholaena lemmoni, Cheilanthes lindheimeri,* and others. Surely here is a fern that might well be popularly known as the Lace Fern, inasmuch as its fronds resemble nothing so much as most delicate lace work, woven of dark green segments and chestnut-brown scaly rachises. Mr. George E. Davenport named this delightful fern in honor of Mr. C. G. Pringle from specimens collected in Arizona. The fern described as *Cheilanthes sonorensis* Goodding is to be regarded, according to Dr. W. R. Maxon, as precisely this species.

About fifteen miles southeast of Magdalena, on the road to Cucurpe, the graceful, delicately cut *Notholaena limitanea* Maxon was collected. It was again collected in a rocky palm-lined canyon near Moctezuma. A truly lovely species, with distribution throughout Arizona, New Mexico, and Sonora, Mexico, it had for years passed as the even more dainty *Notholaena dealbata* Kunze. Dr. Maxon called attention to this error by describing our plant as a new species, *Notholaena limitanea*, and defining the distribution of *Notholaena dealbata* as geographically more to the north and east in the United States. A hardy little creature of the wilds, it seems to delight in growing on rocky hillside slopes or in the talus at the base of limestone cliffs.

It was while camping on the southwestern side of the Babiso Mountains, between Magdalena and Cucurpe, that time was found to explore Palm Canyon. Here two interesting ferns were collected, *Phanerophlebia auriculata* Underwood and *Asplenium palmeri* Maxon. The Palmer Spleenwort is unique in the Trichomanes group of Aspleniums in proliferously creating new plants at the ends of its fronds. Indeed, if it were not for this peculiarity of propagation, this species might be rather difficult to distinguish from the closely allied *Asplenium resiliens* Kunze. While more or less common in Mexico, this species but rarely occurs in the United States. It has been collected at least once in New Mexico and there are two citations from Arizona: the Mule Mountains (Goodding) and the Baboquivari Mountains (Harrison). Professor L. N. Goodding, from the Mule Mountain specimens, described *Asplenium parvulum grandidentatum*, which, however, has since been reduced to synonomy under *Asplenium palmeri* Maxon.

In this rugged mountain canyon *Phanerophlebia auriculata* Underwood was found growing in a cave-like

grotto almost without immediate associates. This lack of company seemed strange where so much riotous vegetation overran the scene. The whole canyon was, in far more than words, a plant paradise, overflowing with wonderful plants of which the following few were noted: *Inodes uresana, Tecoma stans, Berberis haematocarpa, Dasylirion wheeleri, Stachys coccinea,* and a host of others. *Phanerophlebia auriculata* is very distinct among the fern species of the southwest and somewhat resembles the old-fashioned garden favorite, *Cyrtomium falcatum* J. Sm. Early collectors of this plant in the United States appear to have confused it with the more southerly located *Phanerophlebia juglandifolia* J. Sm., and frequently distributed it under the name of *Aspidium juglandifolium* Kunze. *Phanerophlebia auriculata* alone represents the genus in the United States, where it occurs sparingly along the Mexican border in Arizona, New Mexico, and probably Texas.

It was at an already recognized locale that our specimens of *Cheilanthes wrightii* Hooker were gathered along the rocky banks of the Rio San Miguel. The range of the Wright Lip Fern is given by authorities as from western Texas to southern Arizona and adjacent Mexico. Though this delightful wildling shows none of the protective devices characteristic of xerophilous ferns, being usually without pubescence or scales, it here sought to establish its right to a well defined place among desert ferns by growing in close association with species of *Hechtia* and *Graptopetalum* and, more often than not, arose from cushions of *Selaginella rupincola* Underwood.

The most spectacular of our southwestern xerophilous ferns, *Notholaena sinuata* (Lag.) Kaulf., has a comparatively wide range of distribution, extending from Arizona and western Texas to Mexico and, from there, far south into South America. Often to be found as large

CHEILANTHES WRIGHTII HOOK.

tufted plants, strictly erect, and nearly two feet high, this species wants its roots well placed in cliff crevices or among the talus of limestone hillsides, while flaunting its well protected fronds to the bright sunshine. In Sonora, our best specimens were collected in a small arroya not far from Ures. In this setting were found many interesting plants. *Ichthyomethia mollis,* here a good-sized tree, is known as Palo Blanco by the Mexicans of Sonora, who use its leaves and bark for poisoning fish streams. Another strange tree, met with hereabouts, is the Kapok, *Ceiba acuminata.* It is always conspicuous because of the large conic spines on its branches; and it is economically important to the Mexicans in that the wool enclosing the seeds is made into stuffing for bedding and also into wicks for candles. Under the protecting shade of such trees may be found the Chili Tepano, *Capsicum baccatum,* the pods of which are hot *par excellence* and extensively introduced into the savory Mexican cookery. Clambering over the jungle-like forest everywhere, *Cardiospermum halicacabum,* the Balloon-vine, is most evident with its pretty pinkish white flowers and large, balloon-like fruits. While this great wealth of plant-life lent interest to the habitat of the Wavy Cloak Fern it really did little more than enchance the wonder of so beautiful a fern.

Several miles beyond Ures a real Arizona fern was discovered in *Notholaena lemmoni* D. C. Eaton. Undoubtedly a rock-loving species, its herbarium sheet bears this legend: "Rocky slopes on west side of mountain, near Ures, on the road to Babiacori, Sonora, Mexico." The history of this graceful fern is, as it should be, intimately connected with the life and work of Professor J. G. Lemmon. Originally, in 1880, it was collected near Tucson, Arizona, at old Fort Lowell, a famed rendezvous during the Indian wars, now crumbling to ruins under the

shadow of the Catalina Mountains, the highest peak of which is named in honor of this well-known botanist, Mount Lemmon. It is an interesting sidelight upon the character and sincere devotion to science of both Professor and Mrs. Lemmon that, to a great degree, their botanical collections were made in a land infested by hostile Apaches without serious molestation.

Both Professor and Mrs. Lemmon did a great deal with the ferns of Arizona and it is therefore fitting that some recognition of their labors be preserved. In *Notholaena lemmoni* D. C. Eaton, a lovely fern is named in honor of Professor Lemmon; in *Woodsia plummerae,* a truly beautiful fern is described by Professor Lemmon and—"Dedicated to Mrs. Lemmon, whose maiden name is Sarah A. Plummer, and whose devotion to science, arduous labors, and daring heroism while botanizing in the land of the Apache entitle her to high honors and this timely recognition." This small fern is usually found growing in moist situations along the bases of canyon boulders, sometimes singly, more often in clumped groups of individuals. Apparently a somewhat localized species, *Woodsia plummerae* Lemmon, is not always easily differentiated from others of the genus, being rather variable as to size of plants, shape of pinnae and segments, and degree of glandular pubescence. Davenport referred it to *Woodsia mexicana;* D. C. Eaton placed it as a mere form by naming it *Woodsia obtusa* var. *glandulosa,* and many authorities considered it very close to *Woodsia scopulina* D. C. Eaton. It is an Arizona species with its type locality in the Chiricahua Mountains and finding it at La Mina Verde was rather a surprise.

After having gained the highest altitude of the trip at 4,360 feet, we descended, in a deluge of rain, to the hospitality of an abandoned house at La Mina Verde. However glad we were to find shelter for the night, it was as

nothing compared to the delight of awakening on the clearing of the morning to find ourselves in a perfect paradise of ferns. One of the first ferns to greet us here was *Notholaena bonariensis* (Willd.) C. Chr. While authority gives this interesting Cloak Fern a distribution in the United States from Arizona to western Texas, it is more than likely rather strictly confined to the Mexican border region, whence it goes far down into South America. In fact, as its specific name implies, it is a South American plant with type locality at "Bonaria," the well known Buenos Aires of the Argentine Republic. The habitat of this fern is usually one among the rocks of sunny hillside slopes.

It was with no great surprise that specimens of *Notholaena grayi* Davenport were gathered at La Mina Verde, as this fern has been reported as indigenous to northern Mexico by Dr. Edward Palmer. Mr. George E. Davenport, in dedicating this fern to Dr. Asa Gray, has this to say of it: "The species is one of the most elegant yet discovered . . ." And that, indeed, very well describes the Gray Cloak Fern. It was from specimens collected in southeastern Arizona by Mr. William M. Courtis that Mr. Davenport described this plant. Some years ago, Professor L. N. Goodding, upon finding this fern in the Mule Mountains of Arizona, regarded it as an undescribed species and named it *Notholaena hypoleuca,* quite unaware, apparently, of the *Notholaena hypoleuca* of Kunze, a South American species. Perhaps this small fern may best be thought of as only a partial rock-lover as, while it often grows on rocky hillsides, it is mainly found flourishing in open spaces between the rocks in fairly good deep soil.

Not even a partial rock-lover, and never an avowed inhabitant of sunny situations, is the delicately fragile *Bommeria hispida* (Mett.) Underwood. While occasion-

ally, very occasionally, it does have a rocky hillside habitat, it is usually well hidden under low shrubs, growing deeply buried in moist leafmold. It was in just such surroundings that the Hairy Bommeria flourished on canyon slopes at La Mina Verde.

Far more typical of truly xerophilous ferns is *Cheilanthes lindheimeri* Hooker. One must grant that this fern, with its dense equipment of scales and hairs, is amply able to withstand the rigors of life incidental to arid habitats. Often the Lindheimer Lip Fern is to be found growing in extensive masses, shared with grasses and species of *Graptopetalum* and *Selaginella: Selaginella arizonica* Maxon in Arizona, *Selaginella rupincola* Underwood in Sonora. Characteristically its habitat is a rocky or cliffside one. There it becomes one of the showiest of desert ferns and one more or less easy of determination due to the covering of both scales and hairs on the undersides of its fronds. It was fairly common in Sonora, being collected at Ures and here again at La Mina Verde.

At several stations in Sonora, besides La Mina Verde, a rather small fern known as *Notholaena sinuata integerrima* Hooker was collected. Though most often regarded simply as a variety of *Notholaena sinuata* (Lag.) Kaulf., this fern is remarkably distinct of appearance, at least in the field, and there seem to be no gradations in forms between it and the so-called parent species. Hooker originally described this fern, from Mexican specimens, as variety *integerrima* of *Notholaena sinuata*. From material collected in Arizona, Professor Goodding described it as a distinct species under *Notholaena cochisensis*. This species has since been reduced to synonomy by Dr. Maxon. Habitally this form, if mere form it be, never aspires to the tall robustness of *Notholaena sinuata*, but rather is content to remain a small grayish green rock-loving fern.

So wonderfully abundant were ferns at La Mina Verde that almost all the ferns mentioned in this paper were found growing luxuriantly here, with others not indigenous to Arizona, as *Cheilanthes kaulfussii* Kunze, *Pellaea ternifolia* (Cav.) Link, *Pellaea seemanni* Hooker, and, outside of *Polypodiaceae,* the pretty *Anemia anthriscifolia* Schrader.

Boyce Thompson Southwestern Arboretum,
Superior, Arizona

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# A List of Varieties and Forms of the Ferns of Eastern North America

C. A. Weatherby

(*Continued from p. 24*)

Pellaea atropurpurea (Linnaeus) Link, Filicum Species in Horto. . . . Berolinense 59 (1841). *Pteris a.* Linnaeus, Species Plantarum 1076 (1753).—Blades pinnate or bipinnate with entire pinnules.

F. cristata (Trelease) Clute, Fern Bulletin **15**: 47 (1907). *P. a.* var. *c.* Trelease, Report Missouri Botanical Garden **12**: 77, plate 34 (1901).—Tip of blade and lateral pinnules crested.

*P. atropurpurea punctata* and *P. a. venosa* of Gilbert, List North American Pteridophytes 18 (1901), though attributed to Schkuhr, were actually founded nomenclaturally on *Pteris atropurpurea* vars. *venosa* and *punctata* Pursh, Flora Americae Septentrionalis **2**: 668 (1814). These were, in turn, based on plates 100 and 101 of Schkuhr's Kryptogamische Gewächse (1809). His illustrations show respectively a condition sometimes to be found in young fronds in which the veins are clearly visible through the rather thin leaf-tissue (*venosa*) and the normal mature state in which the thick, opaque and dotted leaf-tissue hides the veins (*punctata*).

*Pellaea atropurpurea* var. *minima* Eggert in Farwell, American Midland Naturalist **12**: 281 (1931), is, at least so far as similar specimens in the Gray Herbarium indicate, the same as *P. glabella* Mettenius, discussed in detail in the American Fern Journal by Pickett (**7**: 3–5) and Butters (**7**: 77–87). So is *P. atropurpurea* var. *Bushii* Mackenzie, Manual of the Flora of Jackson Co., Missouri 5 (1902).

ADIANTUM PEDATUM Linnaeus, Species Plantarum 1095 (1753).—Main branches of the blade strongly divergent, curved, the pinnae nearly horizontal; pinnules with well-developed leaf-tissue, except for those at the extreme base and tip nearly equal in size.—Southern Quebec and western New Brunswick to Georgia, Louisiana, Oklahoma and Minnesota.

F. BILLINGSAE Kittredge, AMERICAN FERN JOURNAL **19**: 56, fig. 4 (1929).—Pinnules toward the tips of the pinnae enlarged and overlapping.

F. **laciniatum** (Hopkins), n. comb. *A. p.* var. *l.* Hopkins, Ohio Naturalist **10**: 179, fig. 1 (1910).—Some of the pinnules skeletonized, the very narrow lobes sometimes fertile at the tip.

Var. ALEUTICUM Ruprecht, Beiträge zur Pflanzenkunde des russischen Reiches **3**: 49 (1845).—Main branches but slightly divergent, ascending, not curved; pinnae strongly ascending.—Newfoundland, Quebec and northern Vermont; Pacific slope of North America.

*A. pedatum* var. *triangulare* McCord, Canadian Naturalist, series 2, **1**: 355 (1864), was described as having the pinnules triangular and more deeply lobed than usual. It was probably a juvenile condition which would have changed as the plant grew older.

PTERIDIUM AQUILINUM (Linnaeus) Kuhn in van der Decken, Reisen in Ostafrika **3**, part 3: 11 (1879). *Pteris a.* Linnaeus, Species Plantarum 1075 (1753).—Blade somewhat triangular or in large specimens elongate with nearly equal pinnae, tripinnate below, rather densely pubescent; indusium ciliate. The American plant is:

Var. LANUGINOSUM (Bongard) Fernald, Rhodora **37**: 247 (1935). *Pteris a.* var. *l.* Bongard, Mémoires de l'Académie St. Petersbourg, series 4, **2**: 176 (1832). *Pteridium a.* var. *pubescens* Underwood, Our Native Ferns, ed. 6, 91 (1900).—Pacific Slope; Northern Michigan, Bruce Peninsula, Ontario; eastern Quebec.

F. DECIPIENS (Lawson) Fernald, op. cit. 248 (1935). *Pteris a.* γ *decipiens* Lawson, Edinburgh New Philosophical Journal, new series, **19**: 110 (reprint 11) (1864).—Blade ovate, only bipinnate below.

PTERIDIUM LATIUSCULUM (Desvaux) Hieronymus, wissenschaftliche Ergebnisse der schwedische Rhodesia-Kongo Expedition 1911–1912, **1**, part 1: 7 (1914). *Pteris l.* Desvaux, Mémoires Société Linnéenne Paris **6**: 303 (1827).—Blade thinly pubescent along the veins beneath and on the upper surface near the margin; entire tips of pinnae and pinnules short, lanceolate; indusium not ciliate.—Newfoundland to West Virginia. Minnesota and Missouri and probably farther south.

Var. PSEUDOCAUDATUM (Clute) Maxon, AMERICAN FERN JOURNAL **9**: 44 (1919). *Pteris a.* var. *p.* Clute, Fern Bulletin **8**: 39 (1900).—Blade usually quite glabrous; entire tips of pinnae and pinnules prolonged, linear.—Southeastern Massachusetts to Florida, west to Tennessee, Oklahoma and Texas.

Lawson and others have, in a few cases, used names drawn from European sources for east-American forms; but they do not properly belong to the American plants concerned.

POLYPODIUM VIRGINIANUM Linnaeus, Species Plantarum 1085 (1753). *P. vulgare* of most authors as to the east-American plant.[1]—Blade oblong-oblanceolate, deeply pinnatifid to near the tip, the segments linear-oblong, entire, blunt at tip.

F. ACUMINATUM (Gilbert) Fernald, Rhodora **24**: 141 (1922). *P. vulgare a.* Gilbert, Fern Bulletin **10**: 13 (1902).—Segments tapering more or less gradually to a sharp point, often with somewhat wavy margins.

[1] For a discussion of the reasons for this change, see Fernald, Rhodora **24**: 125*ff*.

F. BRACHYPTERON (Ridlon) Fernald, l. c. *P. vulgare* f. *b*. Ridlon, AMERICAN FERN JOURNAL **11**: 122 (1922). *P. v.* f. *rotundatum* Ridlon, op. cit. **11**: 48 (1921).—Segments very short, nearly or quite as broad as long, rounded at tip or somewhat pointed, shallowly and irregularly toothed.

F. ELONGATUM (Jewell) Fernald, l. c. *P. vulgare* f. *e*. Jewell, Maine Woods **30**: 3 (1908).—Blade abruptly narrowed at about the middle to a long, ribbon-like, only shallowly lobed upper portion.

F. SUBSIMPLEX Fernald, l. c.—Blade narrowly lanceolate, nearly entire.

F. DELTOIDEUM (Gilbert) Fernald, l. c. *P. vulgare* f. *d*. Gilbert, Fern Bulletin **14**: 37 (1906). *P. vulgare,* f. *hastatum* Gilbert, l. c.—Blade rather broad, often triangular in outline, the lowermost segments with an elongate lobe on one or both sides at base.

F. BIPINNATIFIDUM Fernald, l. c.—Segments more or less pinnatifid, their segments broad and blunt.

F. CAMBRICOIDES F. W. Gray, AMERICAN FERN JOURNAL **14**: 5, plate 2 (1924).—Segments deeply cut into long, narrow and acute lobes.

F. CHONDROIDES Fernald, op. cit. 142.—Tip of blade and often tips of pinnae crested.

F. ALATO-MULTIFIDUM (Gilbert) Fernald, l. c. *P. vulgare*, var. *a–m*. Gilbert, Fern Bulletin **14**: 105 (1906). —Tip of blade crested; segments acute and expanded at the base so as to form a broad wing along the rachis. Perhaps not really different from the preceding.

*P. vulgare,* f. *marginale* Gilbert, Fern Bulletin **14**: 35 (1906), with sori near the margin, is probably only a somewhat extreme state of *P. virginianum,* one of whose distinguishing characters is that the sori are nearer the margin than the midrib of the segments. As in most cases in which an American plant has been referred to a European species, various names belonging to Old World forms of *P. vulgare* have been used for American plants to which they do not properly apply.

I have been unable to find authentic material of *P. vulgare* f. *biserratum* Millspaugh, West Virginia Experiment Station Bulletin **24**: 479 (1892). Specimens in the United States National Herbarium supposed to represent this form seem to me indistinguishable from *P. virginianum*, f. *acuminatum*. Should this prove to be the case, Millspaugh's earlier epithet will have to be taken up; but in the absence of a type specimen, I hesitate to make the new combination called for.

The forms of *Equisetum* and *Lycopodium* have been so thoroughly treated by A. A. Eaton in volumes 6–12 of the Fern Bulletin (*Equisetum*) and by Victorin in nos. 3 (*Lycopodium*) and 9 (*Equisetum*) of the Contributions from the Botanical Laboratory of the University of Montreal that there is no occasion for me to consider them here. A few names of true ferns which either escaped me during the preparation of this paper or have been published between the time when it was begun and the end of 1936, are appended.

*Botrychium ternatum*, var. *Agnetis*, Mackay, Proceedings Nova Scotian Institute of Science **10**: xcix (1903) was described as a "condensed form . . . sterile fronds of different ages encircled the stipe of the fertile frond." I have no idea what it was.

*B. obliquum* var. *pennsylvanicum* E. W. Graves, American Fern Journal **25**: 118, plate 10, figure 1B (1935). "Somewhat resembles *B. multifidum* var. *oneidense*, but differs in that the pinnules are broadly triangular instead of broadly oblong." I have regarded such fronds as that illustrated by Mr. Graves as the product of poorly developed or juvenile individuals. Plants which have them should be watched through several years to check variation in leaf-form.

*Osmunda cinnamomea*, f. *crenulata* Dix, American Fern Journal, **26**: 26, plate 2 (1936). Pinnae obtuse, the

upper merely irregularly lobed; pinnules crenate or crenulate.

*O. cinnamomea*, f. *succumbens* Kinney, *op. cit.*, 142. Pinnules overlapping.

*Cystopteris fragilis*, var. *depauperata* Goode, Canadian Naturalist, new series, **9**: 298 (1880) appears from the description to have been founded on dwarfed plants of f. *dentata*.

*C. bulbifera* var. *depauperata* Goode, *op. cit.*, 299, was based on a single dwarfed or juvenile specimen. Neither it nor the preceding seems to deserve any recognition.

GRAY HERBARIUM

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# A Hybrid-fern Name and Some New Combinations

EDGAR T. WHERRY[1]

In the course of compilation of a popular guide to the ferns of the Middle Atlantic States, which it is hoped may be published in the near future, there arose the need for certain nomenclatorial novelties which are here placed on record.

*Asplenium ebenoides* R. R. Scott is now generally accepted to be a hybrid between *Asplenium platyneuron* and *Camptosorus rhizophyllus*. Article 32 of the International Rules of Botanical Nomenclature, 1930, states that bigeneric hybrids are to be designated "whenever it seems useful or necessary, by a name," consisting of "a new 'generic' name usually formed by a combination of the names of the parent genera." In accordance with this plan, it is now proposed to designate the fern in question as ×**Asplenosorus ebenoides** (Scott), nom. hybr. nov. As an appropriate common name, Walking Spleenwort may be used.

[1] Contribution from the Botanical Laboratory and Morris Arboretum of the University of Pennsylvania.

*Botrychium obliquum* var. *pennsylvanicum* Graves. Does not differ essentially from the original *B. obliquum* Muhl. ex Willd., which was, indeed, described from Pennsylvania; will be taken up as representing the earliest name for this in varietal status. Two other well-marked varieties are var. *oneidense* (Gilbert) Waters and var. *tenuifolium* (Underw.) Gilbert. There are also many forms, one of which requires further discussion. This is a mutant with the marginal serrations more or less intensified, and, as shown by Tryon,[2] may develop from the same root which another year produces a normal *obliquum* frond. It has been regarded as the plant to which Sprengel gave the name *B. dissectum*, and, when reduction to the status of form is made, the rules of priority require the combination to read *B. dissectum* f. *obliquum*, as pointed out by Clute. The more southern plant to which Sprengel's name was applied is, however, much more deeply cut, with divergent teeth, and grows independently; in the writer's opinion it is to be classed as a distinct species. Anyone who feels that forms must have technical names can coin a new one for the serrate *obliquum*.

When a species has become segregated into two or more geographic varieties—or subspecies, as they are coming to be termed by an increasing number of authors—all of the segregates should be regarded as of equal rank and assigned trinominals. This has already been done for some of our eastern species, but apparently not for those named below. When there is no name in varietal status already on record, the Rules permit, for the subdivision which includes the type, either a duplication of the species name or the use of "one of the customary epithets, *typicus, genuinus, originarius,* etc.," the latter alternative being preferred here.

[2] This Journal **26:** 26. 1936.

*Botrychium simplex* var. **cordatum** (Fries), comb. nov. *B. lunaria* var. *cordatum* Fries. This is the variety represented by the original *B. simplex* Hitchcock. Others are var. *tenebrosum* (A. A. Eaton) Clausen and var. *laxifolium* Clausen.

*Osmunda claytoniana* var. **vera,** nom. nov. The basis of *O. claytoniana* L. A varietal name is needed to make this coordinate with the Asiatic var. *vestita* (Wall.) Milde.

*Adiantum pedatum* var. **originarium,** nom. nov. The plant named *A. pedatum* L. It grades into var. *aleuticum* Rupr.

*Pteridium latiusculum* var. **verum,** nom. nov. The original *P. latiusculum* (Desv.) Hieron. ex Fries. Another is *pseudocaudatum* (Clute) Maxon.

*Onoclea sensibilis* var. **genuina,** nom. nov. The American *O. sensibilis* L., with an Asiatic counterpart, var. *interrupta* Maxim.

*Athyrium angustum* var. *typicum* (Butters), stat. nov.[3] *A. a.* forma *typicum* Butters. The epithet is needed in varietal status for coordination with vars. *elatius, rubellum,* etc.

*Lycopodium lucidulum* var. **verum,** nom. nov. The variety on which was based *L. lucidulum* Michx. Its counterpart is the more northern var. *occidentale* (Clute) Wilson.

*Lycopodium inundatum* var. **typicum,** nom. nov. The basis of *L. inundatum* L. Here there are two other varieties, var. *bigelovii* Tuckerm. and var. *robustum* R. J. Eaton.

*Equisetum sylvaticum* **var.** *multiramosum* (Fernald) stat. nov. *E. s.* var. *pauciramosum* forma *multiramosum*

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[3] **The category term is placed in bold face here because it is the novelty, rather than the third epithet; the latter is sometimes so treated even when merely changed in status, but in my opinion this may be misleading.**

Fernald. Since I interpret the term form as applying to a peculiar plant which appears sporadically in the midst of normal ones, and variety to a plant of abundant occurrence over a definite range, I can only place this Horsetail in the latter category.

PHILADELPHIA, PA.

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# Ferns of Hot Springs National Park and Vicinity

FRANCIS J. SCULLY

Hot Springs National Park is located in central Arkansas in the eastern part of the Ouachita Mountains. Due to its mountainous character there is a wide range in the natural topography within the area of the park itself and in the surrounding region. One may find rocky bluffs or dry hillsides either open or shaded by a growth of pine, oak, and hickory. The soil is mostly acid, derived from the disintegration of shaley sandstone. There are also isolated outcrops of limestone especially toward the north. In the deeper valleys are accumulations of humus and richer soil, often damp and boggy from springs at the base of the rocky cliffs.

Such a varied range of natural conditions would naturally support a wide variety of ferns. The following list represents the collection made by the writer in Hot Springs National Park and the immediate vicinity.

POLYPODIUM POLYPODIOIDES (L.) Hitchc. Gray Polypody. Common on trees with rough porous bark and on moist mossy rocks, in moderate shade.

ADIANTUM PEDATUM L. Maiden-hair Fern. Occasional at base of shady wooded slopes in rich, moist, well drained soil. Rocky bluffs near the Ouachita River and other smaller streams.

PTERIDIUM LATIUSCULUM var. PSEUDOCAUDATUM (Clute) Maxon. Bracken. Common in open pine woods, in dry or slightly moist acid soil.

CHEILANTHES ALABAMENSIS (Buckley) Kunze. Alabama Lip-fern. Rare, found only on the limestone tufa deposits at the base of Hot Springs Mountain, under shady projecting ledges.

CHEILANTHES TOMENTOSA Link. Woolly Lip-fern. In scattered tufts in dry rocky and moderately shaded localities on North Mountain.

PELLAEA ATROPURPUREA (L.) Link. Purple-stemmed Cliff Brake. Rare, found on limestone tufa deposits at base of Hot Springs Mountain in clefts of open dry ledges.

ASPLENIUM PLATYNEURON (L.) Oakes. Ebony Spleenwort. Common on sandstone ledges especially in low shady woods or at base of partly shaded grassy slopes. Variable in size depending on the soil.

ATHYRIUM ASPLENIOIDES (Michx.) Desv. Lady Fern. Common in moist rich woods near streams. Very variable in size of fronds, number and size of sori, and in depth of serrations on pinnules.

POLYSTICHUM ACROSTICHOLDES (Michx.) Schott. Christmas Fern. Common in moist shaded locations along the banks of streams.

POLYSTICHUM ACROSTICHOIDES var. INCISUM Gray. Incised Christmas Fern. Occasionally found with the type variety.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. Broad Beech-fern. *Thelypteris hexagonoptera* (Michx.) Weatherby. *Phegopteris hexagonoptera* (Michx.) Fée. Common in damp oak woods.

DRYOPTERIS MARGINALIS (L.) Gray. Evergreen Woodfern. *Aspidium marginale* (L.) Sw. *Thelypteris marginalis* (L.) Nieuwland. Occasional on moist shaded sandstone ledges near Ouachita River.

DRYOPTERIS NOVEBORACENSIS (L.) A. Gray. New York Fern. *Aspidium noveboracense* (L.) Sw. Occasional in low moist woods.

WOODWARDIA AREOLATA (L.) Moore. Net-veined Chain-fern. *Lorinseria areolata* (L.) Presl. Several large colonies in vicinity of the park in swampy ground in low shady woods.

CYSTOPTERIS FRAGILIS (L.) Bernh. Brittle-fern. Rare, on moist shaded mossy limestone ledges near Ouachita River.

ONOCLEA SENSIBILIS L. Sensitive Fern. Rare, in moist low woods along streams.

OSMUNDA REGALIS var. SPECTABILIS (Willd.) Gray. Royal Fern. Common in restricted areas in swampy open woods.

OSMUNDA CINNAMOMEA L. Cinnamon Fern. Common in shady bogs, forming large colonies. Fronds often large, up to four feet in length.

Through the kindness of Dr. H. K. Svenson at the Brooklyn Botanic Garden, and Dr. L. S. Hopkins, curator of the American Fern Society herbarium, the identification of the above ferns has been checked.

This list is by no means complete. Further search will more than likely add new species to the list. In the western portion of the Ouachita Mountains along the Oklahoma border Featherly and Still (1) have reported a similar list of ferns. In the Ozark Mountains which lie just north of the Ouachita Mountains and extend into Missouri, Palmer and Steyermark (2) found many of the same ferns. This would indicate a rather widespread distribution of these ferns.

Branner (3) in 1888 gave thirty-six ferns and seven fern allies in his list of Arkansas plants, based on previous collections by Harvey, Coville, Lesquereux, and Nuttall. Bucholz (4) more recently corrected this list and with new additions found forty-six species and three varieties of ferns and fern allies in the state. Palmer also reported two interesting species from the higher

ranges of the Ouachita Mountains about one hundred miles west of Hot Springs National Park.

All these reports list ferns to be found in similar habitats existing in this region. It is very likely that many of these will be found here by a more careful survey.


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(3) Branner, J. C., and Coville, F. V. A list of the Plants of Arkansas. Annual Report for 1888. Arkansas Geol. Survey 4: 155. 1891. Little Rock.

(4) Bucholz, J. T. Notes on Arkansas Pteridophyta. AM. FERN JOUR. 14: 33 (Apr.–June). 1924.

(5) Palmer, E. J. Two Interesting Ferns from Arkansas. AM. FERN JOURN. 14: 39 (Apr.–June). 1924.


HOT SPRINGS, ARKANSAS

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## Recent Fern Literature

Eames, Arthur J. *Morphology of Vascular Plants: Lower Groups (Psilophytales to Filicales)*. McGraw-Hill, New York. ($4.00.)

This book of Professor Eames, Cornell, deals entirely with the general group of plants in which the Fern Society is particularly interested; the Pteridophyta, broadly considered. It is an extremely important book from a botanical point of view. While too technical to be of general interest to Fern Society members at large, it is certainly worthy of mention and review in these pages.

It presents in considerable detail a summary of the findings and conclusions which the comparative study of living and fossil pteridophytes, specially during the

last 25 or 30 years, has contributed. Just about thirty years ago, Professor E. C. Jeffrey, of Harvard, pointed out that the old classification of woody or vascular plants into fern-like plants and seed plants deserved to be replaced. He suggested at that time a division into two new groups: I. Pteropsida, to include true ferns, modern seed plants, and fossil types allied to this group; II. Lycopsida, to include Lycopodium, Selaginella, Isoetes, and various other living and extinct forms.

Professor Jeffrey's suggestions have since been followed with certain amendments and the conclusions of the comparative plant anatomists are presented in up-to-date form in Professor Eames' book. The general division of vascular plants there gives four major subdivisions of one single, large group or phylum, the Tracheophyta. These divisions are as follows: Psilopsida, including the modern tropical Psilotum and certain paleozoic types; Sphenopsida, to include modern Equisetum and ancient types; Lycopsida, Lycopodium, etc.; Pteropsida, to include true ferns and all flowering plants.

So much for a summary of the technical parts. Many interesting facts for the fern student may be gleaned from its pages. That fossil vascular plants extend as far back as the Silurian period is one of the findings of the last few years. The descriptions of the peculiar prothallia of many living pteridophytes is of great interest. The recognition of *Psilotum,* a common West Indian plant, and its congeners as presenting the most primitive type of vascular plant with no real differentiation into stem and leaf and with nothing that can properly be identified as a root is highly significant.—R. C. B.

Weatherby, C. A. *On the Types of Desvaux's American Species of Ferns. Contr. Gray Herb. 114, no. 4.*

The above title represents a valuable contribution to

the nomenclature of American ferns. Hours of careful examination of a large number of specimens, laborious searching of fern literature, and visits to foreign institutions for the sake of examining collections made over 100 years ago are represented in the 24 pages of this report.

To the average fern student, whether technically trained or not, the question of the naming system represents a phase of fern study which is quite outside of the ordinary experience and interest, but this kind of work is basically essential and we may be sure that it has been accurately done.—R. C. B.

Alston, A. H. G. *The Philippine Species of Selaginella.*

In a recent number of the FERN JOURNAL, Dr. Alston's paper on Javanese *Selaginella* was reviewed. The present article represents a continuation of the same kind of study. Again it may be noted, as reported in the other review, that it is unusual to find a systematic paper covering a considerable number of exotic species in which the author does not find occasion to describe a number of new species. The paper lists 46 species, suggesting that that number may eventually prove to be identical with those in other Asiatic regions. He notes that the "chief difficulty has been the large number of species described by Hieronymus; 28 of these have been reduced to synonymy."—R. C. B.

Mr. R. M. Tryon[1] has published a list of 26 species of ferns (plus several varieties) found in the Dune Region of Indiana along the shore of Lake Michigan. He gives detailed notes on the habitats which the different species there prefer. For the most part these are what one would

[1] Tryon, R. M. Ferns of the Dune Region of Indiana. Am. Midl. Naturalist **17**: 425–429 (1936).

expect, but occasionally there is a surprise. *Athyrium angustum,* for instance, is said to grow best in damp, shady woods and var. *elatius* to be a sun-form with upturned pinnae. My own experience in southern New England has been that typical *A. angustum* is a plant of comparatively dry, exposed places, var. *rubellum* taking its place in moist woods; and that var. *elatius* is more or less tolerant of shade. Mr. Tryon further makes the observation that *A. asplenioides* prefers drier ground than *A. angustum*—which again does not accord with my experience in the East, if typical *A. angustum* is meant.

Pepoon's report of *Dryopteris Phegopteris* from the dune area is regarded as erroneous.—C. A. WEATHERBY.

One of the most agreeable signs of the times to the botanist interested in floristics is the activity of a group of field-workers in Virginia, who are studying the distribution of its plants and laying the foundations for a flora of the state, which has not had one since about 1760. This group has started a promising little magazine, called *Claytonia,* and is publishing certain preliminary lists. Prof. Massey has recently put out one of the shield ferns of Virginia, 13 species, with notes and citation of specimens. The record of *Dryopteris spinulosa* var. *americana* from the margin of Lake Drummond in the Dismal Swamp, on the authority of Kearney in 1901, sounds improbable. The chances are that the specimens in question will prove to be typical *D. spinulosa,* a species which has been reported by other collectors from the Dismal Swamp and luxuriant states of which were in the past often determined as *D. dilatata.*[2]—C. A. W.

According to an unsigned article in *Nature,*[3] bracken has become a serious pest in the pastures of Great Britain.

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[2] Massey, A. B. Shield Ferns of Virginia. Claytonia 3: 15–21 (1936).

[3] Nature **138**: 706–707 (Oct. 24, 1936).

In earlier times it was kept within bounds by harvesting for use in thatching, as bedding and as a source of potash in the making of fertilizer, soap, etc., and also by the trampling of animals in closely grazed land. It is no longer used in manufactures and the partial depopulation of rural areas has reduced the number of animals turned out to pasture. In consequence it has spread and has formed such dense stands that, in many cases, the available grazing land has been reduced by one-half or even more. It is said that a single plant will cover an acre in about 30 years.

Control is difficult. Pigs will dig up the rhizomes and eat them, thus reducing the stand somewhat. But the only really effective method is repeated mowing; and this, if done by hand, has proved economically impracticable, since it costs from 3 to 8 shillings to mow an acre once and much of the land concerned is worth only a shilling or two per acre. However, the matter is so serious that special mowing machines have been invented which, under favorable circumstances, bring the cost down to one and a half shillings per acre. It is from these machines that a solution of the problem is expected.

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## Shorter Notes

THE EFFECT OF LIGHT ON THE FRUITING OF THE CHRISTMAS FERN.—It will be recalled that *Polystichum acrostichoides*, forma *incisum* bears sori not only on the upper pinnae, as is the usual habit of the species, but also at the tips of the lower ones. Those of us who are familiar with it in the field have noticed that it occurs often—most often, I believe—in recent clearings and have suspected that the additional fruiting is caused by, or at least correlated with, the greater amount of light let in by the cutting off of the forest.

This year another form has furnished evidence that such is actually the case. For some time I have had growing in a shady spot in my back yard a vigorous plant of *P. acrostichoides*, forma *lanceolatum*, given me by Mrs. Chisholm. For three or four years past it has fruited freely, but always in the conventional manner, on the upper pinnae only. Last spring one of the trees which shaded it had to be cut down; this summer the fruiting fronds bore sori not only on the upper pinnae but also at the extremities of the lower ones. All, moreover, showed a more irregular marginal cutting than before, quite in the manner of forma *incisum*, though the essential traits of forma *lanceolatum* were preserved. Since there was no other disturbance of the plant than the removal of the tree, this seems to point unmistakably to the increased intensity of light as the stimulus which produces greater soriation.—C. A. WEATHERBY, *Gray Herbarium.*

TRICHOMANES PETERSII IN LOUISIANA.—A westward extension of range for this rare species may be recorded on the basis of two specimens in the U. S. National Herbarium, collected at Sulphur Springs, Covington, Louisiana, by Rev. Bro. G. Arsène in July, 1921 (no. 14396), and March, 1924 (no. 14764). They were not identified by Brother Arsène and were, in fact, included in a collection of about 175 Louisiana hepatics presented by him to the National Museum in September, 1924. This collection was subsequently lent, as received, to Miss Caroline C. Haynes for identification. Naturally the identity of the two numbers mentioned was noted when the collection was returned by Miss Haynes a few months later, but unfortunately the specimens became misplaced and have only recently come to light. No. 14396 is in poor condition; on the other hand, no. 14764 is freely fertile

and is so ample that it will be shared with other herbaria. Both are of the characteristic mat-like form. They grew on the trunk of magnolia trees, according to Brother Arsène, but apparently at the base of the tree, since the substratum is not only of bark but to a lesser extent of earth.—WILLIAM R. MAXON, *U. S. National Museum.*

THE IDENTITY OF MENISCIUM OLIGOPHYLLUM.—This name was published by Baker, as a *nomen subnudum,* in Ann. Bot. v. 477 (reprint 104) (1891). He placed it under *M. reticulatum,* merely remarking, by way of description, that it differed "from the type by having only 5–9 pinnae." It was listed in Christensen's Index as a species of doubtful identity; so far as I know, it has never been definitely placed.

Recently a specimen of it from the Linden establishment has come to light in the herbarium of Martin Martens, lately acquired by the Jardin Botanique de l'Etat at Brussels. The specimen consists of a frond-tip showing the terminal pinna and two lateral ones. Though it is not in fruit, there can be little, if any, doubt that it is *Dryopteris macrophylla* (Kze.) C. Chr. of Brazil. *Meniscium oligophyllum* Linden ex Baker may, then, be added to the synonymy of that species.—C. A. WEATHERBY, *Gray Herbarium.*

ANOTHER NEW HAMPSHIRE STATION FOR POLYPODIUM VIRGINIANUM, FORMA CAMBRICOIDES.—This station was discovered by two boys in the summer of 1935. It is on the shore of a lake in the township of Nelson, just eighteen miles from the South Lyndeboro station recently reported by Mrs. Richards, at an elevation of about 1,400 ft. The ferns are on a rock about eight feet above the water with a northwesterly exposure which gets sun during the afternoon. The soil is about one to three inches

thick and is made up mostly of wood from a rotten stump which was cut about sixty years ago. All the specimens —perhaps sixty fronds in all—are within a square no more than eight by eight feet. There is some moss and a few common polypodies, which do not seem to flourish.

Fearing that some one would find the station and rob it, I have transplanted three plants to another location about a mile away in which place they have increased at least 100% in the last year and a half. They seem to prefer a less dry and more shaded location than the original one.—HOWARD GILMORE, *Brookline, Mass.*

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## American Fern Society

Benjamin Franklin Bush, widely known as a botanical collector and author, and a member of the American Fern Society since 1909, died at Independence, Missouri, February 14, 1937, at the age of 79 years. Born in Columbus, Indiana, January 21st, 1858, he went with his mother to Independence in 1865. She later married Robert B. Tindall, a pioneer florist who established the first greenhouse in Independence, and Bush's early interest in plants probably owed much to this association.

Bush was a born naturalist, and he found in the vicinity of Independence a most favorable field for exploration and study. Ornithology was one of his earliest interests, and he became a local authority on the birds of Jackson County. His work on the local flora must also have begun at an early age, since his first list of the species found in Jackson County was published in 1882. In pursuing this study he became a correspondent of Dr. George Engelmann and Dr. Asa Gray, and in later years his correspondents included most of the botanists of America and many abroad.

In 1891 and 1892 he was employed to assist in collecting specimens of wood and other material for the Mis-

souri forestry exhibit at the Columbian Exposition at Chicago; and this work took him into many parts of the state. Later, as a collector for the Missouri Botanical Garden and the Arnold Arboretum, he extended his explorations into Arkansas, Oklahoma, Texas, and other states. Many of his collecting trips were undertaken on his own account, and he prepared sets of plants and distributed them to most of the botanical institutions in the United States and to many in foreign countries. While carrying on this work he discovered a large number of plants new to science, and his collections also extended the known range of hundreds of species.

Mr. Bush was the author of numerous papers on botanical subjects, including plant lists and revisions of a number of genera. He also frequently contributed notes and articles of popular interest on the plants and birds of Missouri to local papers. Many of these were published in the *Kansas City Star*, and amongst them were several on the ferns found in the vicinity of Kansas City.

The study and collection of ferns was always one of Mr. Bush's chief interests, and he knew and had discovered many localities where rare species grew or where ferns were to be found in the greatest variety. He published several papers on the ferns of Missouri, Oklahoma, and Texas, including one of the first extensive lists of the species found in Texas.

For more than forty years he conducted a general store and was postmaster at Courtney, a little village situated in a great bend of the Missouri River 16 miles east of Kansas City, and it was there that much of his botanical work was done in the little leisure time he could find from his duties as merchant and postmaster. Considering the fact that he was working without the advantages of a botanical library or herbarium, the amount of work he accomplished in this field was truly astonishing.

American botany, and particularly the knowledge of the flora of his adopted state, owes much to the work of Benjamin Franklin Bush. He will be remembered by the large collections of plants which he distributed all over the world, by the many new plants which he discovered and some of which he described, and by scores of species which bear his name, as well as by his botanical writings. He will be missed by a large circle of friends who were associated with him and by a wider circle who knew him only through correspondence and through his botanical activities.—ERNEST J. PALMER, *Arnold Arboretum.*

Dr. Elisha L. Lee, retired physician and former member and vice-president of the Fern Society, died in Bridgeport, Alabama, Oct. 16, 1936, in the ninety-eighth year of his age. For a long time he was actively interested in the ferns of his region and contributed occasional articles to the *Fern Bulletin* and at least one to the FERN JOURNAL. Some account of him and of his fern herbarium may be found in Miss McGilliard's paper on the hart's-tongue in Tennessee in vol. 26, no. 4, of the JOURNAL.

Mr. George Redles, a former member of the Society, died in Philadelphia, Jan. 20, 1937, aged 76. He was for a number of years on the staff of Fairmount Park. He was an excellent field botanist, with a very thorough knowledge of the country about Philadelphia. Some of his experiences in exploring it are entertainingly told in his one article in the JOURNAL—vol. 5, page 52.

During the fourth week in June, 1937, the American Association for the Advancement of Science and affiliated organizations will meet in Denver, Colorado. It will not

be practicable for the American Fern Society to hold a meeting for the presentation of papers, but if any of our members expect to attend other meetings and would like to take part in a field trip to see some of the rare ferns which grow in the Boulder region, arrangements can be made, as follows:

Just before the A. A. A. S. meetings open on Sunday, June 20th, and Monday, June 21st, Mr. D. M. Andrews of Rockmont Nursery, Boulder, Colorado, has agreed to guide anyone interested to localities in that vicinity. Transportation will be furnished to members who so desire. Two from the east (Trudell and Wherry) expect to be there, and it is hoped that there may be others interested. Write to Mr. Andrews when you will arrive, and meet the group at the Rockmont Nursery in Boulder.

New members:

Beam, Wesley W., West Point, Pennsylvania.
Bell, Mrs. John J., Winter Park, Florida.
Eddy, Jesse G., 131 Appleton Ave., Pittsfield, Mass.
Gumpfer, Mrs. Edith E., Cornell Ave., Churchville, Bucks Co., Pa.
Porter, Mrs. Fred, 1503 Chamberlain, Chattanooga, Tenn.
Ruggles, Mrs. F. G., 73 Carnegie Ave., East Orange, N. J.
Torrey, Raymond H., 99–28 193rd St., Hollis, Queens, N. Y.

Changes of address:

Cheever, Dr. A. W., 464 Beacon St., Boston, Mass.
Evans, Miss Lucile, 2125 Kenwood Blvd., Milwaukee, Wisconsin.
Lewis, Rev. Charles S., Kinderhook, N. Y.
McAvoy, Miss Blanche, 108 West Ash St., Norwal, Illinois.
Spawn, William, 3730 McKinley St., N. W., Washington, D. C.

The American Horticultural Society, Inc., of Washington, D. C. has invited the President of the American Fern Society to become an honorary vice-president. They propose to review in the National Horticultural Magazine all our articles that are of horticultural interest, as well as announce our meetings and trips.

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# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

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A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.

# American Fern Journal

VOL. 27 JULY–SEPTEMBER, 1937 NO. 3

## Vacationing Among Tennessee Ferns

JESSE M. SHAVER

The old camera and tripod were stored in the back of the car; plant presses with an abundance of driers and ventilators and an old suitcase of clothes were packed in the trunk. Vacation time had arrived and with it the desire to climb the mountains of East Tennessee and collect and photograph the ferns found there. With my friend, Harry Monk, of Nashville, an indefatigable and accurate student of birds, I left Nashville on the morning of August 29, 1935. The plan was to stop along the road at any place that looked attractive and stay as long as we liked. I collected and photographed plants during the daytime and pressed them in the evening while my companion concentrated mainly on the birds. It seemed unwise to stop at the station of Scott's Spleenwort (× *Asplenium ebenoides*) at the Mount View School (Shaver, 1934) since it had been visited not many weeks before and found to be in an unusually flourishing condition, with only two plants present, however; or at the power plant dam at Rock Island where occurs the finest growth of Venus-hair Fern (*Adiantum Capillus-Veneris*) with which I am acquainted. There are masses of this fern along the bluff for perhaps three hundred yards with some of the fronds three or four feet long. The situation

[Volume 27, No. 2 of the JOURNAL, pages 41–72, plates 2 and 3, was issued June 4, 1937.]

is usually favorable with so much water running over the bluff all of the year from the aqueduct above. Many other interesting ferns are here but only the Bulblet Fern (*Cystopteris bulbifera*) occurs in any abundance. There is, however, a nice growth of the Field Horsetail (*Equisetum arvense*) at the foot of the bluff.

Even many of the places where we stopped and many of the ferns that we collected cannot be mentioned—the trip was too long (21 days), the notes too voluminous, the ferns too numerous (more than a thousand specimens were pressed), and too many photographs were taken (186 to be exact). Only the outstanding "finds" can be considered and these in a rather brief and unsatisfactory manner.

A stop was made on the side of the Cumberland Plateau just above Sparta, in White County, where the Field Horsetail (*Equisetum arvense*) grows along the road bank. This horsetail is always of interest to us on account of its apparent rarity in Tennessee (I know of only seven stations in the state—the two mentioned above, two at Reelfoot Lake, Obion Co.; one near Kingston Springs, Cheatham Co.; one near Donelson, Davidson Co.; and one near Kingston, Roane Co. An additional station at Cave Spring, East Tennessee, was given by Gattinger (1901, p. 30) but I have not been able to visit this place as yet. We hoped to find Lloyd's Club-moss (*Lycopodium porophilum*) here since some of my students had collected it here on July 4. In this we were successful, this *Lycopodium* being very common on the sandstone escarpment of the plateau in wet places. A small amount of Maidenhair Spleenwort (*Asplenium Trichomanes*) not previously found here was discovered. In addition the usual ferns of a very damp shady woodland were found. The most interesting of these was probably the very large and beautiful Goldie's Fern. This fern is fairly common in

such situations on the west side of the Cumberland Plateau. The American Shield-fern (*Thelypteris spinulosa intermedia*) was also common here. In the Cumberland Plateau region, it is usually found with Goldie's fern. This fern is not nearly as scarce as Anderson (1930–1931, p. 147) indicated.

Many stops were made on top of the Cumberland Plateau to see the magnificent masses of Cinnamon-fern (*Osmunda cinnamomea*) and Royal Fern (*Osmunda regalis spectabilis*) along the small marsh-like streams. One of these stops was at Caney Fork near Pleasant Hill where I had previously found eighteen species of ferns and the Ground-pine (*Lycopodium obscurum*) and Creeping Selaginella (*Selaginella apus*) within a radius of two hundred yards—an unusual collection for Tennessee. This group included the dainty Climbing-fern (*Lygodium palmatum*) so common near streams in open areas on this plateau. On this trip another fern, the Net-veined Chain-fern (*Woodwardia areolata*) was added to those known to be growing on the Caney Fork here.

Another interesting area is around Daddy's Creek about five miles east of Crossville where only common ferns of the plateau were found. Two or three pleasant hours were spent at the falls of Fall Creek at Ozone and the gorge below. A total of sixteen species of common ferns and one Ground-pine (*Lycopodium obscurum*) were found. The great number of species of ferns found at this place was due in part to the upper escarpment being of sandstone and the lower escarpment of limestone. Bluntlobed Woodsia (*Woodsia obtusa*) was found here, but only rarely occurs in the mountains in sandstone sections. It seems to prefer limestone areas (Woodruff, 1935, p. 281). Only a brief glance was given to the area around Mammy's Creek since this had been studied on earlier trips. It is an extremely interesting area from

the view-point of the fern student because of the number of species present. Here is the last station for the Climbing Fern before entering the Valley of East Tennessee. The limestone bluff on the Clinch River opposite Kingston has a big group of limestone ferns—altogether twelve species and the Field Horsetail. It was interesting to us to find the Common Polypody (*Polypodium virginianum*) growing on a limestone ledge. It is very rare to find this fern growing on any rock but sandstone in Tennessee.

Four days were spent on and around Mt. LeConte in the Smoky Mountain National Park: on the Cherokee Orchard Trail, the Bear Pen Hollow Trail, the Roaring Fork Trail, and the New Found Gap Trail. These trips were mainly on foot and on only one day did we get rained on. Since the Cherokee Orchard Trail is the easiest and most traveled trail up Mt. LeConte, it might be interesting to list the ferns that may be met in an ascent by this route. Before reaching Mr. Whittle's cottage from Gatlinburg, one should see by the road: Christmas-fern (*Polystichum acrostichoides*), New York Fern (*Thelypteris noveboracensis*), Ebony Spleenwort (*Asplenium platyneuron*), Southern Lady-fern (*Athyrium asplenioides*), Hay-scented Fern (*Dennstaedtia punctilobula*), Broad Beech-fern (*Thelypteris hexagonoptera*), Maiden-hair Fern (*Adiantum pedatum*), and the Bracken (*Pteridium latiusculum pseudocaudatum*). Back of Mr. Whittle's cottage occurs the Climbing Fern (*Lygodium palmatum*) and many other ferns obviously transplanted into his yard. No one was at home at the time of our visit and so we were unable to find out whether the climbing fern was growing here naturally. As far as I can discover, this is the only station known for the climbing fern in the Smoky Mountain region. By the stream above Mr. Whittle's place are the grape ferns (*Botrychium dissectum* and *B. dissectum obliquum*). These are not rare

ferns in the Smokies but occur together at appropriate habitats in many places in Sevier County. I found them very common by the Roaring Fork Trail during the first two or three miles and at several places on Jake's Creek above Elkmont. Dr. Dickerson has told me of an additional station near Jake's Creek and says that they are very common in the mountains of Cocke County. With the exception of the station near Mr. Whittle's place, these are all new stations for these two ferns in Tennessee. The Cinnamon Fern is very abundant just above Mr. Whittle's place.

Between Cherokee Orchards and Rainbow Falls, these additional ferns may be seen: Common Polypody (*Polypodium virginianum*), Evergreen Wood-fern (*Thelypteris marginalis*), Brittle Fern (*Cystopteris fragilis*), American Shield-fern (*Thelypteris spinulosa intermedia*), Mountain Spleenwort (*Asplenium montanum*), Virginia Grape-fern (*Botrychium virginianum*), Shining Club-moss (*Lycopodium lucidulum*), Silvery Spleenwort (*Athyrium acrostichoides*), and Maidenhair Spleenwort (*Asplenium Trichomanes*). Between Rainbow Falls and the top of Mt. LeConte, I have only found one additional species, the Spreading Shield-fern (*Thelypteris spinulosa americana*). Thus one may easily see twenty species or varieties of ferns and one club-moss on the trip from Gatlinburg to the top of Mt. LeConte.

The Bear Pen Hollow Trail adds no ferns to the above list. Along this trail however is the Ground-pine (*Lycopodium obscurum*) not found by me on the Cherokee Orchard Trail. On none of the other trails up Mt. LeConte were other ferns found except one on the Roaring Fork Trail, namely, the Narrow-leaved Spleenwort (*Athyrium angustifolium*).

The rest of our studies at this part of the park and around Elkmont added nothing of importance to our

studies until we started down Little River from Elkmont. By the road we found the Woolly Lip-fern (*Cheilanthes tomentosa*) on a rock in Blount County. This we believe is a new station for this fern in Tennessee. Further on at Kinzel Springs we saw this fern at the station discovered by Anderson in 1929 (Anderson, 1930–1931, p. 20). We also visited later on this trip the station in the gorge of Tellico River (Monroe Co.) found in 1882 by A. G. Weatherby and the station on the Nolichucky River mentioned by Knight (1933, p. 28).

We found the region around Kinzel Springs to be exceptionally rich in ferns. This was the only place in Blount County that we saw the Hairy Lip-fern (*Cheilanthes lanosa*). The trip over Rich Mountain, through Cades Cove, and on the side of Gregory Bald furnished many of the common ferns. The occurrence of the Ternate Grape-fern (*Botrychium dissectum obliquum*) in abundance near the foot of Gregory Bald without a single plant of the Cut-leaved Grape-fern (*Botrychium dissectum*) being discovered in spite of very careful search on our part, is of interest. This is the way I have found it on the Cumberland Plateau (Cumberland County), around Nashville (Davidson County), and in Chester County, west Tennessee. This fact is interesting in connection with the discussion of the specific or varietal status of these two ferns (Graves, 1932).

Two days were spent in Monroe County and twenty-nine species of ferns studied and collected. A trip was made up the Tellico River to about the North Carolina line and also to the top of Haw Knob—the highest peak in the county. On the lower stretches of the river, we found the station for the Woolly Lip-fern (*Cheilanthes tomentosa*) and the other ferns collected here by Weatherby (Anderson, 1930–1931). The trip to the White Cliff Springs on Starr Mountain was partially suc-

cessful. Here we found the usual common ferns, the Net-veined Chain-fern (*Woodwardia areolata*) and the Sensitive fern (*Onoclea sensibilis*) but failed to find the Climbing-fern found in 1890 by Scribner (Anderson, 1930–1931, p. 63).

One of the most interesting spots visited in this county was the entrance and exit of Sinkhole Creek into and out of a hill. This is a limestone region and possessed the usual limestone ferns. A rather rare fern for East Tennessee, the Alabama Lip-fern (*Cheilanthes alabamensis*) was common. This is a new station for this fern, previously unknown from this county. These trips were so successful largely because of the kind guidance of Dean T. A. Frick of Hiwasee College, Madisonville.

An exceptionally interesting and profitable stop was made on the French Broad River above Newport (Cocke Co.). A total of sixteen species were seen and collected, including Clayton's Fern (*Osmunda Claytoniana*). This was the first time that we had seen this fern in East Tennessee since we failed to find it on Roaring Fork trail up Mt. LeConte where it had been found earlier by Anderson (1930–1931, p. 67). Later we found it on the Nolichucky River above Erwin (Unicoi Co.). Many plants at each place had old fertile pinnae. We believe that these are new stations for this fern.

There is a thrill in anticipation but we found that there is a greater thrill in actually seeing a sure enough rare fern. Following the instructions given by Knight (1933, pp. 27–28) we found the station of the Rocky Mountain Woodsia (*Woodsia scopulina*) on the Nolichucky River above Erwin (Unicoi Co.) in abundance. Here also was an abundance of Rock Selaginella (*Selaginella rupestris*). This was the first time that I had ever seen this *Selaginella* in Tennessee in spite of intensive search. My lack of success in finding this *Selaginella* had disturbed me

quite a little since Gattinger (1901, p. 31) reported it from "over the state." There were five species of ferns, namely, Woolly Lip-fern (*Cheilanthes tomentosa*), Hairy Lip-fern (*Cheilanthes lanosa*), Maidenhair Spleenwort (*Asplenium Trichomanes*), Gray Polypody (*Polypodium polypodioides*), Rocky Mountain Woodsia (*Woodsia scopulina*), and Small Spleenwort (*Asplenium resiliens*), and this *Selaginella* on a single large rock.

Roan Mountain proved a very interesting spot but furnished no unusual species of ferns.

Our brief studies on the Cumberland Plateau in Fentress County uncovered only common ferns for the plateau, including the Climbing Fern (*Lygodium palmatum*). As far as I am aware this fern has not previously been reported from this county.

Many stops were made in Cumberland County but the species found were those that I had previously found at other stations in this county. My present list includes twenty-six species of ferns, one Ground-pine and one Selaginella from this county. Although some stops were made in Putnam County and I have quite a respectable list of ferns from there, no report on these will be made, for my friend Dr. Bartoo of Tennessee Polytechnic Institute is making an intensive study of the ferns of this county which he plans to publish.

The Grundy County study furnished the usual types of mountain ferns in abundance plus Bradley's Spleenwort (*Asplenium Bradleyi*). This fern has not previously been known from this county. This station is by highway 108 about 2.5 miles east of Palmer, in the usual situation for this species.

About two days were spent in Marion County. The station of the Virginia Chain-fern (*Woodwardia virginica*) discovered by Mr. Hobart Massey was finally found and photographed. A visit was made to the Hart's-

Virginia Chain-fern in the Cumberland Plateau of Tennessee.

tongue Fern (*Phyllitis Scolopendrium*) habitat near South Pittsburg and to a station of Pinnatifid Spleenwort (*Asplenium pinnatifidum*) near Martin Springs. Altogether my list of Marion County ferns totals twenty-nine. These will not be discussed here since my friend Mr. Hobart Massey is studying the ferns of this county and will, I am sure, publish a paper on them shortly.

The studies in Hamilton and Rhea Counties disclosed nothing new and so will be passed over quickly. The studies in Polk County were very interesting and included all of the ferns found here by Gattinger in 1878 with the exception of the Woolly Lip-fern (*Cheilanthes tomentosa*) which we failed to find. Altogether, twenty-four species of ferns were found in Polk County including a station for the Venus-hair Fern (*Adiantum Capillus-Veneris*) previously unknown for this county. Gattinger (1901, p. 29) gave only two stations for this fern in Tennessee. Besides the station mentioned above for Polk County, which is on the highway by the Ocoee River, about five miles above Parksville, and the station at Rock Island mentioned earlier in this paper, I know of two other stations for this fern in Tennessee. One is at Snail Shell Cave near Murfreesboro, Rutherford County (I am indebted to Professor George Davis of the Middle Tennessee State Teachers College for showing me this station) and the other is by the railroad bluff southwest of Ladd's Station, Marion County.

On the entire vacation of twenty-one days a total of forty-one species of ferns, three club-mosses and two Selaginellas were studied in seventeen Tennessee counties, mainly in the eastern half of the state. Extensive collections were made of all species studied with the exception of the Hart's-tongue fern. This fern is so reduced in amount that no real botanist worthy of the name would take a single frond. The collection was purposely made

large in order that it might adequately represent distribution.

### DISTRIBUTION OF THE FERNS STUDIED

WOODSIA OBTUSA (Spreng.) Torr. Near foot of Falls on Fall Creek at Ozone (Cumberland Co.); near entrance of Sinkhole Creek into sinkhole near Tellico Plains (Monroe Co.); by Ocoee River five miles up the river from Parksville (Polk Co.).

CYSTOPTERIS BULBIFERA (L.) Bernh. Foot of falls on Fall Creek at Ozone (Cumberland Co.); bluffs across Clinch River from Kingston (Roane Co.); sinkhole where Sinkhole Creek enters and leaves hill near Tellico Plains (Monroe Co.); by Ocoee River up the river from Parksville (Polk Co.).

CYSTOPTERIS FRAGILIS (L.) Bernh. Cherokee Orchard,[1] Bear Pen Hollow, and Roaring Fork trails up Mt. LeConte (Sevier Co.); knobs about two miles west of Sevierville (Sevier Co.); up ravine to south about one mile down Little River from Kinzel Springs (Blount Co.); Red Ankle Creek (Monroe Co.); French Broad River up river from Newport (Cocke Co.); ravine up Ocoee River about five miles from Parksville (Polk Co.).

ONOCLEA SENSIBILIS L. Caney Fork near Pleasant Hill (Cumberland Co.); White Cliff Spring on Starr Mt. (Monroe Co.); two miles from Monroe County line on highway 30 (Blount Co.); up French Broad River from Newport (Cocke Co.).

THELYPTERIS NOVEBORACENSIS (L.) Nieuwl. Caney Fork near Pleasant Hill, Daddy's Creek near Crossville, Fall Creek near Ozone, Clear Creek, Obey River (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); Cherokee Orchard, Bear Pen Hollow, and Roaring Fork trails up Mt. LeConte, Jake's Creek above Elkmont (Sevier Co.); Little River near Elkmont, side of Rich Mtn., ravine at Kinzell Springs, foot of Gregory's Bald (Blount Co.); Tellico River gorge, Haw Knob (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co); between Roan Mt. village and Burbank (Carter Co.); near Jamestown, Clear Creek (Fentress Co.); stream near Altamont (Grundy Co.); up Ocoee River from Parksville (Polk Co.); Grand View on Cumberland Plateau (Rhea Co.).

[1] Separate stations are separated by a comma, separate counties by a semicolon.

THELYPTERIS MARGINALIS (L.) Nieuwl. Side of Cumberland Plateau near Sparta (White Co.); Caney Fork near Pleasant Hill, Fall Creek gorge at Ozone, Clear Creek, Obey River (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); Cherokee Orchard, Bear Pen Hollow, and Roaring Fork trails up Mt. LeConte, Jake's Creek above Elkmont (Sevier Co.); Little River near Elkmont, Kinzel Springs, foot of Gregory's Bald (Blount Co.); Tellico River gorge, Haw Knob, Starr Mtn. (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); side of Roan Mt. (Carter Co.); Clear Creek (Fentress Co.); near Palmer (Grundy Co.); up Ocoee River from Parksville (Polk Co.); Falling Water Creek (Hamilton Co.); near Grand View (Rhea Co.).

THELYPTERIS GOLDIANA (Hooker) Nieuwl. Side of Cumberland Plateau above Sparta (White Co.).

THELYPTERIS SPINULOSA (O. F. Muell.) Nieuwl. var. INTERMEDIA (Muhl.) Nieuwl. Side of Cumberland Plateau above Sparta (White Co.); gorge below Ozone on Fall Creek (Cumberland Co.); Cherokee Orchards, Bear Pen Hollow, Roaring Fork, and New Found Gap trails to Mt. LeConte, Jake's Creek above Elkmont (Sevier Co.); Kinzel Springs, foot of Gregory's Bald (Blount Co.); Haw Knob (Monroe Co.); Roan Mtn. (Carter Co.).

THELYPTERIS SPINULOSA (O. F. Muell.) Nieuwl. var. AMERICANA (Fischer) Weatherby. Fir-spruce zone on Mt. LeConte and Mt. Kephart to New Found Gap (Sevier Co.); Haw Knob, (Monroe Co.); top of Roan Mtn. (Carter Co.).

THELYPTERIS HEXAGONOPTERA (Michx.) Weatherby. Bank of Barren Fork River across from McMinnville (Warren Co.); side of Cumberland Plateau above Sparta (White Co.); Daddy's Creek near Crossville (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); Cherokee Orchard, and Roaring Fork trails up Mt. LeConte (Sevier Co.); Little River near Elkmont, Kinzel Springs, foot of Gregory's Bald (Blount Co.); Tellico River gorge, Starr Mtn., Red Ankle Creek (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); near Burbank, near Hampton (Carter Co.); near Jamestown (Fentress Co.); Beersheba Springs (Grundy Co.).

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Found at almost every stop in all seventeen counties but most abundant and

luxuriant where the soil overlaid limestone. Not found much above 2500 feet in the high mountains.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. Caney Fork near Pleasant Hill, Daddy's Creek near Crossville, gorge of Fall Creek near Ozone, Clear Creek, Obey River (Cumberland Co.); from foot to top of Mt. LeConte on all trails, Jake's Creek above Elkmont (Sevier Co.); along Little River, Rich Mtn., Kinzel Springs, foot of Gregory's Bald (Blount Co.); Tellico River gorge, Haw Knob (Monroe Co.); Nolichucky River above Erwin (Unicoi Co.); near Burbank, Roan Mtn. (Carter Co.); near Jamestown, Clear Creek (Fentress Co.); near Palmer (Grundy Co.); near top of Little Frog Mtn. on Ducktown side (Polk Co.); near Grand View on Cumberland Mtn. (Rhea Co.).

ATHYRIUM ANGUSTIFOLIUM (Michx.) Milde. Roaring Fork Trail up Mt. LeConte (Sevier Co.); Kinzel Springs (Blount Co.); Starr Mtn. (Monroe Co.).

ATHYRIUM ACROSTICHOIDES (Sw.) Diels. Side of Cumberland Plateau above Sparta (White Co.); found on all trails (Cherokee Orchard, Roaring Fork, New Found Gap, and Bear Pen Hollow) to Mt. LeConte, Jake's Creek above Elkmont (Sevier Co.); Kinzel Springs (Blount Co.); up French Broad River from Newport (Cocke Co.); up the Nolichucky River from Erwin (Unicoi Co.); side of Roan Mtn. (Carter Co.); near top of Little Frog Mtn. on Kemzie highway (Polk Co.).

ATHYRIUM ASPLENIOIDES (Michx.) Desv. Across Barren Fork River from McMinnville (Warren Co.); marsh near Crossville, gorge of Fall Creek near Ozone, Obey River (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); from foot to top of Mt. LeConte at intervals on all trails we traveled, up Jake's Creek from Elkmont (Sevier Co.); foot of Gregory's Bald (Blount Co.); Tellico River gorge, Haw Knob, Starr Mtn. (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); near Burbank, side of Roan Mtn. (Carter Co.); near Jamestown, Clear Creek (Fentress Co.); up Ocoee River from Parksville, top of Little Frog Mtn. (Polk Co.); by Falling Water Creek (Hamilton Co.); near Grand View on Cumberland Plateau (Rhea Co.).

PHYLLITIS SCOLOPENDRIUM (L.) Newm. Near South Pittsburg (Marion Co.).

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Side of Cumberland Plateau above Sparta (White Co.); bluff across Clinch River from Kingston (Roane Co.); Kinzel Springs (Blount Co.); Sinkhole Creek near Tellico Plains, Red Ankle Creek (Monroe Co.); knobs west of Sevierville (Sevier Co.); up French Broad River from Newport (Cocke Co.); Clear Creek (Cumberland Co.); Falling Water Creek (Hamilton Co.).

ASPLENIUM PINNATIFIDUM Nutt. Sequatchie Valley side of Cumberland Plateau near Monteagle (Marion Co.).

ASPLENIUM TRICHOMANES L. Side of Cumberland Plateau above Sparta (White Co.); near Rainbow Falls on Cherokee Orchard trail and on lower part of Roaring Fork trail up Mt. LeConte (Sevier Co.); Little River (Blount Co.); Tellico River gorge (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); Falling Water Creek (Hamilton Co.).

ASPLENIUM RESILIENS Kze. Bluff across Clinch River from Kingston (Roane Co.); side of Rich Mtn. (Blount Co.); entrance of Sinkhole Creek into hill near Tellico Plains, Red Ankle Creek (Monroe Co.); up Nolichucky River from Erwin (Unicoi Co.); up Oceoee River above Parksville (Polk Co.); Falling Water Creek (Hamilton Co.).

ASPLENIUM PLATYNEURON (L.) Oakes. Across Barren Fork River from McMinnville (Warren Co.); Daddy's Creek near Crossville, gorge of Fall Creek near Ozone, Obey River, Clear Creek (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); near Gatlinburg, Cherokee Orchard and Roaring Fork trails up Mt. LeConte, up Jake's Creek from Elkmont, knobs two miles west of Sevierville (Sevier Co.); along Little River near Elkmont, Kinzel Springs, foot of Gregory's Bald (Blount Co.); gorge of Tellico River, along road from Mt. Vernon to White Cliff Springs, Starr Mtn., entrance of Sinkhole Creek into hill near Tellico Plains (Monroe Co.); up Nolichucky River from Erwin (Unicoi Co.); near Hampton (Carter Co.); Clear Creek (Fentress Co.); near Palmer (Grundy Co.); up Ocoee River from Parksville, top of Little Frog Mtn. (Polk Co.); Falling Water Creek (Hamilton Co.).

ASPLENIUM BRADLEYI D. C. Eaton. About two miles east of Palmer on highway 108 (Grundy Co.).

ASPLENIUM MONTANUM Willd. Side of Cumberland Plateau above Sparta (White Co.); Caney Fork River near Pleasant Hill, gorge of Fall Creek near Ozone, Obey River (Cumberland Co.); Cherokee Orchard, Roaring Fork, Bear Pen Hollow, and New Found Gap trails to Mt. LeConte (Sevier Co.); gorge of Tellico River (Monroe Co.); near Palmer (Grundy Co.).

ASPLENIUM CRYPTOLEPIS Fernald. Bluff across Clinch River from Kingston (Roane Co.); entrance of Sinkhole Creek into hill near Tellico Plains (Monroe Co.).

WOODWARDIA AREOLATA (L.) Moore. Caney Fork River near Pleasant Hill, Clear Creek (Cumberland Co.); near top of Starr Mtn. (Monroe Co.).

WOODWARDIA VIRGINICA (L.) Sm. Near Grundy County line on highway 108 (Marion Co.).

PELLAEA ATROPURPUREA (L.) Link. Gorge of Fall Creek near Ozone (Cumberland Co.); bluffs across Clinch River from Kingston (Roane Co.); five miles from Kinzel Springs on road to Rich Mtn. (Blount Co.); entrance of Sinkhole Creek into hill near Tellico Plains (Monroe Co.); Falling Water Creek (Hamilton Co.).

CHEILANTHES ALABAMENSIS (Buckley) Kze. Entrance of Sinkhole Creek into hill near Tellico Plains (Monroe Co.).

CHEILANTHES LANOSA (Michx.) Watt. Railroad bluff at Kinzel Springs (Blount Co.); gorge of Tellico River (Monroe Co.); up Nolichucky River from Erwin (Unicoi Co.); near Hampton (Carter Co.).

CHEILANTHES TOMENTOSA Link. Little River near Elkmont, Kinzel Springs (Blount Co.); gorge Tellico River (Monroe Co.); up Nolichucky River from Erwin (Unicoi Co.); near Hampton (Carter Co.).

ADIANTUM PEDATUM L. Gorge of Fall Creek near Ozone (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); Cherokee Orchard and Roaring Fork trails up Mt. LeConte (Sevier Co.); Little River near Blount Co. line, Kinzel Springs, foot of Gregory's Bald (Blount Co.); gorge of Tellico Plains, Starr Mtn., Red Ankle Creek (Monroe Co.); knobs two miles west of Sevierville (Sevier Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); near Bur-

bank (Carter Co.); up Ocoee River from Parksville (Polk Co.); near Grand View (Rhea Co.); side of Cumberland Plateau above Sparta (White Co.).

ADIANTUM CAPILLUS-VENERIS L. Up Ocoee River from Parksville (Polk Co.).

PTERIDIUM LATIUSCULUM (Desv.) Hieron., var. PSEUDOCAUDATUM (Clute) Maxon. Caney Fork River near Pleasant Hill, marsh near Crossville, Daddy's Creek near Crossville, gorge of Fall Creek near Ozone, Obey River (Cumberland Co.); Cherokee Orchard trail up Mt. LeConte, up Jake's Creek from Elkmont (Sevier Co.); Tellico River gorge, Starr Mtn. (Monroe Co.); up French Broad River from Newport (Cocke Co.); near Jamestown (Fentress Co.); near Palmer (Grundy Co.); up Ocoee River from Parksville (Polk Co.); near Grand View (Rhea Co.).

POLYPODIUM VIRGINIANUM L. Side of Cumberland Plateau above Sparta (White Co.); Caney Fork near Mt. Pleasant, gorge of Fall Creek near Ozone, Clear Creek, Obey River (Cumberland Co.); bluff across Clinch River from Kingston (Roane Co.); Cherokee Orchard, Bear Pen Hollow, Roaring Fork, and New Found Gap trails to Mt. LeConte (Sevier Co.); Little River near Blount Co. line, foot of Gregory's Bald (Blount Co.); Tellico River gorge (Monroe Co.); side of Roan Mtn. (Carter Co.); Clear Creek (Fentress Co.); Falling Water Creek (Hamilton Co.).

POLYPODIUM POLYPODIOIDES (L.) Watt. Bluff by railroad at Kinzel Springs (Blount Co.); White Cliff Springs on Starr Mtn., entrance of Sinkhole Creek into hill near Tellico Springs, Red Ankle Creek (Monroe Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); Beersheba Springs (Grundy Co.); Falling Water Creek (Hamilton Co.).

LYGODIUM PALMATUM (Bernh.) Sw. Caney Fork River near Pleasant Hill, Daddy's Creek near Crossville, Mammy's Creek, Clear Creek, Obey River (Cumberland Co.); Clear Creek (Fentress Co.).

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray. Daddy's Creek near Crossville, gorge of Fall Creek near Ozone, Clear Creek (Cumberland Co.); near Jamestown, Clear Creek (Fentress Co.); up Ocoee River from Parksville (Polk Co.); near Grand View (Rhea Co.).

OSMUNDA CLAYTONIANA L. Up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); near Burbank (Carter Co.).

OSMUNDA CINNAMOMEA L. Caney Fork River near Pleasant Hill, marsh near Crossville, Daddy's Creek near Crossville, gorge of Fall Creek near Ozone, Clear Creek, Obey River (Cumberland Co.); Cherokee Orchards, Roaring Fork trails up Mt. LeConte (Sevier Co.); Rich Mtn., Foot of Gregory's Bald (Blount Co.); Tellico River gorge, Starr Mtn. (Monroe Co.); up Nolichucky River from Erwin (Unicoi Co.); near Burbank (Carter Co.); near Jamestown, Clear Creek (Fentress Co.); ten miles west of Palmer (Grundy Co.); up Ocoee River from Parksville, near top Little Frog Mtn. (Polk Co.); near Grand View (Rhea Co.).

BOTRYCHIUM DISSECTUM Spreng. Cherokee Orchard, and Roaring Fork trails up Mt. LeConte, up Jake's Creek from Elkmont (Sevier Co.); up the Nolichucky River from Erwin (Unicoi Co.).

BOTRYCHIUM DISSECTUM Spreng. var. OBLIQUUM (Muhl.) Clute. Cherokee Orchard, and Roaring Fork trails up Mt. LeConte, up Jake's Creek from Elkmont (Sevier Co.); foot of Gregory's Bald (Blount Co.); up French Broad River from Newport (Cocke Co.); up Nolichucky River from Erwin (Unicoi Co.); Obey River (Cumberland Co.).

BOTRYCHIUM VIRGINIANUM (L.) Sw. Side of Cumberland Plateau above Sparta (White Co.); Cherokee Orchards, and Bear Pen Hollow trails up Mt. LeConte (Sevier Co.); foot of Gregory's Bald (Blount Co.); up French Broad River from Newport (Cocke Co.); Beersheba Springs (Grundy Co.); near top of Little Frog Mtn. (Polk Co.).

EQUISETUM ARVENSE L. Side of Cumberland Plateau above Sparta (White Co.); base of bluff across Clinch River from Kingston (Roane Co.).

LYCOPODIUM LUCIDULUM Michx. Cherokee Orchards, Bear Pen Hollow, and New Found Gap trails up Mt. LeConte (Sevier Co.); side of Roan Mtn. (Carter Co.).

LYCOPODIUM POROPHILUM Lloyd and Underw. Side of Cumberland Plateau above Sparta (White Co.).

LYCOPODIUM OBSCURUM L. Caney Fork near Pleasant Hill, gorge

of Fall Creek near Ozone, Clear Creek (Cumberland Co.); Bear Pen Hollow trail up Mt. LeConte (Sevier Co.).

SELAGINELLA RUPESTRIS (L.) Spring. Up Nolichucky River from Erwin (Unicoi Co.).

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# Ferns of Hardin County, Kentucky

GEORGE K. HOLBERT

Hardin County, one of the largest counties of the State, is situated in north-central Kentucky. Its fern flora is no doubt more or less typical of many other counties. The original county, formed in 1792, exceeded in size the State of Delaware, and from it have been carved in whole or in part thirteen present counties. It is easily accessible, being traversed by the main lines of the Louisville & Nashville and the Illinois Central Railroads and bordering the Ohio River on the north. The Dixie Highway, spanning the country from north to south, and the Central Highway, from east to west, cross each other in the county-seat, Elizabethtown, some twenty-five miles northeast of which is "My Old Kentucky Home," where Stephen Collins Foster wrote the famous song of that name; while half as far to the southeast is the birthplace of Abraham Lincoln, now a national shrine, and twice as far to the south is the Mammoth Cave, one of the natural wonders of the world.

Topographically, Hardin County may be divided into three characteristic sections: Muldraugh's Hill in the northern part, a continuation of the chain of scenic hills known in Indiana as The Knobs; the "barrens" in the central part, and undulating plains in the southern part. On the high points of Muldraugh's Hill is a thin formation of Warsaw rock and lower down the eroded sides sandstones, shales and limestones, with frequent wet-weather springs and waterfalls. Passing to the south from Elizabethtown one encounters a cherty limestone of the St. Louis group, which disintegrates easily, forming a somewhat reddish but productive soil that enters largely into the once noted wheat-lands. A large portion of the surface rock of the county is sub-carboniferous and fre-

quent "sinkholes," and not infrequent caverns, are incident to this formation.

The county lies along the Ohio and Salt Rivers on the north and the Rolling Fork on the northeast, while the southern and western portions are traversed respectively by the Nolin and Rough Rivers and their tributaries. It has numerous fine streams and valleys, large stretches of agricultural lands and woodlands, marshy flats, sand- and limestone ridges and cedar glades. A hundred or more deciduous forest trees are native, the oaks predominating, with such evergreens as the cedars and pines and occasional holly and haunts of hemlock.

While Muldraugh's Hill reaches higher elevations (but less than 1,000 feet above sea level), yet the finest fern stations of the county are among the picturesque hills along Rough River in the western border, where sandstone cliffs rise fifty and a hundred feet in a single perpendicular ascent, with a limestone base revealed in the bottoms of the ravines. There are numerous small streams and springs, some tumbling down precipitous ledges and forming clear pools at the base. The soil for the most part is sandy and stony, of rather poor quality, but rich with leafmold in the deep woods, very soft and loose about the cliffs and boulders, and in places seeping with tannic ooze. The elevation runs some 450 to 650 feet. Here in the "Dismal Hollow," between rugged sandstone walls a hundred feet high, where a cool stream winds down a thickly wooded alluvial gorge to Culverson Creek and where it is said locally "the sun never shines," I first saw ferns enough at one time—*Athyrium acrostichoides, A. angustum* and *A. pycnocarpon, Onoclea sensibilis, Dryopteris intermedia* and *D. marginalis,* clumps and stretches of fern waist-high, elbowing for standing room, with *Polypodium virginianum, Cystopteris bulbifera* and *C. fragilis, Camptosorus rhizophyllus,* and *As-*

*plenium trichomanes* climbing over rocks and the wet and mossy cheeks of cliffs. "Moonshine Cliff," just over the county line, is a two-story cliff, one high above the other (with abandoned relics of moonshine stills in each story). A clear stream pours down making a double cataract and forming a crystal pool at the base, about which is a perfect carpet of soft green woven by twining *Cystopteris bulbifera* with gracefully tapering fronds a yard in length. "Lovers' Leap," the "Raven's Nest," "Beech Woods," and the retreats about Hill's Mill are other localities enchanting with their wilderness of ferns.

I have found more frequent *Osmunda* stations in the quadrant between the Hodgenville road and the Central Highway. In a station back of Round Top schoolhouse all three of the Osmundas are growing together, *O. claytoniana* apparently excelling, while in a wet draw near New Summit *O. regalis* is especially stately. *Adiantum pedatum, Asplenium platyneuron, Botrychium virginianum, Dryopteris hexagonoptera, Pteridium latiusculum, Polystichum acrostichoides, Athyrium angustum,* and *Woodsia obtusa* are common over the county.

I submit the following list of native ferns I have found growing in Hardin County:

ADIANTUM PEDATUM L. American maidenhair. Common in rich well-drained woods. Though usually on a moderate incline or slope and apparently preferring a moist, drained, open shade, yet I have found large colonies in dry stony bramble shade, and creeping out into open sun, at foot of northern slopes of Muldraugh's Hill.

ASPLENIUM PINNATIFIDUM L. Lobed spleenwort. Clinging in small pockets or tight crevices of sandstone cliffs. Though reported by Williamson as common in Kentucky, I have found it rather rare in this county and in stations of two or three to half a dozen individuals.

ASPLENIUM PLATYNEURON (L.) Oakes. Ebony spleenwort. Common in dry stony thickets, shaded fence corners and wooded bluffs. The rankest and densest station I have seen was in a blackberry thicket on the side of a road near Hill's Mill in scanty shade.

ASPLENIUM TRICHOMANES L. Maidenhair spleenwort. Rather rare. In crevices and moss on porous sandstone cliffs and boulders. One boulder found in dense shade near Hardin Springs has a considerable blanket.

ATHYRIUM ACROSTICHOIDES (Sw.) Diels. Silvery spleenwort. In deep wooded ravines, especially along streams, in rich accumulations of humus and leafmold in light sandy and silicious soils, frequently near foot of densely shaded sandstone cliff. One of our finest and most thrifty ferns. 3 to 4 feet in height.

ATHYRIUM ANGUSTUM (Willd.) Presl. Upland lady fern. A common fern of many mutations. Prefers half shade to deep shade, but less frequent and smaller plants are found in more sunny places. Wet, moist or dry soil. 1 to 3½ or 4 feet.

ATHYRIUM PYCNOCARPON (Spreng.) Tidestrom. Narrowleaf spleenwort. (Dr. Wherry has suggested the rather happy common name, "glade fern"—AM. FERN JOURNAL, vol. 25, p. 64.) Rather common than not; half open woods and glady places; in rich soil up the banks of ravines. A large and somewhat pretentious but fragile fern.

BOTRYCHIUM VIRGINIANUM (L.) Sw. Rattlesnake fern. A solitary fern common in dry and rather open woods.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Walking fern. Though mentioned as rare by Mrs. Parsons, I am convinced that it is rather overlooked than rare here. In favorable places I have had little trouble finding it—on Muldraugh's Hill, at Arbuthnot, Hill's Mill, Moonshine Cliff, Hardin Springs, in Dismal Hollow. More frequent

than either *Asplenium pinnatifidum* or *A. trichomanes.* On limestone cliffs and boulders and wet moss-covered limestone rocks in unexposed places and deep retreats. Infrequently on sandstone. Somehow it always reminds me of the primeval.

CYSTOPTERIS BULBIFERA (L.) Bernh. Berry (or bulblet) bladderfern. I have this fine and particularly graceful fern associated with waterfalls and rainbow sprays. Sentimentally, it is fit for romance. Usually draped and festooned on wet, slippery limestone cliffs where water splashes or trickles down, but may be found, less luxuriant, elsewhere. In the "Beech Woods" is a considerable station growing in stony soil on a second bank of Rough River with 24 to 40-inch fertile fronds.

CYSTOPTERIS FRAGILIS (L.) Bernh. Brittle fern. Common on moist ledges and in fissures and stony ground, usually near water. Shade to half shade.

DRYOPTERIS INTERMEDIA (Muhl.) Gray. Common woodfern. I have more frequently found this fern in narrow, close places between rocks and boulders and up the sides and at the foot of sandstone cliffs, especially along streams and in wet dense ravines. Its cutting varies, sometimes the pinnules on the lower side of the base pinnae being two or three times as long as those on the upper side. Some specimens I mistook for *D. campyloptera* until set right by Dr. Benedict.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. Winged (or broad) beechfern. Common and varying through many forms. In rich moist to dry woods, especially on wooded slopes. Fronds 6 to 30 inches. Usually plentiful where found.

DRYOPTERIS MARGINALIS (L.) Gray. Leather Woodfern (the old marginal shield). On shaded cliffs (usually sandstone), at base and clinging high up the sides, sometimes the rootstock protruding far out of crevices and

pockets; at other times sitting snug on the top of a mossy rock, or in stony ground.

DRYOPTERIS THELYPTERIS (L.) Gray. Marsh fern. In wet acid soil of deep woods and shaded bogs. The finest I have found were near Bethlehem Academy.

ONOCLEA SENSIBILIS L. Sensitive fern. Common in lowlands and lightly wooded bottoms.

OSMUNDA CINNAMOMEA L. Cinnamon fern. Not common, but may be found in likely places. In silicious soils, at times with clayey base and rather hard and compact. Sometimes in wet places in company with *O. regalis*, or in drier habitat with *O. claytoniana*. While reported to grow in sun, I have not happened to so find it.

OSMUNDA CLAYTONIANA L. Interrupted fern. In flat or rolling woods and slightly up the slopes of wooded draws, preferring a drier place than *O. regalis*. I have not found it fruiting in the woods, and frequently there it produces only a few fronds, but some plants brought in and set in the garden with no other shade than an ordinary grape arbor were soon producing fine crowns of fronds with frequent fertile pinnae.

OSMUNDA REGALIS var. SPECTABILIS (Willd.) Gray. Royal fern. Silicious soils, preferring open shade, but sometimes in sun with wet footing. Usually in sparse colonies in moist draws and wet swampy shade.

PELLAEA ATROPURPUREA (L.) Link. Purple cliffbrake. Often in scant dry, clayey soil wedged in tight limestone crevices. Seems to enjoy a goodly amount of direct rays of sun and usually found on face of cliff in thin shade. In the western part of the county, I found several plants on a large rock protruding from a hillside in the middle of an old field with no shade but a few persimmon saplings.

POLYPODIUM VIRGINIANUM L. Common polypody. Not common here. Found on sandstone cliffs along Rough

River, more abundant on drier ones, in moss and spare leafmold, forming mats that hang over the margins of high ledges.

POLYPODIUM POLYPODIOIDES (L.) Watt. Resurrection fern. A large boulder near the Raven's Nest on Rough River is well blanketed with this fern, interspersed with *P. virginianum*. I have not found it on trees as further south, and know of no other station in the county than the one mentioned, although there are probably others.

PTERIDIUM LATIUSCULUM (Desv.) Hieron. Eastern bracken. Common; along edges of woods and woodland roads; pigmentation reddish where it grows in sun. Usually 2 to 4 feet, but one grew slightly more than 7 feet last year in the back yard, slender and viny, and clinging up through the dense shade and folds of a kudzu vine. I have heard this fern called locally "the palm fern," but while it has a number of common names I have not heard of its being so called elsewhere (but have somewhere seen *Pteretis nodulosa* referred to as the Palm of the North).

WOODSIA OBTUSA (Spreng.) Torr. Obtuse (or common) woodsia. Frequent; on stony wooded bluffs and in rather open woods and thickets, usually of silicious soils.

WOODWARDIA AREOLATA (L.) Moore. Narrowleaf chainfern. In wet, sour soil in deep woods and seepy drains. Found near Moonshine Cliff and New Summit.

ELIZABETHTOWN, KENTUCKY

# A Further Note on Salvinia

C. A. WEATHERBY

Some years ago (AM. FERN JOURN. **10**: 48–53. 1921) Prof. F. K. Butters and I pointed out that, with a single exception, the plants from the United States which had passed in our manuals as *Salvinia natans* were not that species, but a tropical one which, following the treatments current at that time, we identified as *S. auriculata*, var. *Olfersiana*. Recently (Hedwigia, **74**: 257–284 1935) Robert Herzog has published an excellently clear revision of the genus, in which, by the use of characters previously overlooked or unintelligently observed, he has achieved a very convincing rearrangement of the species. A redetermination of American material in the light of his work has seemed desirable.

Herzog retains three of the five American species recognized by Baker in his "Handbook of the Fern Allies" and in Christensen's Index Filicum—*S. auriculata* Aubl., *S. oblongifolia* Mart. and *S. Sprucei* Kuhn. The other two he reduces to *S. auriculata* of the earlier works; from the aggregate thus formed he erects two newly defined species, true *S. auriculata* and another for which he revives the name *S. rotundifolia* Willd. The most obvious character by which they may be separated lies in the peculiar vestiture of the upper surface of the floating leaves. In both, this consists of regular rows of more or less elongated conical protuberances, each of which bears at its summit a tuft of four jointed hairs. In *S. auriculata* these hairs, though otherwise free, are grown together at their tips, the terminal cells being united into a relatively thick, dark-colored body, and, unless broken, remain so until entirely withered. In *S. rotundifolia* the hairs are wholly free and somewhat spreading. This difference can readily be seen under a hand-lens in living

plants; in dried material, where the protuberances and their hairs are more or less pressed down and matted together, a magnification of 20–40 diameters may be necessary to bring it out clearly. Even when the hairs have been broken apart, some trace of the broad, dark terminal body can usually be found in *S. auriculata*; in *S. rotundifolia* the hair-tips are tapering and colorless.

Other characters are associated with the difference in posture of the hairs. In *S. auriculata* the fruit-bodies containing the macrospores are stalked; in *S. rotundifolia* they are sessile. In the former, the thick floating leaves are ordinarily 1.5–3 cm. in diameter and tend to become yellowish or brownish when dried; in the latter, the comparatively thin leaves average 1 cm. in diameter and dry dull green.

All the material from the United States in the Gray Herbarium and the United States National Herbarium representing the collections on which the old manual records of *S. natans* were based (with the single exception above noted) proves to be *S. rotundifolia.* So far as I have been able to find out, this is the species commonly grown in greenhouses here. It is well figured, under the name *S. Olfersiana,* in Britton, Fl. Bermuda, 428.

So far I can follow Herzog unhesitatingly; there are, however, two details of his work which I am not yet ready to accept. One, the lesser, is his identification of *F. S. Collins* 445 from Bermuda as *S. auriculata.* All the four sheets of this collection (in the Gray, U. S. National and Kew herbaria) have the characteristic hairs of *S. rotundifolia* and the single fruiting individual shows the equally characteristic sessile macrosporocarps. They exhibit no mixture of material. All other collections from Bermuda which I have seen are likewise *S. rotundifolia* and likewise give no evidence of the presence there of any

other species. All the Bermuda material is uncommonly large for *S. rotundifolia* with leaves unusually closely set, folded together and overlapping after the common manner of *S. auriculata*. I can only suppose that in this instance Herzog was misled by a superficial resemblance.

The other point of disagreement relates to Herzog's outright reduction of *S. Radula* Baker to *S. auriculata* without taking any account of its peculiar features in his description of the resulting aggregate. The two are quite alike in their essential trichome-characters but, so far as can be made out in herbarium material, differ, not quite constantly, but with reasonable consistency, as follows:

*S. auriculata.* Floating leaves boat-shaped or conduplicate, prevailingly widest at the broadly cordate base, distinctly broader than long; papillae well developed, 1 mm. or more high in the center of the leaf; leaf-tissue usually glabrous between the papillae.

*S. Radula.* Floating leaves flat, avering much smaller than in *S. auriculata,* broadly elliptic or oblong-elliptic to obovate, widest at or above the middle; papillae low or sometimes nearly obsolete; leaf-tissue often with single trichomes between the rows of papillae.

Herzog regards *S. Radula* as a mere shade-form of *S. auriculata.* It may readily be admitted that decrease in light-intensity might produce a flattening out of the leaves and a reduction in their size; it is not so easy to see how it could change their outline and stimulate the production of additional hairs unconnected with the papillae and scarcely to be interpreted as rudiments of them, since they occur between the rows. There is a similar gradation from small, flat leaves to much larger, folded ones in *S. rotundifolia,* but in that species there is no great reduction of the papillae in the smaller and flatter leaves and no tendency whatever to develop supplementary trichomes.

*S. Radula*, then, would seem to deserve some taxonomic recognition. Some few specimens appear intermediate between it and *S. auriculata*; it would probably be best treated as a variety of that species. But until its fruit is better known and someone has studied the range of its variability under different conditions in experimental cultures, I hesitate to attempt a final disposition of it and here keep it tentatively under Baker's name.

Of the three groups here treated, *S. auriculata* and *S. Radula* show no distinctive ranges; both are rather widely distributed in the American tropics. *S. rotundifolia*, on the other hand, though occurring from Mexico to Uruguay, seems to be wholly continental, except for the station in Bermuda, where, according to Britton, it was introduced in 1903 and has become naturalized.

The following citation of specimens, additional to those listed by Herzog and from collections better represented in American herbaria, may be useful.

SALVINIA AURICULATA Aubl. Hist. Pl. Guiana, **2**: 969, t. 367 (1775). Type locality, French Guiana.—SALVADOR: Laguna de Maquigue, Dept. La Uniòn, Feb. 18, 1922, *Standley*, no. 20904. NICARAGUA: Lake Nicaragua, March 8, 1922, *Greenman*, no. 5757; without definite locality, *C. Wright*, 1853–56. CUBA: Santiago de las Vegas, Prov. Habana, July 8, 1904, *Baker & Wilson*, no. 685; without definite locality, 1859–60, *Wright*, no. 1826; 1865, *Wright*, no. 3913. BRITISH GUIANA: Pomeroon River, Jan. 14–20, 1923, *de la Cruz*, no. 2984. BRAZIL: State of Ceará, various localities, 1935, *Drouet*, nos. 2586a, 2607; State of Pará, *Martius*; Rio de Janeiro, *Riedel*, *Wilkes Exped.* no. 2. PARAGUAY: Lacus Ypacaray, Dec., 1913, *Hassler*, no. 12418.

SALVINIA RADULA Baker, Journ. Bot. **24**: 98 (1886). No type designated; the *Parker* specimen from British Guiana, the first cited and the best of those seen by Baker, may be taken as the type.—PANAMA: Gigante Bay, Aug. 9, 1925, *C. W. Dodge*, no. 3497. CUBA: Ceiba, near Havana, Feb. 24, 1891, *Underwood*. BRITISH GUIANA:

Georgetown, Oct. 24–26, 1919, *Hitchcock*, no. 16556. FRENCH GUIANA: without definite locality, 1838, *Leprieur*, no. 152. DUTCH GUIANA: Paramaraibo, April 27, 1916, *Samuels*, no. 73. ECUADOR: Zamborondon, July 13, 1876, *André*, no. 4054.

SALVINIA ROTUNDIFOLIA Willd. Sp. Pl. **5**: 537 (1810). Type locality, Brazil.—MEXICO, state of YUCATAN: *Gaumer*, no. 1007. GUATEMALA: 1885, *Watson*; Petapa, April, 1889, *J. D. Smith*, no. 1502. BRITISH HONDURAS: Mullins River Road, April 21, 1929, *Schipp*, no. 157. NICARAGUA: Granada, Feb. 2, 1903, *Baker*, no. 2284; same locality, March 8, 1922, *Greenman*, no. 5770. COSTA RICA: Tunnel Camp, Limon Province, Dec. 13, 1929, *Dodge, Catt & Thomas*, no. 5614. BRAZIL: Rio de Janeiro, 1874, *Mosén*, no. 2738. URUGUAY: Vergara, Dec. 20, 1933, *Herter*, no. 1609.

I quite agree with Herzog that *S. auriculata*, var. *Olfersiana* (Klotzsch) Baker rests on size only and should not be kept up in any category. I am also inclined to agree with his reduction of *S. cyathiformis* Maxon to *S. Sprucei*. *S. minima* Baker, which he did not see, has tiny floating leaves which show no trace of papillae, but bear sessile clusters of free trichomes. It is presumably, as he guessed, a much reduced state of *S. rotundifolia*.

I am much indebted to Dr. William R. Maxon for the privilege of examining the Salvinias in the United States National Herbarium and particularly to Sir Arthur W. Hill, Director of the Royal Botanic Gardens, Kew, for the generous loan of nearly all the specimens cited by Baker under *S. Radula* and *S. auriculata* var. *Olfersiana* —an invaluable aid.

GRAY HERBARIUM.

## Recent Fern Literature

Few of us who are not farmers think of ferns as possible weeds; yet some species can be very troublesome—so much so that the United States Department of Agriculture has thought it worth while to bring out, as Farmers' Bulletin no. 687, a revision of a paper on the eradication of ferns from pasture-lands in the eastern states originally prepared by H. R. Cox some twenty years ago. The principal offenders are hay-scented fern and bracken, but in damp spots cinnamon fern, marsh fern and sensitive fern may also achieve undesirable abundance. Of various methods of control, mowing (sometimes supplemented by burning the cut fronds after they have dried) and spraying with a nearly saturated solution of salt have proved most effective. Mowing has to be done by hand in most pastures; a man with a scythe can cover usually about two and a half acres a day. Spraying is quicker (about 5 acres a day per workman) but fully twice as expensive. With both methods two applications a year are necessary—one in June before the spores are ripe and one in August to catch the second growth made after the first fronds are cut or killed. Done in this way both have proved effective, especially when seed of grass and clover has been sowed in the areas where the ferns have been killed off.

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## Shorter Notes

A FERN QUESTIONNAIRE.—Questionnaires are the order of the day—sometimes the annoyance of the day—in some fields of investigation, but perhaps a first venture in the field of fern study may be permitted. The following questions were drawn up in connection with a talk at the field meeting of the Torrey Botanical Club at Branchville, N. J., in May, 1936.

It has been suggested that with their publication some prize might be offered for the most complete set of answers turned in by a Fern Society member. The examiner has no objection provided he does not have to mark the papers; he has plenty of those at present. One prize may be mentioned and is hereby offered (U. S. and Canada distribution): one large hart's-tongue plant, grown at the Brooklyn Botanical Garden.

The chief intent of the questionnaire was to assemble as many items as possible relating to matters of some curious interest relating to ferns and their names. There is so little of economic importance to be advanced in the case of these plants that anything along this line or pertaining to unusual biological features is worthy of record.

What items can you add to those indicated in the list? Dr. John H. Schaffner sent in the last two queries.

## *What Do You Know About Ferns? (Including Fern "Allies")*

1. What is the oldest living fern species known?
2. What fern or ferns are sometimes serious weeds in agriculture?
3. What fern provides a specific in the U. S. Pharmacopeia?
4. What fern provides material for fireworks?
5. What fern is an annual?
6. What fern has the longest leaves?
7. What common fern is a regular article of food in the South Seas?
8. What fern may be called the housewife's friend?
9. With what fern might cosmetics be associated?
10. What fern provides textile material for evening wear?
11. What fern species has the widest natural distribution?
12. What fern lives symbiotically with a blue-green alga?
13. From what fern has a substitute for feathers been obtained?
14. What common cultivated "fern" is not a fern at all?
15. What common fern is liable to cut the skin when picked?
16. What native ferns have evergreen leaves?
17. What is the greatest height to which a fern may grow and where is it found?

18. What common fern may be recognized by its odor when crushed?
19. What fern is sold by the bale?
20. What fern has a tuber like a potato?
21. What fern has been experimented with in the fight against yellow fever?
22. What fern bears some resemblance to iron?
23. What kind of fern is sometimes cooked in volcanic vents for food?
24. What fern surpasses ordinary timber trees as a source of building material in some parts of the tropics?
25. In what kind of fern are stipules found?
26. What fern is most widely used in horticulture?
27. What fern species is reported as causing poisoning of cattle?
28. In what respect have ferns played an unusually important part in the Industrial Revolution?
29. What fern species was formerly sold in millions of plants per year?
30. What is the rarest fern species in the country?
31. What is the smallest fern?
32. What fern does not require a "permanent"?
33. What fern produces abundant nectar on the leaves?
34. What is the greatest diameter of the stem of any tree fern?

PROLIFIC BOTRYCHIUMS.—Two Botrychiums, of the variety called *B. obliquum* var. *pennsylvanicum* by E. W. Graves, both highly copper-colored, were collected by me during the Christmas holidays and placed in a terrarium. In a few weeks the copper color began to fade, and by the end of March the fronds were green again and next year's fronds began to appear. I removed the old fronds. The new ones grew so rapidly in the terrarium that by the end of April they had to be transplanted outside where they took on a slight copper color during the first few weeks. On June 25th a new set of fronds were making growth. When I returned in September, *both* fronds were vigorous, and now in the middle of November *both* fronds are taking on the copper color.

One interesting observation is that the reproductive period is annual only by cause of the seasonal character

of the year. Another is that the copper color comes and goes with the ebb of life, and is seasonal only as this change corresponds to the seasons. Finally, why did the parent frond survive and flourish?—W. L. DIX, *Trenton, New Jersey.*

A PROJECTED FIELD TRIP FOR FERNS AT OWENS, N. J.—For Sunday, Sept. 26, the Torrey Botanical Club is scheduling a field trip with ferns as one main objective. The Torrey Club, with a worldwide membership and subscription list, has its center of organization and meetings in New York City. Each year an extensive program of field trips is scheduled, organized by the Field Committee, of which the Chairman is Mr. Raymond Torrey, recently become a member of the Fern Society. In 1936 over two hundred separate trips were scheduled over a ten-month period.

Usually a number of trips are devoted primarily to ferns and the leaders are generally Fern Society members. For the past two years a fern trip has been scheduled at Springdale, N. J., in which the Fern Society was made joint supporter. For both these trips, the same locality was visited, a large wooded swamp, bordered by limestone ledges, and harboring a considerable series of fern species. Dryopteris hybrids were the particular game sought. Philip Dowell had brought out two Goldiana hybrids from this region, *D. cristata* × *Goldiana*, and *D. Goldiana* × *marginalis*. The latter was again found, after thirty years, but not the former. A number of other hybrids, among *D. Clintoniana, D. cristata, D. marginalis, D. intermedia*, and *D. spinulosa* were found, however.

On the corresponding Sunday in 1937, Sept. 26, another fern trip is set, with fern hybrids again the chief objects of search. The Fern Society is again announced as joint sponsor. While the Springdale region has not been exhausted, it was thought best to try another locale

for the 1937 trip, and Mr. James Edwards has suggested a swamp near Owens, also in Sussex County, but about twenty miles distant from Springdale.

With February anticipating April, a preliminary trip of exploration was made on Washington's birthday, the swamp was located and partly reconnoitered. The situation looks very promising. The extensive tract of woodland, bordered by limestone ledges, was covered with water from the usual heavy Sunday rains of the past season, but it was obviously an ideal location for the swamp *Dryopteris* species, *D. cristata, D. Clintoniana,* and *D. spinulosa. D. marginalis* and *D. intermedia* were found in their evergreen garb along the ledges. Furthermore, *Asplenium platyneuron* was found in luxuriance on one of the ledges. The walking fern and the wall-rue are abundant in parts of Sussex County and are probably present here. The asplenioid hybrid, *A. ebenoides,* has been found more than once in this region and may very well occur on these ledges. Hybrids of the wall-rue have been reported in Europe and once in America. Also, it may be added, *Pellaea glabella* has been collected in the vicinity of Owens.

Write to the Brooklyn Botanic Garden for more specific data as to location and methods of reaching it. By automobile, or train, the town of Sussex is the focal point. The swamp is about five miles north from the town. From New York City it is a trip of a little less than sixty miles by automobile.—R. C. B.

FERNS OF BURMA.—Professor F. G. Dickason, of Judson College, University of Rangoon, Burma, has been at the Ohio State University, Columbus, Ohio, during the past year, making a special study of a large collection of ferns which he had collected during the years 1931–1936 mostly in the general region of the Shan States of upper Burma. This is the same region where Joseph F. Rock

had collected in 1920–24, but on the whole Mr. Dickason's collection came from localities not so far north or east. The Dickason collection contained 249 species and varieties of pteridophytes—222 ferns, 7 lycopods, 18 selaginellas, and 2 equisetums. These with 60 different species in the Rock collection give an indication of the unusual richness of the fern flora of upper Burma. Mr. Dickason prepared a general check-list of Burma ferns which includes 393 species and 71 genera, representing Ophioglossaceae, Marattiaceae, Osmundaceae, Schizaeaceae, Gleicheniaceae, Hymenophyllaceae, Cyatheaceae, Ceratopteridaceae, Polypodiaceae, Salviniaceae, and Marsileaceae. The two genera with the largest representations are Dryopteris with 57 and Polypodium with 53 species and varieties. Among other genera with large numbers of species are Asplenium with 25 and Pteris with 21. Professor Dickason received the M.A. degree from the Ohio State University and is now returning to the University of Rangoon, where he intends to continue his study of Burma pteridophytes.—JOHN H. SCHAFFNER.

The editors of *Standardized Plant Names*, which is now being revised, desire to bring up to date the list of ferns in the American horticultural trade. Any of our members having information as to ferns now offered, which were not included in the 1923 edition of the work, or corrections in the data therein, are urged to send in such information to Dr. Donald Wyman, Arnold Arboretum, Jamaica Plain, Massachusetts.

Mr. Weatherby will be abroad until October. In his absence, manuscript for the JOURNAL should be sent to Dr. William R. Maxon, Smithsonian Institution, Washington, D. C.

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# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

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American Fern Journal

VOL. 27 NOVEMBER–DECEMBER, 1937 NO. 4

# Notes on American Ferns—XXI[1]

WILLIAM R. MAXON

CHEILANTHES KAULFUSSII Kunze.—The present species, though common to the southward, is now first to be reported from the United States. The specimen upon which this record is based was recently received from the University of Texas for identification, being one of an interesting collection made in the Chisos Mountains, Big Bend National Park, Texas, by E. G. Marsh, Jr. (no. 250), in August, 1935. Among United States species *C. Kaulfussii* is at all closely related only to *C. leucopoda* Link, from which it is immediately distinguished by its dark, slender, remarkably elongate stipes and its covering of strongly capitate-glandular hairs throughout; in their short, pentagonal, dissected blades the two species are not very unlike. *C. Kaulfussii* extends pretty well over Mexico, from Chihuahua to Oaxaca, and through Guatemala and Honduras to Costa Rica, where apparently it is rare. Specimens are at hand from Colombia, and it is known also from Venezuela. *C. glandulifera* Liebm. and *C. viscosa* Link (not Carmichael) are synonyms. Under the latter name this beautiful plant was long ago introduced into cultivation in European botanical gardens.

[1] Published by permission of the Secretary of the Smithsonian Institution.

[Volume 27, No. 3 of the JOURNAL, pages 73–108, plate 4, was issued July 1, 1937.]

PHANEROPHLEBIA UMBONATA Underw.—This species, founded on material from Nuevo Leon (*Pringle* 1982) and hitherto known only from Mexico, may be added to the United States fern flora also. The specimens, perfectly characteristic but lacking the rhizome, were collected by Prof. Omer E. Sperry (no. 178), in "Upper Pulliam Canyon, protected site in maple-oak forest, Chisos Mountains, Brewster County, Texas, July 4, 1936," and are part of a collection received from him at the National Herbarium for identification. From *P. auriculata* Underw., the only other species known from the United States, *P. umbonata* is at once distinguished by its relatively narrow non-auriculate pinnae, the arrangement of sori in a submarginal zone (varying in width according to degree of fertility), and its firm, strongly umbonate indusium. Mexican specimens in the National Herbarium are as follows: Nuevo Leon (*Pringle* 1982, 13739; *Tharp* 1817; *C. H. & M. T. Mueller* 353), Coahuila (*Marsh* 268; *Wynd & Mueller* 349), Tamaulipas (*Bartlett* 10095, 10391, 10931; *Viereck* 210, 211, 581; *Runyon* 720, 975, 985). Mr. Runyon records it as "abundant on top of mountains," at 1000 to 1600 meters altitude.

DRYOPTERIS ARGUTA (Kaulf.) Watt.—This species, which is well known to occur from southern California to Washington, in the upper Sonoran and Transition zones, was first reported from Arizona by T. H. Kearney,[1] on the basis of specimens collected near Superior, Pinal County, in 1926, by G. J. Harrison (nos. 2089 and 3180). Additional material from this locality has since been obtained by Kearney & Smith (no. 9008). The range within Arizona is extended by a specimen collected by Elbert L. Little, Jr. (no. 4221), in the Tonto-Parker Creek Forest, Gila Co., at an altitude of 5200 ft., Feb. 27, 1937, and recently received for identification.

[1] Journ. Wash. Acad. Sci. 21: 67. 1931.

SELAGINELLA UNDERWOODII Hieron.—A first record for Texas may be based upon a specimen communicated to the National Herbarium several years ago by Prof. L. H. Bailey for identification. It was collected on Mt. Livermore, Davis Co., in the Davis Mountains, July 9–12, 1921, by Mrs. Roxana D. Ferris and Carl D. Duncan (no. 5388). This species is especially abundant in New Mexico, and is known otherwise from Arizona, Wyoming, and Colorado.

SELAGINELLA BRAUNII Baker.—A specimen so identified later by Mr. C. V. Morton was sent in not long ago by Prof. Orland E. White, of the University of Virginia, who states that it was grown in his own garden from a division received from Mrs. Joseph Walker, of Woodberry Forest, Virginia, who in turn had obtained her living material originally from Georgia. This serves to recall that many years ago two other collections of this Old World species, which has been in cultivation for nearly a century, were received from Georgia. The first of these, handed me by Prof. W. J. Spillman of the U. S. Department of Agriculture, was collected by him in August 1916, in company with Mr. Burdett Loomis, of St. Mary's, Georgia, in an old Catholic churchyard near that place, where it had spread naturally from plants supposed to have been introduced long before by a sea captain. Additional material was sent in subsequently by Mr. Loomis, from whose letter it appeared that the species was to be regarded as truly naturalized locally. However, the original source could not be traced. This species, supposedly a native of China, was long ago (1901) reported by Hieronymus as established in Brazil, and recently has turned up in Jamaica. It is semi-hardy, and through its introduction to new localities as an outdoor plant is likely to become naturalized eventually in the southern Coastal Plain region.

WASHINGTON, D. C.

# Notes on Idaho Ferns

CLAIR L. WORLEY AND LOUIS K. MANN

The state of Idaho possesses a flora rich in variety, due largely to its range of latitude and to its varied topographical features which include lakes, canyons, plains, extensive lava flows, shifting sand dunes, and various types of mountains. Each of these many regions embraces its own peculiar flora, and thus the physiognomy of the state's vegetation is as diverse as the regions themselves.

The plants, and especially the ferns, of central Idaho have been very much overlooked by the botanists in the past. The underlying cause was the inaccessibility of the region, due to its high mountain passes and precipitous river canyons. Only within very recent years have traversable highways opened this extensive botanists' paradise to any collecting trip less elaborate than an expedition.

During the latter half of July and the first half of August, 1936, the authors made a collecting trip into the Sawtooth Mountains, bordering the southern edge of the Stanley Basin of central Idaho. These relatively nude, "sawtooth" mountains rise abruptly from the flat basin so that very few montane hills are found; the entire region is primarily sub-alpine and alpine. Their geology is characterized by crystalline igneous rocks, which are of such a nature as to be easily eroded by climatic conditions. Heavy snow slides and severe mountain winds have converted the peaks into bare precipices and have bedecked the gentle slopes and valley floors with granite detritus supporting only sparse growths of vegetation.

July and August proved to be the most opportune season to botanize these mountains and especially their fascinating alpine meadows. The snow and ice had

An Alpine View of the Sawtooth Range.

nearly receded to the limits of its "pink" perpetual snowfields and the extremely dry spell had not yet arrived.

Since, as far as the authors know, no reports have been printed of the plants from this range of mountains, they thought it might be of interest to list the species observed. Plants in excess of two hundred and fifty species were collected, but only the ferns and their allies will be listed here. The remaining plants will appear in a later list. Since the variety of flowering plants was so great, it was surprising to find so few pteridophytes; a list of them from the Sawtooth Mountains will emphasize their relative scarcity for central Idaho.

On this trip only six ferns and two selaginellas were found and even these were by no means common. This list, likely, is not complete, and it is sincerely hoped that it will be supplemented in the near future.

All collection-numbers refer to the herbarium of the senior author.

## POLYPODIACEAE

1. "The American Rock-brake." CRYPTOGRAMMA ACROSTICHOIDES R. Br. Bot. App. in Franklin's Narr. of a Journey to the Shores of the Polar Sea 767, 1823.

| | |
|---|---|
| Coll. No.:— | 36–98. |
| Associates:— | *Eriogonum ovalifolium, E. heracleoides; Galium* sp.; *Rubus strigosus; Kelloggia galioides.* |
| Soil:— | Granite detritus. |
| Habitat:— | Sunny, dry, exposed. |
| Elevation:— | To 7,000 ft. |
| Slope:— | 30° N. to E. |
| Abundance:— | To 10% of veg. |
| Locality:— | Edge of sub-alpine meadow above and two miles south of Stanley Lake, Stanley, Idaho. |
| Collectors:— | Worley and Mann. |
| Date:— | 7–14–36. |

This fascinating rock-brake did not occur in the fine granite talus, but was characteristic of the detritus com-

posed of rocks ranging from a few inches to a couple of feet in diameter. It was general in all comparable stations in this region of the mountains.

2. "The Spleenwort." ATHYRIUM ALPESTRE Hoppe var. AMERICANUM Butters. Rhodora **19**: 204, 1917.

| | |
|---|---|
| Coll. No.:— | 36–204. |
| Associates:— | *Juncus* sp. and grasses. |
| Soil:— | Granite detritus. |
| Habitat:— | Open rocky ledge; exposed, shaded after 10 A. M., dry. |
| Elevation:— | 8,000 ft. |
| Slope:— | 30°–45° NE to E. |
| Abundance:— | To 10%—not over a dozen specimens. |
| Locality:— | Alpine meadow three miles south of Stanley Lake, Stanley, Idaho. |
| Collectors:— | Worley and Mann. |
| Date:— | 7–22–36. |

Few ferns are more captivating than this delicate species, which sends its lace-like fronds up through the interstices of ugly forbidding granitic boulders. It is a treat to any floristically inclined individual who enjoys observing plants in their native haunts.

3. "The Lady-fern." ATHYRIUM FILIX-FEMINA (L.) Roth var. SITCHENSE Ruprecht ex Moore, Index Fil. 183, 1860.

| | |
|---|---|
| Coll. No.:— | 36–246. |
| Associates:— | *Alnus tenuifolia*; *Mimulus lewisii*; *Actaea arguta*; *Glyceria* sp. |
| Soil:— | Humic—Loam. |
| Habitat:— | Moist, deep shade, very mild. |
| Elevation:— | 6,600 ft. |
| Slope:— | 10°–20° E. |
| Abundance:— | To 50%, a floor-colony. |
| Locality:— | West side of Redfish Lake, Stanley, Idaho. |
| Collectors:— | Worley and Mann. |
| Date:— | 7–26–36. |

The lady-fern represented the only montane fern observed, and its distribution was limited to a few small localities.

Athyrium Filix-femina var. sitchense

4. "The Holly Fern." POLYSTICHUM LONCHITIS (L.) Roth, Tent. Fl. Germ. **3**: 71, 1800.

Coll. No.:— 36–183.
Associates:— *Pedicularis* sp.; *Mitella pentandra*; *Saxifraga arguta*; *Alnus tenuifolia.*
Soil:— Rich humic soil between large rocks.
Habitat:— Moist, shady except at midday, well protected.
Elevation:— To 7,000 ft.
Slope:— 45° NW.
Abundance:— To 10%, one clump only.
Locality:— In a quick-descending creek emptying from the west in Stanley Lake Creek about 4 miles above its junction with the lake itself. Stanley, Idaho.
Collectors:— Worley and Mann.
Date:— 7–20–36.

If the individual who first called Osmunda regalis the "regal fern" had seen this clump in all its glory, he would have been compelled to christen it the "rex" of the entire fern world. No other species could have been more commanding than this specimen, which appeared to overlook and to rule all its associates about it. It was the focus of its domain.

5. "The Oregon Woodsia." WOODSIA OREGANA D. C. Eaton, Can. Nat. II, **2**: 90, 1865.

Coll. No.:— 36–162.
Associates:— *Aquilegia flavescens.*
Soil:— Humic pockets between rocks.
Habitat:— Dry, sunny, mild winds.
Elevation:— 7,000 ft.
Slope:— 5°–10° N.
Abundance:— To 10%.
Locality:— East fork of Stanley Lake Creek ½ mile above the fork. Stanley, Idaho.
Collectors:— Worley and Mann.
Date:— 7–20–36.

6. "The Rocky Mountain Woodsia." WOODSIA SCOPULINA D. C. Eaton, Can. Nat. II, **2**: 90, 1865.

Coll. No.:— 36–169.
Associates:— None.
Soil:— Very rocky with little soil.

Habitat:— Dry, hot, sunny, exposed.
Elevation:— 8,000 ft.
Slope:— 10°–20° E.
Abundance:— To 90%, but few plants.
Locality:— Top of ridge between East and West forks of Stanley Lake Creek. Stanley, Idaho.
Collectors:— Worley and Mann.
Date:— 7–20–36.

## SELAGINELLACEAE

1. SELAGINELLA SELAGINOIDES (L.) Link, Fil. Hort. Berol. 158, 1841.

Coll. No.:— 36–156.
Associates:— Mosses; grasses; *Pedicularis groenlandica*; *Dasiphora fruticosa*; *Gentiana* sp.
Soil:— Very humic to mucky.
Habitat:— Moist, sunny, partially protected.
Elevation:— To 6,400 ft.
Slope:— Vertical sides.
Abundance:— To 10%.
Locality:— Moist meadow adjacent to west end of Stanley Lake, Stanley, Idaho.
Collectors:— Worley and Mann.
Date:— 7–19–36.

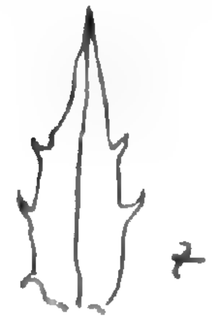
This "darb" was overlooked several times, which only proves that many of our most interesting forms are those hardest to discover.

While working on this species, the senior author noticed that the leaves and sporophylls were not quite true to form. He compared them with specimens in the University of Wisconsin Herbarium. The variations are semi-diagrammatically represented in the plate. In each case b represents the bract and f the leaf. Number I is from —♯1841, Limen Fell, Austwick, W. Y., England, May 18, 1929, *L. R. Wilson*; II is from —♯1573 Isle Royale, Michigan, September 11, 1901, *S. C. Stuntz and C. E. Allen*; III is from—Boundary Lake, Canada, July 31, 1878, *F. H. Hosford*; and IV is from the specimens above. The shading in III and IV represents thick, nearly coriaceous bracts and leaves, while the clear sketches represent very thin semi-hyaline structures.


I



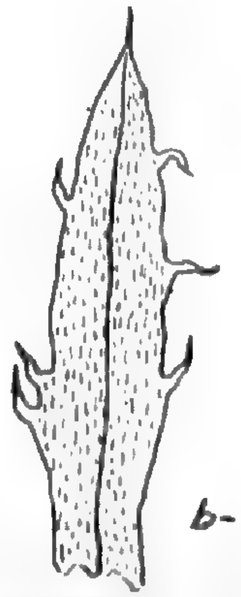
II





III






IV



Leaves and Sporophylls of Selaginella selaginoides.

The plate illustrates the differences found in this collection. Note that both leaves and bracts are much thicker than any above, save III–; that both bracts and leaves are decidedly longer; that the bracts tend to be more attenuate-pointed; and that there is a very marked difference in the shapes of both structures.

2. SELAGINELLA WATSONI Underw. Bul. Torr. Bot. Club **25**: 127, 1898.

| | |
|---|---|
| Coll. No.:— | 36–272. |
| Associates:— | *Polygonum* sp. |
| Soil:— | Granite detritus in pocket on boulder tops. |
| Habitat:— | Very dry, sunny, exposed. |
| Elevation:— | 7000 ft. |
| Slope:— | 0°. |
| Abundance:— | 75%. |
| Locality:— | On large slide on Mt. Heyburn toward creek into Redfish Lake, Stanley, Idaho. |
| Collectors:— | Worley and Mann. |
| Date:— | 7–29–36. |

UNIVERSITY OF WISCONSIN

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## Notes on California Pteridophytes

LOUIS C. WHEELER

This paper includes discussion of the distribution of several California pteridophytes. Several new stations and one species new to California are reported.

The writer is indebted to Dr. H. A. Gleason for looking up material at New York Botanical Garden, to Dr. Wm. R. Maxon and Dr. Norma E. Pfeiffer for making determinations, and to the curators of the following herbaria for allowing the study of the specimens under their care: (C) University of California; (G) Gray Herbarium of Harvard University; (NY) New York Botanical Garden; (P) Pomona College; (UCLA) University of California

at Los Angeles. The specimens in the writer's herbarium are cited as (W). All the writer's collections of Polypodiaceae and *Selaginella* here cited were determined by Dr. Maxon and of *Isoetes* by Dr. Pfeiffer. The writer is responsible for all other determinations, unless otherwise stated.

POLYSTICHUM LEMMONI Underwood. There seems to be no statement in literature giving a reasonably exact source for the type of this species. Maxon in Abrams, Ill. Fl. Pacific States **1**: 10. 1923, states, "Type locality; Vicinity of Mount Shasta, Calif." This was probably a paraphrase of Underwood's statement concerning the source of the type in Native Ferns ed. **6**: 117. 1900, "Near Mt. Shasta, California (*Lemmon*)." That the type did not come from Mt. Shasta itself is evident from Underwood's statement. In fact I have been able to find only one specimen labeled as having come from Mt. Shasta and I shall attempt to prove hereinafter that it came from elsewhere. J. G. Lemmon and wife sometimes referred on labels and in Pacific Coast Ferns, perhaps for convenience but nevertheless carelessly, to the general Mt. Shasta region as "Mt. Shasta" or "Shasta." In so doing they continued the unfortunate habit of some earlier collectors who, as Dr. C. Hart Merriam, N. Am. Fauna USDA [Biol. Survey Mt. Shasta] **16**: 138. 1899, suggests, used the term "Shasta" in a rather loose sense, as covering adjacent mountains not then named.

Dr. H. A. Gleason kindly examined the specimens of *P. Lemmoni* at New York Botanical Garden where Underwood's types are deposited.[1] The specimen which Dr. Gleason chooses as the type, since it is one of the two bearing the name "*P. Lemmoni* Underw." in Underwood's

[1] The writer has since seen these specimens and agrees with Dr. Gleason's conclusions.

handwriting, bears the data, "near Shasta Cal. *J. G. Lemmon* July 1879." Dr. Gleason excludes the other sheet from being the type since it is labeled "Mt. Eddy (W. of Mt. Shasta Calif.)" which does not coincide with Underwood's published statement as to the type locality. The problem now is reduced to finding a definite locality for a collection of this species made by Lemmon in July, 1879, and to proving that this locality is "near Mt. Shasta." Eaton, Ferns of N. America **2**: 128. 1879,[2] first reported this species from California: "Aspidium mohrioides Bory, has recently been discovered in a valley some thirty miles west of Mount Shasta, in California, by Mr. J. G. Lemmon." This "valley some thirty miles west of Mt. Shasta" is doubtless Scott Valley. Farther on Eaton, l. c., 252, gives further information: "mountains of northern California, at an elevation of 8,000 feet, *J. G. Lemmon,* July, 1879." An examination of the specimens of *P. Lemmoni* at the University of California, Berkeley, where the Lemmon Herbarium is deposited, revealed that J. G. Lemmon had collected the fern on Mt. Eddy in 1878 and 1889, in Scott Valley in 1879, and on Scott Mt. on an unstated date. Another of the specimens at New York was from Scott Mt. in 1880 according to the copied label of the Rust Herbarium, though a copied label from the Davenport Herbarium at the Gray Herbarium, apparently though not certainly referring to this same collection, bears the date Aug., 1879. Neither fulfills the requirement of July, 1879, which excludes the Scott Mt. collection. The sheet that does fulfill the requirement bears the label "Scott val.[ley] near Shasta July 23, 1879, Legit J. G. Lemmon" (C). The lack of uniformity in Lemmon's labelling is easily sufficient to account for Underwood's having been supplied only the vague local-

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[2] See Day, Rhodora **20**: 74–75. 1918 as to dates of publication

ity "near Mt. Shasta." In fact there is at (C) a second sheet that bears a very different label from the first, but which I believe to be part of the same collection. The first is labelled, apparently in Mr. Lemmon's hand: "(New to N.[orth] A.[merica] till 1879. Aspidium mohrioides, Mt. Shasta Cal. Legit J. G. Lemmon and wife. (Very rare) 1879." ("Legit J. G. Lemmon and wife" was printed on the label form.) The word "Lemmon" was doubly underscored. I believe that the underscoring indicates Mr. Lemmon as collector. I believe further that Mrs. Lemmon copied what I take to be the earlier label and omitted "Scott val." and changed "Shasta" to "Mt. Shasta." Finally I conclude that Scott Valley, Siskiyou Co., is the type locality. This does not mean that I believe that the type was actually collected on the floor of Scott Valley. The floor of the Valley is at about 3,000 ft. elevation and is low Transition Zone at most. The lowest altitude at which, so far as I know, this fern has been collected is 4,500 ft. in the low Canadian Zone in the Marble Mts. to the west. But a valley includes its sides so a location anywhere on the adjacent mountains or slopes draining into Scott Valley can be considered, in a loose sense, in Scott Valley. It is entirely possible that the Lemmon specimens from Scott Mt., "under *Pinus Balfouriana*," distributed with printed labels bearing no date of collection may be part of the type collection. A hint as to this possibility is given by Eaton, Ferns N. A. **2**: 252. 1880, where he states, "Mountains of northern California, at an elevation of 8,000 ft. J. G. Lemmon, July 1879." Lemmon evidently told Eaton the altitude and date of the collection from Scott Mt. Lemmon's slight (600 ft.) overestimate of the altitude is understandable since the area was then unsurveyed.

Besides the confusion as to the type locality, there has

been confusion in published statements of the occurrence of this species. Parish, Fern Bull. **12**: 11. 1904, states: "Known only from the headwaters of the Sacramento River in Mt. Shasta. . . ." This report was the result of too much quoting and an inadequate consideration of the geography. The Sacramento River really has its headwaters to the south of Mt. Eddy. Perhaps Parish was using "Mt. Shasta" in the traditional broad sense mentioned hereinbefore. Possibly Parish took his geography from Erythea **2**: 142. 1890, where a news note probably by Jepson concludes: "The first camp of the party was established at an elevation of 3,600 ft. on the slopes of Mt. Shasta at the headwaters of the Sacramento River." Parish, having erroneously credited the species to Mt. Shasta, states, Fern Bull. **12**: 83–84. 1904: "*Polystichum Lemmoni* Underw. Mr. C. F. Baker's last distribution includes specimens of this rare fern from Mt. Eddy in Siskiyou Co., where it was collected in Aug. 1893 by Dr. E. B. Copeland. Mt. Eddy is a neighbor of Mt. Shasta, the station already known." Parish had overlooked Watson's report of this (as *Aspidium mohrioides*) Bot. Cal. **2**: 347. 1880, "On the southern slopes of Mt. Eddy, at the headwaters of the South Fork of the Sacramento River, *Lemmon.*" Jepson's report of *P. Lemmoni* from Mt. Shasta, Man. Fl. Pls. Calif., 37. 1923, is perhaps based on Parish's reports noted above. Lemmon's report, Ferns Pacif. Coast ed. **1**: 12. 1882, of this as "A [spidium] mohrioides, Bory 'New Shasta Shield fern' Mt. Eddy, Headwaters of Sacramento River; near Shasta, Cal. 1879. (New Species!)" is the report of two different collections: the collection from Mt. Eddy in 1878 and the collection from Scott Valley in 1879. His statement "near Shasta" did not refer to the now moribund hamlet of Shasta near Redding nor to Mt. Shasta [City], the present legal post office name of what was

formerly known as Sisson and still earlier Sisson's, but to Mt. Shasta, the peak, *i.e.*, the collection from Scott Valley near Mt. Shasta.

In order to assist future workers who may study *P. Lemmoni* a list of the definite citations of collection of this fern follows. The herbaria in which specimens of these collections are deposited are given.

Mt. Eddy, Siskiyou Co., *J. G. Lemmon,* July 12, 1878 (C, UCLA, G, NY). At (C) are three sheets all labelled, on "Lemmon Herbarium" labels, "*Aspidium mohrioides* Bory." Two have identical labels apparently in Mr. Lemmon's hand: "Near Mt. Shasta, Cal. July 12, 1878." The third label written after 1880 (this is evident from the printed date 188[ ] on the label form) apparently in Mrs. Lemmon's hand reads "Mt. Eddy near Shasta Mt. July 1878." The sheet at (UCLA) was on the same label form as the last. Whoever wrote the label forgot to change the second printed "8" when the final written "8" was supplied so the date appears erroneously as "1888." It seems safe to assume this error, as the collection was made on July 12. The sheet at (NY) lacks the original label but the "Herb. of D. C. Eaton" label states that it was collected thirty miles west of Mt. Shasta by J. G. Lemmon in 1878. There is another sheet at (NY) from Mt. Eddy but as it is undated and since Lemmon collected this species on Mt. Eddy in both 1878 and 1889 there is no way of telling from which collection this sheet came. The 1878 collection is cited by Watson, Bot. Calif. **2**: 347. 1880, and by Lemmon, Ferns Pacif. Coast ed. **1**: 12. 1882.

Scott Valley, Siskiyou Co., *J. G. Lemmon,* July 23, 1879 (C, NY). The two sheets at (C) and the single sheet at (NY) have already been discussed. Reported by Eaton, Ferns N. Amer. **2**: 128. 1880, Underwood, Native Ferns, ed. 6, 117. 1900, and by Lemmon, *idem.* Mt. Eddy,

Siskiyou Co. at 5,500 ft. Aug. 18, 1903, *E. B. Copeland 3814* (C, G, P). Reported by Parish, Fern Bull **12**: 83–84. 1904. Dorleska, Trinity Co., 6,500 ft., July 18, 1909, *H. M. Hall 8573* (C). Cited by Mrs. C. C. Hall in Kennedy, Wild Fls. Calif., 158. 1917.

Collections not previously definitely reported are: Trinity Co.: At edge of a snowbank, head of Union Lake Valley, Salmon River Mts., above 6,500 ft., July 22, 1909, *H. M. Hall 8622* (C). Siskiyou Co.: Mts. about the headwaters of the Sacramento River, at 7,500–8,000 ft., Aug. 19, 1881, *C. G. Pringle* (G); under Pinus Balfouriana, Scott Mt., *J. G. Lemmon* in 1879 or 1880 (C, G, NY); about granite rocks, east side of Mt. Eddy, elevation ca. 7,500 ft. at upper limit of yellow pine belt, Aug. 28, 1914, *A. A. Heller 11739* (C), (Distributed as *Dryopteris oregana* C. Chr.); below Cold Spring, West Fork Wooley Creek, Marble Mts. alt. 5,000 ft. Aug. 5, 1908, *G. D. Butler 238* (C, P); dry rocks, Shackleford Creek, Marble Mts., July 12, 1910, alt. 4,500 ft., *G. D. Butler 1756* (C, P), *1757* (C, P). This last has short (maximum length ca. 13 cm.) much congested fronds. It was evidently growing with the other number. It would be worthy of recognition as *forma* if the western flora were sufficiently well known to warrant the giving of names to such trivial variants. Siskiyou Mts., Siskiyou Co.: About rocks on bare north slope, head of East Fork of Horse Creek, alt. 6,500 ft., Aug. 13, 1934, *Wheeler 3114* (UCLA, W); about rocks, dry open north slope, north side of White Mt., alt. 5,800 ft., Aug. 14, 1934, *Wheeler 3137* (UCLA, W).

POLYSTICHUM LONCHITIS (L.) Roth. This species is rare in California. It has been reported: Long Lake, Plumas Co., alt. 6,800 ft., July 12, 1912, *Mrs. C. C. Hall 9347* (C); Smiley, UC Pub. Bot. **9**: 76. 1921, & Jepson, Man. Fl. Pls. Calif., 36. 1923. Castle Lake, Siskiyou

Co. *Pringle* in 1882 (G), Underwood, Our Native Ferns, ed. 6, 115. 1900, & Jepson, *idem*. Castle Lake, Nevada Co., Jepson, *idem*. Unreported collections: Hupa Indian Reservation, Humboldt Co., alt. 500 ft., June, 1901, *H. P. Chandler* (C). Siskiyou Mts., Siskiyou Co.: Rock Gulch off Jaynes Canyon, alt. 6,000 ft., Aug. 6, 1934, *Wheeler 3058* (UCLA, W); Dead Cow Creek, alt. 6,200 ft., Aug. 10, 1934, *Wheeler 3100* (W). In Jaynes Canyon and Dead Cow Creek the fern occurs here and there in fair abundance at the bases of north-facing cliffs and in shady sites near streams.

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon. This fern is of sufficient rarity to warrant citing additional stations. From Siskiyou Co. it was reported first by Merriam (as *Dryopteris aculeata* var. *scopulina*) N. Am. Fauna, USDA **16**: 136. 1899, from Mt. Shasta which seems to be the only station reported for the county. Along the east end of the Siskiyou Mountains summit it is rather abundant. The following collections were made: Siskiyou Mts., Siskiyou Co.: Shady foot of cliff, Rock Gulch off Jaynes Canyon, alt. 6,000 ft., Aug. 6, 1934, *Wheeler 3059* (UCLA, W); about rocks, sunny south slope, head of East Fork of Horse Creek, alt. 6,500 ft., Aug. 13, 1934, *Wheeler 3113* (W); sunny serpentine ridge, Trapper Creek, alt. 6,500 ft., Aug. 26, 1934, *Wheeler 3225* (UCLA, W). *No. 3113* was growing with *P. Lemmoni*. *P. scopulinum* favored the south sunny side of the small rocky summit on which they were growing and *P. Lemmoni* preferred the north side. The two occurred together here and there but no intermediates were noted. The two species occur together elsewhere and are distinguishable: "Mt. Eddy, near Shasta," *J. G. Lemmon*, July 12, 1878 (C). Lemmon collected this at the same time and at apparently the same station as the specimens of *P. Lemmoni* cited hereinbefore.

PELLAEA BRIDGESII Hooker. Ewan, Am. Fern Journ. **24**: 6. 1934, states, concerning the alleged occurrence of this species in Southern California: "The record of Davidson & Moxley . . . , the only one from our area, . . ." There was a much earlier report of this: Heller, Muhl. **4**: 13. 1908, quotes an eastern (U. S.) correspondent who writes . . . "I can cite *Pellaea Bridgesii,* which I have from San Diego County, collected by myself somewhere in the Cuyamaca Mountains, though in those days exact stations were not noted by me." Heller writes me that the name of the correspondent has been forgotten. Consequently the record cannot be checked. It is barely possible that this fern might occur on Cuyamaca Peak but, as the peak only reaches 6,515 ft. altitude, it seems improbable, for the fern is a high-montane species.

As for the Davidson & Moxley report for [Big?] Dalton Canyon, San Gabriel Mts., it was at best based on a juvenile plant of *P. andromedaefolia,* for Dalton Canyon is, at most, low Transition Zone, and since, *fide* Moxley in a letter to Munz, no specimen was preserved, it cannot be validated.

CHEILANTHES INTERTEXTA Maxon. The northernmost collection of this species reported is that cited by Maxon, Proc. Biol. Soc. Wash. **31**: 150. 1918: Mill Creek, Ukiah, Mendocino Co., *Bolander 4640* in 1866. It occurs four miles east of Grenada, Shasta Valley, Siskiyou Co., alt. 2,850 ft., *Wheeler 3344* (G, W). The fern was growing from dry south-facing crevices in lava. The vegetational aspect of the region was definitely that of the Great Basin, for *Juniperus occidentalis* was abundant on the lava hills. While this occurrence seems strange in this region it is matched by the report of this species from Virginia City, Nevada, by Maxon, *idem.* Virginia City is in the Great Basin area.

MARSILEA VESTITA Hooker & Greville. This species has been reported in California as far north as Eagle Lake, Lassen Co., Jepson, Man. Fl. Pls. Cal., 39. 1923. It is common in Modoc Co.: Big Valley, *Milo S. Baker,* June–Aug. 1903 (C); adobe bed of dried pool two miles northeast of Alturas, alt. 4,450 ft., Aug. 18, 1935, *Wheeler 3897* (W); sunny, formerly wet, adobe shore, Everly Reservoir, Devil's Garden, alt. ca. 5,000 ft. Sept. 18, 1935, *Wheeler 3993* (G, W); in shallow pool and dry rocky stream bed, Fletcher Creek, at Pease' Place, Devil's Garden, alt. ca. 5,000 ft. Sept. 12, 1935, *Wheeler 3975* (G, W). It is apparently rare in Siskiyou Co.: Submersed in river, Shasta River two miles below Yreka Creek, Siskiyou Mts. alt. 2,200 ft., Oct. 14, 1934, *Wheeler 3323* (W). This last was determined by Maxon.

In Southern California this species is infrequent. The station farthest to the northwest reported in Southern California is Santa Monica, Davidson, Cat. Pls. L. A. Co., 34. 1896. It has been collected in Ventura Co.: Edge of pond five miles north of Ventura, June 24, 1927, *Feudge 1611* (P).

PILULARIA AMERICANA A. Br. Reported in California as far north as Calaveras Co., J. T. Howell, Leafl. West. Bot. 1: 14. 1932. The following additional collections have been made: Submersed in a rainpool in a clay mesa between Boulder and Churn Creeks three miles northeast of Redding, Shasta Co., Mar. 31, 1935, *Wheeler 3394* (W). Devil's Garden, alt. ca. 5,000 ft., Modoc Co.: Sunny shore in drying mud, South Mt. Reservoir, Aug. 22, 1935, *Wheeler 3911* (G, W); sunny muddy shore, Everly Reservoir, Sept. 17, 1935, *Wheeler 3990* (G, W); adobe mud at edge of sunny streamlet, Back Tuttle Place, Sept. 30, 1935, *Wheeler 4030* (W). *Pilularia* is abundant on the mud flats around the numerous stock-watering reservoirs on the Devil's Garden. Here and also at

Redding it grows intermixed with young *Eleocharis* from which it is scarcely distinguishable by the aspect of the aërial parts. It is necessary to wash the mud from samples taken here and there until the small round sporocarps which readily distinguish *Pilularia* from *Eleocharis* are found. Perhaps diligent examination of rainpools throughout the state will reveal that *Pilularia* is a common component of their characteristic vegetation.

ISOETES NUTTALLII A. Br. There has been considerable debate as to whether any Southern California material should be referred to this species. See Munz & Johnston, Am. Fern Journ. **12**: 122. 1922. Munz, Man. So. Calif. Bot., 12. 1935, gives definitely only the mesas at San Diego for the occurrence of this species in So. California. Likewise Pfeiffer, Ann. Mo. Bot. Gard. **9**: 131. 1922, reports this only from San Diego Co. in Southern California. The following collections were made at Puddingstone Dam, San Jose Hills, Los Angeles Co.: Wet slope, abundant locally, alt. 900 ft. Mar. 11, 1934, *Wheeler 2436* (G, W); damp sloping ground which was near a vernal streamlet but was never flooded; with *Callitriche marginata*, alt. 1,000 ft., Mar. 6, 1934, *Wheeler 2437* (G, W).

ISOETES ORCUTTII A. A. Eaton. This is reported only as far north as Contra Costa Co. by Pfeiffer, Am. Mor. Bot. Gard. **9**: 133. 1922. It was abundant, submersed in a rainpool in a clay mesa between Boulder and Churn Creeks three miles northeast of Redding, Shasta Co., Mar. 31, 1935, *Wheeler 3395* (W). This collection extends the known range of this species about 175 miles north.

ISOETES HOWELLII Engelmann. Unreported in Siskiyou Co. but reported by Pfeiffer, Ann. Mo. Bot. Gard. **9**: 141. 1922, in adjacent Trinity Co. Siskiyou Co.: Sunny bed of dried rainpool, Soda Creek, Sterling Mt., Siskiyou Mts., alt. 5,500 ft., July 3, 1934, *Wheeler 2871*

(W). Unreported in northeastern California. Reported by Pfeiffer from the central Sierra Nevada and Chico. In the small lakes in Pine Creek drainage at the extreme north end of the Warner Mts. in California this species is abundant. (This Pine Creek is the one Russell, Univ. Calif. Pub. Geol. **17**: 393. 1928, proposes to call *Pine Creek North* in order to distinguish it from the Pine Creek east of Alturas.) The following collections were made: Warner Mts., Modoc Co.: Pine Creek: Abundant in and at edge of shallow sunny pond, Rock Lake, alt. 6,300 ft., Aug. 3, 1935, *Wheeler 3757* (G, W); on sunny muddy shore and in shallow water, Cave Lake, alt. 6,800 ft., Aug. 14, 1935, *Wheeler 3857* (G, W); in sunny mud at edge of lake, formerly submersed, Lily Lake, alt. 6,800 ft., Oct. 6, 1935, *Wheeler 4025* (W). Submersed in heavy soil in sunny pond, Brandey, East Fork Bidwell Creek, alt. 7,900 ft., Aug. 5, 1935, *Wheeler 3785* (G, W).

SELAGINELLA SCOPULORUM Maxon. The nearest station to California reported in literature for this species is: Sumpter Valley watershed, Blue Mountains, Baker Co., Oregon, alt. 2,280 m., *Ferris & Duthie 941*, by Maxon, Am. Fern Journ. **11**: 37. 1921.

It occurs along the Siskiyou Mountains summit in California and adjacent Oregon about 260 miles southwest of the Blue Mountains station: OREGON, Jackson Co.: Dry rocky exposed south ridge, Siskiyou Peak, Siskiyou Mts., alt. 6,700 ft., July 25, 1934, *Wheeler 2981* (UCLA, W). (This Siskiyou Peak is not the peak by that name on the Ashland Oregon Quadrangle. That peak is now called Ashland Peak on the Klamath National Forest map (1934 half-inch scale) and Siskiyou Peak lies between the heads of the East and West Forks of Long John Creek.) CALIFORNIA, Siskiyou Co.: Siskiyou Mts.: Open rocky summit, Big Rock, Dog Fork of Middlehell Creek, alt. 6,860 ft., Aug. 3, 1934, *Wheeler 3036* (W); about rocks

on sunny south slope with *Juniperus communis* L. var. *montana* Ait., on the peak locally known as "Black Mt." but unnamed on maps, one-half mile west of White Mt., alt. 6,300 ft., Aug. 14, 1934, *Wheeler 3122* (W).

SELAGINELLA WALLACEI Hieron. Reported by Maxon in Abrams Ill. Fl. Pac. St. **1**: 49. 1923, "Oregon & south along the coast to Marin Co., Calif." It occurs about sixty miles inland in Siskiyou Mts., Siskiyou Co.: Dry sunny south facing rock crevices, East Fork Horse Creek, alt. 5,000 ft., Aug. 15, 1934, *Wheeler 3158* (W); south slope about rocks, West Fork Seiad Creek, alt. 3,800 ft., Apr. 14, 1935, *Wheeler 3419* (W).

GRAY HERBARIUM, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

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# Keys to the Ferns of Iowa[1]

A. S. LYNESS, PH.D.

## I. A VEGETATIVE KEY TO THE GENERA OF IOWA FERNS AND FERN-ALLIES

A. Leaves always simple, but often deeply pinnatifid. B.
B. Leaves united by their margins to form a sheath about the stem ..... *Equisetum.* 10.
B. Leaves not united by their margins ..... C.
C. Leaves 2-lobed, imbricated on pinnately branched stems, which emit rootlets beneath; plants small and floating on the water ..... *Azolla.* 4.
C. Leaves quill-like, arising from a short, fleshy, bi-lobed or trilobed corm; plants rooted in mud, partly or entirely submerged in water. *Isoetes.* 11.
C. Leaves small and entire, or larger and deeply pinnatifid, borne on terrestrial plants ..... D.
D. Leaves small and scale-like, arranged in two to many ranks along branching annual or perennial stems ..... E.

[1] Adaptable to other states of the Middle West.

E. Leaves convex on the back, 4- to many-ranked, tipped with distinct, translucent awn; spores of two kinds ..... *Selaginella.* 21.

E. Leaves flattened, imbricated, 4- to 16-ranked, acuminate or acute; spores of one kind and sulphur-yellow ..... *Lycopodium.* 12.

D. Leaves larger, never scale-like, entire or deeply pinnatifid ..... F.

F. Leaves entire, narrowed from the base to a long, acuminate point, which often roots and starts a new plant; sori linear or oblong on the under side of the leaves ..... *Camptosorus.* 6.

F. Leaves cut almost or quite to the midrib into uniform or variable segments ..... G.

G. Leaves ovate-oblong in outline; segments varying but little in length from tip to base. *Polypodium.* 17.

G. Leaves broadly triangular in outline; segments lengthening rapidly from tip to base. .. ..... H.

H. Sterile and fertile fronds different. *Onoclea.* 14.

H. Sterile and fertile fronds alike. *Thelypteris.* 22.

A. Leaves compound ..... I.

I. Leaves palmately compound, quadrifoliolate; leaflets simple, entire; petioles long, slender; plants rooted in mud, leaves above the water ..... *Marsilea.* 13.

I. Leaves ternately compound ..... J.

J. Upper pinnae undivided, the lower more or less pinnatifid; fertile fronds with marginal, linear, continuous sori ..... *Pteridium.* 20.

J. Ternate divisions pinnate with pinnatifid pinnae; fertile branch long-stalked, rising above the sterile leaves with sporangia on either side of its branches ..... *Botrychium.* 5.

I. Leaves pinnately compound ..... K.

K. Leaves once-pinnate ..... L.

L. Pinnae not pinnatifid ..... M.

M. Sori round; leaves narrowly oblong or lanceolate; pinnae with sharply toothed or spinulose margins; fertile pinnae on contracted tip of fertile frond ..... *Polystichum.* 18.

M. Sori linear or elongated ..... N.
N. Leaves linear-lanceolate, 6 to 12 dm. high; pinnae entire or crenulate, not auricled. *Athyrium.* 3.
N. Leaves linear-oblanceolate, 2 to 5 dm. high; pinnae auricled, with crenate or incised margins ..... *Asplenium.* 2.
L. Pinnae pinnatifid ..... O.
O. Sterile and fertile fronds very different ..... P.
P. Fertile frond much shorter than the sterile; pinnae pod-like; sterile frond 6 to 30 dm. high ..... *Pteretis.* 19.
P. Fertile frond about as long as sterile, much contracted, or with a few contracted pinnae for spore-bearing on the sides of the otherwise sterile fronds ..... *Osmunda.* 15.
P. Fertile fronds much longer than sterile and with narrower divisions; margins of segments reflexed over sporangia, finally spreading out flat ..... *Cryptogramma.* 8.
O. Sterile and fertile fronds very much alike ..... Q.
Q. Sori oblong or linear, curved at one end over the veins, often horseshoe-shaped; indusia sometimes toothed ..... *Athyrium.* 3.
Q. Sori round or roundish, with or without indusia ..... R.
R. Indusia, if present, superior .....*Thelypteris.* 22.
R. Indusia wholly or partly inferior ..... S.
S. Stipes continuous with the rhizome, unjointed; vascular bundles in stipe oval, roundish or flat; indusia attached at the side ..... *Cystopteris.* 9.
S. Stipes commonly jointed above the base; vascular bundles in the stipe V- or X-shaped; indusium nearly cleft into segments, which are mostly concealed by the sporangia. *Woodsia.* 23.
K. Leaves twice-pinnate ..... T.
T. Leaves with pinnatifid pinnules ..... U.
U. Leaves low and tufted, 8 to 15 cm. high, pubescent, especially beneath; sori small, roundish, distinct, or nearly continuous, formed in the

reflexed margins of the separate lobes of the segments ..... *Cheilanthes.* 7.

U. Leaves larger, 15 to 20 cm. high, not pubescent, deltoid-ovate in outline; sori copious, naked, forming submarginal rows around the segments. ..... *Thelypteris.* 22.

U. Leaves large, 20 to 40 cm. broad, on stalks 20 to 40 cm. high, obliquely orbicular in outline, not pubescent; sori borne on the upper cleft margins of the pinnules; stalks shining. *Adiantum.* 1.

T. Leaves with undivided pinnules ..... V.

V. Leaves 1 to 6 dm. high; pinnae broadly linear or oblong; fertile fronds green, and taller than the sterile ones, with pinnules more contracted; sori marginal and covered with the reflexed margins of the pinnules ..... *Pellaea.* 16.

V. Leaves 3 to 16 dm. high; sterile pinnules oblong-oval to lance-oblong; fertile branch of frond destitute of chlorophyll, much contracted; naked short-stalked sporangia borne on the narrow pinnules of the fertile branch. *Osmunda.* 15.

NOTE:—In the above key the number after the generic name refers to the number of that genus in the Key to the Iowa species which is to follow.

(*To be continued*)

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## Recent Fern Literature

The latest addition to state fern lists which has come to our attention is one on Iowa.[1] It is a pamphlet of 52 pages, including descriptions of species, excellent habitat views of many of them, and county maps showing by dots the distribution of each within the state. The work gives evidence of care in its preparation, and contains fewer

[1] Melhus, I. E. Native Ferns of Iowa. Iowa State College Extension Circular no. 225, June, 1936.

errors than several other recent fern books. *Pellaea glabella* is correctly listed as the only widespread representative of this genus, and the cut of *Cystopteris fragilis* is good enough to show the features of var. *genuina*. One unfortunate transposition of cuts between pages 29 and 31 may be noted. The data given as to the rarer species of the state are disappointing, several which apparently here reach range-limits being confused with others or overlooked entirely; these comprise *Adiantum capillus-veneris*, *Cryptogramma stelleri*, *Woodsia cathcartiana*, *Phegopteris dryopteris*, *Lycopodium clavatum*, and *L. flabelliforme*. And a number of county records given in articles which have appeared in the pages of this JOURNAL are not included on the maps.

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## Shorter Notes

A SUGGESTION FOR FIELD STUDY.—The subject of ferns and fern allies as host plants for several species of dodder (*Cuscuta*) has recently been discussed interestingly by Dean,[1] on the basis of both field and experimental greenhouse studies, with a review of the scant literature. Out of two dozen species of pteridophytes experimented with in 1933, Singh was able to parasitize *Cuscuta reflexa* upon only one, *Athyrium pectinatum* Wall., of India, though he was notably successful with nearly all angiosperms tried. The list of definitely identified pteridophyta hosts (mainly as wild plants) for the various species of *Cuscuta* is, in fact, a short one: *Asplenium Trichomanes*, *Athyrium filix-femina*, *A. pectinatum*, *Dryopteris dentata*, *D. filix-mas*, *D. Robertiana*, *Cystopteris fragilis*, *Marsilea Drummondii*, *Equisetum pratense*, and *E. variegatum*. Surely members of the Fern Society can increase this number. It is the writer's guess that such rank-growing lowland

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[1] Henry L. Dean, "*Cuscuta as a Parasite upon Pteridophytes*," in Annals of Botany, **50**: 823–825. 1936.

plants as *Dryopteris thelypteris, D. cristata,* and *Osmunda cinnamomea* can rather readily be added, and probably several other of our native species as well, assuming that such unlikely host plants as *Cystopteris fragilis, Asplenium Trichomanes,* and *Dryopteris Robertiana* have been properly identified. Who among our members can add to the list? Besides the fern specimen, good herbarium material of the *Cuscuta,* ample for specific identification and for future reference, should in every case be collected.—WILLIAM R. MAXON, *U. S. National Museum.*

NARROW-LEAVED SPLEENWORT FOUND IN WAYNE COUNTY, PA.—The Narrow-leaved Spleenwort (*Asplenium pycnocarpon*) is rare enough in some localities to make its discovery worth mention. I found about twenty plants at the upper end of Lobez' Pond, about one mile west of Shehawken, Wayne County, Pennsylvania, in August, 1937. I believe this is the only reported station for this fern in either Wayne or Susquehanna Counties.

The land was "cleared" about fifty years ago, and is now covered with second growth maples. Along with this fern were growing *Asplenium acrostichoides, Dryopteris intermedia,* and *Adiantum pedatum.* On rocks in the immediate vicinity were several small colonies of *Camptosorus rhizophyllus.* The pond is 1,650 feet above sea-level.—W. L. DIX.

SAW-FLY LARVAE EAT EQUISETUM ARVENSE.—During the first week in June, 1937, I noticed many sterile shoots of *Equisetum arvense* L. having their branches gnawed or eaten off. The plants were in a ravine near Columbus, Ohio. A little investigation disclosed numerous larvae on some plants as the cause of the injury. The larvae were identified by Professor Alvah Peterson of the Department of Zoology and Entomology as a species of saw-

fly. This was the first injury of the sort that I had ever noticed, although it must be a common phenomenon. In some plants the end of the stem and several whorls of upper branches were completely eaten off. Mostly, however, the central portion of the stem and the sheaths were left, the larvae only gnawing off one or more of the branch ridges. A single lepidopterous larva was also found eating the branches of a shoot. The same injury was noted on sterile shoots of the field horsetail in July at Elk Rapids, Michigan, but the larvae doing the damage had all disappeared.—JOHN H. SCHAFFNER, *The Ohio State University.*

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## American Fern Society

As scheduled in the July–September FERN JOURNAL, the joint field trip of the Torrey Botanical Club and the Fern Society, was held as planned in the vicinity of Owens, Sussex County, New Jersey, Sunday, September 26th. Twenty-five enthusiasts appeared at the time appointed under ideal weather conditions. The glaciation to which this part of New Jersey had been subjected, produced many very favorable fern habitats; the numerous swamps, bogs and bare rock ledges support a variety of luxuriant ferns. In the little-disturbed woodlands and swamps near Owens the immense old trees protect a superb representation of fern species in which Dryopteris predominate. The group assembled at Wallkill Lake and were soon carefully scanning the limestone outcrops, noting *Asplenium trichomanes* and *A. platyneuron, Dryopteris marginalis, Camptosorus rhizophyllus,* and *Cystopteris fragilis* (var. *Mackayii*).

After exhausting the possibilities of the lake-margin the party was guided into the woods and adjacent swamp, which fortunately was not very wet at that time. Here in

the extensive stands of beautiful ferns, Dr. Wherry called attention to a large number of *D. simulata* and, close by, to some very good specimens of that favorite hybrid, *D. Boottii.* In addition the following species were on our list of finds in this area: *Botrychium obliquum* and *B. dissectum, Osmunda regalis* and *O. cinnamomea, Asplenium platyneuron, Athyrium acrostichoides* and *A. angustum,* the northern lady-fern, *Polystichum acrostichoides, Thelypteris noveboracensis, T. palustris, Dryopteris cristata, D. clintoniana, D. marginalis, D. spinulosa* (including var. *fructuosa*) and *D. intermedia, Dennstaedtia punctilobula, Onoclea sensibilis, Lycopodium lucidulum, Selaginella apoda.* After a rather thorough exploration, Messrs. Benedict and Edwards, the energetic and tireless leaders, suggested visiting another locality as a climax to the day's activities. With few exceptions the whole party followed to a cut on the D. L. & W. R. R. through limestone, near Andover Junction. Here, between the rocky wall and the railroad were found *Botrychium virginianum, Osmunda claytoniana, Polypodium virginianum, Adiantum pedatum, Pellaea atropurpurea* and *P. glabella, Asplenium trichomanes, Athyrium pycnocarpon, Camptosorus rhizophyllus, Dryopteris Goldiana, D. marginalis, D. Goldiana × marginalis, Phegopteris hexagonoptera, Cystopteris bulbifera* and *C. fragilis.*

In the party of twenty-five the Fern Society was represented by eight members, R. C. Benedict, W. L. Dix, W. H. Dole, J. L. Edwards, Mrs. Charles Y. Tanger, H. W. Trudell, Dr. Edgar T. Wherry and Miss Mary Wright.—HARRY W. TRUDELL.

# Index to Volume XXVII

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## ERRATA

Page 17, last line, for VARIEGATUM, read VARIEGATA
Page 30, line 2 from bottom, for **25:**, read 25
Page 58, line 19, for var., read **var.**
Page 60, line 20, for ACROSTICHOLDES, read ACROSTICHOIDES

# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

C. A. WEATHERBY

R. C. BENEDICT W. R. MAXON

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# American Fern Journal

VOL. 28 JANUARY–MARCH, 1938 NO. 1

## Ophioglossum petiolatum Hooker

ROBERT T. CLAUSEN

Because of the delays incident to the publication of a world monograph of the Ophioglossaceae, it seems desirable at this time to present independently a discussion concerning the status and relationships of the much misunderstood *Ophioglossum petiolatum*. The detailed synonymy is given below:

*Ophioglossum petiolatum* Hooker, Exotic Flora **1**: 56. 1823. Based on specimens sent from the West Indies to the Liverpool Botanical Garden, where the plants were cultivated. The exact place of collection of the types is apparently unknown. The two specimens shown in the illustration accompanying the original description may be considered as typifying the species. Hooker states that it differs from *O. ovatum* and *O. vulgatum* in the long-pedunculate fertile spike, the slender habit, and the narrower, much more acuminate lamina.

*Ophioglossum moluccanum* Schlecht., Adumbratio Filicum in promontorio Bonae Spei provenientium p. 9. 1825. Based on *O. simplex* Rumphius, Herb. Amboinense **6**: 152. pl. 68, fig. 2. 1750.

*Ophioglossum cordifolium* Roxb.; Wall. List no. 47. 1828.

*Ophioglossum elongatum* A. Cunningham, in Hooker's Companion to the Botanical Magazine **2**: 361. 1836. Based on material from North Island, New Zealand.

*Ophioglossum cognatum* Presl, Suppl. Tent. Pterid. p. 53. 1845. Based on material from Calcutta, Bengal, India.

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[Volume 27, No. 4 of the JOURNAL, pages 109–144, plates 5–7, was issued Jan. 3, 1938.]

*Ophioglossum Cumingianum* Presl, Suppl. Tent. Pterid. p. 52. 1845. Based on the collection of Cuming, no. 284, from the island of Corregidor in Manila Bay, the Philippines. The writer has examined material from the type collection at the Gray Herbarium. This is the same as *O. petiolatum,* but material of this number in the U. S. National Herbarium is *O. reticulatum.*

*Ophioglossum obovatum* and *O. timorense* Miquel, in Ann. Mus. Bot. Lugd.-Bat. **4**: 93. 1868–69. Based on material from the island of Timor. So far as can be determined from the original descriptions, both of these names probably should be considered synonyms of *O. petiolatum.* The types have not been available for examination.

*Ophioglossum vulgatum* L., var. *australasiaticum* Luerssen in part, in Journ. des Museum Godeffroy **3**: 246c. 1875. This includes both *O. petiolatum* Hooker and *O. pumilum* Raciborski.

*Ophioglossum pedunculosum* sensu Prantl (not Desvaux, 1811), in Jahrb. Bot. Gart. Berlin **3**: 328. 1884. The type of *O. pedunculosum* Desvaux is filed in the herbarium at the Museum of Natural History in Paris and a photograph of the type sheet is now available at the Gray Herbarium. As Weatherby (Contr. Gray Herb. **114**: 29. 1936) has already indicated, this plant of Desvaux is not the same as *O. pendunculosum* as interpreted by Prantl. The Desvaux type is a plant about 18 cm. high, with a much enlarged bulbous rootstock bearing numerous roots and two leaves with the blades basally inserted. The expanded portion of one of these blades is about 4 cm. long by 1.8 cm. broad, oblong-elliptical and apiculate, with a conspicuous pale median band extending the length of the lamina. The fertile stalk is 12 cm. long and the spike about 2 cm. This plant is the same as *O. fibrosum* Schumacher of Africa, India, and the East Indies. Since *O. pedunculosum* Desv. is the first name to have been applied to this eastern species, it must now replace *O. fibrosum,* while *O. petiolatum,* the next earliest available name, must be used for the population erroneously designated as *O. pedunculosum* by Prantl.

*Ophioglossum Raciborskii* van Alderwerelt van Rosenburgh, in Bull. Jard. Bot. Buit. Series 2, no. 28: 35. 1918. Based on *O. moluccanum* Schl., forma *lanceolatum*

Copy of Illustration Accompanying Original Description of Ophioglossum petiolatum Hooker, Exotic Flora 1: 56. 1823.

Raciborski, in Nat. Tijdschrift Ned.-Ind. **59**: 236. tab. 2, fig. 4. 1900. The original description is based on a specimen from Klappa Noenggal, near Buitenzorg, Java, the collection of C. A. Backer 23403. This represents a narrow-bladed form of *O. petiolatum* which does not merit nomenclatorial recognition. The venation-characters mentioned by van Rosenburgh are of trivial consequence. The species was named in honor of M. Raciborski who studied *Ophioglossum* in the Dutch East Indies.

*Ophioglossum pedunculatum* Nakai, in Bot. Mag. Tokyo **39**: 193. 1925. This name is an error for *O. pedunculosum*, supposedly of Desvaux, in Berl. Mag. **5**: 306. 1811. The spelling was not corrected, but rather was perpetuated in a later paper by the same author. According to Nakai (1925) this species resembles smaller specimens of *O. reticulatum*, but the margins of the leaves, instead of being entire, are crenate.

*Ophioglossum littorale* Makino, in Journ. Jap. Bot. **6**: 27. 1929. Although the writer has not yet had opportunity to study authentic material of this, Makino's original description so strongly suggests *O. petiolatum* that it seems best tentatively to list the name in the synonymy of this species.

*Ophioglossum floridanum* E. P. St. John (including forma *favosum* and f. *reticulosum*), in Am. Fern Journ. **26**: 52–55, fig. 1–3. 1936. Based on abundant material from near Gainesville, Fla., and on specimens from many other stations in central Florida. Plants of this population are in every respect identical with material of *O. petiolatum* from Java, Sumatra, and elsewhere. Not even varietal separation of the East Indian and Florida plants seems possible. The plate accompanying the original description of *O. petiolatum* shows plants which are entirely like *O. floridanum* except that the blades have longer hafts, but the length, or the presence or absence, of a haft on the sterile blade is a character of slight taxonomic consequence in *Ophioglossum* and certainly should not be used here as a basis for the separation of species. Further, although the venation in *O. floridanum* is highly variable, since it is in every respect like that of *O. petiolatum* from all parts of its range, there seems little basis for according nomenclatorial distinction to the Florida

Ophioglossum petiolatum from Alachua County, Florida.
Specimens Collected by R. P. St. John.

plants. The minor variations in shape of blade and venation within the American population scarcely deserve naming.

The species may now be recharacterized as follows: Plant 6–21 cm. high, with short slender erect rhizome bearing several long fleshy roots and one or usually several leaves during a single growing season; vegetative reproduction common, by means of modified long slender roots, buds from these giving rise to new plants; common stalk 2–9 cm. long; blade rather thin in texture, lance-ovate, ovate, or elliptical-ovate, acute at apex, obtuse or subtruncate at base, cuneate into a short haft or sessile, 1.5–6 cm. long, 0.6–1.7 cm. wide; venation lax, veins few, areoles large; fertile stalk 1.5–9 cm. long; fruiting spike 1–4 cm. long; sporangia 0.5–1 mm. in diameter. Gametophyte apparently unknown.

The history of *Ophioglossum petiolatum* is one of taxonomic blundering and misinterpretation. Although the species was already known somewhat before the publication of the first edition of the Species Plantarum, yet there seems to have been no end of misunderstanding concerning its proper status, its distribution, and its range of variation. It has been almost periodically described as new, each time with a different name and usually without any mention of the previous descriptions or an examination of the considerable literature which should always be consulted before a new name is placed on record, to avoid renaming long-known species.

The first description was by Rumphius in 1750. He clearly described plants from Amboina as *O. simplex* and providing a drawing showing that he unquestionably was dealing with the present population. Unfortunately, the name *O. simplex* was not used by later writers. Instead, new names were introduced, while rather recently *O. simplex* has been assigned to an entirely different species

from Sumatra. This last application of the name is tenable under the International Rules of Nomenclature, since *O. simplex* Rumphius, having been published before 1753, is not valid.

Hooker, in 1823, described and illustrated *O. petiolatum* from plants cultivated in England, which were originally obtained from somewhere in the West Indies. Hooker's description is entirely adequate and his name should have been used subsequently as the proper designation for this species. Other workers, however, misinterpreted *O. pedunculosum* Desvaux, a quite different species, and have used this name for the *O. petiolatum* population, which was thought to be entirely of Old World distribution. Actually *O. petiolatum* has a rather wide distribution in the New World, but seems to be less common here than in the Old World, where it is apparently fairly abundant. Since much of the American material in herbaria lacks specific locality-data, it has not been possible to work out the detailed range of this species in the Americas, but the evidence available indicates that, besides being found in central Florida, it occurs on various islands of the West Indies, in Central America, and in northern South America. The American plants exactly match Old World specimens.

In the Old World, there has been much misconception concerning the range of variation in this species. Enthusiatic "splitters" have frequently described minor variants as new species, thus adding to the synonymy. None of these trivial variations in leaf shape or in the minute details of venation seems worthy of naming. Often all of the supposed different species may occur in the same patch or colony, as a few large series demonstrate.

*O. petiolatum* really is very closely related to *O. reticulatum* and in certain parts of the world, notably in India, China, and Mexico, the two populations seem somewhat to

intergrade. Usually, however, they appear distinct and are readily separable. *O. petiolatum* generally may be distinguished by its lance-ovate blade, which is acute at the apex, by the rather long, slender fertile segment, and by the lax venation. Typically, also, it is somewhat smaller than *O. reticulatum*.

*O. petiolatum* is a plant of moist meadows, damp grassy places, and occasionally of moist woodlands and thickets. The range includes central Florida, Trinidad and elsewhere in the West Indies, Mexico, northern South America, tropical Africa and Madagascar (*fide* Christensen, 1932), India, Ceylon, Siam, China, Japan, Philippines, Borneo, Sumatra, Java, New Guinea, New Caledonia, New Zealand, Fiji, and Samoa.

In the following list of citations, names of herbaria have been abbreviated as follows: (Claus), private herbarium of the writer; (G), Gray Herbarium of Harvard University; (M), herbarium of the Missouri Botanical Garden; (Ph), herbarium of the Academy of Natural Sciences of Philadelphia; (E. St. J.), private herbarium of E. P. St. John; (R. St. J), private herbarium of R. P. St. John; (U), United States National Herbarium; (NY), herbarium of the New York Botanical Garden.

FLORIDA. Alachua Co.: eight miles south of Gainesville, *R. P. & E. P. St. John* 416 (Claus, G, Ph, E. St. J. & R. St. J.). Citrus Co: Floral City, *R. P. St. John* 907 (Claus, R. St. J.). Hernando Co: Brooksville, *R. P. St. John* 600 (R. St. J.). Pasco Co.: Dade City, *R. P. St. John* 628 (R. St. J.). Sumter Co.: Wahoo, *R. P. St. John* 634 (Claus, R. St. J.).

TRINIDAD. About 4500 ft., *R. S. Williams* 1600 (NY).

MEXICO. Borrego, Region de Orizaba, *Bourgeau* 3013 (G, NY).

COLOMBIA. Ex. herb. Thomas Moore (G).

PERU and CHILE. Specimens without specific locality data.

RANGE OF OPHIOGLOSSUM PETIOLATUM.

TROPICAL AFRICA and MADAGASCAR. Reported by Christensen (1932), but no specimens have been seen by the writer.

INDIA. Assam: Khasi Hills, *G. Mann* in part (U). Bengal: ————, *Wallich* 47 (U). Madras: Nilgiris Mts., *J. S. Gamble* (U). Punjab: Dharmkot, Dharmsala, *R. R. & I. D. Stewart* 5480 (U); also 2064 in part (B, U).

CEYLON. ————, *W. Ferguson* 220 & 221 (U).

SIAM. Dai Sutep Summit, *H. M. Smith* 406 (U).

CHINA. Hupeh: ————, *A. Henry* 5933 in part (G). Kwantung: Yam Na Shan (Mei District), *W. T. Tsang* 21442 (NY); Yuyuen, *S. P. Ke* 52847 (NY).

JAPAN. Taiwan: Taihoku, *J. Tanaka* 1717 (U). Yezo: Hakodadi, *C. Wright* (G, U, NY).

BONIN ISLANDS. ————, *C. Wright* (G, U).

PHILIPPINES. Luzon. Island of Corregidor in Manila Bay, *Cuming* 284 in part (G). Benguet: Baguio, *R. S. Williams* 1601 (U); also *A. D. E. Elmer* 5830 (U).

BRITISH NORTH BORNEO. Kiau, Mt. Kinabalu, *D. L. Topping* 1636 (U, NY); also *M. S. Clemens* 10093 (G, U). Dallas, *J.* & *M. S. Clemens* 26158 (NY).

SUMATRA. Silo Maradja, Asahan (East Coast), *H. H. Bartlett* 8140 (U). Delang Piso-piso, Karo Plateau, *H. H. Bartlett* 6535 (U).

JAVA. Mt. Salak, ex herb. O. Kuntze (NY). Mangladjarjar, *J. P. Mousset* (NY). ————, *H. O. Forbes* 1105 (G). ————, *J. P. Mousset* 200 (G).

NEW GUINEA. Mafulu, Central Division, *L. J. Brass* 5329 (NY).

AUSTRALIA. Reported from Queensland by Prantl (1884).

NEW CALEDONIA. ————, *I. Franc* 476 (NY).

NEW ZEALAND. North Island: Te Pahi, *T. Kirk* (G); Kaspara, *T. Kirk* (M). South Island: Mt. Tulesse, *T. Kirk* (G).

FIJI. ————, *Sir Everard im Thurn* 307 (U), questionable material.

SAMOA. U. S. Exploring Expedition under Capt. Wilkes 1838–42, No. 5 (U).

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# A County Check-List of Florida Ferns and Fern Allies

DONOVAN S. CORRELL

During the summer of 1936, the author spent about two months in Florida collecting mainly orchids, ferns, and grasses. An attempt was made to cover as much territory as possible, and several thousand specimens were collected. Some photographs and extensive field notes of habits and habitats were made. After identification of the fern material was completed it was decided that enough was available, combining the specimens of ferns and fern allies collected on this trip with the collections already deposited in various herbaria in the East, to justify the preparation of this paper. This seemed especially desirable since there has been no previous extensive distributional study published for the Pteridophytes of Florida.

The result of this work is summarized by the accompanying map.[1] Each dot within a county represents one species which has been collected in that county. Thus, the total number of species which have been collected from a given county may be learned at a glance by noting the number of dots in that county. This does not necessarily indicate the number of collections made. The number of collections are largest in those counties most accessible, and these counties are, for the most part, vacation centers. Sixty-one of the 119 species and 3 varieties found in

[1] To appear with the next installment.

Florida have been found in Dade County; and Alachua, Citrus, Hernando, Highlands, Orange, Polk, and Seminole counties each have more than 30. On the other hand, certain regions have been neglected. Some counties in northern Florida have scarcely, or never, been visited by botanists, especially Bradford, Gilchrist, Hamilton, Taylor, and Union counties, and the south-central section of the state, comprising Charlotte, De Soto, Glades, Hardee, Hendry, and Okeechobee counties, is likewise, for the most part, unexplored. That part of Florida west of the Apalachicola River should prove to be of much interest to future collectors since, at present, so little is known about the vegetation of that area.

It is hoped that this paper will encourage collecting in those sections of Florida which heretofore have been neglected. There is, however, danger of over-collecting certain rarer and less well-established species to the point of eventually exterminating some of them, especially since fire must also take its toll. Judging from the number of collections represented in the larger herbaria, there seems to be little need for further collections of certain species in a few counties, *e.g.*, some of the species of *Trichomanes*, *Asplenium*, *Dryopteris*, and *Campyloneuron* from Dade County. These should be sought for in other counties. The same applies to collecting in such places as the Fern Grottoes near Pineola in Citrus County and the Devil's Millhopper near Gainesville in Alachua County.

The writer wishes to express his sincere appreciation to Dr. H. L. Blomquist for his many helpful suggestions and aid in the identification of dried material. The writer also wishes to thank Dr. H. J. Oosting and Dr. L. E. Anderson for their helpful criticisms, and his wife, Dr. Helen B. Correll, for her interest and assistance in the preparation of the manuscript. Acknowledgment is due

Mr. C. A. Weatherby of the Gray Herbarium, Harvard University, for his suggestions concerning nomenclature.

Through their generosity and cooperation, the following people have made it possible for the writer to obtain the records contained in this work: Dr. W. M. Buswell, the University of Miami, Coral Gables, Fla.; Mr. Arthur N. Leeds, Academy of Natural Sciences, Philadelphia, Pa.; Dr. W. R. Maxon, U. S. National Museum, Washington, D. C.; Dr. J. B. McFarlin, Highlands Hammock State Park, Sebring, Fla.; Rev. Hugh T. O'Neill, The Catholic University of America, Washington, D. C.; Dr. F. W. Pennell, Academy of Natural Sciences, Philadelphia, Pa.; Dr. J. K. Small, New York Botanical Garden, New York, N. Y.; Dr. L. B. Smith, Gray Herbarium, Harvard University, Cambridge, Mass.; Dr. H. K. Svenson, Brooklyn Botanic Garden, Brooklyn, N. Y.; and Mr. Erdman West, Agricultural Experiment Stations, Gainesville, Fla.

In many instances there are available a larger number of collections of a species from the same county and often from the same locality. It did not seem practical or necessary to cite all of these collections since the county is generally selected as the unit of distribution. Citations have, therefore, been limited to one collection of a species from a county. To conserve space, citations have been omitted for some species because of their common occurrence and wide distribution. In citing the specimens examined and included from the various herbaria, initials are used corresponding to the following legend: "B"—Brooklyn Botanic Garden, Brooklyn, N. Y.; "C"—The Catholic University of America, Washington, D. C.; "D"—Duke University, Durham, N. C.; "F"—The University of Florida, Gainesville, Fla.[2]; "G"—Gray Herba-

[2] The University of Florida herbarium number is included with the initial used.

rium, Harvard University, Cambridge, Mass.; "H"—Highlands Hammock State Park, Sebring, Fla.[3]; "M"—The University of Miami, Coral Gables, Fla.; "N"—U. S. National Museum, Washington, D. C.; "NY"—New York Botanical Garden, New York, N. Y.; "P"—Academy of Natural Sciences, Philadelphia, Pa.

## PTERIDOPHYTA

### ORDER 1. OPHIOGLOSSALES

FAMILY 1. OPHIOGLOSSACEAE Adder's-tongue Family

#### 1. BOTRYCHIUM Sw. Grape-ferns

1. BOTRYCHIUM ALABAMENSE Maxon. Moist, low woods along streams. Counties: Liberty: *Small, E. and R. St. John* (NY).

2. BOTRYCHIUM BITERNATUM (Lam.) Underw. Moist lowland woods and stream banks. Counties: Jefferson: *Lighthipe* (B); also "Florida": *Chapman* (P).

3. BOTRYCHIUM OBLIQUUM Muhl. Moist woods or hammocks. Counties: Alachua: *O'Neill* 1590 (C); Hernando: *E. St. John* (NY); Highlands: *McFarlin* (H); Pasco: *O'Neill* 1057 (C); Polk: *Buswell* (M).

4. BOTRYCHIUM VIRGINIANUM (L.) Sw. Moist wooded slopes and in thickets along streams. Counties: Alachua: *Correll* 6440 (D); Gadsden: *Chapman* (NY); Leon: *O'Neill* (F17); Walton: *Glück* (D).

#### 2. CHEIROGLOSSA Presl. Hand-fern

1. CHEIROGLOSSA PALMATA (L.) Presl. Mostly on trunks of cabbage-trees (*Sabal palmetto*) in axils of the leaves. Counties: Brevard: *O'Neill* (C); Broward: *Correll* 6133 (D); Collier: *Scull* (F11646); Dade: *Small and Carter* 939 (P); Indian River: *Singeltary* (D); Lee: *Small* 7746 (NY); Manatee: *Underwood* 2058a (NY); Monroe: *Small* (NY); Orange: *West* (F10226); Saint Johns: *Reynolds* (NY); Seminole: *Small, E. and R. St. John* (NY).

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[3] All of the specimens cited have been examined by the writer except those from the University of Florida, The University of Miami, and Highlands Hammock State Park. The writer is especially indebted to Mr. Erdman West, Dr. W. M. Buswell, and Dr. J. B. McFarlin for supplying these records.

### 3. OPHIOGLOSSUM L. Adder's-tongues

1. OPHIOGLOSSUM CROTALOPHOROIDES Walt. Low, moist soil. Counties: Alachua: *St. John* (F1241); Franklin: *Chapman* (NY); Levy: *Garber* (P); Manatee: *Garber 2* (NY); Nassau: *Faxon and Hutchings* (NY).

2. OPHIOGLOSSUM ENGELMANNI Prantl. Shaded slopes and banks, limestone soil. Counties: Hernando: *Small, E. and R. St. John* (NY); Jackson: *Small and Wherry* 11686 (NY).

3. OPHIOGLOSSUM FLORIDANUM E. St. John. Weedy banks along streams, moist soil. Counties: Alachua: *Correll* 6445 (D); Citrus: *E. St. John* (N); Sumter: *Small, E. and R. St. John* (NY).

4. OPHIOGLOSSUM TENERUM Mett. In boggy soil or low pine-lands. Counties: Alachua: *West* (F2); Broward: *Eaton* (G); Citrus: *Small, E. and R. St. John* (N); Duval: *Curtiss* 4953 (NY); Jackson: *Chapman* (NY); Lee: *Standley* 354 (N); Levy: *Garber* (P).

5. OPHIOGLOSSUM VULGATUM L. Moist soil in open woods or meadows. Counties: None. "Florida": *Le Conte* (NY).

## ORDER 2. FILICALES

### FAMILY 1. HYMENOPHYLLACEAE Filmy-Fern Family

### 1. TRICHOMANES L. Filmy-ferns

1. TRICHOMANES KRAUSII Hook. & Grev. Base of tree trunks, on shrubs, roots, logs, and floor of hammocks, in shade. Counties: Dade: *Correll* 6093 (D).

2. TRICHOMANES LINEOLATUM (v.d.B.) Hook. On edges of lime-stone-sinks in hammocks. Counties: Dade: *Small and Carter* (P).

3. TRICHOMANES PETERSII A. Gray. In shade, on moist rocks in hammocks. Counties: Hernando: *E. St. John* (NY).

4. TRICHOMANES PUNCTATUM Poir. On limestone rocks and in lime-sinks of hammocks. Counties: Citrus: *E. St. John* (N); Dade: *Correll* 6025 (D); Sumter: *Small* (F3095).

### FAMILY 2. OSMUNDACEAE Cinnamon-fern Family

### 1. OSMUNDA L. Cinnamon-ferns

1. OSMUNDA CINNAMOMEA L. Swamps, marshes, and open, wet woods. No collections have been seen from any counties south of Glades, Lee, and Palm Beach counties. The 26 counties represented by collections indicate that the species is increasingly common northward.

1a. OSMUNDA CINNAMOMEA f. FRONDOSA (Torr. & Gray) Britt. Swamps, marshes, and open, wet woods. Counties: Brevard: *Fredholm* 5570 (G); Highlands: *McFarlin* 10255 (H); Polk: *Gray* (H); Saint Johns: *Reynolds* (P); Seminole: *Rapp* (G); Volusia: *Deam* 1660 (P).

2. OSMUNDA REGALIS L. Wet ground in cypress swamps, marshes, and low hammocks. Although generally distributed throughout the state, few collections have been seen from the southern part of the peninsula. No collections have been seen for Charlotte, Collier, Glades, Hendry, or Monroe counties.

FAMILY 3. SCHIZAEACEAE Curly-grass Family

1. ACTINOSTACHYS Wall. Fuzzy-ferns

1. ACTINOSTACHYS GERMANI Fée. Low, moist hammocks on decaying wood. Counties: Dade: *Eaton* 996 (G).

(*To be continued*)

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# Keys to the Ferns of Iowa

A. S. LYŃESS, PH.D.

(Continued from vol. 27, page 135)

## II. A VEGETATIVE KEY TO THE SPECIES OF IOWA FERNS AND FERN-ALLIES

In the following key the names of the genera are arranged in alphabetical order down the center of the page. The only synonyms given are those used in Gray's Manual, Seventh Edition. The number following each synonym in the key is the number of the page in Gray's Manual on which that particular plant description is found.

### 1. ADIANTUM L.

*Adiantum pedatum* L. is the only species found in Iowa. It is quite common.

### 2. ASPLENIUM L.

This genus is represented in Iowa by a single species, *Asplenium platyneuron* (L.) Oakes.

### 3. ATHYRIUM

a. Leaves pinnate with pinnatifid pinnae; sori slightly curved, the lower ones often double, five or six pairs to each segment; stipes straw-colored, somewhat chaffy below, at least when young. *Athyrium acrostichoides* (Sw.) Diels. Syn. *Asplenium acrostichoides* Sw. ..... 39.

a. Leaves pinnate; pinnae of the fertile frond narrower than those of the sterile; sori linear, twenty to forty on each side of the midvein; stipes brownish, chaffless, slightly scaly below. *Athyrium angustifolium* (Michx.) Milde. Syn. *Asplenium angustifolium* Michx. ..... 39.

a. Leaves pinnate with bipinnatifid pinnae; lower pinnae almost once again pinnate; sori short, oblong, linear or occasionally horseshoe-shaped; stipes straw-colored or brownish, not scaly. *Athyrium Filix-femina* (L.) Roth. Syn. *Asplenium Filix-femina* (L.) Bernh. ..... 40.

### 4. AZOLLA Lam.

Leaves small, the lower lobe reddish, the upper one green with a reddish border; plants much branched.
*Azolla caroliniana* Willd.

### 5. BOTRYCHIUM SWZ.

a. Sterile portion stalked; petioles 2 to 16 cm. in length ..... b.

b. Ultimate segments of sterile leaf wedge-shaped ..... c.

c. Ultimate segments usually less than 3 mm. wide and often 2-toothed at their apices with teeth less than 1 mm. wide. *Botrychium dissectum* Spreng. Syn. *Botrychium obliquum* Muhl., var. *dissectum* (Spreng.) Clute ..... 49.

c. Ultimate segments commonly 5 to 10 mm. wide, with crenate or serrate margins. *Botrychium dissectum* Spreng., var. *obliquum* (Muhl.) Clute. Syn. *Botrychium obliquum* Muhl. ..... 48.

b. Ultimate segments of sterile leaf varying from round-reniform to obovate, their margins entire or finely incised. *Botrychium multifidum* (Gmel.) Rupr. Syn. *Botrychium ternatum* (Thunb.) Sw., var. *intermedium* D. C. Eaton.

a. Sterile portion sessile above the middle of the plant, broadly triangular; fertile portion long-stalked, usually 15 cm. or more in length. *Botrychium virginianum* (L.) Sw.

## 6. CAMPTOSORUS Link.

There is but one species of this little evergreen fern in the state—*Camptosorus rhizophyllus* (L.) Link.

## 7. CHEILANTHES Swz.

Lower surfaces of leaf segments densely tomentose with whitish-brown, soft, matted, flattened, jointed hairs.
*Cheilanthes Feei* Moore.

## 8. CRYPTOGRAMMA R. Br.

The only species that has been found in Iowa is *Cryptogramma Stelleri* (Gmel.) Prantl.

## 9. CYSTOPTERIS Bernh.

a. Leaves lanceolate, 3 to 6 dm. long, long-pointed, with bulblets beneath; vascular bundles in stipe roundish ..... *Cystopteris bulbifera* (L.) Bernh.
a. Leaves oblong-lanceolate, 1 to 3 dm. long, short-pointed, without bulblets beneath; vascular bundles in stipe oval or flat. *Cystopteris fragilis* (L.) Bernh.

## 10. EQUISETUM L.

a. Cones apiculate; sterile shoots usually unbranched. b.
b. Teeth of sheaths persistent, black with white margins, only their bristle tips deciduous; sheaths loose; cones short-peduncled or sessile and apiculate. *Equisetum variegatum*, var. *Jesupi* A. A. Eaton.
b. Teeth of sheaths deciduous ..... c.
c. Sheaths loose, green, and widened upwards; deciduous teeth leave black, triangular bases; cones sessile or nearly so and topped with a rigid point.
*Equisetum laevigatum* R. Br.
c. Sheaths tight with one or two black girdles; deciduous teeth leave a continuous black rim on the sheath ..... d.

d. Sheaths longer than broad, with 4-carinate ridges; teeth brown; cones pointed.
*Equisetum hyemale* L.

d. Sheaths nearly as broad as long, with 3-carinate ridges, green at first but soon turning gray, with black bands above and below, splitting with age; cones sessile, strongly apiculate. *Equisetum prealtum* Raf. Syn. *Equisetum hyemale* L., var. *robustum* (A. Br.) A. A. Eaton ..... 53.

a. Cones without a point ..... b.

b. Sterile shoots usually unbranched; teeth of sheaths deciduous; sheaths green, dilated above, with a narrow black band at the top, rarely one below; cones short-peduncled and rounded at the top.
*E. kansanum* Schaffner.

b. Sterile shoots usually much branched; teeth of sheaths persistent ..... c.

c. Branches compound; primary branches 4- or 5-angled; sheaths with 3 or 4 ridges, green, with papery, reddish-brown teeth; teeth of sheaths acuminate or awl-shaped; cones without a point.
*Equisetum sylvaticum* L.

c. Branches simple ..... d.

d. Branches strongly upcurved, solid, 3- or 4-angled; teeth of branch-sheaths triangular-lanceolate, with sharp, acuminate points; sheaths yellowish-brown; cones on fertile shoot long-peduncled.
*Equisetum arvense* L.

d. Branches horizontal and hollow ..... e.

e. Branches 3-angled; teeth on branch-sheaths, deltoid, acute; main sheaths with about 11 short, persistent, ovate-lanceolate teeth; cones rounded, without a point ..... *Equisetum pratense* Ehrh.

e. Branches 4- to 6-angled with erect tips; teeth dark brown, narrow, acute, rigid, distinct; sheaths appressed, cones short-peduncled.
*Equisetum fluviatile* L.

## 11. ISOETES L.

The only species of this genus that has ever been found in Iowa is *Isoetes melanopoda* J. Gay. One specimen of this plant was collected by Vasey near Clinton, in 1862.

## 12. LYCOPODIUM L.

a. Sporangia in axils of dark, green, shining leaves, not aggregated in terminal strobili; leaves pointed, distinctly broader above the middle, arranged in alternate rows of shorter and longer leaves; shorter leaves usually sporophylls.
*Lycopodium lucidulum* Michx.

a. Sporangia borne in terminal strobili ..... b.

b. Strobili sessile at ends of leafy branches; leaves equal, erect or incurved, in eight rows on the lower branches and in six rows on the upper branches; spikes 1 to 15 ..... *Lycodium obscurum* var. *dendroideum* (Michx.) D. C. Eaton.

b. Strobili borne at the top of scaly peduncles ..... c.

c. Peduncles about 3 cm. long; 1 to 3 spikes to the branch; leaves scale-like with acute tips; branches few-forked, very flat and horizontally spreading; terminal branch divisions 5 to 15 cm. long.
*Lycopodium complanatum* L.

c. Peduncles about 7 cm. long; mostly 4 spikes to the branch; leaves scale-like with pointed tips, bright green; branches several-forked and spreading out like a fan; terminal branch divisions .5 to 4 cm. long ..... *Lycopodium complanatum* var. *flabelliforme* Fernald.

c. Peduncles slender, 10 to 15 cm. long; 2 to 4 cylindrical spikes to the branch; leaves linear, awl-shaped, light green, tipped with a fine bristle; ascending, short and very leafy branches; stems extensively creeping ..... *Lycopodium clavatum* L.

## 13. MARSILEA L.

*Marsilea vestita* Hook. & Grev. is the only species represented in Iowa.

## 14. ONOCLEA L.

*Onoclea sensibilis* L. is the single Iowa species.

## 15. OSMUNDA L.

a. Leaves bipinnate; veins in sterile pinnules once or twice dichotomous; fertile portion racemose-paniced at the summit of the frond.
*Osmunda regalis* L., var. *spectabilis*

(Willd.) Gray. Syn. *Osmunda regalis* L..... 46
a. Leaves pinnate with pinnatifid pinnae ..... b.
b. Sterile pinnae with a distinct tuft of tomentum at the base beneath; fertile fronds contracted, bearing numerous cinnamon-colored sporangia.
*Osmunda cinnamomea* L.
b. Sterile pinnae without the tuft of tomentum at the base, a few contracted pinnae near the middle of the frond bearing the sporangia; stipes tomentose when young, naked when mature.
*Osmunda Claytoniana* L.

## 16. PELLAEA Link.

a. Scales on the rhizome usually with a few prominent, blunt teeth on each side, about six times as long as wide; spores nearly smooth; stipes dark brown; fronds small, grayish-green in color; pinnae mostly simple ..... *Pellaea glabella* Mett.
a. Scales on the rhizome entire, or obscurely toothed; spores ragged in appearance; stipes purplish-black; fronds rather large, bluish-green in color; pinnae stiff and mostly compound.
*Pellaea atropurpurea* (L.) Link.

## 17. POLYPODIUM L.

Leaves 8 to 30 cm. long; sori prominent, hemispherical, without indusia. *Polypodium virginianum* L. Syn. *Polypodium vulgare* of American authors, not L. ..... 34.

## 18. POLYSTICHUM Roth.

Leaves long-stalked, dark green in color and evergreen.
*Polystichum acrostichoides* (Michx.) Schott.

## 19. PTERETIS Raf.

This genus is represented in Iowa by the single species *Pteretis nodulosa* (Michx.) Nieuwl. Syn. *Onoclea Struthiopteris* of manuals, not Hoffm. ..... 45.

## 20. PTERIDIUM Scopoli

a. Leaves deltoid to ovate-deltoid, ternate at the top of long, sturdy stalks, pale green; marginal continuous sori covered by a double indusium ..... b.

b. Pinnules oblong-lanceolate, undivided above, pinnatifid below. *Pteridium latiusculum* (Desv.) Hieron. Syn. *Pteris aquilina* of manuals, not L. ..... 36.

b. Pinnules generally linear and entire, narrow and much elongated, especially near the terminus of the frond. *Pteridium latiusculum* (Desv.) Hieron., var. *pseudocaudatum* (Clute) Maxon. Syn. *Pteris aquilina* L., var. *pseudocaudata* Clute ..... 36.

## 21. SELAGINELLA Beauv.

Leaves closely imbricated about a cylindrical, much-branched stem. *Selaginella rupestris* (L.) Spreng.

## 22. THELYPTERIS Schmidel.

a. Leaves simple,* triangular in outline, often broader than long ..... b.

b. Leaves 18 to 30 cm. long, deeply pinnatifid, almost pinnate at the base, slightly pubescent, often finely granular beneath; stipes naked, segments sessile; sori small, round, naked. *Thelypteris hexagonoptera* (Michx.) Weatherby. Syn. *Phegopteris hexagonoptera* (Michx.) Fee ..... 35.

b. Leaves 2 to 26 cm. long, deeply pinnatifid near the stipes, hairy on the veins, especially below; stipes usually pubescent near the blade; vascular bundles in the stipe 2, oval or flat; 1st segments linear-lanceolate, 2nd segments oblong. *Thelypteris Phegopteris* (L.) Slosson. Syn. *Phegopteris polypodioides* Fee ..... 35.

a. Leaves compound ..... c.

c. Leaves triangular or triangular-ovate, fully bipinnate below; sori without indusia ..... d.

d. Leaves pinnately divided, the lowest pinnae much the largest; under surface minutely glandular. *Thelypteris Robertiana* (Hoffm.) Slosson. Syn. *Phegopteris Robertiana* (Hoffm.) A. Br. ..... 35.

d. Leaves ternately divided, each of the lowest segments nearly as large as the rest of the leaf, gla-

* Leaves simple in the sense that the divisions are not completely separated; connected at least by a wing along the rachis.

brous. *Thelypteris Dryopteris* (L.) Slosson. Syn. *Phegopteris Dryopteris* (L.) Fee. ..... 35.

c. Leaves ovate or narrower, pinnate with pinnatifid pinnae; sori with indusia ..... e.

e. Stipes and rhizomes nearly naked; veins once-forked; leaves lanceolate; margins of segments of leaf strongly revolute; sori crowded, 10 to 12 in each segment; vascular bundles in petiole 2, oval or flat. *Thelypteris palustris* (Salisb.) Schott, var. *pubescens* (Lawson) Fernald. Syn. *Aspidium Thelypteris* (L.) Sw. ..... 41.

e. Stipes and rhizomes scaly; veins mostly more than once-forked ..... f.

f. Sori marginal; leaves 3 to 7 dm. long; pinnae lanceolate, acuminate, slightly broadest above the base; pinnules crowded, oblong-scythe-shaped, with entire or crenate margins. *Thelypteris marginalis* (L.) Nieuwl. Syn. *Aspidium marginale* (L.) Sw. ..... 42.

f. Sori not marginal ..... g.

g. Segments of pinnae not spinulose ..... h.

h. Leaves large, 6 to 10 dm. long; pinnae 15 to 23 cm. long, widest at the middle; indusia flat, thinnish, orbicular, with a narrow sinus; vascular bundles in petiole 7. *Thelypteris Goldiana* (Hook.) Nieuwl. Syn. *Aspidium Goldianum* Hooker ..... 42.

h. Leaves 3 to 6 dm. long; pinnae 5 to 8 cm. long, triangular-oblong, widest at the base; vascular bundles in petiole 5. *Thelypteris cristata* (L.) Nieuwl. Syn. *Aspidium cristatum* (L.) Sw. ..... 42.

g. Segments of pinnae spinulose; leaves almost tripinnate ..... i.

i. Leaves ovate-lanceolate; pinnae oblique to the rachis, elongate-triangular, the lowest pair broadly triangular; scales on the stipe brownish, one-colored; indusia entire and without marginal glands, glabrous or nearly so. *Thelypteris spinulosa* (O. F. Muell.) Nieuwl. Syn. *Aspidium spinulosum* (O. F. Muell.) Sw. ..... 43.

i. Leaves oblong-ovate; pinnae nearly or quite at right angles to the rachis, the lower unequally ovate-lanceolate; scales of stipe light brown, mostly with dark centers; indusia delicate, denticulate and beset with stalked glands. *Thelypteris spinulosa* (O. F. Muell.) Nieuwl., var. *intermedia* (Muhl.) Nieuwl. Syn. *Aspidium spinulosum* (O. F. Muell.) Sw., var. *intermedium* (Muhl.) D. C. Eaton ..... 43.

## 23. WOODSIA R. Br.

a. Leaves slightly reduced at the base, 2 to 5 dm. long, minutely glandular-hairy; pinnae rather remote, bluntish ..... *Woodsia obtusa* (Spreng.) Torr.

a. Leaves slightly reduced at base, 5 to 15 cm. long, 2 to 4 cm. wide, smooth above, thickly clothed underneath with rusty bristle-like chaff; pinnae crowded. *Woodsia ilvensis* (L.) R. Br.

a. Leaves 1 to 2 dm. long, loosely hispidulous, with minute, white hairs; pinnae numerous, pinnatifid, with 10 to 16 short, ovate or oblong, toothed divisions. *Woodsia scopulina* D. C. Eaton.

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NOTE:—All the plants described in the above keys are mentioned in Gray's Manual, Seventh Edition, except *Pellaea glabella* and *Equisetum kansanum*.

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STEVENS POINT, WISCONSIN

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# Botrychium dissectum

ROSAMOND SHURTLEFF

Variation of both the fertile and sterile fronds is a well-known occurrence throughout the entire genus *Botrychium*. The inconstancy of form of the sterile segments and the appearance of sporadic sporangia and fertile pinnae on the sterile segments of certain species are common knowledge. These variations have been discussed in such reports as those of R. M. Tryon (1) on annual variations of the sterile frond, of E. S. Ford (2) on supernumerary fertile pinnules in the Rattlesnake fern, and of M. A. Chrysler (3) on abnormalities of both fertile and sterile segments of *Botrychium* species.

A collection of *Botrychium dissectum* Sprengel and *Botrychium dissectum* Sprengel var. *obliquum* (Muhl.) Clute made last fall (1936) from an abandoned field in the vicinity of Norton shows more extreme variation in this species than previously reported. In fact, one or two new types of variation for this species appeared.

Figures 1 and 2 show extremes of variation for fertile and sterile segments.

The sterile segment shows two new variations besides the well-known variance in the dissecting of the pinnae. On one plant there are two sterile segments of the same age (Fig. 1). Although it is not uncommon for a frond of the previous year to remain after the one of the current year develops, it is uncommon for two of the same age to appear. In several other plants there is an abortion of the pinnae. In one fern all the pinnae on one side are suppressed, while in another the tip is reduced to a mere appendage. Neither of these forms has been recorded for this species so far as I know.

The fertile segment also shows variations in both the occurrence and number of fertile portions. Most noticeable is one plant which has several pinnae transformed until there appear to be four fertile stalks. Besides a variation in the number of fertile segments, sporadic sporangia are found on the sterile segment of one plant. Although such sporangia are common in *Botrychium simplex* E. Hitchcock, they are not frequently found in *B. dissectum*. In one other plant the second fertile segment is set half-way up the stem of the sterile segment. This is unusual; a second fertile stalk arises ordinarily like the first near the base of the sterile segment.

Since there has been so much discussion over the status of the dissected form of *B. dissectum*, it is significant to note that all these variations appear irrespectively in the species and in the variety as well as in the few intergrading types found with them. Thus this collection emphasizes the extreme variability of the entire species.

## LITERATURE CITED

Chrysler, M. A., Abnormalities of Botrychium and Certain Other Ferns. *Bull. Torrey Bot. Club* 53: 279–288. 1926.

Ford, E. S., Additional Fertile Pinnules in the Rattlesnake Fern. AMER. FERN JOUR. 25: 18–20. 1935.

FIG. 1. BOTRYCHIUM DISSECTUM SPRENG. VAR. OBLIQUUM (MUHL.) CLUTE.
FIG. 2. BOTRYCHIUM DISSECTUM SPRENG.

Tryon, R. M., *Botrychium dissectum* and forma *obliquum*. AMER. FERN JOUR. 26: 26–30. 1936.

WHEATON COLLEGE, NORTON, MASSACHUSETTS

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# Midland Fern Notes

EDGAR T. WHERRY

During the summer of 1937 the writer drove from Philadelphia to Salt Lake City and back, visiting en route a number of fern localities; Mr. J. E. Benedict, Jr., of Washington, D. C., took part in the first half of this trip. Notes as to species observed which seem of general interest are here placed on record, except for the state of Colorado, on which a separate article has been prepared. Specimens obtained have been placed in the herbarium of the Academy of Natural Sciences of Philadelphia.

MICHIGAN.—We barely entered this state late in May, paying a visit to Mr. and Mrs. Boydston, who live at Thorn Acres about four miles south of Niles, in Berrien County. Here in ponds and on sandy slopes at the edge of the floodplain of the St. Joseph river there is an unusual abundance of Equisetums, of which five species were recognized: *arvense, fluviatile, laevigatum, palustre,* and *prealtum.* This appears to represent a southern limiting station for *E. palustre* (var. *americanum*), for although it is here within a mile of the Indiana line the thorough exploration of the latter state by Mr. Deam has never turned it up there.

IOWA.—A visit to Pikes Peak State Park in Clayton County yielded *Selaginella rupestris,* not heretofore reported from this county, and two varieties of *Cystopteris fragilis.* Examination of their rootstocks and indusia showed these to be vars. *genuina* and *protrusa,* the former growing on steep bluffs, the latter in humus-rich soil on gentler slopes.

At Decorah search was made for the two rarities there reported. One, *Phegopteris robertiana,* was soon found west of town on a moist, crumbly, north-facing limestone bluff; unfortunately it is in danger of destruction, since the road close to which it grows leads to a state park, and may at any time be "improved" by landscrapers. The other, *Woodsia scopulina,* could not be located, and in view of the dominance of limestone in the region its occurrence there seems improbable.

The *Woodsia* which grows on the quartzite rocks in Gitchie Manitou State Park, in Lyon county at the extreme northwest corner of the state, has been reported both as *W. scopulina* and *W. oregana*; but a visit there disclosed that it is neither, as it shows instead the dense glandularity characteristic of *W. cathcartiana.*

SOUTH DAKOTA.—There being reports of both *Woodsia oregana* and *W. mexicana* in the Black Hills, some attention was paid to this group there, especially in the Custer State Park. No trace of the glabrous fern bearing the former name, or of the downwardly narrowed, thick-margined, conspicuously hairy-indusiate Mexican Cliff-fern could be found. Instead the plants seen were all more or less intermediate between these two extremes, the margins being more or less thickened—never markedly so—and short-stalked glands being present on vascular parts, but sparse or lacking on laminar tissue. Here, as in western Iowa, *W. cathcartiana* seems unquestionably represented, although some material appears to lie intermediate between that and some other species, and will require detailed study for proper classification and naming.

OKLAHOMA.—During August a brief visit was made to Cimarron, the northwesternmost county, to look for the

unusual ferns which have been reported there.[1] From Kenton highway No. 64 was followed eastward for 6 miles, and a private lane northward about a mile farther, until cliffs became prominent. The native vegetation in low moist places proved to have been largely destroyed by grazing animals, making search for *Dryopteris filix-mas* hopeless, but small ferns could still be seen in crevices of the sandstone rocks. North-facing cliffs and ledges yielded *Cheilanthes eatoni*, *C. feei*, and *C. wootoni*, together with *Selaginella underwoodii*, not previously recorded for this region. On south-facing ones the yellow globules formed by the rolling up of the fronds of *Notholaena standleyi* were conspicuous, and while examining these several small but unmistakable plants of *Pellaea wrightiana* were found.

TEXAS.—In the hope that some of these Cimarron valley specialties might also turn up in the Texas panhandle, the Palo Duro State Park east of Canyon, Randall County, was next visited. Here, however, only the widespread *Cheilanthes feei* and *Pellaea atropurpurea* could be found on the rocks, and *Equisetum prealtum* along the creek.

LOUISIANA.—Under the guidance of Miss Caroline Dormon, of Chestnut, three species not listed by Brown[2] for this state were obtained: *Cheilanthes lanosa*, in crevices of sandstone north of Kisatchie (15 miles south of Provencal); *Selaginella riddellii*, in a sand-barren 2 miles southeast of Goldonna, both in Natchitoches Parish; and *Lycopodium prostratum*, in a wet thicket 1½ miles north of Lucky, Bienville Parish.

PHILADELPHIA, PA.

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[1] Greene, THIS JOURNAL 17: 125. 1927; Bush. Am. Midl. Nat. 12: 91. 1930; Featherly and Still, Okla. A. & M. Coll. Expt. Sta. Circ. 80. 1934.

[2] La. Cons. Rev. 5: 12. 1936.

## Recent Fern Literature

Dr. Wherry's welcome "Guide to Eastern Ferns" is a pocket-size volume of 220 pages, attractively printed and bound by The Science Press Printing Co.[1] Eighty-nine species are described in detail and each is illustrated by a full-page line drawing; in addition there is an abbreviated account of eight species of *Isoetes* and a more or less brief description of various fern varieties and hybrids.

The list of ferns and fern-allies for the range (Pennsylvania, New Jersey, Delaware, Maryland, and Virginia) seems to be complete. The omission of *Equisetum scirpoides*, credited to Pennsylvania by Gray, Britton & Brown, Clute, Schaffner and others, is presumably only a conspicuous instance of the Guide's avoidance of errors previously copied by writer after writer.

In addition to being accurate, the Guide is brief. Only essential material is admitted. The account of each fern is confined to one page which, in every instance, faces the illustration. The characters given are those not easily obtainable from the drawings, or those which should be emphasized as being diagnostic. In no case has the desire for brevity detracted from the value of the book except, perhaps, in the index. This is condensed to a single page and lists only genera. To find a species in *Dryopteris* one may have to turn thirty pages of text.

The glossary is fresh and original. The terms that students are most likely to misunderstand are informally interpreted from the point of view of teacher rather than lexicographer. Both collectors and cultivators of ferns will find useful the detailed information furnished concerning soil and rock preferences.

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[1] Guide to Eastern Ferns. By Edgar T. Wherry. IV + 220 pages, 96 figures. The Science Press Printing Co., Lancaster, Pa. [Dec.] 1937. $1.00.

The pages about hybrids will be especially appreciated. Information about them has not hitherto been available in such convenient and usable form.

The treatment of varieties, though excellent as a whole, is in some cases less satisfactory. One could scarcely determine *Botrychium simplex*, var. *laxifolium* Clausen by the description, which speaks of the plant as "large all around" and places the sterile segment "high," though the figure shows the sterile blade arising well below the middle.

The illustrations vary greatly in quality. Many of the drawings are accurate and life-like representations; others are as conventionalized as if prepared solely for decorative effect.

There is no key except an informal one to families and subfamilies, the advantage of which is not apparent.

The classification and nomenclature are alert but conservative. The author cherishes no prejudices. He often reports sympathetically the conclusions of writers whom he does not follow. He usually furnishes, in a sort of narrative form, synonymy sufficient for the needs of those who read the popular magazines and texts. He uses *Thelypteris* for the marsh-fern and its near relatives and places Scott's spleenwort under his recent *Asplenosorus*, a name which, itself a hybrid of *Asplenium* and *Camptosorus*, indicates that the plant is a hybrid between species of the two genera.

The common names are usually suggestive and descriptive. Several new ones are proposed. They are generally apt, but their very appropriateness may make them too seductive in cases where, as with "tapering fern" for *Thelypteris noveboracensis*, they are not, as they should be, really distinctive. Ostrich fern and various southern ferns also taper.

Though the style of the "Guide" is non-technical, the text, as we should expect, is accurate and scientific. With unusual skill and judgment the data needed for the identification and study of the ferns of the central eastern states have been compressed into the smallest compass. The volume, therefore, will serve the purpose for which it was written. No one undertaking the study of ferns can afford to be without this companionable little book—ROBERT P. ST. JOHN.

The Oglebay Plant Club of Wheeling, West Virginia, has begun the publication of a little mimeographed periodical called "The Letter"—an example which might well be followed by other local organizations. The fifth number, for July, 1937, contains a list, by Russell West, of the ferns of Oglebay Park. Fifteen species, all of the more common woodland and old-field types, are included.

Our Chilean member, Sr. Looser, continues his distinguished work on the ferns of his country. His latest publications include the following.

"La Schizaea chilena," a study of the distribution and characters, and a bibliography, of the sole Chilean species, *Schizaea fistulosa* Labill. *S. chilensis* and *S. valdiviana* of Philippi are reduced to synonymy under it.[1]

"Hymenophyllum falklandicum Baker en la provincia de Malleco." A collection by the author at Termas de Tolhuaca, some 1500 kilometers north of any station previously recorded, is reported. Critical discussion of and a key to related species are given.[2]

"Sobre algunas Helechos chilenos descritos por el Dr. R. A. Philippi." Philippi was, in the words of Dr.

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[1] Rev. Universitaria 22: 115–124, 2 figs. June–July, 1937.

[2] Rev. Univ. 22: 235–240, 3 figs. June–July, 1937.

Clausen, an "enthusiastic splitter." As Sr. Looser says, "he described an enormous number of species, often based on a single specimen or on weak characters, many of which have not been found again and have remained doubtful." Fortunately, his type specimens have been preserved at the National Museum at Santiago and Sr. Looser has undertaken the highly useful work of studying them critically. In this paper he reports on some of them, as follows.

*Lycopodium erectum* Phil. is reduced to a variety of *L. magellanicum*. *L. chonoticum* is provisionally maintained as a good species, but may prove only a form of *L. confertum*. *Mertensia litoralis* is a good species, *Dicranopteris litoralis* (Phil.) Looser. *M. oligocarpa* is a synonym of *Dicranopteris pedalis*. *Hymenophyllum densifolium* is a variety of *Serpyllopsis caespitosa*; *H. quadrifidum* one of *H. plicatum*. *H. terminale* is the same as *H. cuneatum* var. *rariforme* Christensen & Skottsberg. *Trichomanes dichotomum* Phil. (not Kunze) becomes *T. Philippianum* Sturm. *T. spinulosum* is a synonym of *H. dicranotrichum*.[3]

Volume 15, number 1, of the "Mount Rainier National Park Nature Notes" (March, 1937) is devoted to an account of the ferns of the Park by C. Frank Brockman, naturalist of the Park staff. The pamphlet, of 44 mimeographed pages, includes a brief general account of ferns, their classification, life-history, mythology, and medicinal uses; a check-list of the species of the Park; an elaborate descriptive key; original sketches and detailed discussion of most of the 32 species listed; and a glossary. One page is mimeographed upside down and the detail given in an illustration as characteristic of *Polypodium vulgare* is not

[3] Rev. Univ. 22: 105–114. June–July, 1937.

the typical form but var. *occidentale* Hook. (*P. Glycyrhiza* D. C. Eaton, *P. falcatum* Kellogg); but in general the work is accurately and interestingly done and full of information. It should be of much usefulness to the fern-lover who visits the Park.

## Shorter Notes

THE IDENTITY OF WOODWARDIA THELYPTERIOIDES PURSH. —In my list of varieties and forms of the ferns of eastern North America, I was compelled to leave *Woodwardia thelypterioides*, the sole basis of *W. virginica* forma *thelypterioides* (Pursh) Gilbert, as a name of doubtful application. The original description apparently applied to some *Woodwardia* except in one particular—the plant was said to be pubescent and no pubescent state of either of our east-American species has ever been found.

Fortunately, when the Lambert herbarium containing most of Pursh's specimens was broken up and sold, Sir William Hooker got hold of at least some of the ferns, and the type sheet of *W. thelypterioides* is preserved at Kew, where I had an opportunity to examine it in the summer of 1937. It bears two fronds, a small fruiting one of *Woodwardia virginica* (a "weak state," as Hooker said) and an unusually large sterile one of marsh fern, *Dryopteris Thelypteris*, var. *pubescens*. Pursh could not have looked very hard at the venation when he assigned the two to the same species, but he apparently did see the pubescence of the marsh-fern element and included it in his description.

Pursh's name must be eliminated as a basis for anything, since it is founded on two quite irreconcilable elements.—C. A. WEATHERBY.

CHEILANTHES CASTANEA IN OKLAHOMA.—A Lipfern collected by the author in Devils Canyon, Canadian County, Oklahoma, has kindly been determined by Dr. William R. Maxon, curator of the United States National Herbarium, as a form of *Cheilanthes castanea* Maxon. The record is of interest as probably the first report of this species in Oklahoma. Featherly and Still[1] in their State list have included 8 other species of Cheilanthes.

Specimens collected on shaded sandstone cliffs in Devils Canyon on Sept. 27, 1936, have been deposited in the United States National Herbarium and in the Herbarium of the University of Oklahoma. In a list of the pteridophytes of this area, the author[2] cited the species incorrectly as *Cheilanthes tomentosa* Link.

The occurrence in west central Oklahoma of *Cheilanthes castanea,* originally described from Mexico, adds interest to the unusual flora of Devils Canyon and adjacent canyons. These protected canyons are known especially for the eastern flora on their rich, moist soils. Here sugar maples (*Acer saccharum*) are dominant in relict, disjunct islands about 175 miles west of the western limit of the species in eastern Oklahoma. In these canyons they have persisted since a probable period of more humid climate when the range may have been continuous eastward.

Meeting these eastern plants are western plants on the dry, exposed canyon walls. Among these are *Selaginella sheldoni* of southwestern Oklahoma and Texas, here near the northeastern limit of the species, and a moss, *Husnotiella revoluta* var. *palmeri,* typical of Mexico and the southwestern border of the United States.—ELBERT L. LITTLE, JR., *Flagstaff, Arizona.*

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1 Featherly, H. I., and Clara E. Still. The ferns of Oklahoma. Okla. Agric. Mech. Coll., Bot. Stud. No. 1, 24 pp. 1934.

2 Little, Elbert L., Jr. Bryophytes and pteridophytes of some west central Oklahoma canyons. Okla. Acad. Sci. Proc. 16: 47–52. 1936.

CLIMBING FERN FOUND IN UPSHUR COUNTY, WEST VIRGINIA.—In June, 1937, Miss Maxine Thacker, a teacher of biology in Buckhannon-Upshur High School, Buckhannon, W. Va., called my attention to a fern specimen which a student in one of her classes had collected and brought in. This fern proved to be the Climbing Fern (*Lygodium palmatum* (Bernh.) Sw.), and represents, so far as the author is aware, the only station for the plant now known in West Virginia.

The plant was found about two miles southeast from the village of Frenchton, Upshur County, on a small tributary of the West Fork of the Monongahela River. The elevation here is about fifteen hundred feet above sea-level, and the soil is intensely acid, made more so by the seepage from an abandoned coal opening. The ravine where the fern was found is heavily wooded with mixed deciduous forest, the near-by undercover containing Mountain Laurel (*Kalmia*), Rosebay (*Rhododendron*), and *Vaccinium* (sp.). Fern associates are *Onoclea sensibilis*, *Polystichum acrostichoides*, *Thelypteris noveboracensis*, *Dryopteris marginalis*, *D. intermedia*, *Phegopteris hexagonoptera*, and *Botrychium virginianum*. Specimens from the colony have been deposited in the herbarium of West Virginia University.

A previous West Virginia station for the Climbing Fern was reported in THE AMERICAN FERN JOURNAL, Jan.–March, 1924, by Rev. Fred W. Gray. This station, which was located near Lewisburg, Greenbrier County, was, unfortunately, destroyed during a road-construction job. Since the species occurs in Virginia, and reappears in southern Ohio, we have been expecting to find it again in West Virginia, and the author hopes, later in the summer, to make a survey of the general territory around Frenchton to determine how widely spread it may be in

this area.—MAURICE BROOKS, *West Virginia University, Morgantown, W. Va.*

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## American Fern Society

An informal meeting of the Society was held at Indianapolis on the morning of December 31st, 1937, in connection with the annual gathering of the American Association for the Advancement of Science. About twenty members and guests were present. Professor Clute presided. After some pleasant reminiscences, he suggested various subjects for present consideration, future investigation and reports in the JOURNAL. Some of them are: the desirability of using the term "Var. typica" or something similar, to indicate the form of the species first described; the manufacture of common names; the validity of recent segregates from what we had thought were well-known species. He, Dr. Svenson and Professor Schaffner emphasized the opportunity open to members in more or less cooperative geographic studies —mapping ranges of species from personal observation and from specimens in herbaria and reporting on their favored habitats in different regions. Professor Butters spoke of his work on lady-ferns and of observations on the soil-preferences of *Pellaea* and *Polypodium;* he reported royal fern growing and flourishing in two feet of water in an apparently natural lake, in so large a colony that a canoe could be quite concealed in it. Professor Miyake of the Imperial University of Tokio, told something of the rapid growth of botanical study in Japan. The first professor of botany, a graduate of Cornell, was appointed in 1876; the first species described by a native author was published in 1890. There are about 100 species of ferns in Japan proper, including some tropical ones in the southern part, and about 500 in all the Japa-

nese possessions. Professor Schaffner spoke of the curious reactions of plants to their environment; in one year when a patch of *Equisetum* was mowed, there was a high proportion of twisted stems among the new growth, in the next, when no cutting was done, very few. Soil-preferences of the same species varied in different parts of its range, particularly from north to south. Dr. Shaver gave interesting data as to the distribution of ferns in Tennessee. The southern lady-fern is found on the summits of the Appalachians, the northern on the lower slopes. *Botrychium dissectum* occurs only east of the Cumberland Plateau, *B. obliquum* throughout, but especially in wooded angles between two confluent streams. Mr. Tryon had observed *Pellaea glabella* on both sandstone and limestone in Wisconsin. Miss Schmidt told of her efforts to grow spores of *Botrychium.* Germination on nutrient solutions is not difficult, but raising the young plants to maturity is. Mr. Weatherby reported that a new check-list of North American ferns was approaching completion.

An experience meeting without a set program was perhaps something of an experiment, but if the present writer's enjoyment of the occasion is representative, it was surely a successful one. The thanks of the Society are due to Professor Clute, who skillfully and agreeably kept the ball of discussion rolling, and to the members who responded in so interesting a manner.—C. A. WEATHERBY.

The library of the late Dr. Philip Dowell has been presented to John B. Stetson University, Deland, Florida.

A request has come in for a set of herbarium specimens of American fern hybrids for the British Museum. Mr. Alston writes that he has been studying the European hybrids and that he would like material of the American hybrids for comparison. If any members having dupli-

cate herbarium specimens will forward them to the Brooklyn Botanic Garden, addressed to R. C. Benedict, the collection will be sent on to Mr. Alston when assembled. Meanwhile, a request has gone forward to him, asking whether a similar set of European hybrids can be obtained for the study collection of the Fern Society Herbarium.

Mr. Alston would also like specimens of *Selaginella ludoviciana* and opinions as to its distinctness from *S. apoda*.

New members:

Bolan, Miss Edith M., 3 Smith St., Caribou, Maine
Burns, George W., Dept. of Botany, University of Minnesota, Minneapolis, Minn.
DeVol, Charles E., Marion College, Marion, Indiana
Green, Forrest K., 912 Philadelphia, Memphis, Tenn.
Hartwell, Mrs. Florence C., Bolton, Vermont
Loew, Prof. F. A., Huntington College, 916 Himes St., Huntington, Indiana
McCutcheon, T. P., R. D. no. 2, Downingtown, Pa.
Miyake, Dr. Kiichi, Dept. of Botany, Tokyo Imperial University, Tokyo, Japan
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Uphoff, Mrs. Emma, 88 Prospect St., Little Falls, N. J.

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# American Fern Journal

VOL. 28 APRIL–JUNE, 1938 NO. 2


## The Ferns and Fern Allies of Kentucky[1]


THOS. N. MCCOY


Kentucky should be of special interest botanically, because of its location. The state reaches from the Appalachian Mountains to the Mississippi River, a distance of some 420 miles, and is midway between the Great Lakes and the Gulf of Mexico. The overlapping of the northern flora with the southern flora at this midpoint gives this state a very interesting cross-section of the fern flora of the eastern half of the United States.

This work is based on the specimens in the herbaria of the University of Kentucky, the Kentucky Experiment Station, Frank T. McFarland, and the Philadelphia Academy of Natural Sciences, with as many species as could be collected by the writer. Fifty-five counties and all the Natural Regions except the Ohio River Flood Plain and the Western Coal Field are represented. The writer has collected all the species in this list except *Trichomanes Boschianum* Sturm, *Woodwardia areolata* (L.) Moore, *Ophioglossum vulgatum* Linnaeus, *Ophioglossum Engelmanni* Prantl, *Botrychium dissectum* Sprengel, and *Lycopodium complanatum* Linnaeus var. *flabelliforme* Fernald, and specimens of each have been deposited in the herbaria of the Philadelphia Academy of Sciences and the Morehead State Teachers College. The list includes only species of which authentic specimens have been seen.

[1] A portion of a thesis presented to the graduate school of the University of Kentucky for the Master of Science degree.


[Volume 28, No. 1 of the JOURNAL, pages 1–40, plates 1–4, was issued March 17, 1938.]

*Asplenium ebenoides* R. R. Scott, *Dryopteris cristata* (Linnaeus) A. Gray, *Phegopteris polypodioides* Fée, and *Woodsia ilvensis* (Linnaeus) R. Brown, previously reported for the state, have been omitted because a specimen could not be located. Further exploration will doubtless reveal a few more species within the confines of this state, but until they are found we cannot include them in the list.

The writer wishes to express thanks to Dr. Frank T. McFarland, for his counsel and guidance in the preparation of the thesis of which this paper is a part; also to Mr. C. A. Weatherby, for helpful suggestions. Further, he is indebted to Dr. Edgar T. Wherry for the list of ferns and fern allies of Kentucky that are in the Philadelphia Academy of Sciences Herbarium which represents extensive collections throughout the state, for checking the identification of a large part of his collection, and for the liberal contribution of personal notes and information. To the late E. W. Graves, who just a few days before his death, checked the identification of the Botrychiums and added much to the study of this group of plants, I am much indebted. The following key is adapted from many authors.

KEY TO THE FERNS AND FERN ALLIES OF KENTUCKY

1a. Plants twining and climbing ..... *Lygodium palmatum* (43)
1b. Plants not vine-like ..... 2
2a. Plants aquatic; leaves 4-foliolate ..... *Marsilea quadrifolia* (53)
2b. Plants terrestrial; leaves not 4-foliolate ..... 3
3a. Fronds pellucid, a single layer of cells.
*Trichomanes Boschianum* (1)
3b. Fronds not translucent, many cells thick ..... 4
4a. Stems jointed ..... 5
4b. Stems not jointed ..... 6
5a. Fertile stem branchless, without chlorophyll; sterile stems green, with branches at the nodes ..... *Equisetum arvense* (54)
5b. Stems monomorphic, branches absent, cone apiculate.
*Equisetum prealtum* (55)
6a. Sporangia borne in a simple spike or in a panicle and not in the axils of bracteal leaves ..... 7
6b. Sporangia not in a spike, or if a spike is formed the sporangia in the axils of bracteal leaves ..... 12

7a. Sterile portion of frond entire, net-veined ..... 8
7b. Sterile portion of frond dissected, free-veined ..... 9
8a. Secondary veins numerous; sterile blade with a short point at the tip ..... *Ophioglossum Engelmanni* (48)
8b. Secondary veins nearly absent; tip of sterile blade rounded. *Ophioglossum vulgatum* (47)
9a. Sterile segment sessile near the middle of the plant. *Botrychium virginianum* (52)
9b. Sterile segment on a long petiole from near the base ..... 10
10a. Pinnae cut into rectangular segments and notched at the end. *Botrychium dissectum* (49)
10b. Pinnae not cut into rectangular segments ..... 11
11a. Pinnules narrowly elongate-triangular in general form, tapering to a narrow point ..... *Botrychium obliquum* (50)
11b. Pinnules oblong, tenuous, with or without many lobes. *Botrychium obliquum* var. *tenuifolium* (51)
12a. Sporangia borne on reduced pinnae or on a separate frond... 13
12b. Sporangia not on reduced pinnae ..... 19
13a. All pinnae of the fertile frond reduced ..... 14
13b. Not all the pinnae reduced ..... 16
14a. Fertile fronds reduced to veins, sporangia naked. *Osmunda cinnamomea* (46)
14b. Fronds rolled up into berry-like bodies which enclose the sporangia ..... 15
15a. Fronds rolled up into berry-like bodies, which enclose the sporangia; divisions of the sterile frond lobed, not serrate. *Onoclea sensibilis* (41)
15b. Fronds rolled up into bean-like bodies, which enclose the sporangia; divisions of the sterile fronds not lobed, finely serrate ..... *Woodwardia areolata* (42)
16a. Fronds bipinnate, fertile panicle terminal. *Osmunda regalis* var. *spectabilis* (44)
16b. Fronds pinnate ..... 17
17a. 3–4 pairs of reduced pinnae in the middle of the frond. *Osmunda Claytoniana* (45)
17b. Pinnae reduced at the upper half of the fertile frond..... 18
18a. Fertile pinnae much reduced only in the upper part of the blade; sterile pinnae with appressed bristly teeth. *Polystichum acrostichoides* (26)
18b. Fertile pinnae slightly reduced, sterile pinnae with large spiny teeth, the lower often fertile at tip; fronds larger and darker colored ..... *Polystichum acrostichoides* f. *incisum* (27)
19a. Sporangia borne on dorsal or marginal parts of the frond..... 20
19b. Sporangia borne in the axils of leaves ..... 56
20a. Indusia absent ..... 21
20b. Indusia present ..... 23
21a. Fronds triangular ..... *Dryopteris hexagonoptera* (28)
21b. Fronds oblong ..... 22
22a. Fronds smooth and green ..... *Polypodium virginianum* (2)
22b. Fronds covered with brownish scales. *Polypodium polypodioides* (3)
23a. Indusia formed by an inrolled margin of the frond ..... 24
23b. Indusia not an inrolled margin of the frond ..... 30

24a. Sori distinct ..... 25
24b. Sori a continuous marginal band ..... 27
25a. Midrib of the pinnule present.... *Dennstaedtia punctilobula* (40)
25b. Midrib of the pinnule absent ..... 26
26a. Stipe forked at the top; blade a semicircle.
*Adiantum pedatum* (4)
26b. Stipe not forked; rachis zigzag.
*Adiantum Capillus-Veneris* (5)
27a. Stipes solitary; frond ternate, large.
*Pteridium latiusculum* (6)
27b. Stipes tufted; frond not ternate, small ..... 28
28a. Fronds with rusty jointed hairs .....*Cheilanthes lanosa* (7)
28b. Fronds glabrous ..... 29
29a. Fronds tripinnate at the base; rootstock with reddish scales; stipe smooth .....*Pellaea glabella* (9)
29b. Fronds more than tripinnate; rootstock with grayish scales; stipe rough .....*Pellaea atropurpurea* (8)
30a. Indusia cup-shaped, attached to the receptacle beneath the sporangia .....*Woodsia obtusa* (39)
30b. Indusia not cup-shaped ..... 31
31a. Indusia orbicular or kidney-shaped ..... 32
31b. Indusia oblong, straight or curved ..... 41
32a. Indusia attached by the side ..... 33
32b. Indusia attached by the center ..... 35
33a. Bulblets present .....*Cystopteris bulbifera* (36)
33b. Bulblets absent ..... 34
34a. Rootstocks elongate, old frond-bases absent, growing point long-exserted and sparsely scaly; the basal pinnules distinctly stalked ..... *Cystopteris fragilis* var. *protrusa* (37)
34b. Rootstocks short, old frond-bases present, growing point obscure, densely scaly; basal pinnules sessile, pinnules broadest above the middle..... *Cystopteris fragilis* var. *Mackayi* (38)
35a. Midnerve of the pinnule straight; at least some hairs present; rootstock creeping ..... 36
35b. Midnerve of the pinnules curved at base; no hairs; rootstock short, erect ..... 37
36a. Margin of the fertile frond strongly revolute; veins of sterile frond forked; marsh or bog plant.
*Dryopteris Thelypteris* (33)
36b. Margin of the frond not revolute; veins all simple; not a marsh or bog plant .....*Dryopteris noveboracensis* (29)
37a. Sori near the midvein .....*Dryopteris Goldiana* (32)
37b. Sori not nearer midvein than margin ..... 38
38a. Bipinnate or bipinnatifid, texture thick, firm, teeth blunt..... 39
38b. Tripinnate or tripinnatifid, texture delicate, teeth sharp, somewhat spine-tipped ..... 40
39a. Pinnules entire or crenate .....*Dryopteris marginalis* (30)
39b. Pinnules toothed or lobed.
*Dryopteris marginalis* f. *tripinnatifida* (31)
40a. Pinnae of the lowermost pair deltoid, their basal pinnules elongate; cutting of margin inconspicuous, the teeth appressed; indusia glabrous; scales on the stipe light brown throughout .....*Dryopteris spinulosa* (34)

40b. The pinnae of lowermost pair ovate, their basal pinnules shortened; cutting on margin conspicuous, the teeth diverging; indusia with knobbed hairs; scales with dark brown center. *Dryopteris spinulosa* var. *intermedia* (35)
41a. Fronds small, evergreen, and rock-loving ..... 42
41b. Fronds tall, and herbaceous ..... 52
42a. Fronds entire; veins netted..... *Camptosorus rhizophyllus* (25)
42b. Fronds pinnate or pinnatifid ..... 43
43a. Fronds pinnatifid, long-attenuate. *Asplenium pinnatifidum* (10)
43b. Fronds pinnate, at least at base..... ..... 44
44a. Both stipe and rachis green..... *Asplenium cryptolepis* (19)
44b. Both stipe and rachis not green ..... 45
45a. Fronds pinnate only at the base ..... 46
45b. Fronds pinnate all the way up ..... 47
46a. One-third of the stipe brown, texture of frond thickish; pinnae serrate; 2–3 pairs of stalked pinnae; spores light brown. *Asplenium Trudelli* (12)
46b. Stipe brown to black and shining, the color extending well into the lamina; 4–6 pairs of stalked pinnae; pinnae subentire; texture thinnish; spores dark brown. *Asplenium kentuckiense* (11)
47a. Fronds more than once pinnate; pinnae pinnatifid or deeply cut-lobed ..... 48
47b. Fronds not more than once pinnate, pinnae entire or serrate 49
48a. Fronds almost deltoid; rachis and adjacent stipe flat and green ..... *Asplenium montanum* (18)
48b. Fronds oblong-lanceolate; the basal pinnules sometimes shorter than in the middle; rachis black and shining. *Asplenium Bradleyi* (17)
49a. Pinnae oval or wedge-shape..... ...*Asplenium Trichomanes* (13)
49b. Pinnae oblong to linear, auricled ..... ..... 50
50a. Pinnae mostly opposite; stipe black ....*Asplenium resiliens* (16)
50b. Pinnae alternate; stipe brown ..... ..... 51
51a. Pinnae finely serrate..... .....*Asplenium platyneuron* (14)
51b. Pinnae deeply serrate. *Asplenium platyneuron* f. *serratum* (15)
52a. Fronds once pinnate, pinnae entire. *Athyrium pycnocarpon* (20)
52b. Fronds more than once pinnate, pinnae incised ..... ..... 53
53a. Fronds bipinnatifid.....*Athyrium thelypteroides* (21)
53b. Fronds bipinnate ..... 54
54a. Fronds broadest near the base; generally the second pair of pinnae longest .....*Athyrium asplenioides* (22)
54b. Fronds not broadest near the base ..... ..... 55
55a. Fronds alike, broad, the sori separate. *Athyrium angustum* var. *rubellum* (23)
55b. Fronds unlike, the fertile contracted, narrow; sori merged at maturity .....*Athyrium angustum* var. *elatius* (24)
56a. Plants leafy, rooted in soil; sporophylls in four-sided spikes; heterosporous .....*Selaginella apoda* (62)
56b. Plants moss-like; sporophylls like leaves or in round spikes; homosporous ..... 57

57a. Sporangia in axils of foliage leaves, not forming a spike..... 58
57b. Sporangia in axils of reduced bracteal leaves, forming spikes ..... 59
58a. Leaves broader above the middle, toothed.
*Lycopodium lucidulum* (57)
58b. Leaves lance-linear, attenuate, entire.
*Lycopodium Selago* var. *patens* (56)
59a. Fertile branch leafy up to the spike.
*Lycopodium obscurum* var. *dendroideum* (58)
59b. Spikes borne on scaly peduncles ..... 60
60a. Running stems at the surface of ground; branches 2–4 mm. broad .....*Lycopodium complanatum* var. *flabelliforme* (59)
60b. Running stems deep in the ground; branches 1–2 mm. broad ..... 61
61a. Lateral leaves appressed; branches erect and crowded.
*Lycopodium tristachyum* (60)
61b. Lateral leaves spreading; branches spreading and open.
*Lycopodium tristachyum* var. *sharonense* (61)

*(To be continued)*

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# A County Check-List of Florida Ferns and Fern Allies

DONOVAN S. CORRELL

*(Continued from Page 16)*

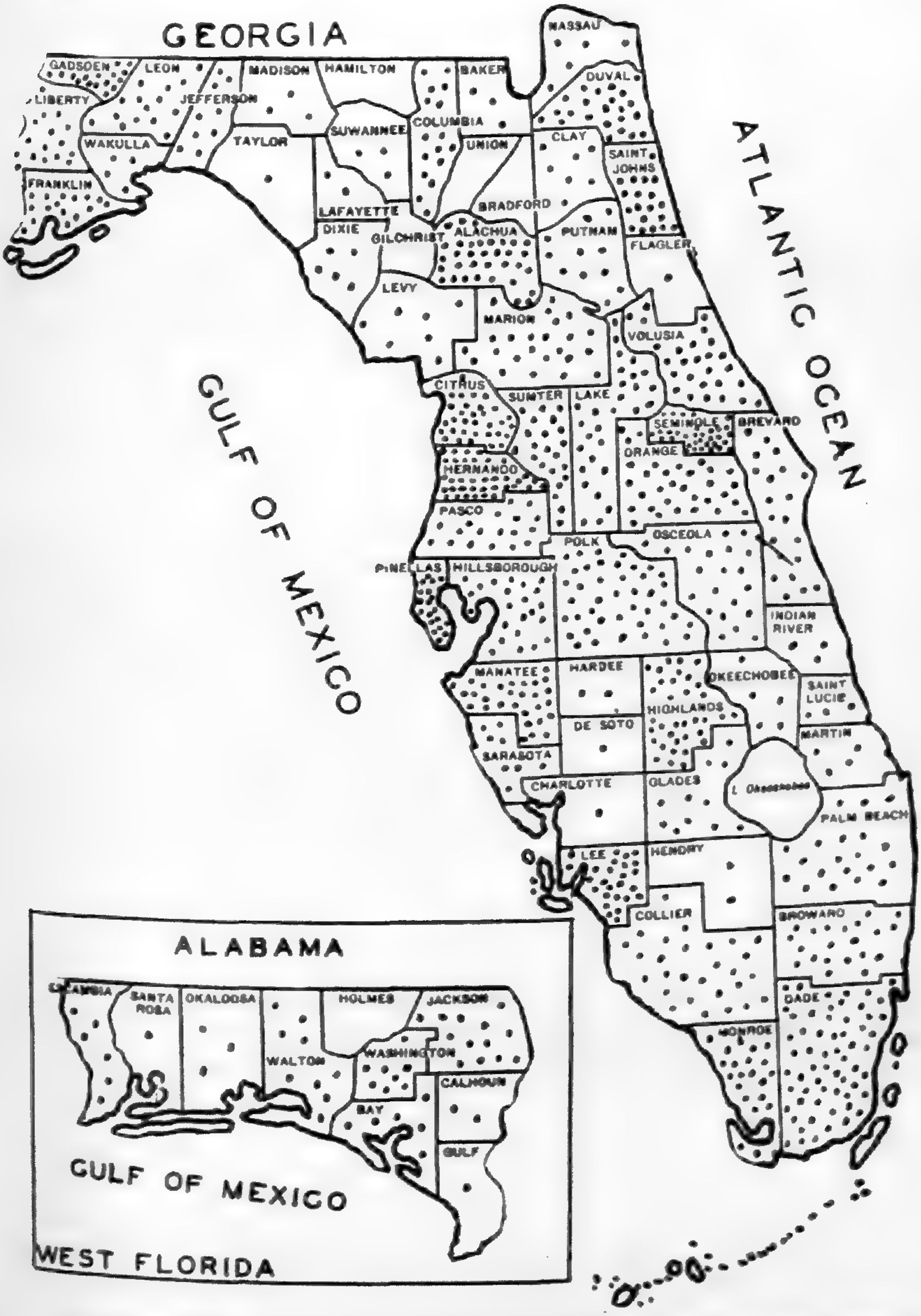
### 2. ANEMIA Sw.

1. ANEMIA ADIANTIFOLIA (L.) Sw. Rocky soil in dry, open pinelands and hammocks. Counties: Citrus: *Correll* 5831 (D); Collier: *Buswell* (M); Dade: *Correll* 6011 (D); Monroe: *Correll* 6067 (D); Sumter: *Scott* (D).

### 3. LYGODIUM Sw. Climbing-ferns

1. LYGODIUM JAPONICUM (Thunb.) Sw. Moist soil in thickets of swamps, and along roadsides. The recent discovery of the Japanese climbing-fern in northern Florida adds another state to the range of this rapidly spreading species. The writer has collected this Old World species in Georgia and South Carolina where it has become well-established. It has also been found in Alabama, and may be expected in other southern states. Counties: Liberty: *Small, E. and R. St. John* (NY).

2. LYGODIUM PALMATUM (Bernh.) Sw. Low, moist soil in woods and thickets. The occurrence of this typically northern plant in Dade County is very unusual. This is especially significant since no other collections were seen from the state. Collectors should make




Map of Florida showing the distribution of the various species of pteridophytes by counties. Each dot within a county represents one species collected there.

an effort to find this species in northern Florida. Counties: Dade: ——— (B).

FAMILY 4. CERATOPTERIDACEAE Floating-fern Family

1. CERATOPTERIS Brongn. Floating-ferns

1. CERATOPTERIS PTERIDOIDES (Hook.) Hieron. Floating on still water of canals and rivers. Counties: Citrus: *Curtiss* 5973 (NY); Hernando: *Curtiss* (F97); Highlands: *Correll* 6178 (D); Lake: *Hyning* (F98); Seminole: *Rapp* (P).

FAMILY 5. POLYPODIACEAE Fern Family

1. ACROSTICHUM L. Leather-ferns

1. ACROSTICHUM AUREUM L. Low hammocks in brackish situations, salt marshes and swamps. Counties: Collier: *Moldenke* 1003 (D); Dade: *Tatnall* 745 (P); Lee: *Eaton* 1169 (G); Monroe: *Correll* 6077 (D); Pinellas: *Biltmore Herbarium* 195b (N).

2. ACROSTICHUM DANEAEFOLIUM Langsd. & Fisch. Brackish and freshwater swamps and marshes, wet hammocks, and open places. Counties: Brevard: *Singeltary* (D); Broward: *Correll* 6145 (D); Citrus: *Correll* 5789 (D); Collier: *Faxon* (G); Dade: *Moldenke* 393 (D); Glades: *Lovett* 222 (D); Hendry: *Lovett* 236 (D); Highlands: *McFarlin* 9418 (H); Hillsborough: *Churchill* (G); Lee: *Hitchcock* 543 (G); Manatee: *Singeltary* 32 (D); Orange: *Rapp* (P); Palm Beach: *O'Neill* (F145); Pinellas: *Miller and Reeves* (D); Polk: *McFarlin* 4731 (H); Saint Johns: *Reynolds* (G); Sarasota: *Scott* (D); Seminole: *Lambert* 20 (P); Volusia: *Slopon* (G).

2. ADIANTUM L. Maidenhair-ferns

1. ADIANTUM CAPILLUS-VENERIS L. Limestone rocks, in hammocks and along river banks. Counties: Alachua: *Correll* 5774 (D); Calhoun: *Small and West* (F107); Citrus: *E. St. John* (NY); Columbia: *Correll* 6453 (D); Gadsden: *Leeds* 523 (P); Hernando: *Singeltary* (D); Jackson: *Curtiss* 6805 (NY); Levy: *E. St. John* (NY); Liberty: *Correll* 5674 (D); Saint Johns: *Correll* 6379 (D); Washington: *Small and Knight* (D).

2. ADIANTUM MELANOLEUCUM Willd. Hammocks, edge of limesinks. Counties: Dade: *Small* 8130 (NY).

3. ADIANTUM TENERUM Sw. Low hammocks and open limestone rocks. Counties: Alachua: *O'Neill* 587 (C); Citrus: *Correll* 5817 (D); Dade: *Correll* 6030 (D); Hernando: *Correll* 5840 (D); Marion: *Davenport* (NY); Saint Johns: *Reynolds* (P); Volusia: *Reynolds* (NY).

### 3. ANCHISTEA Presl. Virginia chain-fern

1. ANCHISTEA VIRGINICA (L.) Presl. Swamps and marshes, low prairies, and thickets in hammocks. The Virginia chain-fern has been found in 27 counties. It is particularly abundant in northern Florida, becoming less common southward.

### 4. ASPLENIUM L. Spleenworts

1. ASPLENIUM ABSCISSUM Willd. Limestone rocks in low, moist hammocks. Counties: Alachua: *Small and Wherry* 11649 (NY); Citrus: *Correll* 5821 (D); Dade: *Soar* (NY); Hernando: *Correll* 5841 (D); Marion: *Reynolds* (P); Sumter: *Small, Knight, E. and R. St. John* (P).

2. ASPLENIUM ADIANTUM-NIGRUM L. On limestone rocks. Although collected many years ago (1879) near Ocala, no further collections of this species seem to have been made in Florida. This is an Old World species which is perhaps not easily acclimated to conditions in Florida. Counties: Marion: *Reynolds* (B).

3. ASPLENIUM AURITUM Sw. On tree trunks or rocks in hammocks. Counties: Hillsborough: *Knight* (D); Pasco: *R. and E. St. John* 405 (P); Sumter: *Lewton* (NY).

4. ASPLENIUM BISCAYNEANUM (D. C. Eaton) A. A. Eaton. Limestone sinks and cliffs. Counties: Dade: *Small* 10534 (D).

5. ASPLENIUM CRISTATUM Lam. Limestone rocks and in limesinks in hammocks. Counties: Citrus: *Buswell* (M); Sumter: *Small, Knight, E. and R. St. John* (P).

6. ASPLENIUM CURTISSII Underw. On limestone rocks and in limestone sinks in hammocks. Counties: Alachua: *Small and Knight* (NY); Citrus: *Correll* 5836 (D); Hernando: *Singeltary* (D); Marion: *Underwood* 1813 (NY).

7. ASPLENIUM DENTATUM L. On rock walls in hammocks. Counties: Dade: *Correll* 5980 (D).

8. ASPLENIUM HETEROCHROUM Kunze. Limestone rocks and limesinks in low hammocks. Counties: Alachua: *Correll* 5777 (D); Citrus: *Correll* 5822 (D); Columbia: *Correll* 6449A (D); Hernando: *Singeltary* (D); Jackson: *Small and West* (F207); Lafayette: *Leeds* 374 (P); Liberty: *Correll* 5680 (D); Marion: *Correll* 5780 (D); Seminole: *Lambert* 14 (P); Volusia: *Fuller* (G).

9. ASPLENIUM PLATYNEURON (L.) Oakes. Open, moist woods, hammocks, and along stream banks. Counties: Alachua: *Correll* 6434 (D); Brevard: *Palmer* 657 (G); Citrus: *Correll* 5822A (D); Columbia: *Bitting* 9 (NY); Dade: *Underwood* 1559 (NY); Dixie: *Correll* 5748 (D); Duval: *Churchill* (G); Gadsden: *West* (F2149);

Hernando: *Norton* 447 (N); Hillsborough: *Blanton and O'Neill* 6710 (C); Jackson: *Small and West* (F240); Jefferson: *Wherry* (P); Lake: *Nash* 1138 (G); Leon: *Correll* 5572 (D); Liberty: *Small and DeWinkeler* 11443 (NY); Marion: *Palmer* 39405 (P); Orange: *Rapp* (P); Pasco: *Benedict and Wiegand* (D); Polk: *McFarlin* 3555 (H); Sumter: *Scott* (D); Suwanee: *West and Arnold* (F111); Volusia: *Faxon* (G); Wakulla: *Correll* 5671 (D).

10. ASPLENIUM PUMILUM Sw. Limestone rocks and ledges in hammocks. Counties: Alachua: *O'Neill* (C); Hernando: *E. St. John* (F913).

11. ASPLENIUM RESILIENS Kunze. On rocks in hammocks, and in rocky woods along river bluffs. Counties: Alachua: *West* (F259); Citrus: *Maxon, Grout, and McFarlin* 10267 (H); Columbia: *Correll* 6449 (D); Gadsden: *Leeds* 514 (P); Hernando: *Correll* 5842 (D); Liberty: *Curtiss* 3720 (P); Marion: ——— (NY); Volusia: *Fuller* (G); Washington: *Wherry* (P).

12. ASPLENIUM SERRATUM L. On the base of trees, and on logs and stumps in hammocks. Counties: Collier: *Correll* 5962 (D); Dade: *Correll* 5985 (D); Lee: *Small* 7745 (NY); Monroe: *O'Neill* (C); Volusia: *Curtiss* (NY).

13. ASPLENIUM VERECUNDUM Chapm. In lime-sinks and on rocks in low hammocks. Counties: Alachua: *Small and Wherry* 11651 (NY); Citrus: *Correll* 5837 (D); Columbia: *Correll* 6450 (D); Dade: *Correll* 6094 (D); Hernando: *Singeltary* (D); Jackson: *Chapman* (NY); Marion: *Underwood* 1876 (NY); Monroe: *Small and Carter* (P).

## 5. ATHYRIUM Roth. Lady-ferns

1. ATHYRIUM ASPLENIOIDES (Michx.) Desv. Low, moist woods along streams, and in hammocks. Counties: Alachua: *West* (F298); Columbia: *Bitting* 5 (NY); Duval: *Curtiss* 5102 (N); Gadsden: *O'Neill* (F300); Leon: *Berg* (NY); Liberty: *Correll* 5681 (D).

## 6. BLECHNUM L. Swamp-ferns

1. BLECHNUM OCCIDENTALE L. Low hammocks or woods, along rocky streams. Counties: Hernando: *Small, Mosier, and DeWinkeler* (D).

2. BLECHNUM SERRULATUM L. C. Rich. Swamps, marshes, thickets, moist prairies, and hammocks. Counties: Brevard: *Bartram* (P); Broward: *Correll* 6123 (D); Clay: *Blanton* 6722 (C); Collier: *Correll* 5945 (D); Dade: *Moldenke* 334 (D); Glades: *Lovett* 241 (D); Hernando: *Small* (F331); Highlands: *Leeds*

241 (P); Hillsborough: *Correll* 5875 (D); Lake: *Underwood* 1520 (NY); Lee: *Correll* 5902 (D); Manatee: *Correll* 5883 (D); Monroe: *McFarlin* 9884 (H); Orange: *Bitting* 7 (NY); Osceola: *Singeltary* (D); Palm Beach: *Pyron* (D); Pasco: *O'Neill* (C); Pinellas: *Reeves and Miller* (D); Polk: *McFarlin* 3752 (H); Putnam: *Scott* (D); Saint Johns: *Reynolds* (NY); Sarasota: *Scott* (D); Seminole: *Lambert* 17 (P); Sumter: *St. John* (F2151); Volusia: *Friesner* 2031 (D).

### 7. CAMPYLONEURON Presl. Strap-ferns

1. CAMPYLONEURON ANGUSTIFOLIUM (Sw.) Fée. On trees in hammocks. Counties: Collier: *Scull* (F11521); Dade: *Eaton* (NY); Seminole: *Eaton 1023 in part* (G).

2. CAMPYLONEURON COSTATUM (Kunze) Presl. On trees and logs in hammocks. Counties: Collier: *Eaton* 1135 (G).

3. CAMPYLONEURON LATUM Moore. On the base of trees, and on rock ledges in hammocks. Counties: Dade: *Eaton* 562 (N); Highlands: *Correll* 6173A (D).

4. CAMPYLONEURON PHYLLITIDIS (L.) Presl. On tree trunks, logs, stumps, and in wet soil of hammocks. Counties: Brevard: *Palmer* (G); Collier: *Correll* 5956 (D); Dade: *Correll* 6019 (D); Duval: *Curtiss* (NY); Highlands: *Correll* 6258 (D); Lake: *West* (F363); Lee: *Hitchcock* 530 (NY); Manatee: *Underwood* 2055 (NY); Marion: *Walker* (C); Monroe: *Pollard, Collins, and Morris* 204 (N); Orange: *Barber* (NY); Palm Beach: *Underwood* 2222 (NY); Polk: *McFarlin* 4115 (H); Saint Johns: *Reynolds* (NY).

### 8. CHEILANTHES Sw. Lip-ferns

1. CHEILANTHES MICROPHYLLA Sw. On shell mounds or shell islands. Counties: Citrus: *R. St. John* (NY); Collier: *O'Neill* 7590 (D); Duval: *Curtiss* 3682 (NY); Lee: *Small* 7756 (NY); Washington: *Small and Knight* (NY).

### 9. CYRTOMIUM Presl.

1. CYRTOMIUM FALCATUM (L. fil.) Presl. On coquina stone walls. Although this Old World species has been well-established for a number of years on the coquina stone walls of Fort Marion in St. Augustine, it does not seem to be spreading. No collections have been seen other than those from the fort. Counties: Saint Johns: *Correll* 6381 (D).

### 10. DENNSTAEDTIA Bernh.

1. DENNSTAEDTIA ADIANTOIDES (Humb. & Bonpl.) Moore. Dense,

moist hammocks. Counties: Palm Beach: *Small, Mosier, and Matthaus* (NY).

### 11. DRYOPTERIS Adans. Shield-ferns

1. DRYOPTERIS AMPLA (H. & B.) Kuntze. Low, moist hammocks. Counties: Collier: *Buswell* (NY); Dade: *Correll* 6095 (D); Manatee: *Cuthbert* (F476); Polk: *O'Neill* (N).

2. DRYOPTERIS AUGESCENS (Link) C. Chr. Hammocks or woods, on exposed limestone rocks. Counties: Alachua: *Correll* 5764A (D); Citrus: *Small* 10403 (NY); Dade: *R. St. John* 308 (NY); Dixie: *Correll* 5749A (D); Highlands: *Miller* (D); Liberty: *Small and DeWinkeler* 11437 (N); Osceola: *Singeltary* 21 (D); Sumter: *Scott* (D).

3. DRYOPTERIS DENTATA (Forsk.) C. Chr. Hammocks, and low, moist, rocky woods along streams. Counties: Alachua: *Correll* 5764 (D); Dade: *Small and Mosier* 5490 (NY); Franklin: *Chapman* (NY); Gadsden: *Biltmore Herbarium* 1446e (N); Hardee: *Small, Knight, E. and R. St. John* (NY); Highlands: *Correll and McFarlin* 6253 (D); Hillsborough: *Blanton and O'Neill* 6768a (C); Orange: *Williamson* (P); Pasco: *O'Neill* (C); Pinellas: *Miller and Reeves* (D); Polk: *Correll* 6284 (D); Seminole: *Correll* 6359 (D); Sumter: *R. St. John* (NY).

4. DRYOPTERIS FLORIDANA (Hook.) Kuntze. Hammocks and low, swampy, rocky woods throughout most of the state. Counties: Alachua: *Correll* 5763 (D); Brevard: *Small, Mosier, and DeWinkeler* 10973 (NY); Citrus: *Correll* 5795 (D); Clay: *Canby* (N); Columbia: *Bitting* 6 (NY); Duval: *Curtiss* 4809 (NY); Gadsden: *Chapman* (NY); Hernando: *McFarlin* 3614 (C); Highlands: *Correll* 6171 (D); Hillsborough: *Britton and Shafer* 130 (NY); Jackson: *Small and Knight* (D); Lake: *Nash* 773 (P); Leon: *Small, E. and R. St. John* (NY); Levy: *Garber* (P); Marion: *Underwood* 1816 (NY); Nassau: *Faxon* (G); Okeechobee: *Buswell* (M); Orange: *Maxon* 10806 (N); Pasco: *O'Neill* (C); Polk: *Wherry* (P); Putnam: *Scott* (D); Saint Johns: *Reynolds* (NY); Seminole: *Lambert* 8 (P); Sumter: *Lewton* (NY); Volusia: *Friesner* 2033 (D); Wakulla: *Correll* 5672 (D).

5. DRYOPTERIS GONGYLODES (Schk.) Kuntze. Marshes, swamps, and low hammocks. Counties: Brevard: *Palmer* (G); Broward: *Correll* 6119 (D); Collier: *Correll* 5959 (D); Dade: *Small and Carter* 1121 (P); Glades: *Lovett* 224A (D); Hardee: *Curtiss* 6760 (NY); Highlands: *Correll* 6268 (D); Lake: *Underwood* 1905a (NY); Lee: *Curtiss* 3740 (N); Manatee: *Tracy* 7633 (NY);

Martin: *Correll* 6157 (D); Orange: *Rapp* (P); Osceola: *Singeltary* 28 (D); Palm Beach: *Randolph* 129 (G); Pasco: *O'Neill* 1709 (C); Polk: *Scott* (D); Seminole: *Correll* 6366 (D); St. Lucie: *Small* 4314 (NY); Volusia: *Faxon* (P).

6. DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. Low, moist, rich woods, usually along stream banks. Counties: Jackson: *Small and Wherry* 11689 (NY).

7. DRYOPTERIS **macilenta** (E. St. John), comb. nov. (*Thelypteris macilenta* E. St. John, Amer. Fern. Jour. 26: 52. 1936). Rocky hammock. Counties: Hernando: *E. St. John* 204 (NY).

8. DRYOPTERIS NORMALIS C. Chr. Open, moist hammocks and woods. Counties: Alachua: *Correll* 5757 (D); Brevard: *Mattern* (N); Broward: *Moldenke* 481 (NY); Citrus: *Correll* 5833 (D); Clay: *Smith* 12 (G); Collier: *Leeds* 329 (P); Columbia: *Correll* 6454 (D); Dade: *Correll* 6108 (D); Dixie: *Correll* 5749B (D); Duval: *Curtiss* 4810 (NY); Escambia: *Price* (NY); Franklin: *Jourman* (P); Gadsden: *Leeds* 531 (P); Glades: *Lovett* (D); Hernando: *Small, Mosier, and DeWinkeler* 11339 (NY); Highlands: *Correll* 6252 (D); Hillsborough: *Curtiss* 3743 (NY); Jackson: *Small and Wherry* 11687 (NY); Jefferson: *Lighthipe* (B); Lafayette: *Leeds* 325 (P); Lake: *Nash* 840 (NY); Lee: *Correll* 5899 (D); Liberty: *Small, E. and R. St. John* (NY); Manatee: *Tracy* 7632 (NY); Marion: *Correll* 5779 (D); Okeechobee: *Correll* 6159 (D); Orange: *Correll* 6350 (D); Palm Beach: *Deam* 1663 (P); Pasco: *O'Neill* (C); Polk: *Correll* 6291 (D); Putnam: *Garber* (NY); Saint Johns: *Reynolds* (NY); Seminole: *Correll* 6368 (D); Sumter: *Lewton* (NY); Suwanee: *Wiegand and Manning* 22 (G); Volusia: *Small* (NY); Wakulla: *Correll* 5667 (D); Washington: *Wherry* (P).

9. DRYOPTERIS PANAMENSIS (Presl) C. Chr. Wet hammocks and in seepage along wooded river banks. Counties: De Soto: *Bright* 4585 (G); Pasco: *O'Neill* 7589 (D); Polk: *Correll* 6287 (D).

10. DRYOPTERIS PATENS (Sw.) Kuntze. Hammocks. Counties: Dade: *Eaton* (N).

11. DRYOPTERIS REPTANS (J. F. Gmel.) C. Chr. On rocks in open, moist hammocks and woods. Counties: Alachua: *Small and Wherry* 11652 (NY); Citrus: *Correll* 5818 (D); Dade: *Correll* 6035 (D); Hernando: *Singeltary* (D); Marion: *Smith* (G); Monroe: *Small* 7489 (NY).

12. DRYOPTERIS SETIGERA (Blume) Kuntze. Swamps, marshes, and wet woods. Counties: Hernando: *St. John* (F451); Highlands: *Correll* 6249 (D); Manatee: *Reasoner* (NY); Orange (?):

*Buswell* (M); Osceola: *Singeltary* (D); Polk: *Small and Matthaus* 11615a (NY); Saint Johns: *Knight* (NY); Seminole: *Correll* 6363 (D); Volusia; *Small* 11569 (D). Naturalized from the old world tropics.

13. DRYOPTERIS SUBMARGINALIS (Langsd. & Fisch.) C. Chr. Hammocks. Counties: Collier: *Buswell* (NY); Palm Beach: *Small, Mosier, and Matthaus* (NY).

14. DRYOPTERIS SUBTETRAGONA (Link) Maxon. Hammocks and low, moist, open woods. Counties: Citrus: *Correll* 5824 (D); Hernando: *Small, Knight, E. and R. St. John* (NY); Marion: *Adams* (G); Sumter: *Adams* (G).

15. DRYOPTERIS THELYPTERIS (L.) A. Gray. Swamps, marshes, wet thickets on edge of hammocks. Although the marsh shield-fern is considered a typically northern plant it ranges as far south as Dade county in southern peninsular Florida. Since I have seen collections from 22 scattered counties, it would appear that this species occurs throughout the state.

### 12. GONIOPHLEBIUM Presl. Brazilian polypody

1. GONIOPHLEBIUM BRASILIENSE (Poir.) Small. Low hammocks. Counties: Collier: *Small, Mosier, and DeWinkeler* (NY).

### 13. HYPOLEPIS Bernh.

1. HYPOLEPIS REPENS (L.) Presl. Hammocks, and moist soil along streams in open woods. Counties: Hernando: *St. John* (F565); Highlands: *Correll* 6165 (D); Hillsborough: *Wright* 3 (NY); Monroe: *Faxon* (G); Okeechobee: *Buswell* (M); Orange: *Williamson* (NY); Osceola: *Singeltary* 22 (D); Pasco: *O'Neill* (C); Pinellas: *R. St. John* 183 (NY); Polk: *Palmer* (G); Putnam: *Correll* 6411 (D); Seminole: *Rapp* (NY).

*(To be continued)*

# A Comparison of the Basal Scales and Indusia of Dryopteris Goldiana x Marginalis with Those of Its Parent Species

SYDNEY S. GREENFIELD

Almost three decades ago, studies on fern hybrids were the subject of considerable discussion. The work consisted largely of demonstrating the existence of these hybrids and describing them. Slosson (1900) was able to produce fern hybrids experimentally, and Dowell (1908) and Benedict (1909) described the numerous interspecific hybrids in the genus *Dryopteris* which were found in nature.

The hybrid *D. Goldiana* × *marginalis* was described by Dowell as being intermediate between its alleged parents in all characteristics. These included general habit, appearance, color and position of the sori. The description was general and based largely upon gross characters. Benedict (1909) pointed out that although the *D. cristata* × *marginalis* hybrid which he described was intermediate in character, not all plants were intermediate to the same extent, some showing greater resemblance to one parent species, and some to the other. Fern hybrids have also been found to be sterile and to have a tendency to produce abnormal or abortive spores.

In October of 1935, Dr. Benedict collected about 80 specimens of *D. Goldiana* × *marginalis* as well as twenty of each of the parent species. They were found growing in the same locality near Springdale, New Jersey. These leaves were pressed and constituted the material used in the present study. It was undertaken to study the hybrid in comparison with its parent species, particularly with regard to the basal scales and indusia, in order to determine the possibility of diagnostic characters in these structures, and upon what basis they might be differ-

entiated. This work was done in the Botany laboratory of the Biology Department of Brooklyn College during the spring of 1936. I am greatly indebted to Professor Ralph C. Benedict for his invaluable aid and helpful suggestions offered throughout the course of the study.

METHODS.—Representative basal scales and indusia were removed from various parts of the dried specimens. The basal scales were fairly flat, and were mounted on slides in a mixture of 50 parts tap water, 35 parts glycerin, and 15 parts of 95 per cent ethyl alcohol. The indusia were wrinkled and were relaxed by boiling in water for three or four minutes before being mounted. Evaporation from the mounting medium left the tissues in glycerin, in a semi-permanent condition convenient for study and storage.

OBSERVATIONS AND DISCUSSION.—In general, the hybrid plants corresponded to the description given by Dowell (1908) except that they were found to be quite variable. Some closely resemble one parent, many appear intermediate, and others resemble the other parent species. But in all cases they were distinguishable as hybrids. Many sori from each leaf were examined and found sterile, the sporangia being small and abortive. In a very few cases, small, coal-black spores were found; some others had pale green and granular walls. In no case were spores found which appeared anything like the golden brown spores of the parent species.

THE BASAL SCALES; D. MARGINALIS.—The scales at the base of the leaves of this fern are very numerous and have the appearance of chaff. Most of them are from 10 mm. to 25 mm. in length, and each has a small, dark brown area at the base. The rest of the scale is light tan in color (fig. 1). Some of the scales are smaller and more regularly shaped. The cells at the end of attachment are short and broad, being almost isodiametric, and the

walls have curved edges. The cell pattern becomes brick-like and more regular, distal to this base region. Cell-wall pits are rare and found only in the sclerotic area at the base.

D. GOLDIANA.—The scales are dark brown and thick (fig. 2). The proximal cells are very irregular in number of sides and in size, but are mostly isodiametric in shape. The cellular pattern is fairly regular and brick-like throughout the rest of the scale. The cell endings are angular, with slightly curved junctions. The dark brown, sclerotic area is spread over most of the scale, and the cell-wall pits are abundant in this region. In the clear peripheral area, pits are rare, and multicellular projections (laciniae) occur frequently along the edges (fig. 4). Most of the scales are from 14 mm. to 20 mm. in length. The frequency of occurrence of cell-wall pits in this species' scales is shown in cell walls from the dark brown area of the basal scale (fig. 6). These pits appear as thin, non-sclerotic portions of the cell wall. The types found are illustrated in figure 5, the most common being a, c and d.

D. GOLDIANA × MARGINALIS.—The hybrid has scales ranging in type from one to the other parent. They may be divided into three groups, however, 10 per cent in each of two parental-type groups, and about 80 per cent in the intermediate group. These classes are not distinct but constitute an intergraded series from one type to the other. The intermediate type of basal scale has a dark brown area proportionally larger than that in *D. marginalis,* and smaller than in *D. Goldiana.* (Compare figures 1, 2 and 3.) It occupies about half the area of the scale, and is sometimes discontinuous, existing as two or three islands on the clear background. The proximal region is the darkest, the intensity of the brown color diminishing with each brown island from the base. This type was not found on any basal scale of either parent

species. Both parental types have a very dark and a very light area on the scale, but the intermediate type hybrid has an intermediate brown color in the distal islands. Pits are abundant in the cell walls of the dark brown areas, but scarce or absent in the regions of intermediate color. They were not found in the cell walls of the clear, light tan area. Most of the hybrid scales are from 12 mm. to 16 mm. long, never reaching the size of the largest parental scales (fig. 3).

Several basal scales were tested for various cell-wall substances in order to determine the possible presence of these substances in the sclerotic cell walls. All tests gave negative results except the alcoholic phoroglucin solution (1 g. phoroglucin in 100 cc. 95 per cent ethyl alcohol) with subsequent application of a drop of concentrated HCl. This gave a brilliant red color, which is the specific reaction for lignin. Therefore, in addition to being sclerotic, these cell walls in the brown areas are lignified.

THE INDUSIA.—*D. marginalis* has indusia with very numerous cells per unit area, and the cell walls are very much wrinkled, giving the indusium a characteristic appearance (fig. 9). The indusia are about 1.0 mm. in longest diameter, somewhat smaller than those of *D. Goldiana,* but having more cells in an equal area. The cellular pattern is wrinkled in the mature dry condition, with dominant radial lines. The cell walls were somewhat relaxed after the boiling treatment, and figure 9 illustrates the nature of the cell-wall wrinkling under very high magnification.

*D. Goldiana* has large round indusia which are about 1.5 mm. in longest diameter. The cell walls are not much wrinkled, relax easily, and the cellular pattern is broad. The dominant lines in the indusial wall pattern are concentrically circular (Fig. 7).

*D. Goldiana* × *marginalis.* As in the case of the basal

scales, we may divide the indusia into three groups, two parental types and an intermediate type. There is a correlation between the scale and indusial type, as there is between these organs and the general habit of the plant. In the parental types, the hybrid indusia are much smaller than those of the pure species. These hybrid indusia are very variable and form an intergrading series in type, with about 80 per cent definitely showing intermediate characteristics.

The intermediate type of indusium (fig. 8) is from 0.5 to 0.8 mm. in diameter, being much smaller than either parental species. The number of cells per unit area varies within a single indusium as it does from one to another. This condition is not present in either parent. There are no dominant lines, and the walls are heavy and wrinkled. The cell walls are generally thicker than those of the parent species. In some indusia there are regions of broad cells and others of small wrinkled cells, suggestive of the types found in both parents.

Herbarium specimens from various collections were examined and found to conform with the foregoing observations. In some cases, however, the hybrid indusia were found slightly larger than those herein recorded.

SUMMARY.—The basal scales and indusia of *Dryopteris Goldiana*, *D. marginalis* and the interspecific hybrid *D. Goldiana* × *marginalis* were studied comparatively. The scales and indusia of the pure species were found to be characteristically different. Those of the hybrid presented a series of types ranging from one parent to the other, with the majority of about 80 per cent being definitely intermediate. There is a correlation between the type of indusium, basal scales and the general habit of the plant.

## LITERATURE CITED

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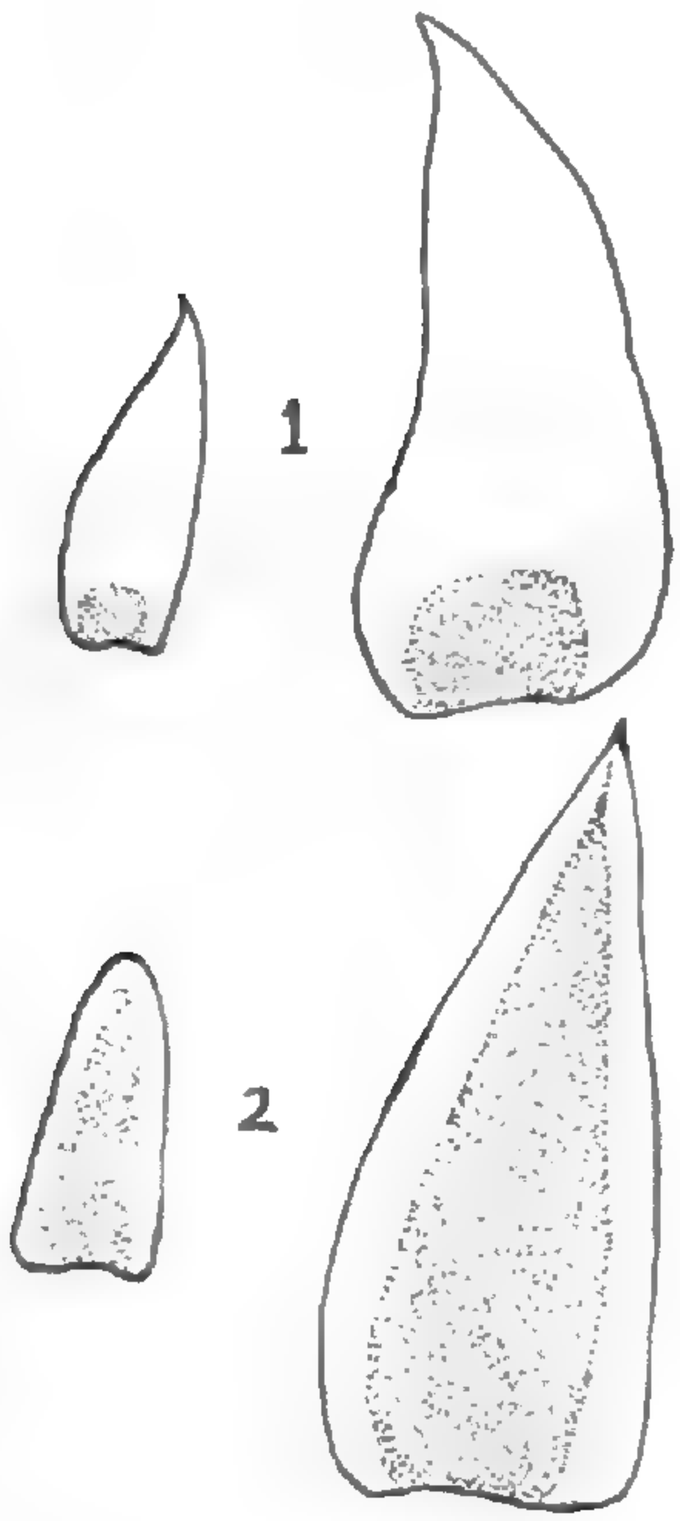
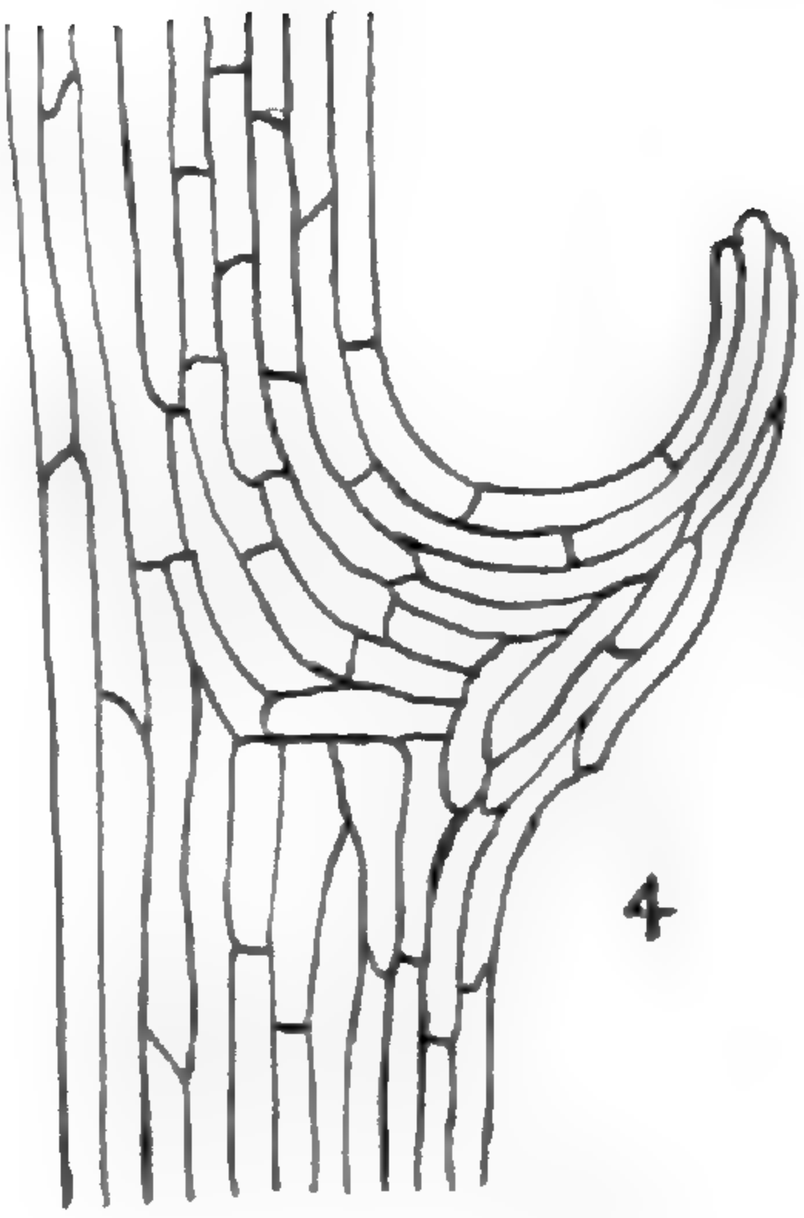
Dowell, P. 1908. New ferns described as hybrids in the genus Dryopteris. Bull. Torrey Club 35: 135–140.
Slosson, M. 1900. Experiments in hybridizing ferns. Fernwort Papers, 19–25, 20 D.

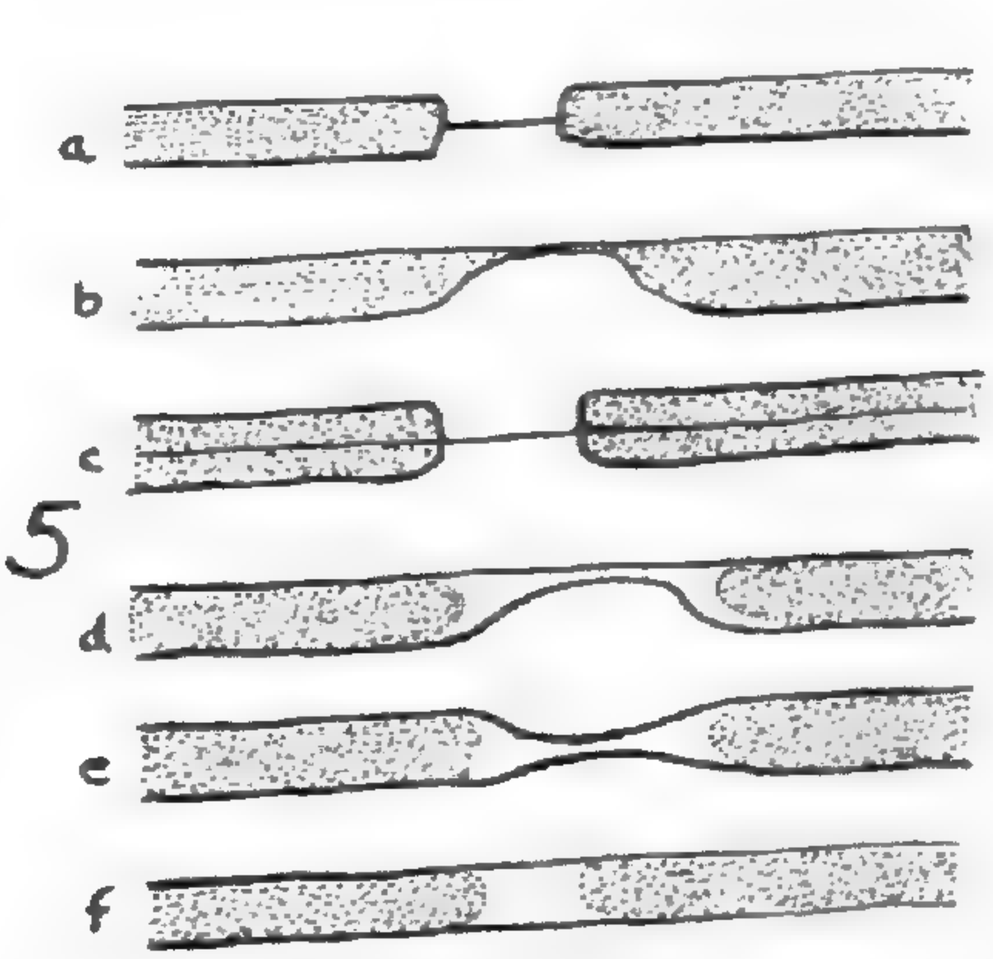
## EXPLANATION OF PLATES

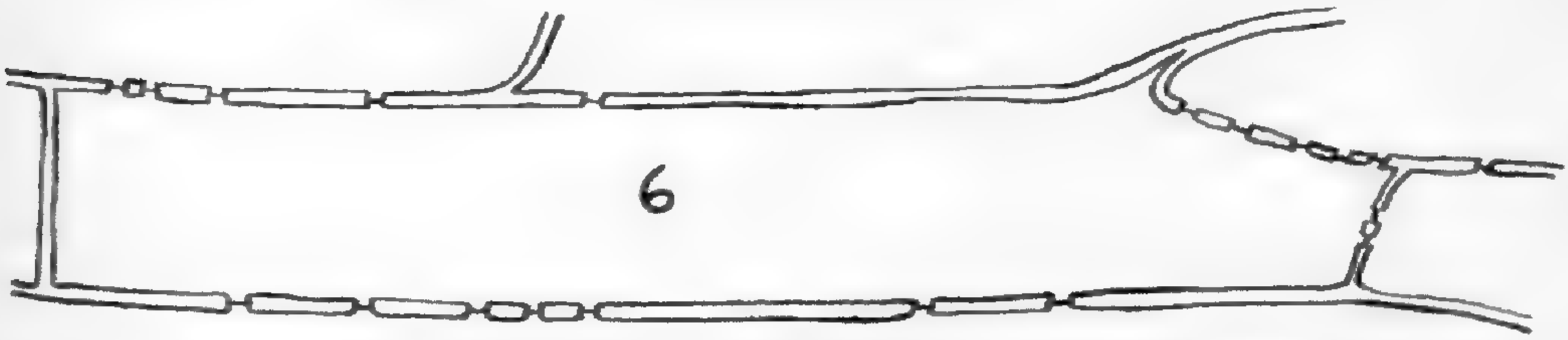
PLATE 6. Figs. 1–6. Basal scales. Fig. 1. Basal scales of *D. marginalis*. Fig. 2. Basal scales of *D. Goldiana*. Fig. 3. Basal scales of *D. Goldiana* × *marginalis*. The shaded areas indicate the dark brown sclerotic regions. Fig. 4. Multicellular projection from the periphery of a basal scale of *D. Goldiana*. Fig. 5. Cell wall pits, very highly magnified. Fig. 6. Diagram of the frequency of cell wall pits in the dark brown areas of the scales of *D. Goldiana*.

PLATE 7. Fig. 7. Camera lucida drawing of cell walls of an indusium of *D. Goldiana*. Fig. 8. Indusium of *D. Goldiana* × *marginalis*, magnification as in fig. 7. Fig. 9. More highly magnified portion of the indusium of *D. marginalis*, showing the nature of the cell wall wrinkling.

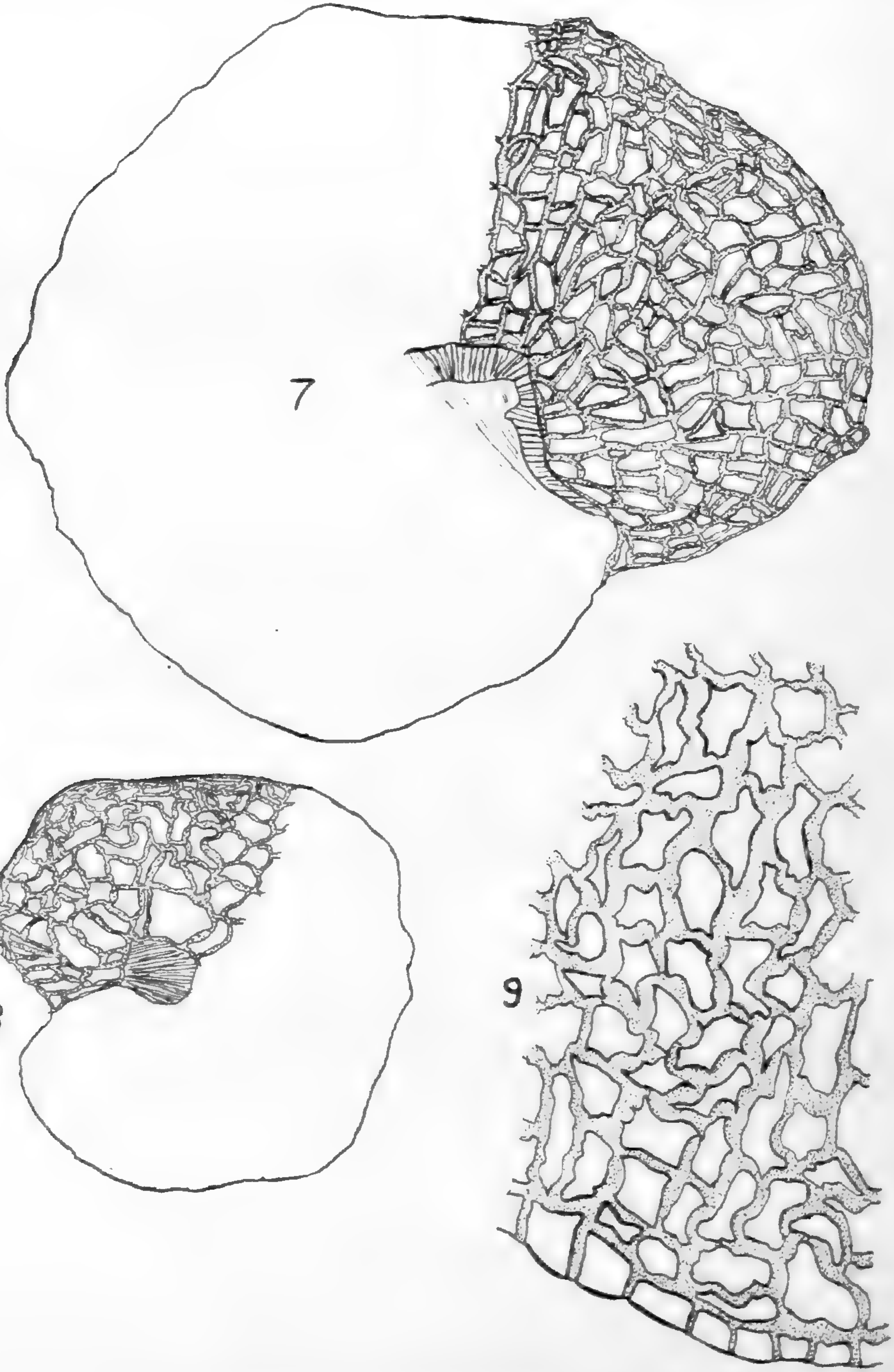



Dryopteris Goldiana × marginalis and its Parents.




Dryopteris Goldiana × marginalis and its Parents.

# Woodsia Oregana in Iowa

W. A. ANDERSON

In examining some fern material in the herbarium of the State University of Iowa it has recently become evident to me that the Iowa specimens which for many years have passed as *Woodsia scopulina* D. C. Eaton in reality should be referred to *W. oregana* D. C. Eaton. This is clearly a case of misidentification, which has been perpetuated for a number of years.[1] The late Professor Shimek had recognized the error, as is evidenced by some of his notes accompanying unmounted specimens in the herbarium, but he had neither corrected the mounted sheets nor published anything on the subject. Melhus[2] reports this species correctly, but since his paper was prepared chiefly for use in secondary schools, he does not attempt to explain corrections of this sort. Present records indicate that *Woodsia scopulina* does not occur in Iowa.

All of the Iowa specimens of *Woodsia oregana* come from a small outcrop of Sioux quartzite which occurs in the extreme northwestern corner of the state. The only station known to the writer is in fact so near the border, that had the northern boundary of Iowa been run half a mile south of its present position, we could not claim either the rock or the fern which grows on it. A specimen of *W. oregana* from Luverne, Minnesota, indicates that it is elsewhere in the same region. It may not be inappropriate to mention that we have in the herbarium

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[1] Shimek, B., Bull. Lab. Nat. Hist. St. Univ. Iowa v. 159 (1901). Pammel, L. H. and Charlotte King, Ia. Acad. Sci. Proc. ix. 149 (1902). Greene, Wesley, Plants of Iowa p. 123 (1907). Cratty, R. I., Iowa State College Jour. Sci. vii. 179 (1932).

[2] Melhus, I. E., Native Ferns of Iowa, Iowa St. Col. Extension Circ. 225 (1936).

of the State University, more and finer specimens of *Woodsia oregana* from this Iowa station than are to be found at present at the station itself. All of these are somewhat glandular, in this respect approaching *W. Cathcartiana* Robinson.

Reports of eastern stations of this fern indicate that it is usually found on limestone,[3] and as a relict species in unglaciated areas.[4] The highly silicious quartzite would seem unsuitable as a substrate until one realizes that the fern is actually growing in wind-blown prairie soil which is lodged in the crevices of the rock.

As to glaciation, this quartzite outcrop shows abundant and pronounced scratches. This section is generally covered with the Kansan drift,[5] but is outside the limits of the three later glaciers. It seems therefore that in Iowa *Woodsia oregana* is not a pre-Pleistocene relict, but has come in during the relatively long interval of time since Kansan glaciation.

Dr. E. T. Wherry, in his paper "Midland Fern Notes" (this JOURNAL **28**: 29), states that "the *Woodsia* growing in Gitchie Manitou State Park . . . has been reported both as *W. scopulina* and *W. oregana;* but a visit there disclosed that it is neither, as it shows instead the dense glandularity characteristic of *W. cathcartiana.*"

This leads at once into a consideration of the status of *W. Cathcartiana.* This species was first described by B. L. Robinson[6] as a segregate from *W. scopulina* with which it had previously been placed. Britton and Brown[7] treat it as a synonym of *W. scopulina* and Ryd-

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3 Fernald, M. L., Rhodora xx. 96 (1918). Fassett, N. C., Rhodora xxxv. 389 (1933).

4 Fernald, M. L., Rhodora xxxvii. 218 (1935).

5 Kay, G. F. and E. T. Apfel, Pre-Illinoisan Pleistocene Geology of Iowa, Ia. Geol. Survey XXXIV. (1929).

6 Robinson, B. L., Rhodora x. 30 (1908).

7 Britton and Brown, Illustrated Flora i. 13 (1913).

berg[8] as a synonym of *W. mexicana.* House,[9] Stebbins[10] and Fassett[11] all mention difficulties in identifying it.

The plant under discussion is not *Woodsia scopulina,* as is set forth in Robinson's original description. In the Iowa herbarium we have two specimens of *W. mexicana, Palmer,* No. 1436 (Texas), and *Parry and Palmer,* No. 1000 (Mexico). These are distinct enough from all descriptions of *Woodsia Cathcartiana.* The differences between *W. Cathcartiana* and *W. oregana,* its nearest relative, may be tabulated as follows:

| *Woodsia Cathcartiana* | *Woodsia oregana* |
|---|---|
| Fronds lanceolate | Fronds narrowly lance-oblong |
| Pinnae oblong | Pinnae triangular-oblong |
| Segments divided by wide sinuses | Segments divided by narrow sinuses |
| Glandular | Glabrous (or somewhat glandular) |

Now the average specimen of this complex from the Sioux quartzite outcrop in Iowa has lance-oblong fronds, triangular-oblong pinnae, wide sinuses and is more or less glandular! One specimen has a broadly lanceolate frond, rather crowded triangular pinnae, rather narrow sinuses, and is almost glabrous. In cases like this one doesn't know which part of the plant to believe!

Another set of specimens in the Iowa herbarium may throw some light on this problem. I have before me two sheets of ferns collected by T. H. Macbride in August, 1893, at Hot Springs, South Dakota. At first glance the specimens appear to be all alike, so much so that they would pass as duplicates. They all have the lanceolate outline and narrow, distant pinnae of *Woodsia Cathcartiana,* yet when examined with a lens those on one

[8] Rydberg, P. A., Flora of the Prairies and Plains p. 7 (1932).
[9] House, H. D., AM. FERN JOUR. xxiii. 2 (1933).
[10] Stebbins, G. L., Rhodora xxxvii. 72 (1935).
[11] Fassett, N. C., Rhodora xxxv. 389 (1933).

sheet have white, jointed hairs and membranous indusium, while the other is merely glandular and has filamentous indusial segments. These have been identified respectively as *W. scopulina* and *W. oregana,* which in my opinion is correct. The only satisfactory way to handle such a complex group of closely related forms is to make divisions between species primarily on characters of fruiting structures, and to remember that leaf outline, texture and glandularity are apt to be variable wherever found. For this reason it seems best to assign these Iowa specimens to *Woodsia oregana.*

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## Recent Fern Literature

The discovery in Europe of an occurrence of *Dryopteris fragrans* has led to publication of an elaborate study of this fern by Kalliola.[1] He points out that in 1911 the species was divided by Komarov[2] into two varieties, a northern, v. *lepidota* and a more southern, v. *remotiuscula;* the latter name therefore has priority over *Hookeriana,* given by Fernald[3] to the corresponding American extreme.

Occurrences thus far known in Asia, North America, and Greenland are summarized. They all lie so far north or at such high altitudes as to lead to its classification as an arctic-alpine species. Numerous statements as to the habitat are quoted, all leading to the conclusion that although not restricted to calcareous rocks, it is on the whole a lime-favoring (kalkholde) species.

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1 *Dryopteris fragrans* (L.) Schott, ein für Europa neuer Farn. Reino Kalliola, Ann. Bot. Soc. Zool.-Bot. Fennicae Vanamo, 9: No. 4, 56 pp. 1937. German with Finnish summary.

2 In Fedde, Report. Spec. Nov. 9: 394. 1911, under *Nephrodium;* Flora URSS., XXX, 1: 38, 1934, under *Dryopteris.*

3 Rhodora 25: 1. 1923.

On July 24, 1935, this fern was found for the first time in Europe, in the Kevo Canyon, Utsjoki Province, Finland, lat. 69° 41′ north, long. 26° 59′ east. One might suppose that in so remote a place the fern would be safe against molestation, yet an interesting sidelight on the way modern civilized man behaves even in that country is furnished by Fig. 2, which represents "The rock wall of the Kevo Canyon, taken at a point similar to and not far from the station of the *Dryopteris fragrans*. Representation of the actual spot is undesirable, from the standpoint of nature-protection." The rock is an amphibolite containing enough lime to satisfy plants which require it, but also supporting a good many acid soil species, as shown by lists of associated mosses and vascular plants given. Several of these are likewise rare and disjunct species, the locality being thus a typical relict one.

From a consideration of the distributional relations, Kalliola concludes that the ancestral home of *Dryopteris fragrans* was in the mountains of eastern Asia. From there it spread into all north-polar lands before the Glacial Period, and being able to withstand extreme cold, it probably survived close to the margins of ice sheets. Its present distribution is rather unusual, and is studied in relation to climatic zones. It proves to occur chiefly north of the 30° isoamplitude line—that is, the line connecting points showing this temperature range between the warmest and coldest months. Locally it goes south to the 25° line, or in Japan slightly below this. The Finnish occurrence is believed to have arisen from the chance blowing of a spore from the Ural Mountains, about 1300 km. away, in early post-glacial time.

Among "popular" fern books, Professor Clute's probably hold the record for longevity. "Our Ferns in their Haunts," published in 1901, has been kept constantly in print ever since. "Fern Allies," dating from 1905, is

still current, after a recent reprinting. No doubt one reason, at least, for their long life lies in the author's skill in putting scientific fact into a form palatable to the layman. These books are not merely devices for naming specimens; they can be read, and with enjoyment.

The span of existence of "Our Ferns" is now extended by what, though its title is somewhat different, is in effect a second edition.[4] The new book is better printed than the old, but in other respects follows it closely. It has the same abundance of information, descriptive, historical, ecological, medical and mythological, clearly and interestingly set forth. It keeps Mr. Stilson's landscapes, perhaps a bit old-fashioned now, but still pleasant to look upon, and his excellent illustrations of detail, given a new clearness and contrast by the use of coated paper and supplemented by some new ones by another hand, not always so good. The illustrated key to genera, the check-list of ferns of northeastern North America,[5] the introductory matter on life history and diagnostic characters —in short, all the features of the previous book have been retained. All have been extensively and thoroughly rewritten. We have an old friend, matured by the passing years and better dressed.

The American Fern Society gets due mention in the introduction, along with the *Fern Bulletin* and the *American Botanist;* but the FERN JOURNAL seems to have been overlooked.

More attention than before is paid to varieties and forms. A goodly number receive at least incidental mention, in a properly subordinate position. Unfortunately,

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4 Clute, Willard Nelson. Our Ferns, their Haunts, Habits and Folklore. Frederick A. Stokes Co., New York. 1938. xi, 388 pp., numerous ill., 8 colored. $4.

5 The new check-list adopts the unusual and at first confusing system of placing synonyms before the accepted name.

the accompanying descriptions are not always either definite or accurate; in one case, that of *Woodsia Cathcartiana*, the original diagnosis is exactly reversed. A real effort has been made at once to keep the Latin nomenclature conservative and to bring it into accord with the now universally accepted rules. Considering Prof. Clute's past impatience with the niceties of nomenclatural practice, this effort has been surprisingly and commendably successful. It is necessary to warn the unwary against only a very few falls from grace. *Botrychium obliquum*, for instance, is made to include the two earlier names *B. dissectum* and *B. multifidum* (the latter, however, probably by inadvertence), in direct contravention of the rules. More serious, from a technical point of view, is the casual manner in which numerous new combinations[6] are tossed off in the text without any indication that they are new and frequently without any reference to the names on which they are founded. The effect of this nomenclatural misdemeanor seems to have been foreseen by Prof. Clute himself. He writes, in his section on nomenclature, "The trouble comes when the taxonomist changes the plant from one category to another, thus making new combinations to vex the student." He changes categories; and the present reviewer is vexed!

For all that, we like the book; we wish it a long and successful career.—C. A. WEATHERBY.

The pages of the AMERICAN FERN JOURNAL do not often present reviews of best selling fiction, and this note will hardly constitute an adequate review. However, in Vaughn Wilkins' "And so Victoria," (Macmillan, 1937) the following passage occurs:

"Across the stream a young oak tree bowed five dull

[6] I have counted 32 so far; each time I look in the book I find one or two more.

silver shafts over the current. Brown leaves lingered on it, and tiny bright ivy climbed it.

"Its neighbor was undermined by water, and had become the prey of life more vigorous than its own. There was a vivid moss about its base; ivy climbed upward to the hole from which sprouted the ribbons of hart's tongue fern—upward to the boughs and twigs clothed in the sad green of lichen."

The description is not exactly clear to this reviewer, but perhaps that is due to his ignorance of the English scene. But certainly the suggestion of parasitism by "vivid moss" is a biological nullity. However, the hart's tongue fern is sometimes described as almost ubiquitous in the moist English climate, and perhaps a hollow in a partly rotted stump may be as appropriate there as it is occasionally here for *Dryopteris marginalis*.

As an unrelated addendum it may be recorded that a plant of hart's tongue raised from spores which were probably of English origin has survived the past two winters in a Brooklyn backyard garden. It may also be added that a later generation of sporeling plants from the same source are available at the Brooklyn Botanic Garden, and may be obtained, as previously, for the cost of packing and shipping, estimated at about 25 cents a plant.—R. C. B.

Alston, A. H. G. The Selaginellae of the Malay Islands. II. Sumatra. Bulletin du Jardin Botanique de Buitenzorg. Ser. III. **14**: Juin, 1937.

Selaginellaceae. Mitt. Institut Allg. Botanik, Hamburg **7**: Pt. 4. 1937.

In these two papers, Dr. Alston continues his reports regarding the genus Selaginella. Twenty-five species are recorded from Sumatra as compared with twenty-two for Java, and forty-three for the Philippine Islands. In all, twenty-nine species are discussed in this paper, a few

being included from other Malay islands outside of Sumatra. Six of the species are noted as known only from Sumatra; the others are mostly wide-ranging in the Malayan region generally.

The second paper reports on a collection made in Borneo by H. Winkler. In this preliminary report, fourteen species are listed.

Pteridophyta of St. Kitts. Jour. Bot. Sept. 1937.

Coming much nearer is this report on the ecological conditions of the West Indian island of St. Kitts with special reference to the ferns. Ninety-eight different species are listed, with one new species-name, due to the recognition of a distinction between an American *Dryopteris* and an Old World species with which it has usually been associated. Dr. Alston's moderation in recognizing new species is again attested in all three papers; not one new species is described. For the St. Kitts paper, most of the identifications were made by Dr. W. R. Maxon.

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## Shorter Notes

HARDY FERNS AT THE INTERNATIONAL FLOWER SHOW.—In the most favored localities of the northeastern states it is possible in a day's ramble to find as many as forty different species of ferns, but rarely more than this number. Twenty-five or thirty species is a good count in the less favored districts.

The visitors to the recent International Flower Show in New York City were able to see nearly twice the average number. Mr. and Mrs. Edward D. Thurston of Sharon, Connecticut, were responsible for getting together and forcing into good natural growth a list of sixty-one different fern species. It is remarkable not only to see so large a number, but also more remarkable that they were

able to bring so many species into such a good state of development.

In connection with the exhibit, the Millbrook Garden Club had printed a list of the ferns exhibited with the following concluding paragraph:

"All the native ferns in this collection from the largest to the smallest may be grown from spores by simple methods which are possible for everyone to follow. An unlimited number of these lovely species may then be established in suitable places on the rocks or in the woods and open spaces of your private grounds or in the protected areas of our State Parks. Let us urge you, then, in the interest of conservation as well as for your own pleasure to grow ferns."

Later we hope to have some account written by Mr. and Mrs. Thurston of the methods used to bring these native species into good development. We hope also that their suggestion that many undertake the raising of ferns from spores may be widely followed.—R. C. BENEDICT.

SUPPOSED OCCURRENCE OF EQUISETUM TELMATEIA IN MICHIGAN.—In his "Ferns and Fern Allies of the Keweenaw Peninsula, Michigan" (AMER. FERN JOURN. **27**: 11-20. 1937), O. A. Farwell again includes *Equisetum telmateia* Ehrh. as a member of the Michigan flora. I have never seen a specimen from east of the Sierra Nevada of the Pacific states in any herbarium, although I have studied the material in most of the large herbaria and many smaller ones in the United States and also made a complete study of the Equiseta in some of the largest herbaria in Europe. Since the Keweenaw peninsula is about 1,500 miles east of the known distribution of this species in America, it would present a very interesting geographical problem if the plant is really there. Mr. Farwell should study the station again or indicate its

*(Photograph by Studios of Ed. Herbert, Inc., New York)*

HARDY FERNS AT THE INTERNATIONAL FLOWER SHOW.

exact location that others might visit it. I was in the Keweenaw peninsula the past summer but saw nothing of such a plant. In the absence of definite data it would be best, until the matter is definitely cleared up, to assume that an accidental interchange of original, temporary labels might have been made.—JOHN H. SCHAFFNER, *The Ohio State University.*

DRYOPTERIS GOLDIANA × MARGINALIS.—I wish to report the occurrence of the hybrid fern *Dryopteris Goldiana* × *Dryopteris marginalis* in Indiana and Pennsylvania. In Indiana the plant was collected by the author on a rich, damp, rocky bluff of White River just north of the Martin County State Forest, Martin County, August 20, 1935, no. *2,015* and July 4, 1937, no. *3,219.* The specimen from Pennsylvania, in the Herbarium of the University of Wisconsin, was collected by John Bright "in deciduous woods on a mountain slope, Ohiopyle, Fayette County, September 6, 1931, no. *5,914.*"

The general aspect of the plant is different from either of the parents. The sori are borne midway between the midvein and the margin; the sori of *Dryopteris marginalis* are borne on the margin and those of *Dryopteris Goldiana* are near the midvein. The pinnules are crenulate, pinnatifid or deeply pinnatifid, usually more deeply cut than in typical *Dryopteris Goldiana,* never as deeply cut as in *Dryopteris marginalis.* The basal pinnae are usually wider at the middle than at the base as in *Dryopteris Goldiana* but they may be wider or almost as wide at the base as in *Dryopteris marginalis.* The scales on the lower part of the stipe are dark brown with a light brown margin, typical of *Dryopteris Goldiana.*—R. M. TRYON, JR., *Chicago, Illinois.*

# American Fern Society

## Report of the President for 1937

This year has been one of continued progress. We are now wholly out of debt, and thanks to gifts from a member who prefers to remain anonymous we have been able to order offset-process reprints of several early numbers of the JOURNAL of which our stock was exhausted, so that we shall now be able to fill a considerable number of orders for complete sets. However, in view of our modest surplus income, it has been deemed wise to postpone the printing of the 25-year index for another year.

The JOURNAL has been kept down to a total of 144 pages for volume 27, but in view of the fact that a rather considerable amount of manuscript is awaiting publication, its size will be definitely increased next year, to about 160 pages. Discussions of the ferns of two states not heretofore represented in regional fern lists—New Hampshire and Colorado—are soon to appear. Similar treatments covering other states will be welcome, as will also brief non-technical articles from any and all of our members.

As has been the case for several years past, the number of members lost by death or resignation has been exceeded by that of new members, so that the Society is slowly increasing in size; yet the fact that the sales of two recent "popular" but rather inaccurate books on eastern native species have mounted into the thousands shows that there must be many people interested in ferns who have not joined us. Feeling that this might be due to the existence of this Society not being widely enough known, an experiment has been tried. A pocket-size Guide to Eastern Ferns has been compiled and published, in an edition of 2000 copies, and is being sold at cost. In it half a page is devoted to a statement of the work of the American Fern Society, and everyone interested in ferns is invited

to join. Data as to what percentage of the users of this book apply for membership will be awaited with interest.

Respectfully submitted,

EDGAR T. WHERRY, *President.*

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# Report of the Treasurer for 1937

*Receipts*

| | *Amount* | *Sub-Totals* | *Total* |
|---|---|---|---|
| Cash on hand January 1, 1937 | | | $ 317.51 |
| Postage Stamps | | | 10.17 |
| 1936 Membership Arrears | $ 21.45 | | |
| 1936 Subscription Arrears | 1.25 | $ 22.70 | |
| 1937 Membership Renewals | 395.95 | | |
| 1937 New Members (21) | 31.50 | 427.45 | |
| 1937 Subscription Renewals | 74.29 | | |
| 1937 New Subscribers | 20.29 | 94.58 | |
| 1938 Membership Renewals | 16.00 | | |
| 1938 New Members | 7.50 | 23.50 | |
| 1938 Subscription Renewals | 30.36 | | |
| 1938 New Subscribers | 3.11 | 33.47 | |
| Sale of back numbers A. F. J. | 49.02 | 49.02 | |
| Sale of Hart's Tongue Fern | 1.00 | 1.00 | |
| Gifts | 221.67 | 221.67 | |
| Reprints—Accounts Receivable | 4.17 | 4.17 | |
| Mrs. Eva M. Bissell Bequest | 500.00 | 500.00 | 1,377.56 |
| | | | $1,705.24 |

*Disbursements*

| | | |
|---|---|---|
| Science Press | | |
| A. F. J., Vol. 26, No. 4 | 126.93 | |
| A. F. J., Vol. 27, No. 1 | 116.53 | |
| A. F. J., Vol. 27, No. 2 | 104.17 | |
| A. F. J., Vol. 27, No. 3 | 106.70 | 454.33 |
| Reprints | 25.41 | 25.41 |
| Kirby Lithograph Co. | | |
| Reprints Vol. 1 and Vol. 3 | 184.85 | 184.85 |
| Notes Payable (final payment) | 200.00 | 200.00 |

| | | | |
|---|---|---|---|
| Purchase of back numbers A. F. J. | | | |
| Brooklyn Botanic Garden | 3.00 | | |
| Mr. G. Schmidt | 27.46 | 30.46 | |
| Trade Discount | 2.84 | 2.84 | |
| Agency Commission | 8.05 | 8.05 | |
| Bank Charges | .52 | .52 | |
| Transfer—Mrs. Bissell Bequest from B'klyn Trust Co. to Greenpoint Savings Bank | 500.00 | 500.00 | |
| Expenses—President | 4.50 | 4.50 | |
| Treasurer | 23.12 | 23.12 | |
| Secretary | 21.00 | 21.00 | 1,455.08 |
| Cash on hand December 31, 1937 | | | $ 250.16 |

During the past year the resources of the Fern Society have been increased by a bequest of $500.00 from the estate of Mrs. Eva M. Bissell, for the use of the herbarium. The money received from this bequest has been deposited in the Greenpoint Savings Bank in Brooklyn, provision having been made that no funds shall be drawn from the account except with the signature of both the president and the treasurer of the Society. The Society has received $221.64 in contributions during the past year. Of this amount $8.14 was given by two members for cost of illustrations; $13.50 was a gift (in two instalments) by a member who wishes to remain anonymous; a sum of $200.00 was given by another member (anonymous), who previously made a loan of $500.00 to the society, tiding it over during the dark days of 1934, when the present treasurer assumed office. The thanks of the Fern Society are especially due to this member, who did much to make our continuation possible. We are now entirely free from any debt.

The treasurer makes an apology for the poor condition of the wrapper enclosing Mr. Weatherby's "Varieties and Forms of the Ferns of Eastern North America," sent out to the members of the Society. The extent to which the

paper of these old envelopes had deteriorated was not realized at the time of mailing. These reprints (including cost of mailing) represent a donation from one of our members.

Respectfully submitted,

HENRY K. SVENSON, *Treasurer.*

## Report of the Auditors

On March 12, 1938, Miss Hester M. Rusk and I examined the books of the American Fern Society and checked the treasurer's financial statement for December 31, 1937. We found the accounts complete and the financial statement accurate.—THOMAS S. CONSTANTINE, *Chairman, Auditing Committee.*

## Report of the Curator

During the past two years specimens contributed by the members listed have been mounted and incorporated in the Society's Herbarium, as follows:

| | | | |
|---|---|---|---|
| C. L. Gruber, | sheets | numbered | 4760–4814 |
| M. A. Marshall, | " | " | 4815–5057 |
| C. A. Weatherby, | " | " | 5058–5087 |
| Mrs. Chas. Y. Tanger, | " | " | 5088–5109 |
| U. S. Nat'l Museum, | " | " | 5110–5283 |
| Philip Dowell, | " | " | 5284–5396 |
| Fred W. Gray, | " | " | 5397–5428 |
| Ira Wiggins (?), | " | " | 5429–5473 |
| F. J. Scully, | " | " | 5474–5487 |
| H. E. Ransier, | " | " | 5488–5524 |
| Philip Dowell, | " | " | 5525–5615 |

Our Herbarium thus now includes 5615 mounted sheets. Unmounted material still on hand will add about 100 sheets more. A ream of mounting paper donated to the herbarium by Dr. Wherry has been largely used up.

As stated in a former report several sheets of Equisetaceae and Lycopodiaceae were damaged by water dripping from a leaky pipe. Duplicate specimens of any species in these two genera are needed to replace those damaged. Either mounted or unmounted specimens will be gladly received from any member who has them to spare.

For several years past, occasional requests for the loan of specimens have gone unanswered because unaccompanied by postage. Postage bills on correspondence, etc., amounting to several dollars each year were gladly carried by the Curator as his donation to the Society, until the late depression and the present recession cut his income to such an extent that he was compelled to "cease and desist" from this practice. If members who want to use material for comparison and study will include postage with their initial request, specimens will be sent with a reasonable degree of promptness.—L. S. HOPKINS, *Curator.*

NOTE CONCERNING LOANS OF SPECIMENS TO MEMBERS. —During the period when our former Treasurer failed in carrying out his obligations to the Society, loans and donations from individual members enabled us to carry on. For several years Curator Hopkins has generously donated not only his services, but also the cost of extensive correspondence in connection with loans of specimens to members. Now that the Society has recovered financially, however, an allotment is being made in our budget to cover all such expenses. Members who are making a study of any group of ferns, and wish to borrow such specimens of that group as we may have in our herbarium, are cordially invited to do so. We merely request that postage be paid both ways, that the specimens be kept in a safe place, so that they do not become damaged, and that they be returned within a reasonable time.—EDGAR T. WHERRY, *President.*

We regret to announce the death on January 20th of Dr. John K. Small of the New York Botanical Garden, at the age of 68. Although he never became affiliated with the American Fern Society, he wrote a number of articles and books on ferns, including Ferns of Florida (1931), and Ferns of the vicinity of New York (1935). During his last illness, when his heart was so weak that he was confined to bed, he kept at work on two additional fern books, correcting the final proofs of Ferns of the Southeastern States, which will be published soon, and finishing the manuscript of a companion volume to cover the ferns of the south-central United States.

## New members:

Bostock, Mrs. H. S., 15 West Main St., Madison, Wisconsin.
Darling, Thomas, 328 North 16th St., Allentown, Pa.
Demaree, Dr. Delzie, A. & M. College, Monticello, Arkansas.
Earle, Dr. T. T., University of Minnesota, Minneapolis, Minn.
Flowers, Seville, University of Utah, Salt Lake City, Utah.
Ford, Oren T., 2516 Sixth Ave., Sacramento, Cal.
Gibson, Kasson S., 417 Cumberland Ave., Chevy Chase, Md.
Greenfield, Sydney S., 325 Ocean Ave., Brooklyn, N. Y.
Greenlee, Miss Leslie, 861 Anaconda Ave., Charleston, West Virginia.
Hallenbeck, Esly, 14 Washington Road, Scotia, N. Y.
Stoddard, Mrs. Ralph, 156–26 Oak Ave., Flushing, Long Island, N. Y.

## Changes of address:

Gruber, C. L., 31 East Main St., Fleetwood, Pa.
Knobloch, Irving W., Mojarachic, via San Juan, Chihuahua, Mexico.
Ruggles, Mrs. F. G., 69 Arsdale Terrace, East Orange, N. J.
Trudell, H. W., 303 Highland Ave., Abington, Pa.
Yang, Mrs. M. S., Ingtai, Foochow, China.

Vol. 28 July-September, 1938 No. 3

# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY



## CONTENTS



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# The American Fern Society

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## American Fern Journal

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An illustrated quarterly devoted to the general study of ferns.

Subscription, $1.25 per year, foreign, 10 cents extra; sent free to members of the AMERICAN FERN SOCIETY (annual dues, $1.50; life membership, $25.00). Extracted reprints, if ordered in advance, will be furnished authors at cost. They should be ordered when proof is returned.

Volume I, six numbers, $2.00; other volumes $1.25 each. Single back numbers 35 cents each. Vol. I, No. 1; vol. III, nos. 2, 3 and 4; and vol. IV, no. 1, cannot be supplied except with complete volumes. Ten per cent. discount to members and institutions on orders of six volumes or more.

Matter for publication should be addressed to C. A. WEATHERBY, at 27 Raymond St., Cambridge, Mass.

Orders for back numbers and other business communications should be addressed to the Treasurer of the Society.

### LIBRARIAN

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### CURATOR OF THE HERBARIUM

L. S. HOPKINS ..... Culver-Stockton College, Canton, Mo.

A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.

# American Fern Journal

VOL. 28 JULY–SEPTEMBER, 1938 NO. 3

## The Phenomenon of Forking in Ferns

R. M. TRYON, JR.

For several years I have been interested in forked ferns and have collected over three hundred specimens, representing twenty-eight species. Most of these have been collected in Indiana. In this article I will give a simple explanation of forking: its cause, production and result. I am indebted to Mr. C. A. Weatherby and Mr. R. C. Benedict for their help in the preparation of this paper.

Although the cause of forking is primarily a problem for the cytologist and geneticist, certain facts may be garnered from gross observation that throw some light on the problem.

Sometimes a plant will bear forked fronds year after year with the type of forking essentially the same in successive years. An example of this is *Pellaea atropurpurea* var. *cristata* Trelease. This variety growing at Eureka, St. Louis county, Missouri, has produced the same kind of forked fronds for years. Another example is a plant of *Polystichum acrostichoides* (Michx.) Schott which I found in La Porte county, Indiana (Fig. 1). This is an extreme form with all of the pinnae forked and the tip of the frond forked many times. The fronds of 1936 show exactly the same kind of forking as those of 1935. Dr. E. G. Logue has germinated spores from a forked plant of *Dryopteris Goldiana* (Hooker) Gray and grown the young plants. He says that the young plants show

[Volume 28, No. 2 of the JOURNAL, pages 41–80, plates 5–8, was issued June 18, 1938.]

the same type of forking as the parent. In these cases the cause of forking was undoubtedly genetic but it remains for the cytologist to determine its exact nature. Perhaps, as Bower suggests, hybridization was the cause: "A crested state may be, like apospory and apogamy, in some way the expression of an incompatibility of chromosome-number in synaptic pairing, consequent on the promiscuous hybridization which is always possible in Ferns."[1]

The largest proportion of forking is of the ephemeral type, present one year and absent the next. Most of the plants will bear only one or two forked segments. This type of forking does not seem to be related to fundamental genetic changes. Rarely somatic genetic changes may result in a forked frond but they are rare and cannot be considered as the cause of the bulk of ephemeral forking. The only explanation is environmental change. Of course, if environmental change is to produce forking, the genetic background must be favorable. Perhaps only certain rare gene-complexes can be influenced by environmental change so as to produce forking. Along a roadside where the trees had been cut for a right-of-way I found several plants of *Dryopteris cristata* (L.) Gray with forked fronds. In such a case environmental change is obvious but in most cases of forking the plant occurs in an undisturbed habitat. Even if an environmental change can be observed, there is nothing to indicate that one certain factor, such as an excess of sunlight, caused the forking. The cause of forking in these cases is entirely speculative.

Forking may be progressive evolution or retrogressive evolution, that is, reversion. In his studies of varieties of *Nephrolepis exaltata*, Benedict cites var. *Baeri* as an example of progressive evolution. He says: "From *splen-*

[1] F. O. Bower, *The Ferns*, Vol. I, p. 333.

*dida* there has come a new bud sport apparently progressive in cresting to a further degree, the variety *Baeri*. . . .''[2] *Baeri* is a distinct and stable form. Speaking of *Baeri* and other crested forms he says: ''Is it not probable that such cresting is caused by some similar cytological modification in each case; that cresting is a unit character?''[3] In our native ferns crested forms that are stable may be examples of progressive evolution.

However, I believe that ephemeral forking in our native ferns is not progressive evolution but rather reversion. There are three lines of evidence that lead to this conclusion: phylogeny and recapitulation, stability of the forking and the relation of the place of forking to the stability of the frond.

A study of phylogeny and recapitulation shows that the primitive type of leaf-construction was based on equal dichotomy (Fig. 2). The leaf-construction of our native ferns is based on sympodial dichotomy which evolved from equal dichotomy. Therefore, when a fern that develops in this manner exhibits equal dichotomy of the frond or any segment, it is held that it has reverted to the primitive type.

Ephemeral forking cannot be related to progressive evolution which would necessarily produce stable forking.

In my specimens I find the following relationship between the forked segments and the position of the fork on the segment: of 808 forked segments, 678 are forked at the tip, 109 in the middle and 21 at the base. Of the 678 segments forked at the tip 600 are pinnae and 78 are fronds. Of the 109 segments forked in the middle, 91 are pinnae and 18 are fronds. Of the 21 segments forked at the base 16 are pinnae and 5 are fronds. The seg-

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[2] Benedict, *New Bud Sports in Nephrolepis*, Genetics, 8: 87 (1928).

[3] *Ibid.*

ments are forked most frequently at the tip and pinnae are forked much more often than fronds. In the typical frond there is a gradation of stability from the bases of the frond, pinnae and other segments to their tips, with the smallest veins often showing equal dichotomy. It is logical to assume that reversion would take place most frequently in the least stable parts of the frond and least frequently in the most stable parts of the frond. The coincidence of the data with the stability of the frond indicates that ephemeral forking is a type of reversion.

Usually a forked frond shows complete reversion, that is it has reverted to equal dichotomy and both shanks of the fork will be approximately the same size (Figs. 3 and 4). Occasionally, one will find a forked frond that is not dichotomously forked, that is, one shank of the fork will be much larger than the other (Figs. 5 and 6). In this case the reversion is incomplete, the smaller shank not being developed enough to result in equal dichotomy. Sometimes a frond may revert to the primitive type many times and in this case a multiple forked frond results (Fig. 1).

Forking takes on many forms and is exceedingly variable. As a rule only a few of the fronds on a plant are forked, sometimes only one is forked and rarely all of them are forked. A single frond may bear a single forked pinnule or all of the pinnae may be forked. Often all of the forked fronds on a plant will be forked in the same place but sometimes one will be forked at the tip of the frond and the others will be forked on the pinnae. A pinnula, pinnule, pinna or frond may be forked and any or all of these may occur on the same frond. A segment may be forked once or many times. In my specimens of multiple forks I find that pinnae are not forked as many times as frond-tips. The most I find a pinna forked is four times while some frond-tips are forked up to twenty times.


Forking in Ferns

Fig. 7

Fig. 8

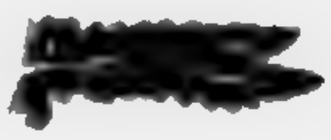

Fig. 9

Fig. 10

Fig. 11

Fig. 12a

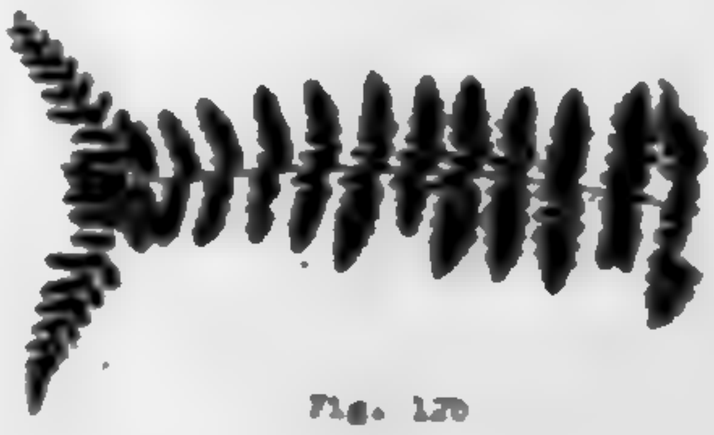

Fig. 12b

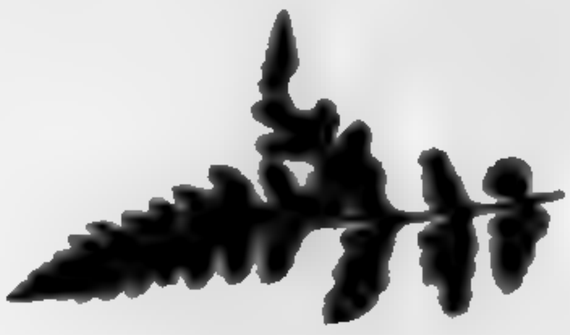

Fig. 13

Fig. 15

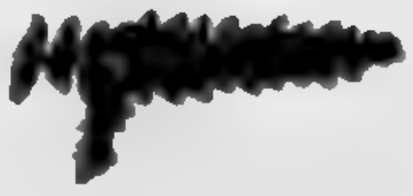

Fig. 14

Fig. 16

FORKING IN FERNS

In my specimens of forked pinnae I find eight different types of simple forks: 1) a Y-shaped fork with the shanks straight and far apart (Fig. 7), 2) a Y-shaped fork with the shanks straight and close together (Fig. 9), 3) a Y-shaped fork with the shanks curving outward (Fig. 8), 4) a Y-shaped fork with the shanks curving inward (Fig. 10), 5) a Y-shaped fork with the shanks curving inward and crossing each other (Fig. 11), 6) a fork with the shanks widely spreading (Figs. 12a, 12b), 7) a fork with one shank parallel to the main axis and the other shank forming an acute angle with the main axis (Fig. 13) and 8) a fork with one shank parallel to the main axis and the other shank forming an obtuse angle with the main axis (Fig. 14). Of course, there are intergradations between these types. All of these types have been described from cases of complete reversion, if the reversion is incomplete one shank will be shorter than the other. The fork may be at any place on a pinna, at the base so that it appears as if there were two pinnae (Fig. 15) or at the very tip so that the tip is merely blunt and not apparently forked (Fig. 16).

Forked fronds and pinnules do not show as much variation, they are usually of the straight Y type (Fig. 7).

I find seven types of multiple forks: 1) a straight Y type with the segments remote from each other (Fig. 17), 2) the same type of fork as 1 with the segments more or less crowded (Fig. 18), 3) a fork with the segments crowded at the tip and crisped because of a superfluous amount of tissue (Fig. 19), 4) a fork with the segments curved (Fig. 20), 5) a double fork in which one shank of the second fork is parallel with the main axis and seems to be an extension of it (Fig. 22) and 6) the same type of fork as 5 with the parallel shank of the second fork forked again (Fig. 23). All of these are cases of complete reversion or a single incomplete reversion with many complete reversions.

Fig. 20

Fig. 24

Fig. 19

Fig. 23

Fig. 26

Fig. 18

Fig. 22

Fig. 25

Fig. 17

Fig. 21

Fig. 27a Fig. 27b Fig. 27c Fig. 27d Fig. 27e Fig. 27f Fig. 27g Fig. 27h Fig. 27i

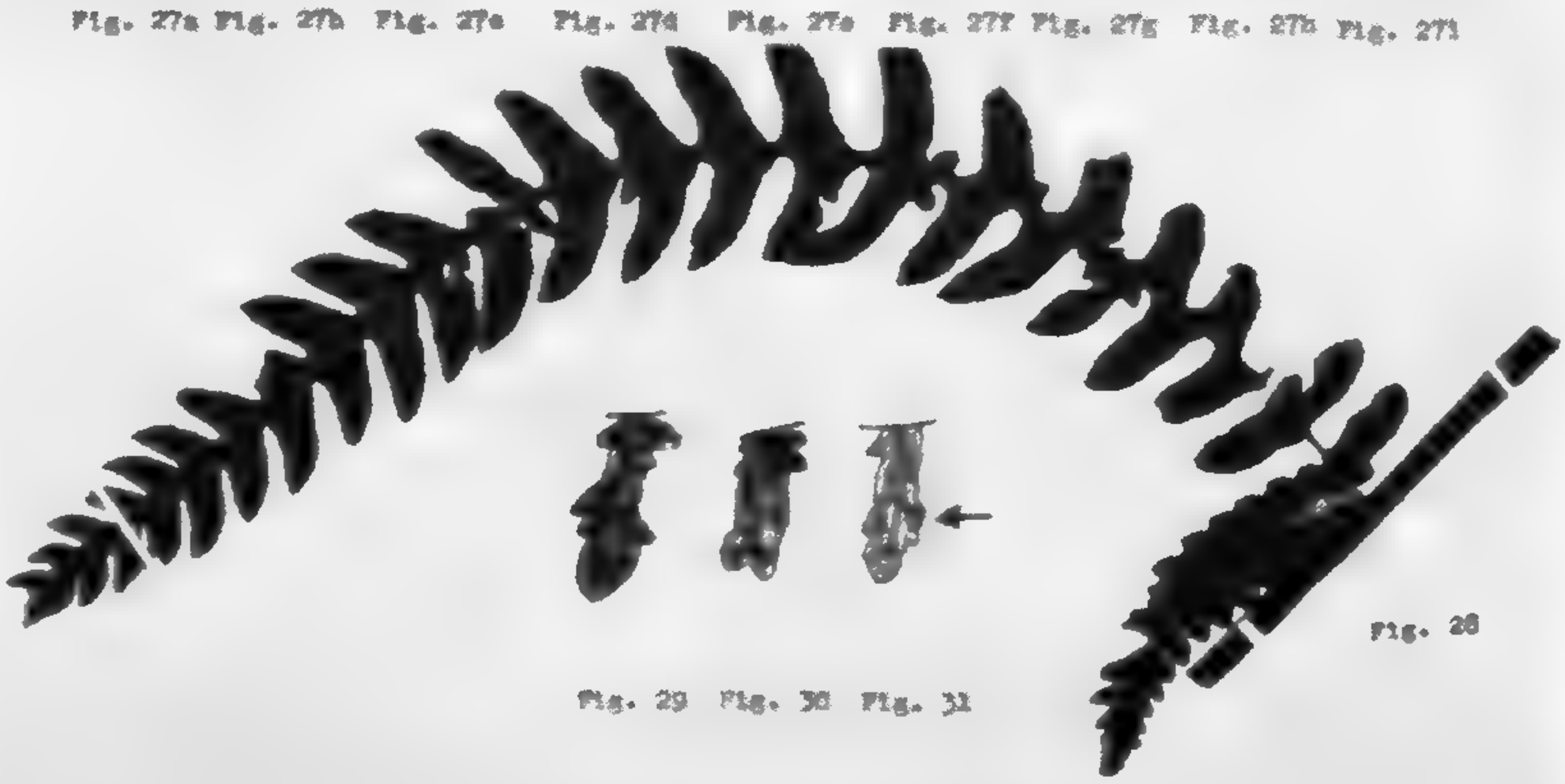

Fig. 28

Fig. 29 Fig. 30 Fig. 31

## Forking in Ferns

Sometimes one will find a case of multiple incomplete reversion. The most common cases of this type of forking are *Osmunda cinnamomea* f. *auriculata* (Hopkins) Kittredge and a form that may be referred to *Osmunda cinnamomea* f. *incisa* (Huntington) Gilbert. In the later form the pinnules are not strictly incised but rather are lobed, the lobes extending out from the pinnule and increasing its size. I have also found this type of forking in *Polystichum acrostichoides* (Michx.) Schott (Fig. 25) and *Dryopteris noveboracensis* (L.) Gray (Fig. 26) where it gives rise to "incisa" and "auriculata" forms.

These forms may be related to multiple incomplete reversion as follows: A sequence may be traced in *Osmunda cinnamomea* L. from a dichotomously forked pinnule showing complete reversion (Fig. 27a) to an unequally forked pinnule showing incomplete reversion (Fig. 27d). The incomplete reversion may be at the base of the pinnule and from this type of fork a regular sequence may be built up to a large "incised" pinnule (Fig. 28). Such pinnules at the bases of the pinnae of a frond constitute *Osmunda cinnamomea* f. *auriculata* (Hopkins) Kittredge, if smaller pinnules (Fig. 27i) are scattered along the pinnae of a frond the form would be referable to *Osmunda cinnamomea* f. *incisa* (Huntington) Gilbert. A similar sequence may be traced in *Polystichum acrostichoides* (Michx.) Schott (Figs. 21–25). Thus forking becomes the basis of a new type of leaf construction.

In *Osmunda cinnamomea* L. the incomplete reversions are usually at the base of the pinnule but they may be irregularly scattered above (Fig. 29). Sometimes a pinnule will show incomplete reversion below and complete reversion at the tip (Fig. 30) or a pinnula may show complete reversion (Fig. 31).

CHICAGO, ILL.

## EXPLANATION OF PLATES

Fig. 1—*Polystichum acrostichoides* (Michx.) Schott, Fig. 2—*Osmunda cinnamomea* L., Figs. 3, 4—*Dryopteris spinulosa* (Mueller) Kuntze, Fig. 5—*Dryopteris Thelypteris* var. *pubescens* (Lawson) Prince ex Weatherby, Fig. 6—*Dryopteris Boottii* (Tuckerman) Underwood, Fig. 7—*Onoclea sensibilis* L., Fig. 8—*Polystichum acrostichoides* (Michx.) Schott, Fig. 9—*Dryopteris Thelypteris* var. *pubescens* (Lawson) Prince ex Weatherby, Figs. 10, 11—*Polystichum acrostichoides* (Michx.) Schott, Fig. 12a—*Dryopteris Thelypteris* var. *pubescens* (Lawson) Prince ex Weatherby, Fig. 12b—*Dennstaedtia punctilobula* Moore, Fig. 13—*Dryopteris Boottii* (Tuckerman) Underwood, Fig. 14—*Dryopteris Thelypteris* var. *pubescens* (Lawson) Prince ex Weatherby, Fig. 15—*Osmunda cinnamomea* L., Fig. 16—*Osmunda regalis* var. *spectabilis* (Willd.) Gray, Figs. 17–25—*Polystichum acrostichoides* (Michx.) Schott, Fig. 26—*Dryopteris noveboracensis* (L.) Gray, Figs. 27–31—*Osmunda cinnamomea* L.

# A County Check-List of Florida Ferns and Fern Allies

DONOVAN S. CORRELL

(*Continued from page 54*)

### 14. LITOBROCHIA Presl. Giant-bracken

1. LITOBROCHIA TRIPARTITA (Sw.) Presl. Hammocks, swamps, and in dense thickets. Although not discovered in Florida until 1925, this Old World species is apparently well-established in dense swamps of the southern peninsula. Counties: Broward: *Correll* 6125 (D); Collier: *McFarlin* (H); Dade: *Meredith* (P); Highlands: *Buswell* (NY); Manatee: *Maxon* 10826 (N); Okeechobee: *Buswell* (M); Palm Beach: *Small, Mosier, and Matthaus* (NY).

### 15. LORINSERIA Presl. Chain-fern

1. LORINSERIA AREOLATA (L.) Presl. Swamps, marshes, and wet woods along streams. This chain-fern is widely distributed in northern Florida. It is found sparingly south of the lake region, probably reaching its southern limit in Highlands, Lee, Osceola, and Polk counties.

### 16. MENISCIUM Schreb.

1. MENISCIUM RETICULATUM (L.) Schk. Everglade hammocks and swamps. Counties: Dade: *Eaton* 779 (G).

2. MENISCIUM SERRATUM Cav. In pond-apple hammocks. Collection: "South shore of Lake Okeechobee": *Harshberger* (NY). Hendry or Palm Beach county.

### 17. NEPHROLEPIS Schott. Sword-ferns

1. NEPHROLEPIS BISERRATA (Sw.) Schott. In hammocks, often on trees. Counties: Broward: *Moldenke* 483 (D); Collier: *Small, E. and R. St. John* (NY); Dade: *Correll* 5987 (D); Highlands: *Correll* 6272 (D).

2. NEPHROLEPIS CORDIFOLIA (L.) Presl. On floors of low hammocks, sometimes epiphytic. Counties: Manatee: *Maxon* 10824 (N).

3. NEPHROLEPIS EXALTATA (L.) Schott. In hammocks, on trees or limestone rocks. Counties: Brevard: *MacElwee* (P); Broward: *Leeds* 343 (P); Collier: *Correll* 5961 (D); Dade: *Correll* 5987A (D); Highlands: *McFarlin* 9424 (H); Hillsborough: *Curtiss* 3764 (P); Lake: *Nash* 1288 (P); Lee: *Correll* 5919 (D); Manatee:

*Cuthbert* (F600); Marion: *Correll* 5778 (D); Orange: *Rapp* (P); Osceola: *Singeltary* 29 (D); Palm Beach: *Deam* 1667 (P); Pasco: *O'Neill* 1383 (C); Pinellas: *Williamson* (P); Polk: *Wherry* (P); Sarasota: *Smith* (P); Seminole: *Lambert* 18 (P); St. Lucie: *Leeds* 344 (P).

### 18. ONOCLEA L. Sensitive-ferns

1. ONOCLEA SENSIBILIS L. Low, moist woods, swamps, or in flood-plain regions. Counties: Leon: *Berg* (NY).

### 19. PALTONIUM Presl. Ribbon-ferns

1. PALTONIUM LANCEOLATUM (L.) Presl. In hammocks on tree-trunks. Counties: Dade: *Curtiss* (NY).

### 20. PELLAEA Link. Cliff-brakes

1. PELLAEA ATROPURPUREA (L.) Link. On rocky limestone ledges, exposed situations. Counties: Walton: *Biltmore Herbarium* 755a (N); Washington: *Wherry* (P).

### 21. PHLEBODIUM R. Br. Serpent-ferns

1. PHLEBODIUM AUREUM (L.) R. Br. Mostly on palmettos on edges of hammocks or in pinelands. Counties: Brevard: *Smith* (P); Broward: *Correll* 6135 (D); Collier: *Buswell* (M); Dade: *Small and Mosier* 6589 (D); Duval: *Rizer* (N); Glades: *Lovett* 235 (D); Hernando: *Jones* 6 (N); Highlands: *McFarlin* 9336 (H); Hillsborough: *Correll* 5867 (D); Lake: *Nash* 1500 (NY); Lee: *Correll* 5900 (D); Manatee: *Oosting* 164 (D); Orange: *Moldenke* 5382 (NY); Osceola: *Singeltary* 25 (D); Palm Beach: *Underwood* 2217 (NY); Pasco: *O'Neill* (C); Polk: *McFarlin* 3497 (H); Saint Johns: *Reynolds* (NY); Sarasota: *Scott* (D); Seminole: *Williamson* (P); Sumter: *Lewton* (NY); Volusia: *Fuller* (G).

### 22. PHYMATODES Presl. Vine-ferns

1. PHYMATODES HETEROPHYLLUM (L.) Small. On smooth-barked shrubs or trees in low hammocks. Counties: Collier: *Glück* (D); Dade: *Correll* 6021 (D); Monroe: *Small* 7474 (D); Palm Beach: *St. John* (F658).

### 23. PITYROGRAMMA Link

1. PITYROGRAMMA CALOMELANOS (L.) Link. Low, swampy woods along river. Counties: Polk: *Small, Knight, E. and R. St. John* (D).

### 24. POLYPODIUM L. Polypodys

1. POLYPODIUM PECTINATUM L. In hammocks, on rotting logs, stumps, rocks, or in humus. Counties: Citrus: *Correll* 5798 (D);

Collier: *Eaton* 1133 (G); Dade: *Eaton* (G); Hernando: *Small and Matthaus* 11617 (NY); Highlands: *Correll* 6174 (D); Hillsborough: *Curtiss* 3661 (NY); Lake: *Nash* 2264 (NY); Manatee: *Underwood* 2053 (NY); Marion: *Underwood* 1815 (NY); Martin: *Curtiss* 5861 (N); Monroe: *Small, Mosier, and Matthaus* 1901 (G); Orange: *Harper* 228 (NY); Pasco: *Underwood* 1932 (NY); Polk: *Smith* 179 (G); Putnam: *Correll* 6405 (D); Saint Johns: *Reynolds* (NY); Seminole: *Correll* 6374 (D); Sumter: *Lewton* (NY); Volusia: *Curtiss* 3661 (NY).

2. POLYPODIUM PHYMATODES L. In hammocks and swampy woods on logs, or at base of tree trunks. The writer observed a plant of this species growing in the Royal Palm Nursery at Oneco, in Manatee County, Florida. Mr. N. A. Reasoner, proprietor, told me that he had collected the plant at Cape Sable in Monroe County. Since this Old World species is commonly cultivated in Florida, it is rather unusual that it should first be discovered as an escape in such an isolated section of the state. A specimen of the plant is in the Duke Herbarium.

3. POLYPODIUM PLUMULA H. B. K. In hammocks, on trunks and branches of trees. Counties: Alachua: *West* (F675); Brevard: *Whitney* (G); Citrus: *Leeds* 347 (P); Dade: *Small, Cuthbert, Mosier, and DeWinkeler* 9179 (D); Hernando: *St. John* (F10599); Hillsborough: *Correll* 5868 (D); Lake: *Scott* (D); Marion: *Smith* (N); Martin: *Curtiss* 5861 (G); Monroe: *Pollard, Collins, and Morris* 203 (N); Orange: *Williamson* (P); Polk: *Buswell* (M); Saint Johns: *Reynolds* (G); Seminole: *Correll* 6358 (D); Sumter: *Smith* (G); Volusia: *Faxon* (P).

4. POLYPODIUM POLYPODIOIDES (L.) Watt. In hammocks or woods, on tree trunks and branches, or rotting stumps and logs. The Resurrection-fern is perhaps the most common and widely distributed of all the ferns in Florida. It has been collected in 33 counties, representing every section of the state.

### 25. POLYSTICHUM Roth. Christmas-ferns

1. POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Rich, moist, rocky, wooded slopes. Counties: Gadsden: *Small* (NY); Jackson: *R. St. John* (NY); Leon: *Small, E. and R. St. John* (NY); Liberty: *Correll and Kurz* 5685 (D); Walton: *Small and West* (F708); Washington: *Wherry* (P).

### 26. PTERIDIUM Scop. Bracken-ferns

1. PTERIDIUM CAUDATUM (L.) Maxon. In hammocks and open, dry pinelands. This species seems to be confined to the southern

part of the peninsula. It has been collected as far north as the lake region. In hammocks, it often assumes a vine-like habit and grows in a tangle over shrubs and small trees.

2. PTERIDIUM LATIUSCULUM (Desv.) Hieron. var. PSEUDOCAUDATUM (Clute) Maxon. Exposed, sandy soil, edge of hammocks and in open woods. It is the writer's opinion that the species ranges north of Florida and only the variety occurs within the state. It has been found as far south as the Lake Okeechobee region where its range overlaps that of *P. caudatum*. Those plants resembling the species are usually shade forms or juvenile specimens of the variety.

### 27. PTERIS L. Brake-ferns

1. PTERIS BAHAMENSIS Agardh (*Pycnodoria pinetorum* Small). In pinelands, lime-sinks, or rarely in hammocks. Counties: Broward: *Leeds* 339 (P); Dade: *Correll* 5996 (D); Monroe: *Correll* 6068 (D).

2. PTERIS CRETICA L. (*Pycnodoria cretica* (L.) Small). On rocks, in rocky soil in hammocks, or along river-bluffs. Counties: Alachua: *Correll* 5762 (D); Citrus: *Correll* 5820 (D); Columbia: *Correll* 6462 (D); Hernando: *St. John* (F755); Liberty: *Correll* 5679 (D); Marion: *Underwood* 1819 (NY).

2a. PTERIS CRETICA L. var. ALBOLINEATA Hook. Hammocks. Counties: Hernando: *R. St. John* (NY).

3. PTERIS MULTIFIDA Poir. (*Pycnodoria multifida* (Poir.) Small). Open limestone rocks, or on old stone walls. Counties: Citrus: *Small, E. and R. St. John* (NY); Saint Johns: *Knight* (NY).

4. PTERIS VITTATA L. (*Pycnodoria vittata* (L.) Small). In hammocks, or on old stone or brick walls. Judging from the collections made, this Old World species appears to be well-established in the flora of Florida. Counties: Alachua: *Cody* (NY); Broward: *Correll* 6142 (D); Collier: *Small, E. and R. St. John* (NY); Dade: *Correll* 6084 (D); Monroe: *Buswell* (M).

### 28. SPHENOMERIS Maxon

1. SPHENOMERIS CLAVATA (L.) Maxon. In lime-sinks, on limestone in pinelands, or rarely in hammocks. Counties: Dade: *Small and Mosier* 6612 (NY).

### 29. STENOCHLAENA J. E. Smith. Holly-ferns

1. STENOCHLAENA KUNZEANA (Presl) Underw. Lime-sinks in low hammocks. Counties: Dade: *Correll* 6088 (D).

2. STENOCHLAENA TENUIFOLIA (Desv.) Moore. Hammocks. Counties: Hillsborough: *Small, et al.* (NY).

30. TECTARIA Cav. Halberd-ferns

1. TECTARIA AMESIANA A. A. Eaton. Lime-sinks in low hammocks. Counties: Dade: *R. St. John* (NY).

2. TECTARIA CORIANDRIFOLIA (Sw.) Underw. Lime-sinks in low hammocks. Counties: Dade: *Eaton* 563 (NY).

3. TECTARIA HERACLEIFOLIA (Willd.) Underw. In lime-sinks and on limestone rocks in hammocks. Counties: Citrus: *Correll* 5816 (D); Dade: *Correll* 6034 (D); Hernando: *Smith* 31 (G).

4. TECTARIA MINIMA Underw. Lime-sinks and on limestone rocks in hammocks, or on the edge of hammocks. Counties: Citrus: *O'Neill* 5610 (C); Dade: *Correll* 6090 (D); Monroe: *Small* 8129 (P).

31. VITTARIA J. E. Smith. Shoestring-ferns

1. VITTARIA LINEATA (L.) J. E. Smith. Usually on the trunks of cabbage-palms (*Sabal palmetto*) or palmettos, in hammocks or pinelands. Counties: Brevard: *Reynolds* (D); Broward: *Correll* 6132 (D); Citrus: *St. John* (F834); Collier: *Correll* 5972 (D); Dade: *Correll* 5982 (D); Duval: *Vail* (NY); Hernando: *O'Neill* (C); Highlands: *Correll* 6176 (D); Hillsborough: *Harris* (N); Indian River: *Small* 8846 (NY); Lake: *Underwood* 1627 (NY); Lee: *Hitchcock* 544 (NY); Manatee: *Oosting* 166 (D); Marion: *Underwood* 291 (P); Monroe: *Small and Wilson* 1759 (NY); Orange: *Blanton* (G); Osceola: *Singeltary* 30 (D); Palm Beach: *Curtiss* 5551 (G); Pinellas: *Wilson* (NY); Polk: *McFarlin* 3505 (H); Saint Johns: *Reynolds* (NY); Seminole: *Glück* 8406 (D); Volusia: *Straub* 45 (G).

## ORDER 3. SALVINIALES

### FAMILY 1. MARSILEACEAE — Pepperwort Family

1. MARSILEA L. Water-clover

1. MARSILEA VESTITA Hook. & Grev. In ponds, ditches, or on moist soil. Counties: Dade: *Underwood* 66 (P); Lake: *Nash* (P).

### FAMILY 2. SALVINIACEAE — Salvinia Family

1. AZOLLA Lam. Water-ferns

1. AZOLLA CAROLINIANA Willd. Floating on still water of lakes, ponds, and on shores of streams. Counties: Alachua: *West* (F317); Citrus: *Correll* 5823 (D); Clay: *Canby* (G); Columbia: *Huger* (NY); Duval: *Curtiss* 6349 (NY); Franklin: *Chapman*

1585b (NY); Glades: *Leeds* 366 (P); Hernando: *O'Neill* 761 (D); Indian River: *Leeds* 365 (P); Jefferson: *Lighthipe* (NY); Lake: *Underwood* 1498 (NY); Lee: *Harshberger* (NY); Marion: *Smith* (N); Orange: *Rapp* (P); Osceola: *Singeltary* (D); Polk: *Correll* 6334 (D); Seminole: *Garber* (P); Sumter: *Smith* (N); Volusia: *Torrey* (NY).

### 2. SALVINIA Adans. Floating-moss

1. SALVINIA ROTUNDIFOLIA Willd. Floating on still or stagnant water of ponds, streams, or lakes. Counties: Dade: *Small, Mosier, E. and R. St. John* (NY); Seminole: *Correll* 6376 (D); Volusia: *Keeley* (P).

## ORDER 4. LYCOPODIALES

### FAMILY 1. PSILOTACEAE — Psilotum Family

#### 1. PSILOTUM R. Br.

1. PSILOTUM NUDUM (L.) Griseb. In hammocks and swamps, decayed places on base of tree trunks, or on rotting wood. Counties: Alachua: *Weber and West* (F10623); Brevard: *Fredholm* 6141 (G); Broward: *Correll* 6124 (D); Charlotte: *R. and E. St. John* (P); Collier: *Correll* 5957 (D); Dade: *Small* 7490 (NY); Duval: *Vail* (NY); Gulf: *Chapman* (NY); Highlands: *Correll and McFarlin* 6269 (D); Hillsborough: *Small and Matthaus* 11622 (NY); Lake: *Nash* 1543 (NY); Lee: *Standley* 30 (NY); Manatee: *Underwood* 2058a (NY); Monroe: *Wherry* (P); Orange: *Rapp* (P); Palm Beach: *Underwood* 2235 (NY); Polk: *McFarlin* 6394 (H); Saint Johns: *Reynolds* (N); Sarasota: *St. John* (F949); Seminole: *Rapp* (NY); Suwanee: *Arnold and West* (F1205); Volusia: *Reynolds* (N).

### FAMILY 2. LYCOPODIACEAE — Club-moss Family

#### 1. LYCOPODIUM L. Club-mosses

1. LYCOPODIUM ADPRESSUM (Chapm.) Lloyd and Underw. Moist, open, boggy soil, low prairies and pinelands. Counties: Alachua: *Arnold* (F860); Broward: *Small and Carter* 1173 (NY); Duval: *Curtiss* 3787 (NY); Franklin: *Chapman* (NY); Lake: *Underwood* 1926 (NY); Lee: *Standley* 353 (NY); Manatee: *Simpson* (N); Orange: *Rapp* (P); Osceola: *Singeltary* 9 (D); Palm Beach: *Underwood* 2227 (NY); Pasco: *O'Neill* 1594 (C); Pinellas: *Tracy* 6628 (NY); Polk: *McFarlin* 4049 (H); Putnam: *Correll* 6419 (D); Seminole: *Rapp* (F853); Walton: *Tracy* 8640 (N).

2. LYCOPODIUM ALOPECUROIDES L. Moist, open, boggy soil, and

low pinelands and prairies. Counties: Alachua: *O'Neill* (C); Baker: *Lighthipe* 730 (NY); Bay: *Billington* (N); Brevard: *Fredholm* 5969 (G); Clay: *Canby* (G); Columbia: *Huger* (NY); Duval: *Curtiss* 3788 (NY); Franklin: *Chapman* (NY); Gadsden: *Leeds* (P); Highlands: *Correll* 6202 (D); Hillsborough: *Blanton and O'Neill* 6929 (C); Jefferson: *Lighthipe* (B); Lake: *Nash* 1508 (NY); Leon: *O'Neill* (C); Manatee: *Tracy* 6626 (NY); Nassau: *O'Neill* 6027 (C); Orange: *Moldenke* 5377 (NY); Pasco: *O'Neill* 6112 (C); Pinellas: *Tracy* 6626 (NY); Polk: *McFarlin* 4049 (H); Putnam: *Correll* 6418 (D); Seminole: *Eaton 1042 in part* (G); Volusia: *Hulst* (B); Washington: *Price* (NY).

3. LYCOPODIUM CAROLINIANUM L. Moist, open, boggy soil, swamps, low prairies and pinelands. Counties: Baker: *Lighthipe* 729 (NY); Bay: *Correll* 8442 (D); Brevard: *Fredholm* 6048 (G); Calhoun: *West* (F895); Duval: *Curtiss* 5758 (NY); Franklin: *Chapman* (NY); Gadsden: *Leeds* 534 (P); Highlands: *McFarlin* 10286 (H); Lake: *Nash* 1451 (NY); Lee: *Standley* 12710 (N); Okaloosa: *Wherry* (P); Orange: *Lewton* (NY); Osceola: *Singeltary* 26 (D); Palm Beach: *Underwood* 2226 (NY); Pinellas: *Tracy* 6628 (NY); Polk: *McFarlin* 5814 (H); Putnam: *Correll* 6423 (D); Seminole: *Eaton 1042 in part* (G); Walton: *Correll* 8453 (D).

4. LYCOPODIUM CERNUUM L. Banks of streams, low hammocks, and boggy soil. Counties: Alachua: *Chapman* (NY); Duval: *Curtiss* 3790A (NY); Gadsden: *Leeds* 533 (P); Hernando: *Small, Knight, E. and R. St. John* (NY); Highlands: *Correll and McFarlin* 6276 (D); Hillsborough: *Small and Matthaus* 11620 (D); Lee: *Buswell* (M); Manatee: *Moldenke* 5923 (NY); Orange: *Franklin* (NY); Osceola: *Singeltary* 15 (D); Pinellas: *Miller and Reeves* (D); Polk: *McFarlin* 4124 (H); Seminole: *Rapp* (F899).

5. LYCOPODIUM DICHOTOMUM Jacq. In swamps on trees. Counties: Collier: *McFarlin and Mosier* 7357 (H).

6. LYCOPODIUM PROSTRATUM Harper. Moist, open, boggy soil, low pinelands and prairies. Counties: Bay: *Banker* 3618 (B); Duval: *Curtiss* 5358 (NY); Franklin: *Correll* 5647 (D); Hillsborough: *O'Neill* 6929 (D); Manatee: *Simpson* 131 (NY); Nassau: *Oosting* 238 (D); Putnam: *Correll* 6418A (D); Volusia: *Hulst* (B); Walton: *Correll* 8454 (D).

## FAMILY 3. SELAGINELLACEAE — Spike-moss Family

### 1. SELAGINELLA Beauv. Spike-mosses

1. SELAGINELLA ACANTHONOTA Underw. Dry, sandy soil in pinelands and scrub. Counties: Dade: *Moldenke* 882 (NY); Gadsden:

*Curtiss* (N); Highlands: *Correll and McFarlin* 6234 (D); Lake: *Harper* 16 (G); Manatee: *Tracy* 7554 (G); Osceola: *Harper* 10 (N); Polk: *McFarlin* 4068 (H).

2. SELAGINELLA APODA (L.) Fernald. In wet soil along streams, ditches, and in swamps, meadows, and wet woods. Counties: Alachua: *West, Small, and Arnold* (NY); Gadsden: *Bush* 233 (N); Jefferson: *Lighthipe* (B); Leon: *Palmer* 38480 (NY); Liberty: *Correll* 5675 (D); Polk: *Correll* 6288 (D).

3. SELAGINELLA ARENICOLA Underw. Dry, sandy soil in pinelands and scrub. Counties: Dade: *Eaton* (G); Gadsden: *Curtiss* (N); Hernando: *Baker* 5 (N); Highlands: *McFarlin* 9374 (NY); Lake: *Underwood* 1255 (NY); Manatee: *Combs* (N); Orange: *Palmer* 38316 (N); Polk: *McFarlin* 4064 (H); Putnam: *Harper* (NY); Seminole: *Rapp* (G).

4. SELAGINELLA EATONI Hieron. In moist soil of lime-sinks, in hammocks. Counties: Dade: *Small and Carter* 1149 (NY); Monroe: *Small and Carter* 3229 (NY).

5. SELAGINELLA FLORIDANA Maxon. Dry, sandy soil in pinelands and scrub. Counties: Dade: *Eaton* (G); Lake: *Nash* 1449 (NY); Manatee: *Tracy* 7554 (NY); Orange: *Rapp* (N); Osceola: *Harper* 10 (NY); Pinellas: *Reeves* (D); Polk: *Baker* 3 (N); Volusia: *Baker* 6 (N).

6. SELAGINELLA FUNIFORMIS Van Eseltine. Open, dry, sandy soil of sand-dunes and scrub. Counties: Broward: *Small and Wilson* 1752 (NY); Collier: *Standley* 52533 (N); Dade: *Moldenke* 882 (D); Franklin: *Biltmore Herbarium* 3432b (NY); Highlands: *Correll* 6169 (D); Lake: *Harper* 16 (NY); Martin: *Brown* C (N); Orange: *Rapp* (NY); Pinellas: *Huger* (NY); Polk: *Baker* (NY); Putnam: *Hasbrouck* (N); Sarasota: *Small and Matthaus* 11627 (NY).

7. SELAGINELLA LUDOVICIANA A. Br. In moist soil about swamps and in low pinelands. Counties: Gadsden: *Chapman* (G); Jackson: *Palmer* (G); Leon: *Nash* 2527 (NY); Liberty: *Oosting* 103 (D); Polk: *Smith* (N).

## ORDER 5. ISOETALES

### FAMILY 1. ISOETACEAE — Quillwort Family

#### 1. ISOETES L. Quillworts

1. ISOETES ALATA Small. In wet soil around ponds, along sluggish streams, and in swamps. Counties: Sumter: *Curtiss* 6696 (B).

2. ISOETES CHAPMANII (Engelm.) Small. Limestone ledges, along rivers and streams. Counties: Jackson: *Chapman* (NY).

3. ISOETES FLACCIDA Shuttlw. Muddy situations in marshes, hammocks, and along sluggish streams. Counties: Brevard: *Curtiss* 3813 (B); Dade: *Small and Carter* 1209 (NY); Franklin: *Chapman* (N); Jefferson: *Eaton* 222 (G); Leon: *Harper* 22 (NY); Levy: *Harper* 68 (NY); Manatee: *Garber* 32 (NY); Polk: *Smith* (N); Volusia: *Curtiss* 3813 (N); Wakulla: *Harper* 13 (NY).

## ORDER 6. EQUISETALES

### FAMILY 1. EQUISETACEAE Horsetail Family

### 1. EQUISETUM L. Horsetails

1. EQUISETUM PREALTUM Raf. Along wet, sandy stream banks, Counties: Liberty: *Kurz* 5 (NY).

## EXCLUDED SPECIES

*Trichomanes Boschianum* Sturm and *Ceratopteris deltoidea* Benedict have been reported from Florida. However, since they were not observed in any of the collections studied, they have been excluded from this check-list.

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DEPARTMENT OF BOTANY,
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# The Ferns and Fern Allies of Kentucky

THOS. N. MCCOY

(*Continued from page 46*)

## FAMILY HYMENOPHYLLACEAE

1. TRICHOMANES BOSCHIANUM Sturm (Filmy Fern). Rare. In situations free from direct sun-rays and bathed by water from wet rocks. Edmonson, Lawrence, and Rockcastle counties.

## FAMILY POLYPODIACEAE

2. POLYPODIUM VIRGINIANUM Linnaeus (Common Polypody). *Polypodium vulgare* of authors, not Linnaeus. Common. On sandstone. One instance growing on a tree some forty feet from the ground. Bath, Bell, Boyd, Carter, Christian, Edmonson, Elliott, Floyd, Greenup, Laurel, Madison, McCreary, Morgan, Powell, Rowan, Warren, and Whitley counties.
3. POLYPODIUM POLYPODIOIDES (Linnaeus) Watt (Resurrection Fern). Common. Sandstone and trunks of trees. Boyd, Calloway, Christian, Edmonson, Greenup, Marshall, Oldham, Pulaski, Rowan, Spencer, Warren, and Whitley counties.
4. ADIANTUM PEDATUM Linnaeus (Maidenhair Fern). Common. Moist shade, rich leaf mold. Anderson, Bath, Bell, Boyd, Breathitt, Calloway, Carter, Edmonson, Elliott, Graves, Greenup, Harlan, Jessamine, Laurel, Madison, McCreary, Morgan, Powell, Pulaski, Rowan, and Whitley counties.
5. ADIANTUM CAPILLUS-VENERIS Linnaeus (Southern Maidenhair). Rare. Dripping limestone. One specimen in Gray Herbarium labelled, "Aug. 1899—Carter Caves, Ky,—(G. G. Jr.)"? One specimen found in Boyd County, but the only known station at present is in Pulaski County.

6. PTERIDIUM LATIUSCULUM (Desvaux) Hieron. (Bracken). *Pteris aquilina* of many American authors. Common. Very scrubby in the mountains, but vigorous in fertile soil, especially in the Purchase Region. Bell, Boyd, Calloway, Christian, Edmonson, Lincoln, Madison, McCreary, Morgan, Powell, Rowan, Whitley, and Wolfe counties.
7. CHEILANTHES LANOSA (Michaux) Watt (Hairy Lipfern). Not common. A rock dweller, Calloway, Edmonson, and Warren counties.
8. PELLAEA ATROPURPUREA (Linnaeus) Link. (Purple Cliffbrake). Common. Limestone cliffs. Anderson, Boyd, Carter, Edmonson, Fayette, Floyd, Garrard, Jessamine, Madison, Mercer, Pulaski, Rockcastle, Rowan, and Warren counties.
9. PELLAEA GLABELLA Mettenius. Not common. Limestone cliffs. Carter, Madison, McCreary, Jessamine, and Pulaski counties.
10. ASPLENIUM PINNATIFIDUM Nuttall (Lobed Spleenwort). Common. Sandstone cliffs and boulders. Bell, Boyd, Calloway, Carter, Edmonson, Elliott, Floyd, Greenup, Madison, McCreary, Morgan, Powell, Rowan, Rockcastle, Warren, and Whitley counties.
11. ASPLENIUM KENTUCKIENSE McCoy. Rare. Sandstone cliffs and boulders. Boyd, Calloway, and Rowan counties.
12. ASPLENIUM TRUDELLI Wherry (Trudell's Spleenwort). Rare. On sandstone cliffs and boulders with *A. pinnatifidum* and *A. montanum*. Elliott, McCreary, Rowan, and Whitley counties.
13. ASPLENIUM TRICHOMANES Linnaeus (Maidenhair Spleenwort). Common. Deep shade in the spray of waterfalls, or more commonly lying on wet moss on sandstone. Bell, Boyd, Calloway, Carter, Edmonson,

Elliott, Fayette, Greenup, Harlan, Powell, Rockcastle, Rowan, Warren, and Wolfe counties.

14. ASPLENIUM PLATYNEURON (Linnaeus) Oakes (Ebony Spleenwort). Very common. Everywhere; rocks, rocky soil, and open thicket. Bell, Boyd, Calloway, Campbell, Carter, Christian, Edmonson, Elliott, Fayette, Floyd, Garrard, Grayson, Greenup, Harlan, Jessamine, Laurel, Lincoln, McCreary, Muhlenberg, Pulaski, Rockcastle, Rowan, and Warren counties.
15. ASPLENIUM PLATYNEURON f. SERRATUM (E. S. Miller) Hoffmann. *Asplenium platyneuron* var. *serratum* (E. S. Miller) BSP. Common. With the species. Bell, Boyd, Elliott, Greenup, Rowan, and Whitley counties.
16. ASPLENIUM RESILIENS Kunze (Blackstem Spleenwort). *Asplenium parvulum* Martens and Galeotti. Not common. On limestone. Barren, Bell, Boyd, Edmonson, Fayette, Garrard, Jessamine, Powell, Pulaski, and Rowan counties.
17. ASPLENIUM BRADLEYI D. C. Eaton (Bradley's Spleenwort). Rare. Sandstone cliffs. Bell, Carter, Edmonson, Estill, Powell, Rowan and Whitley counties.
18. ASPLENIUM MONTANUM Willdenow (Mountain Spleenwort). Not common. Sandstone cliffs and boulders. Makes more vigorous growth in moist shade. Bell, Edmonson, Elliott, Harlan, McCreary, Menifee, Morgan, Rockcastle, Rowan, and Whitley counties.
19. ASPLENIUM CRYPTOLEPIS Fernald (American Wallrue). *Asplenium Ruta-muraria* of American authors; not Linnaeus. Not common. Limestone cliffs. Carter, Garrard, Jessamine, Mercer, Powell, Pulaski, Rockcastle, and Rowan counties.
20. ATHYRIUM PYCNOCARPON (Sprengel) Tidestrom (Narrowleaf-Athyrium). *Athyrium angustifolium*

(Michaux) Milde. Common. Rich woods; shaded seeps. Anderson, Bell, Boyd, Bourbon, Carter, Edmonson, Elliott, Fayette, Greenup, Harlan, Nelson, Pulaski, and Rowan counties.

21. ATHYRIUM THELYPTEROIDES (Michaux) Desvaux (Silvery Athyrium). *Athyrium acrostichoides* (Swartz) Diels. *Asplenium acrostichoides* Swartz. Common. Swampy places. Boyd, Carter, Elliott, Greenup, Harlan, Hopkins, Morgan, Powell, and Rowan counties.

22. ATHYRIUM ASPLENIOIDES (Michaux) Desvaux (Lady Fern). *Athyrium Filix-femina* American authors in part. *Asplenium Filix-femina* American authors in part. Common. Rich woods. Bell, Campbell, Calloway, Carter, Edmonson, Lincoln, Kenton, McCreary, Powell, Rowan, and Whitley counties.

23. ATHYRIUM ANGUSTUM (Willdenow) Presl, var. RUBELLUM (Gilbert) Butters. Common. Rich woods. Bath, Boyd, Elliott, Fulton, McCreary, Morgan, Powell, Rowan, and Whitley counties.

24. ATHYRIUM ANGUSTUM var. ELATIUS (Link) Butters. Not common. Rich woods; sometimes with sedges and grasses. Bell and Lincoln counties.

25. CAMPTOSORUS RHIZOPHYLLUS (Linnaeus) Link (Walking Fern). Common. Rockloving; limestone and sandstone. Bath, Bell, Boyd, Calloway, Carter, Edmonson, Fayette, Garrard, Harlan, Hopkins, Jessamine, McCreary, Powell, Pulaski, Rowan, and Whitley counties.

26. POLYSTICHUM ACROSTICHOIDES (Michaux) Schott (Christmas Fern). Very common. Everywhere. Bath, Bell, Boyd, Carter, Calloway, Christian, Edmonson, Elliott, Floyd, Graves, Garrard, Greenup, Harlan, Jessamine, Laurel, Lincoln, Madison, Marshall, Morgan, McCreary, Pulaski, Rowan, Powell, Warren, and Whitley counties.

27. POLYSTICHUM ACROSTICHOIDES f. INCISUM (Gray) Gilbert. *Polystichum acrostichoides* var. *Schweinitzii* (Beck) Small. Occasionally found with the species. Carter, Elliott, Morgan, and Rowan counties.
28. DRYOPTERIS HEXAGONOPTERA (Michaux) C. Christensen (Beech Fern). *Phegopteris hexagonoptera* (Michaux) Fée. *Thelypteris hexagonoptera* (Michaux) Weatherby. Common. Rich woods. Bath, Bell, Boyd, Calloway, Carter, Edmonson, Elliott, Fulton, Green, Greenup, Graves, Harlan, Laurel, Lincoln, Marshall, McCreary, Morgan, Powell, Rowan, Whitley, and Wolfe counties.
29. DRYOPTERIS NOVEBORACENSIS (Linnaeus) A. Gray (New York Shield Fern). *Aspidium noveboracense* (Linnaeus) Swartz. *Thelypteris noveboracensis* (Linnaeus) Nieuwland. Common. Rich woods; near streams of water. Bell, Boyd, Calloway, Carter, Edmonson, Elliott, Harlan, Kenton, Laurel, Lincoln, McCreary, Morgan, Muhlenberg, Powell, Rowan, and Whitley counties.
30. DRYOPTERIS MARGINALIS (Linnaeus) Gray (Marginal Shield Fern). *Aspidium marginale* (Linnaeus) Swartz. *Thelypteris marginalis* (Linnaeus) Nieuwland. Common. Fertile rocky soil; rocks in moist shady places. Bell, Boyd, Carter, Edmonson, Elliott, Fayette, Franklin, Garrard, Jessamine, Laurel, McCreary, Morgan, Powell, Pulaski, Rowan, and Whitley counties.
31. DRYOPTERIS MARGINALIS f. TRIPINNATIFIDA (Clute) Weatherby. Not common. Found with the species. Elliott county.
32. DRYOPTERIS GOLDIANA (Hooker) A. Gray (Goldie's Shield Fern). *Aspidium Goldianum* Hooker. *Thelypteris Goldiana* (Hooker) Nieuwland. Rare. Moist sandstone; shady woods. Boyd, Harlan, and Kenton counties.

33. DRYOPTERIS THELYPTERIS (Linnaeus) A. Gray (Marsh Fern). *Aspidium Thelypteris* (Linnaeus) Swartz. *Thelypteris palustris* (Salisbury) Schott var. *pubescens* (Lawson) Fernald. Rare. Marshes with sedges and grass. Rowan and Carter counties.

34. DRYOPTERIS SPINULOSA (O. F. Mueller) Kuntze (Spiny-toothed Shield Fern). *Aspidium spinulosum* (O. F. Mueller) Swartz. *Thelypteris spinulosa* (O. F. Mueller) Nieuwland. Rare. Fertile sandy humus soil in woods where there is plenty of shade and moisture. Jefferson and Greenup counties.

35. DRYOPTERIS SPINULOSA var. INTERMEDIA (Muhlenberg) Underwood (Spinulose Shield Fern). *Aspidium spinulosum* var. *intermedium* (Muhlenberg) D. C. Eaton. *Thelypteris spinulosa* var. *intermedia* (Muhlenberg) Nieuwland. Common. Fertile sandy humus soil where there is plenty of shade and moisture. Carter, Bell, Edmonson, Elliott, Greenup, McCreary, Powell, and Whitley counties.

36. CYSTOPTERIS BULBIFERA (Linnaeus) Bernhardi (Bulblet Fern). Common on limestone cliffs and ledges, but rarely found elsewhere. Carter, Edmonson, Fayette, Garrard, Jessamine, Powell, Pulaski, Rowan, and Warren counties.

37. CYSTOPTERIS FRAGILIS (Linnaeus) Bernhardi var. PROTRUSA Weatherby (Fragile Fern). Common. Rocky mountainous woods; open pasture thickets. Bell, Boyd, Carter, Campbell, Edmonson, Elliott, Greenup, Hardin, Harlan, Graves, Powell, Rowan, Warren and Woodford counties.

38. CYSTOPTERIS FRAGILIS var. MACKAYII Lawson. Not common. Seems to prefer rocks more than var. *protrusa*. Edmonson, Elliott, and Greenup counties.

39. WOODSIA OBTUSA (Sprengel) Torrey (Common Woodsia). Common. General. Anderson, Bell, Boyd,

Calloway, Carter, Christian, Edmonson, Floyd, Harlan, Jessamine, Marshall, Rockcastle, Rowan, and Warren counties.

40. DENNSTAEDTIA PUNCTILOBULA (Michaux) Moore (Hay-Scented Fern). *Dicksonia punctilobula* (Michaux) Gray. Common. Local; sandstone cliffs and ledges; open shale banks along the roadside. Bath, Bell, Carter, Edmonson, Harlan, Lincoln, McCreary, Monroe, Morgan, Powell, and Rowan counties.

41. ONOCLEA SENSIBILIS Linnaeus (Sensitive Fern). Common. Wet meadows; edge of ponds and ditches along the roadside. Bell, Boyd, Calloway, Edmonson, Elliott, Fulton, Greenup, Laurel, McCreary, Powell, Pulaski, Rowan, and Whitley counties.

42. WOODWARDIA AREOLATA (Linnaeus) Moore. This species was first reported from Kentucky (Laurel County) by Prof. E. Lucy Braun in American Midland Naturalist **18**: 363–366, May, 1937. Shortly afterward, in this JOURNAL **27**: 97, July, 1937, Judge G. K. Holbert reported it from Hardin County. I am indebted to him for herbarium specimens and a living plant. None of his material was fruiting, and I took it at first for *Onoclea sensibilis,* but further examination of material and manuals (Gray's and Bloomquist's) revealed a distinct difference in the sterile fronds. The pinnae of *Onoclea sensibilis* are more or less lobed and not serrate, while the pinnae of *Woodwardia areolata* are not lobed and are finely serrate, and have more anastomosing veins. The fruiting frond is reduced to small bean-like bodies enclosing the sporangia.

"In wet sour soil in deep woods and seepy drains. Found near Moonshine Cliff and New Summit, Hardin Co." Laurel Co.

## FAMILY SCHIZAEACEAE

43. LYGODIUM PALMATUM (Bernhardi) Swartz (Climbing Fern). Not common. Shady thickets. Bell, Carter, Laurel, McCreary, Powell, and Whitley counties.

## FAMILY OSMUNDACEAE

44. OSMUNDA REGALIS var. SPECTABILIS (Willdenow) Gray (Royal Fern). *Osmunda regalis* of American authors in part. Common. Boggy ground; cracks of wet rocks. Bell, Calloway, Carter, Edmonson, Elliott, Jefferson, McCreary, Powell, and Whitley counties.
45. OSMUNDA CLAYTONIANA Linnaeus (Interrupted Fern). Not common. Rich woods; open thickets. Boyd, Morgan, and Rowan counties.
46. OSMUNDA CINNAMOMEA Linnaeus (Cinnamon Fern). Common. Boggy ground; moist rocky woods. Bell, Boyd, Carter, Edmonson, Harlan, McCreary, Morgan, Rowan, and Wolfe counties.

## FAMILY OPHIOGLOSSACEAE

47. OPHIOGLOSSUM VULGATUM Linnaeus (Adder's Tongue). Rare. Rich woods. Barren County. The other specimens collected by the early botanist give the location as "Spots among the Barrens" and "Bank of Lick Creek and Kentucky River."
48. OPHIOGLOSSUM ENGELMANNI Prantl. Rare. Limestone. Rockcastle and Boone counties. (Barren, Warren, and Logan counties according to E. J. Palmer, AM. FERN JOUR. **22**: 43–47.)
49. BOTRYCHIUM DISSECTUM Sprengel. *Botrychium obliquum* var. *dissectum* (Sprengel) Clute. Rare. Boone County. Collected by Short, Sept. 17, 1830. One specimen in Missouri Botanical Garden collected by Sadie Price (no date), Richpond, Ky.
50. BOTRYCHIUM OBLIQUUM Muhlenberg. *Botrychium*

*dissectum* var. *obliquum* (Muhlenberg) Clute. Not common. Open moist thickets; creek bottoms. Bell, Boyd, Harlan, Kenton, and Whitley counties.

51. BOTRYCHIUM OBLIQUUM var. TENUIFOLIUM (Underwood) Gilbert. Not common. Growing with the species. Bell, Boyd, and Lawrence counties.

52. BOTRYCHIUM VIRGINIANUM (Linnaeus) Swartz (Rattlesnake Fern). Common. Rich woods. Anderson, Bell, Boyd, Calloway, Carter, Christian, Edmonson, Fayette, Graves, Greenup, Harlan, Jessamine, Marshall, Morgan, Powell and Rowan counties.

## FAMILY MARSILEACEAE

53. MARSILEA QUADRIFOLIA Linnaeus (Water Clover). Rare. Rooted in mud around the edge of a pond. Fayette County.

## FAMILY EQUISETACEAE

54. EQUISETUM ARVENSE Linnaeus (Field Horsetail). Common. Wet banks. Carter, Fayette, Greenup, Muhlenberg, Powell, Rowan, and Whitley counties.

55. EQUISETUM PREALTUM Rafinesque (Tall Scouring Rush). *Equisetum robustum* A. Braun. *Equisetum hyemale* var. *affine* (Engelmann) A. A. Eaton. *Equisetum hyemale* var. *robustum* (A. Braun) A. A. Eaton. Not common. Cinders along railroads; sandy creek banks. Bath, Carter, Jessamine, Powell, and Rowan counties.

## FAMILY LYCOPODIACEAE

56. LYCOPODIUM SELAGO Linnaeus var. PATENS (Beauvois) Desvaux. *Lycopodium lucidulum* var. *porophilum* (Lloyd & Underwood) Clute. Not common. Sandstone cliffs. Boyd, Carter, Laurel, Rowan, and Warren counties.

57. LYCOPODIUM LUCIDULUM Michaux (Shining Club-moss). Not common. Deep humus in moist shady situations around sandstone cliffs. Bell, Elliott, Jackson, McCreary, and Whitley counties.
58. LYCOPODIUM OBSCURUM Linnaeus var. DENDROIDEUM (Michaux) D. C. Eaton (Ground Pine). Not common. Sandy humus soil around sandstone cliffs. Boyle, Elliott, McCreary, Powell, Rowan, and Whitley counties.
59. LYCOPODIUM COMPLANATUM Linnaeus var. FLABELLIFORME Fernald (Running Cedar). Rare. One specimen reported from the state. Collected by R. M. Hamilton, Ezel, Morgan County, Jan. 27, 1923.
60. LYCOPODIUM TRISTACHYUM Pursh (Northern Running Cedar). Not common. Thickets on top of mountains. Bell, Laurel, McCreary, Powell, Rowan, and Whitley counties.
61. LYCOPODIUM TRISTACHYUM var. SHARONENSE Blake. Rare. Growing with the species. Powell County.

## FAMILY SELAGINELLACEAE

62. SELAGINELLA APODA (Linnaeus) Fernald. *Selaginella apus* Spring. Not common. Wet sandstone; boggy ground. Bell, Elliott, Laurel, McCreary, Muhlenberg, Powell, and Rowan counties.

CATLETTSBURG, KY.

# On Polystichum aleuticum C. Chr., a New North American Species

CARL CHRISTENSEN

The occurrence in North America of a new *Polystichum* totally different from all other species hitherto found there is surprising, and a few remarks about it will certainly be of interest to the readers of this JOURNAL. It was found in the island of Atka, one of the Aleutian Islands, in 1932 by a member of a Swedish expedition to Alaska and the Islands. The leader of the expedition, Mr. Eric Hultén, well known for his great work on the flora of Kamtschatka and now curator of the Botanical Museum at Lund, Sweden, placed the whole collection of Pteridophytes made in the Aleutians in my hands for determination. Besides several common temperate or subarctic species the collection contained a few tufts of a *Polystichum*, which I at once regarded as a new and very interesting novelty. I described it as *P. aleuticum* and my description with photograph was recently published by Mr. Hultén together with other new species from the islands.[1]

The remarks after the description are written by me, and I show there that the species is totally different from all American species but very closely related to several forms from West China, *e.g.*, *P. sinense* Christ, *P. shensiense* Christ, *P. moupinense* (Franch.) Bedd. and others, some of which very well may be regarded as forms or varieties of the Himalayan *P. Prescottianum* (Wall.) Moore. The specimens from Atka resemble closely some smaller forms of these species, perhaps best agreeing with some Chinese ones hitherto referred to *P. lachenense* (Hook.) Bedd. I found them, however, distinctly differ-

[1] Eric Hultén: New or notable species from Alaska. Svensk Bot. Tidskrift 30: 515–528. 1936.

ent "in their peculiar eroso-dentate, greenish, flat indusia and the castaneous, thick stipes of older leaves, very similar to those of *Asplenium Trichomanes* or *A. castaneum.*" This is certainly correct, but nevertheless the validity of the species may be doubted.

Two years after my description of *P. aleuticum* was written, I had for determination a collection from the high mountains of West China and in the course of this work I found that the Chinese specimens of *P. lachenense* do not agree very well with Hooker's original description and plate of the type from Himalaya.[2] He says: "The fronds, and consequently the stipites are very densely tufted, and though most of the fronds seem unable to bear the severity of the winter's cold or the long covering of snow, the stipites remain, stout, black, glossy, and withered at the points. It wants the wiry habit of *Asplenium Trichomanes*, otherwise the general size and form of the pinnules are not much unlike those of a form of that species." These words are as if written after the Atka specimens except that the stipes of these are not black and glossy but rather dull castaneous. Further Hooker described the fronds as coriaceous, but Clarke as "scarcely coriaceous"; those of *P. aleuticum* are herbaceous but rather firm; finally Hooker illustrated the scales as dentate, while those of our species are entire, pale straw-colored, the stipes in age naked. After this the differences between the Himalayan and the Aleutian fern seem to be very insignificant, and I am therefore now inclined to consider *P. aleuticum* a form or a variety of *P. lachenense.*

Whether a valid species or not, the occurrence of this fern in Atka is remarkable. Fomin[3] mentions no species of this group as East-Siberian and the locality is thus a very remote and isolated one. The case is however not

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[2] Hooker: Sp. Fil. vol. IV, p. 8, pl. 212.

[3] Fomin: Flora Sibiriae et Orientis Extremi. Vol. V. 1930.

unique, for Hultén describes in the same paper a *Saxifraga aleutica,* the nearest relative of which is Himalayan.

COPENHAGEN

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## Recent Fern Literature

SOME MISUNDERSTANDINGS ABOUT TEXAS FERNS.—In July, 1937, the Texas Agricultural Experiment Station issued a bulletin on the flora of the state[1] in which 2½ pages are devoted to a list of Pteridophyta. This list contains such an unusual number of misprints and apparent misidentifications that comment on it seems desirable. Students of the reversal of sex in plants by radiation will be struck by the success of brain waves in making *Athyrium asplenioides* a "Malefern" (p. 10). *Selaginella arizonica* has become *S. "arenicola"* (a Floridian species) and *S. sheldoni* appears as *S. "Sherwoodii"* (a name given, though not by Maxon, to an Appalachian plant).

About 10 species of Appalachian or more northern range are listed, and although it is true that we do not know all the details of distribution of such species, their occurrence in Texas seems highly improbable,—*Dryopteris intermedia* and *Selaginella rupestris,* for example, both rare even as far southwest as Missouri.

Interestingly enough, evidence that misidentification has actually occurred is furnished by two other publications which appeared shortly afterward. In one dealing with valuable plants[2] we find (p. 4) this valuable item "*Polypodium virginianum* L. The Licorice Fern of southeastern United States. This peculiar fern . . .

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[1] Catalogue of the Flora of Texas, by V. L. Cory and H. B. Parks. Agr. Expt. Sta. Bull. 550. 1937. 130 pages.

[2] Valuable Plants Native to Texas, by H. B. Parks. id. Bull. 551. 1937. 173 pages.

grows commonly on the bark of leaning trees. . . .'' Clearly, then, the report in the state list of *Polypodium virginianum* (not known south of the higher Ozarks) is based on misidentification of *P. polypodioides.* Incidentally, no one who has ever tasted its rootstock would class it as a licorice fern. In the same bulletin we learn that the *Asplenium*s (actually *A. platyneuron, A. resiliens* and *A. trichomanes*) are valuable because they are ''Resurrection Ferns.''

On page 25 of the third publication[3] the plant lists are indicated to have been compiled by amateurs. The description of the Big Thicket area shows that its soils are dominantly sandy and the photographs represent vegetation of the warm Coastal Plain type, Cypress and Palmetto being prominent. This makes it clear that the record of *Athyrium thelypteroides* from this part of Texas (also in the State list) represents nothing but *A. asplenioides;* and that of *Lycopodium lucidulum* represents sterile *L. alopecuroides.* What could have been mistaken for the limestone cliff species, *Cheilanthes alabamensis, Pellaea atropurpurea,* and *Selaginella wrightii,* among cypress-swamp ferns is not so clear, but then of course these species occur in western Texas and so belong in the state list if not in the Big Thicket one.

It may be questioned whether publication of unchecked lists of this sort do not do more harm than good to the study of plant geography, because once a record is printed, enthusiastic but uncritical compilers are sure to copy it from one publication to another. Then, when some careful worker leaves it out of a geographic paper, he gets accused of overlooking a record which he had actually discarded, for good reason. That facts of real scientific

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[3] Biological Survey of the East Texas Big Thicket Area, by Parks, Cory and others. Private Publication, 51 pages. (1936) 1937.

interest may be obscured is illustrated by one further item in the State list: *Lygodium palmatum.* This fern is not known to grow west of central Tennessee, hundreds of miles from the Texas border. On the other hand, *Lygodium mexicanum* is already known to extend from central Mexico to the Rio Grande, while *L. japonicum*, after escaping from gardens, has spread widely over the Gulf states. The ascertaining of which of these it is that has reached eastern Texas would be a matter of real plant-geographic interest; but to list it as the northeastern *L. palmatum* will result merely in misleading earnest but inexperienced compilers of range data or maps.—E. T. W.

In a list of the Pteridophyta of Horry County, South Carolina, which has just been published[1] several unfortunate slips occur. This county, it should be noted, lies on the coast at the eastern tip of the state, and offers no rock or ravine habitats for upland ferns. We are therefore, unable to accept the reports of *Polypodium virginianum* (as *P. vulgare*), *Polystichum Lonchitis*, and *Dennstaedtia* (as *Dicksonia*) *punctilobula.* They evidently represent misidentifications of three ferns which are common in the county but are not listed, respectively *Woodwardia areolata*, *Polystichum acrostichoides*, and *Athyrium asplenioides.* Compilers of plant-geographic maps should not include unchecked lists of this sort.—E. T. W.

Careless identification of pteridophytes is, moreover, not confined to the south. In a brief note in a popular journal[1] a writer recently gave a faithful description of the features and habitat of *Lycopodium annotinum* in northern Pennsylvania, and then proceeded to guess that "it is

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[1] The Vascular Plants of Horry County, South Carolina, by S. A. Ives and X. A. Smith. Furman Bulletin, Greenville, South Carolina, **20**(9): 25. April, 1938.

[1] Lycopodium porophilum. Amer. Botanist, **44**: 67. April, 1938.

likely the rare variety *porophilum.*" The appearance of such records in print is most unfortunate, because nothing can be done to stop their reappearance in one compilation after another ever after. For the benefit of students of the distribution of ferns who earnestly desire to have their data correct it may be pointed out here that *Lycopodium selago* var. *patens*, the so-called *L. porophilum*, is as yet known in Pennsylvania only in Pike County.—E. T. W.

Two works of quite different scope, but both important for the classification of ferns, have recently appeared—Clausen's Monograph of the *Ophioglossaceae* and Christensen's summary of the families and genera of true ferns in Verdoorn's Manual of Pteridology.

Clausen's work—the first first general treatment of the family since Prantl's fifty years ago—is a sane and clear-headed study of an exceptionally difficult group. The author has had to confess failure in the original object of his effort—to find more fundamental and reliable characters for the delimitation of species than had hitherto been used. Such characters have not appeared; worse, those of venation and spores adduced by Prantl have proved not to hold; and Dr. Clausen has, like most of his predecessors, been forced to fall back on leaf-form, pubescence, size, and habit as working criteria. He has found, also, that the *Ophioglossaceae*, generally regarded as the oldest of surviving ferns, do not fall readily into the geographic divisions valid for most vascular plants, but tend to show the very wide and often broken ranges more characteristic of lower orders, such as mosses and fungi. This is less noticeable in the presumably oldest genus, *Botrychium*, and more so in the presumably youngest, *Ophioglossum*, which seems to have had time to spread over most of the earth, but not to develop local variants.

Under these circumstances, Dr. Clausen has wisely

steered a highly conservative course. *Ophioderma* and *Cheiroglossa,* segregated by many authors, remain as subgenera of *Ophioglossum.* Out of 52 recognized species, only two are new and those from remote parts of South America and Africa, whence novelties might be expected. Many previously proposed species are reduced to subspecies[1] or varieties, or rejected altogether. Thus, *Botrychium silaifolium, B. Coulteri* and *B. californicum* become subspecies of *B. multifidum* and *B. onondagense* and *B. minganense* varieties of *B. Lunaria. Ophioglossum tenerum* is reduced to varietal rank under *O. nudicaule* and *O. californicum* to a subspecies of *O. lusitanicum,* both species originally described from the Old World and both, by these additions, expanded to a nearly world-wide range. Butters's varieties of *B. virginianum,* Graves's of *B. obliquum,* and E. P. St. John's *O. floridanum* are suppressed entirely. An older name, as a subspecies of *B. boreale,* is found for H. St. John's *B. pinnatum.* On the other hand, new varieties in *B. simplex* and *B. matricariaefolium* are found necessary to take care of their variations.

Dr. Clausen concludes modestly: "In this paper, most of the essential taxonomic data relating to the Ophioglossaceae . . . have been brought together. With these data organized, the way is open for serious work within the family." Just this sort of thing—the gathering together, organizing, and evaluating of the mass of material accumulated during recent years—is greatly needed in many groups of plants—much more than description

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[1] Dr. Clausen follows a rather pronounced trend in America at present in his use of the term "subspecies." But unlike some of his predecessors, who have merely—and inarticulately—substituted "subspecies" for "variety," he gives a lucid statement of his system and by employing both terms to express differences in rank, correlates that system with the facts of nature as he sees them and more or less closely with previous European usage.

of uncorrelated new species. Dr. Clausen is to be congratulated on a noteworthy contribution to that need.[2]—C. A. W.

Verdoorn's Manual of Pteridology has had a somewhat unfortunate introduction to the American public, in that one of the specimen pages chosen for inclusion in its advertising circular contains two errors almost startlingly obvious to anyone acquainted with the ferns of North America. But the quality of the work is by no means to be inferred from this unlucky prelude. It gives an interpretative summary of all that is known about ferns—structure, diseases, association with symbiotic fungi, genetics, cytology, manner of growth, chemistry, ecology, geographic distribution, classification and probable evolution. Each branch of the subject is treated by a recognized authority. The book is hardly for the beginner, for it is written in technical style and a good part of it in German; but it is an invaluable storehouse of information and a mental stimulus for those qualified to use it.

Of particular interest to many of us is Dr. Christensen's new classification of the families and genera of true ferns, not only as the result of his many years of study of the group, but as the reaction of an expert and experienced taxonomist to the researches of the morphologists and students of evolution, particularly von Goebel and Bower. Such researches have unquestionably tended to encourage generic splitting. They have thrown emphasis on characters of anatomy, scales, prothallia, etc., which were either unknown to earlier investigators or regarded by them as of little import, and which are, in long series of species, less consistent than the soral characters formerly thought to be fundamental. And by the theory that identical characters may be developed independently in different

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2 Clausen, R. T. A Monograph of the Ophioglossaceae. Mem. Torrey Bot. Club, 19: no. 2 (1938). 177 pp., 33 figs. $2.00.

lines of descent, they have tended to minimize the importance of resemblances, just as they have magnified the importance of differences.

The effect of all this is very visible in Dr. Christensen's new scheme. Not only is the sequence of families and of genera within the families quite different from the familiar plan of the Index Filicum, but there are more of both, by a considerable percentage. The tree ferns now have two families instead of one; and new ones are set up for *Loxsoma* and *Loxsomopsis*, *Plagiogyria*, and that curious little fern of the Roraima region of South America, *Hymenophyllopsis*, which has the habit, simple leaf-structure and type of indusium of *Hymenophyllum*, combined with the possession of scales and sporangia like those of a tree-fern. The *Polypodiaceae* now comprise fifteen subfamilies as against the nine of the Index and the sequence and grouping of genera is greatly changed. *Woodsia*, for instance, remains near *Dryopteris*, but its former companion, *Cystopteris*, is placed with *Athyrium*, and *Pteretis* and *Onoclea* have a subfamily of their own between the groups of *Vittaria* and *Blechnum*. Of the three great genera of the Index, only *Asplenium* has come through unscathed. *Dryopteris* is divided into six main genera (with *Thelypteris* accepted as the name for the marsh-fern group) and several others less definitely recognized; and *Polypodium* is not only split into some eleven parts, but these are variously intermixed with other genera previously distinguished.

It has often been pointed out that the achievement of a natural classification has proceeded in the ferns probably more slowly than in any other group of vascular plants. As Dr. Christensen himself states, his present arrangement is still highly tentative. Much remains to be found out; the existence of characters demonstrated

in a few species has to be assumed in many others, like them, but not fully investigated; and much depends on pure conjecture. But we may confidently hope that we have here a step toward a final and natural arrangement; and it is of very great interest.

Messrs. Alston and Walton contribute a clear treatment of the *Lycopodiinae* and Max Hirmer of the groups of *Equisetum* and *Psilotum;* but here there is much less of novelty.[3]—C. A. W.

Martha H. Hollinshead writes pleasantly in *Torreya* (**38**: 63–66, May–June, 1938) of the ferns of the New Jersey pine barrens. She mentions eleven species, including the oak fern which has been found once, in a well, in that, for it, forbidding region.

In the number of "Little Gardens" for the summer of 1938 Edith Hardin English writes of western rock-ferns as candidates for cultivation. *Cryptogramma acrostichoides, Cheilanthes gracillima* and *Ch. siliquosa* (*Pellaea densa*), *Polystichum Lemmoni* and *P. scopulinum, Woodsia oregana* and *W. scopulina, Asplenium Trichomanes* and *A. viride,* and *Pityrogramma triangularis* are mentioned as attractive subjects for the rock garden. No doubt they are; but if they take to transplanting no more kindly than do eastern rock-ferns a heavy mortality among them is likely to attend that process. And at this distance recommending to gardeners such rarities as the two Polystichums looks like encouraging crime—unless nursery stock raised from spores is available.

A. B. Massey and R. P. Carroll have listed the pteridophytes of Mountain Lake, Giles County, Virginia.

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3 Manual of Pteridology. Edited by Frans Verdoorn. Martinus Nijhoff, the Hague. 1938. Pp. xx, 640; many figs.

Thirty-seven species are recorded, with notes as to habitat and distribution. The most notable report is that of *Lycopodium annotinum*, a southward extension of range of about one hundred miles.[4]

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## Shorter Notes

DISTINGUISHING EQUISETA WITH ONE OR TWO ROWS OF TUBERCLES ON THE RIDGES.—It is sometimes difficult to determine definitely whether a given specimen of Equisetum has two rows of tubercles or a single row or cross-bands of silex on the ridges. The difference between the two types will stand out very prominently if one covers a patch of the stem with ink from an ordinary fountain pen, by simply rubbing the back of the pen-point on the specimen until there is enough ink to partly fill the grooves and cover the ridges with a film of the ink. In a moment, if the ink has been applied either to fresh or dry stems, the nature of the ridges will show very definitely. By this method the double rows of tubercles of *E. hiemale* L. will make a striking picture in contrast with the single rows of *E. praealtum* Raf. and *E. laevigatum* A. Br. In the same way *E. trachyodon* A. Br. and *E. variegatum* Schleich. can be separated from *E. nelsoni* (A. A. Eat.) Schaffn. Large specimens of *E. trachyodon* have, in the East, frequently been mistaken for small specimens of *E. hiemale* but *E. trachyodon* can easily be distinguished by its persistent sheath teeth with entire absence of any abscission groove.—JOHN H. SCHAFFNER.

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WHAT OSMUNDA IS EARLIEST?—Is there a definite and regular order of development among the three species of *Osmunda?* In my garden, *Osmunda Claytoniana* has

[4] Claytonia 4: 45–48 (1938).

definitely led the series this spring, both in the unrolling of its leaves and in the ripening of the spores which were shed about May 1. The cinnamon fern is second in the same locality, the spores being nearly two weeks later than the *Claytoniana* fern. In the same garden the royal fern was last both in leaf-development and in spore-ripening, which occurred ten days after that of the cinnamon fern.

It is of course obvious that no single garden or locality is likely to furnish a conclusive answer. I shall be much interested to hear reports from Fern Society members in answer to this question.—R. C. BENEDICT.

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ROOT HAIRS OF EQUISETUM PRAEALTUM RAF.—One of the best plants for the demonstration of root hairs is *Equisetum praealtum* Raf. Water roots can be grown easily and in a very short time. The upper half of healthy, mature shoots should be cut just above one of the nodes and placed in a bottle or jar of water for a few days. In a short time the lowest node and sometimes the next above, if both are in water, will develop roots, or often both roots and branches. The roots soon attain a length of 5–10 centimeters and are covered with long root hairs except the tip. Above the tip there is a zone of developing root hairs from the incipient stage to the mature condition. The fully developed hairs are from 5–6 mm. or more in length and show prominently to the naked eye as they are spread out in the water of the bottle. They appear very long under the low power of the microscope.—JOHN H. SCHAFFNER.

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TRICHOMANES BOSCHIANUM IN WEST VIRGINIA.—*Trichomanes Boschianum* was found for the first time in West Virginia on April 16, 1938. A good-sized colony

was found deep under a wet, overhanging cliff one mile from Stiltner in Wayne County. Although the woods around the cliff have recently been cut off and the area used for pasturage, the ferns are so far under the cliff that they will not be subject to trampling and the location seems to be permanently moist. It would seem therefore that unless too many people visit the location to collect specimens and thus destroy the colony, it will be there for many years to come. Specimens have been deposited in the private herbarium of Lewis Plymale, and in the herbaria of the University of Kentucky and of Marshall College. It will be distributed from the latter institution in their next century of vascular exsiccati as #712.—LEWIS PLYMALE, *Dept. of Botany, University of Kentucky.*

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A NORTHERN FERN IN WEST VIRGINIA.—The slender Rock-brake, *Cryptogramma stelleri* (Gmelin) Prantl, has been known heretofore east of the Rocky Mountains only as far south as Johnston Co., Iowa, Lycoming Co., Pennsylvania, and Bergen Co., New Jersey, the last station, at latitude 40° 58′, being the southernmost. While exploring for ferns in Randolph Co., West Virginia, on July 9, 1938, Mr. J. E. Benedict, Jr., and the writer unexpectedly discovered a small but thriving colony of it, in moist, sheltered recesses in a limestone cliff at 2850 feet altitude. It lies at latitude 38° 49′, over 200 miles south of the nearest Pennsylvania station, and so represents a case of disjunction similar to, though of lesser magnitude than, that of the Hart's Tongue. During the Glacial Period both of these ferns may well have grown at various intervening stations, but have died out from these as a result of climatic changes.—EDGAR T. WHERRY, *Philadelphia, Pa.*

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Through an oversight, for which the editor responsible wishes to apologize, the report of the Judge of Elections was not printed with the other officers' reports in the preceding number of the Journal. It follows:

111 ballots were returned. Eight of these were postmarked later than December 10th, and were not counted.

The results follow:

| | |
|---|---|
| For President—Dr. Edgar T. Wherry | 100 |
| For Vice-President—Mr. Arthur N. Leeds | 100 |
| For Secretary—Mrs. Elsie G. Whitney | 99 |
| For Treasurer—Dr. Henry K. Svenson | 99 |
| For Honorary Membership—Dr. Campbell E. Waters | 101 |

I therefore declare the above candidates elected as indicated.

The following note on one of the ballots seems worthy of record. "I regret not being able to attend the Fern Meeting. It is too long a journey for my 81 years. L. F. Kimball." Mrs. Kimball now lives in California; a member of the Fern Society for forty years, and still interested.

Respectfully submitted,

W. L. DIX, *Judge of Elections.*

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# American Fern Journal

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AMERICAN FERN SOCIETY



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Breckenridge, Prof. Lester Paige, North Ferrisburg, Vt. ..... 1915
Brettle, Mrs. A. C. (Marion B.), 159 Pleasant Ave., Hamburg, N. Y. ..... 1935
Bristol, Bennet B., Foxboro, Mass. ..... 1935
Brooks, Arthur S., 132 East Center St., Marion, Ohio ..... 1935
Brooks, Maurice G., West Virginia University, Morgantown, West Virginia ..... 1926
Broun, Maurice, Hawk Mt. Sanctuary, Route 1, Orwigsburg, Pa. ..... 1934
Brown, Miss Bertha M., 10 Greenman Ave., Westerly, R. I. ..... 1921
Brown, Hubert H., 9 Halford Ave., Toronto 9, Canada ..... 1926
Brumbach, William C., Esterly P.O., Penna. ..... 1936
Buchanan, Mrs. Edwin C., Stony Brook, Long Island, N. Y. 1938
Buell, J. H., Appalachian For. Exp. Station, 223 Federal Bldg., Asheville, N. C. ..... 1936
Burkart, Dr. Arturo, General Paz 1361, Buenos Aires, Argentina ..... 1933
Burnham, Stewart H., Dept. of Botany, College of Agriculture, Ithaca, N. Y. ..... 1897
Burns, George W., Dept. of Botany, Univ. of Minnesota, Minneapolis, Minn. ..... 1938
Burrows, Edwin J., Great Barrington, Mass. ..... 1934
Butters, Prof. Frederick K., Univ. of Minnesota, Minneapolis, Minn. ..... 1917

Campbell, Dr. Douglas Houghton, Leland Stanford University, Calif. ..... 1915
Campbell, Miss Faye, Fairbrook Farm, North Egremont, Mass. ..... 1934
Canan, Miss Elsie D., 836 Napoleon St., Johnstown, Penna. 1935
†Capp, Seth Bunker, P.O. Box 2054, Philadelphia, Penna. ..... 1915
Carlson, Mrs. T. O., 26 Melrose Rd., Mountain Lakes, N. J. 1934
Carpenter, Dr. Frank M., 1291 Lake Ave., Rochester, N. Y. 1937
Carroll, Lt. Col. Robt. P., Virginia Military Institute, Lexington, Va. ..... 1938
Cathcart, W. H., 10700 Euclid Ave., Cleveland, Ohio ..... 1931
Cheever, Dr. Austin Walter, 464 Beacon St., Boston, Mass. 1911
Cheney, Prof. Ralph H., Biol. Dept., Long Island Univ., Brooklyn, N. Y. ..... 1925

Child, W. A., 389 Hess St. South, Hamilton, Ontario ..... 1917
Chillas, Richard B., Jr., 233 Winona Ave., Germantown, Philadelphia, Penna. ..... 1935
Chisholm, Mrs. Maud L., Proctor, Vermont ..... 1923
Christensen, Dr. Carl, Skaanegade 6, Copenhagen, Denmark 1915
Clark, Mrs. B. Preston, 132 Marlboro St., Boston, Mass. ..... 1928
Clausen, Robert T., Bailey Hortorium, Sage Place, Ithaca, N. Y. ..... 1933
Clayton, Ernest, 434 Laurel Ave., San Anselmo, Marin Co., Calif. ..... 1928
*Clute, Prof. Willard Nelson, 5257 Hinesley Ave., Indianapolis, Ind. ..... 1893
Constantine, Thomas S., 793 East 169th St., New York, N. Y. 1936
Corne, Miss F. E., 17 Hilliard St., Cambridge, Mass. ..... 1910
Correll, Donovan S., Botanical Museum, Harvard Univ., Cambridge, Mass. ..... 1936
Cotner, Mrs. Anita J., 408 West Koch St., Bozeman, Mont. 1935
Cottrell, G. W., 41 Ross Road, Belmont, Mass. ..... 1936
Cowan, Alexander, Valleyfield, Penicuik, Midlothian, Scotland 1914
Dane, Mrs. Ernest B., Roughwood, Chestnut Hill, Mass. ..... 1925
Darbaker, Prof. L. K., 424 Franklin Ave., Wilkinsburg, Penna. ..... 1935
Darden, Mrs. J. Hughes, 1712 Linden Ave., Nashville, Tenn. 1934
Darling, Cyrus, Box 193, Westboro, Mass. ..... 1929
Darling, Thomas, Jr., 328 North 16th St., Allentown, Penna. 1938
Deam, Charles Clemon, R. D. 3, Bluffton, Ind. ..... 1905
Dean, Mrs. Ada F. T., 43 Euclid Ave., Pittsfield, Mass. ..... 1934
Delafield, Mrs. John R., 17 East 79th St., New York, N. Y. 1923
Demaree, Dr. Delzie, Agric. & Mech. College, Monticello, Ark. 1938
Derickson, Prof. Samuel H., Lebanon Valley College, Annville, Penna. ..... 1935
DeVol, Charles E., Marion College, Marion, Ind. ..... 1938
Diddell, Mrs. W. D., 333 East 7th St., Jacksonville, Fla. ..... 1935
Dix, W. L., Morrisville, Penna. ..... 1933
Dole, W. Herbert, 23 Overlook Ave., West Orange, N. J. ..... 1926
Doubleday, Mrs. Arthur W. (Florence F.), Woodstock, Vermont ..... 1928
Dunbar, Henry F., Arrow Head Farm, R. D. 3, Kingston, N. Y. ..... 1938
Duncan, Robert, 136 Woodland Rd., Chestnut Hill, Mass. ..... 1927

Earle, R. S., 350 Commonwealth Ave., Boston, Mass. ..... 1927
Earle, Dr. T. T., Newcomb College,, New Orleans, La. ..... 1938
Eddy, Jesse G., 131 Appleton Ave., Pittsfield, Mass. ..... 1937
Edson, Mrs. Josephine Z., 54 Fairview Ave., Rochester, N. Y. 1936
Edwards, James L., 27 Stanford Place, Montclair, N. J. ..... 1932
Egerton, John B., 333 East 20th St., Baltimore, Md. ..... 1929
Emlen, Mrs. Arthur C., Awbury, Germantown, Philadelphia, Penna. ..... 1936
Emmons, Edwin Thayles, Care of Geneva Daily Times, Geneva, N. Y. ..... 1915
Ernst, L. R., 6058 Kingsbury Ave., St. Louis, Mo. ..... 1938
Evans, Miss Lucile, 2125 E. Kenwood Blvd., Milwaukee, Wis. 1936
Eveleth, Dr. F. S., 12 Court St., Concord, New Hampshire ..... 1938

Ewan, Joseph, Dept. of Biology, Univ. of Colorado, Boulder, Colo. ..... 1930

Fagley, Rev. Frederick L., 287 Fourth Ave., New York, N. Y. 1932
†Farwell, Oliver Atkins, Box 265, Lake Linden, Mich. ..... 1913
Fessenden, G. Russell, 2716 Wisconsin Ave., N.W., Washington, D. C. ..... 1937
Featherly, H. I., Dept. of Botany, Oklahoma Agric. & Mech. College, Stillwater, Okla. ..... 1928
Finegan, Mrs. Thomas E. (Grace B.), Richmondville, Schoharie Co., N. Y. ..... 1925
Fleischman, Grace Cole, 227 North 8th Street, Corvallis, Ore. 1934
Flett, J. B., R. D. 2, Bremerton, Wash. ..... 1899
Flowers, Seville, Univ. of Utah, Salt Lake City, Utah ..... 1938
Floyd, Frederic Gillan, Sierra Madre, Calif. ..... 1897
Foote, Mrs. Caroline C., 119 East 40th St., New York, N. Y. 1925
Ford, Oren T., 551 Fricke Court, Santa Barbara Ave., Los Angeles, Calif. ..... 1937
Frazee, Vernon L., 67 East 4th St., Clifton, N. J. ..... 1930

Gannett, Lewis S., 120 East 16th St., New York, N. Y. ..... 1928
Gibson, Kasson S., 417 Cumberland Ave., Chevy Chase, Md. 1938
Gilbert, Charles C., 931 Stahlman Bldg., Nashville, Tenn. ..... 1936
Goodale, Prof. Alfred S., Dept. of Botany, Amherst College, Amherst, Mass. ..... 1921
Graves, Dr. Arthur Harmount, 1000 Washington Ave., Brooklyn, N. Y. ..... 1935
Green, Forrest K., 912 Philadelphia, Memphis, Tenn. ..... 1937
†Greene, F. C., Geological Survey, Box 138, Rolla, Mo. ..... 1913
Greene, Henry Jewett, Green Top, Petersham, Mass. ..... 1929
Greenfield, Sydney S., 325 Ocean Ave., Brooklyn, N. Y. ..... 1938
Greenlee, Miss Leslie, 861 Anaconda Ave., Charleston, W. Va. 1938
Griffeth, Mrs. C. P., 41 Lake View Park, Rochester, N. Y. ..... 1934
Groff, Miss Mary E., Charles Road, R. D. 6, Lancaster, Penna. 1933
Grout, Dr. Abel Joel, Manatee, Florida ..... 1910
†Gruber, C. L., 31 East Main St., Fleetwood, Penna. ..... 1907
Gumpper, Mrs. Edith E., Cornall Ave., Churchville, Bucks Co., Penna. ..... 1937

Haas, Dr. Flora Anderson, Sorrento, Florida ..... 1917
Hall, Miss Anna L., 103 Macon St., Brooklyn, N. Y. ..... 1929
Hall, Mrs. Carlotta C., 2570 Cedar St., Berkeley, Calif. ..... 1913
Hallenbeck, Esly, 14 Washington Rd., Scotia, N. Y. ..... 1938
Halsey, Miss Alice, 29 East 29th St., New York, N. Y. ..... 1923
Harper, Prof. Robert Almer, Columbia University, New York, N. Y. ..... 1913
Hartline, Mrs. D. S., East 4th & Spruce Streets, Bloomsburg, Penna. ..... 1910
Hartwell, Mrs. Florence C., Bolton, Vermont ..... 1937
Hayes, Mrs. Edwin A., 466 Elm Street, New Haven, Conn. 1934
Hazen, Dr. Tracy Elliot, Columbia University, New York, N. Y. ..... 1910
Hermann, Dr. F. J., Div. Pl. Expl. & Intro., Dept. of Agriculture, Washington, D. C. ..... 1935

Highton, W. Lincoln, 77 Roseville Ave., Newark, N. J. ..... 1932
Higman, Harry W., 1320 East 63d St., Seattle, Wash. ..... 1932
Hiss, Mrs. Berry, Hill and Hollow Farm, Hyde Park, N. Y. 1936
Holbert, Judge George K., Elizabethtown, Ky. ..... 1936
Hopkins, Miss Jessie, Cardinal, Virginia ..... 1938
Hopkins, Prof. Lewis S., Culver-Stockton College, Canton, Mo. 1905
House, Dr. H. D., Education Bldg., Albany, N. Y. ..... 1918
Howard, Mrs. David G., 137 Monticello Ave., Annapolis, Md. 1937
Humphrey, George Scranton, 19 Hyatt St., Staten Island, N. Y. ..... 1911
Hunnewell, Francis Welles, Washington St., Wellesley, Mass. 1915
Hutchinson, Mrs. Susan W., 724 South Orange Drive, Los Angeles, Calif. ..... 1923
Hyde, Mrs. Clarence R., 242 Henry St., Brooklyn, N. Y. ..... 1934

Jehlen, C. F., 12A Madeline Parkway, Yonkers, N. Y. ..... 1936
Jennings, Dr. Otto Emery, Carnegie Museum, Pittsburgh, Penna. ..... 1911
Judd, Mrs. Mary P., 14 Bruce Road, Upper Montclair, N. J. 1934
Jurica, Hilary S., St. Procopius College, Lisle, Ill. ..... 1919

Kamm, Mrs. Oliver (Minnie W.), 365 Lake Shore Rd., Grosse Pointe Farms, Mich. ..... 1922
Kelton, Mrs. George H. (Ruth C.), North Road, Bedford, Mass. ..... 1926
†Kidder, Nathaniel T., Milton, Mass. ..... 1921
Killip, Ellsworth P., Smithsonian Institution, Washington, D. C. ..... 1916
Kimball, Miss Laura F., 1515 L Ave., National City, San Diego Co., Calif. ..... 1897
Kimber, Miss N. B., 538 Locust Ave., Germantown, Philadelphia, Penna. ..... 1925
Kittredge, Miss E. M., Vergennes, Vermont ..... 1922
Knappen, Mrs. Theo. M. (Nellie C.), 2925 Tilden St. N.W., Washington, D. C. ..... 1925
Knight, William A., 175 Oneida St., St. Augustine, Fla. ..... 1931
Knobloch, Dr. Irving W., Mojarachic, via San Juan, Chihuahua, Mexico ..... 1933
Knowlton, Clarence Hinckley, Hingham, Mass. ..... 1911
Kobbé, Frederick W., 1155 Park Ave., New York, N. Y. ..... 1921
Kriebel, R. M., 1111 N St., Bedford, Ind. ..... 1933
Kull, Blaisdell, 203 Lincoln Ave., New Brunswick, N. J. ..... 1935

Lawton, Dr. Elva, Hunter College, 2 Park Ave., New York, N. Y. ..... 1926
Lee, Edward, Dept. of Botany, Univ. of California, Berkeley, Calif. ..... 1936
Leeds, Arthur N., 1025 Westview Ave., Germantown, Philadelphia, Penna. ..... 1921
Leonard, Emery C., Smithsonian Institution, Washington, D. C. ..... 1920
Lewis, Rev. Charles S., Kinderhook, N. Y. ..... 1917
Lewis, Clarence McK., 1000 Park Ave., New York, N. Y. ..... 1935
Lewis, Rev. William Fisher, 2nd., 108 Bank St., Burlington, Vt. ..... 1920

Lillibridge, Miss Amy A., 432 Wayland Ave., Providence, R. I. ..... 1921
Lippincott, Dr. Rebecca C., 122 West Main St., Moorestown, N. J. ..... 1931
Litch, C. M., 47 Blossom St., Fitchburg, Mass. ..... 1916
Little, Elbert L., Jr., Box 1700, Flagstaff, Ariz. ..... 1927
Loew, Prof. F. A., Huntington College, 916 Himes St., Huntington, Ind. ..... 1938
Logue, Dr. Everett G., First National Bank Bldg., Williamsport, Penna. ..... 1930
Lombard, Dr. Robert H., 28 Indian Hill Rd., Worcester, Mass. 1916
Long, Bayard, 250 Ashbourne Rd., Elkins Park, Philadelphia, Penna. ..... 1911
Looser, Gualterio, Casilla 5542, Santiago, Chile ..... 1928
Lott, Mrs. Y. C., 1718 S. W. 23d St., Miami, Florida ..... 1935
†Lowe, Mrs. Frank E. (Rachel L.), 104 Neal St., Portland, Me. 1917
Lownes, Albert E., P.O. Box 1531, Providence, R. I. ..... 1924
Lumis, Mrs. Harriet R., 28 Bedford Rd., Springfield, Mass. 1937
Lyon, Dr. Harold Lloyd, P.O. Box 411, Honolulu, T. H. ..... 1911

McAvoy, Miss Blanche, 108 West Ash St., Normal, Ill. ..... 1920
MacCaskill, Allan, Jr., Coleraine, Victoria, Australia ..... 1925
McCoy, Prof. Thos. N., Prin. First Ward School, Catlettsburg, Ky. ..... 1934
McCutcheon, T. P., R. D. 2, Downingtown, Penna. ..... 1938
McFarland, Prof. Frank T., Dept. of Botany, Univ. of Kentucky, Lexington, Ky. ..... 1915
McGilliard, Miss Eleanor, Dept. of Biology, Univ. of Chattanooga, Chattanooga, Tenn. ..... 1935
McVaugh, Rogers, Div. Pl. Explor. & Intro., Dept. of Agriculture, Washington, D. C. ..... 1934
Maclaren, Miss Sallie S., South Egremont, Mass. ..... 1934
Mansfield, Dr. William, College of Pharmacy, Albany, N. Y. 1922
†Marble, John E., 1313 Garfield Ave., South Pasadena, Calif. 1928
Marchant, A. H., Rangeley Park, Winchester, Mass. ..... 1938
Marie-Victorin, Prof., Université de Montreal, Montreal, Canada ..... 1917
Mark, Miss Clara G., 270 South State St., Westerville, Ohio 1913
Marsh, Mrs. Spencer S., Midwood Terrace, Madison, N. J. 1927
Marsh, Spencer S., Midwood Terrace, Madison, N. J. ..... 1927
Masek, John, Apopka, Florida ..... 1935
Massey, Prof. A. B., Virginia Polytechnic Inst., Blacksburg, Va. ..... 1935
Maxon, Dr. William R., Smithsonian Institution, Washington, D. C. ..... 1895
May, Dr. James V., First National Bank Bldg., Marinette, Wis. ..... 1927
Mendelson, Dr. Walter, 639 Church Lane, Germantown, Philadelphia, Penna. ..... 1910
Merrill, Henry Wilson, East Hiram, Maine ..... 1906
Miller, Mrs. Lawrence K., 42 Brunswick St., Pittsfield, Mass. 1934
Mirick, Miss Nellie, 232 East Walnut St., Oneida, N. Y. ..... 1896
Mitchell, Miss Gladys E., Box 95, Princeton, N. C. ..... 1936
Miyaka, Dr. Kiichi, Dept. of Botany, Tokyo Imperial Univ., Tokyo, Japan ..... 1938

Molé, Mrs. Harvey E., Rowan Road, Summit, N. J. ..... 1932
Monks, Mrs. Samuel M., 415 Prospect Ave., Hartford, Conn. 1927
Monroe, Prof. Will S., R.D. 1, Waterbury, Vermont ..... 1923
Moore, Prof. Dwight M., Univ. of Arkansas, Fayetteville, Ark. ..... 1935
Moore, Dr. George T., Missouri Botanical Garden, St. Louis, Mo. ..... 1915
Moss, Mrs. C. E., Box 1176, Johannesburg, South Africa ..... 1916
Mottier, Dr. David M., Indiana University, Bloomington, Ind 1911
Munz, Prof. Philip A., 1165 Indian Hill Blvd., Claremont, Calif. ..... 1921

Neidorf, Charles, 1719 Washington Ave., New York, N. Y. ..... 1937
Newell, Chauncey Jackson, Alstead, N. H. ..... 1902
*Noyes, Miss Elmira Elsie, 912 Brandon Ave., Norfolk, Va. 1893
Nyman, Mrs. Harriet J., 441 Beverly Ave., San Leandro, Calif. ..... 1935

Ogden, Mrs. E. C., 22 University Place, Orono, Maine ..... 1937
Oliphant, Roy L., 98 Glen Ave., Oakland, Calif. ..... 1930
Osmun, Prof. Albert Vincent, Massachusetts State College, Amherst, Mass. ..... 1901
Osterlund, P., 131–15 140th St., South Ozone Park, New York, N. Y. ..... 1920
Otis, Ira C., 4320 First Ave., N. E., Seattle, Wash. ..... 1921
Otis, Dr. Mabel H., 815 Fifth Ave. Bldg., Moline, Ill. ..... 1933
Ottley, Prof. Alice M., Dept. of Botany, Wellesley College, Wellesley, Mass. ..... 1930

Palmer, Dr. Ernest J., 1090 Center St., Jamaica Plain, Mass .1909
Palmer, Dr. Theo. Sherman, 1939 Biltmore St., N.W., Washington, D. C. ..... 1911
Park, Mrs. Franklin A., 812 Park Ave., New York, N. Y. ..... 1935
Parks, H. B., R.D. 1, Box 368, San Antonio, Texas ..... 1938
Peterson, Mrs. E., R.D. 3, Box 84, Miami, Florida ..... 1931
Petzke, Ernest A., M.D., Hixton, Wis. ..... 1926
Phair, Miss Gertrude G., 804 East 19th St., Brooklyn, N. Y. 1916
Pickett, Prof. Fermen Layton, State College of Washington, Pullman, Wash. ..... 1914
Pond, Bremer Whidden, 5 Boylston St., Cambridge, Mass. ..... 1910
Porter, Mrs. Fred, 1503 Chamberlain, Chattanooga, Tenn. ..... 1937
Porter, Miss May N., 11 Greenridge Ave., White Plains, N. Y. ..... 1929
Pretz, Harold W., 123 South 17th St., Allentown, Penna. ..... 1909
Proctor, George R., Marietta College, Marietta, Ohio ..... 1938

Quinn, James J., Winchester, Mass. ..... 1929

Ransier, Hubert Earl, Manlius, N. Y. ..... 1902
Renz, Dr. Herman A., 7717 North Paulina St., Chicago, Ill. 1935
Rhodes, Charles Orman, 103 Clark St., Groton, N. Y. ..... 1896
Ridlon, Harry Cooper, Bennington, Vermont ..... 1908
Ridlon, Mrs. John, Rhuddlans-on-the-Cliff, Newport, R. I. ..... 1937
Robertson, Mrs. Carl T., 1626 Holyrood Rd., N.E., Cleveland, Ohio ..... 1937

Rooney, Mrs. Frank (Anna K.), 810 East 40th St., Brooklyn, N. Y. ..... 1916
†Rossberg, William B., 44 Hawkins St., New Britain, Conn. ..... 1911
Rugg, Harold Goddard, Box 241, Dartmouth College, Hanover, N. H. ..... 1906
Ruggles, Mrs. F. G., 69 Arsdale Terrace, East Orange, N. J. 1937
†Rusk, Miss Hester M., Brooklyn Botanic Garden, Brooklyn, N. Y. ..... 1934
Ryan, Glen H., 392 Sinex Ave., Pacific Grove, Calif. ..... 1936

St. John, Edward, Floral City, Citrus Co., Florida ..... 1934
St. John, Robert P., Floral City, Citrus Co., Florida ..... 1934
Sanford, Samuel Newton Folius, 234 Berkeley St., Boston, Mass. ..... 1918
Scamman, Miss Edith, 474 Portland Rd., Saco, Maine ..... 1937
Schaffner, Prof. John H., Ohio State University, Columbus, Ohio ..... 1920
Schmidt, Miss Claudia, 39 Ely Ave., West Springfield, Mass. 1937
Schuurman, J. A., 1103 Castle Bldg., 1410 Stanley St., Montreal, Canada ..... 1934
Scully, Dr. Francis J., 904 Medical Arts Bldg., Hot Springs, Ark. ..... 1934
Seeger, William L., R.D. 1, Atchinson, Kansas ..... 1937
Segar, Miss Gladys, 108 Midland Ave., Montclair, N. J. ..... 1937
Sener, Miss Ruth, 233 Charlotte St., Lancaster, Penna. ..... 1932
Sharpe, Dr. M. R., Uxbridge, Mass. ..... 1929
Shaver, Prof. J. M., Peabody College, Nashville, Tenn. ..... 1934
Shelar, Keller, State Teachers' College, Slippery Rock, Penna. 1935
Singletary, Miss Mary L., Kissimee, Florida ..... 1934
Slater, Mrs. Elsie, 516 Prospect Ave., El Paso, Texas ..... 1938
Slater, Wm. A., Care Gulf Refining Co., P.O. Box 1166, Pittsburgh, Penna. ..... 1933
Smith, Dr. Albert C., New York Botanical Garden, New York, N. Y. ..... 1931
Smith, Ewart G., 147 High Street, Christ Church, New Zealand ..... 1927
Smith, Prof. Frances G., Dept. of Botany, Smith College, Northampton, Mass. ..... 1933
Smith, Mrs. Frank C., Jr., 32 Cedar St., Worcester, Mass. ..... 1931
Somerville, Mrs. Mary F., 1015 Harrison St., Superior, Wis. ... 1923
Soxman, G. M., 718 Haines Ave., Dallas, Texas ..... 1935
Spahr, Mrs. Albert H., Fairbrook Farm, North Egremont, Mass. ..... 1934
Spawn, William, 3730 McKinley St. N.W., Washington, D. C. 1936
Spicer, Wilmot J., 27½ Hunter St., Glens Falls, N. Y. ..... 1936
Standley, Paul C., Field Museum of Natural History, Chicago, Ill. ..... 1915
Steagall, Miss Mary M., 808 So. Illinois Ave., Carbondale, Ill. 1923
Stearns, Mrs. H. B., Saranac Lake, N. Y. ..... 1923
Steere, Dr. William C., Dept. of Botany, Univ. of Michigan, Ann Arbor, Mich. ..... 1935
Steil, Dr. William N., 830 North 24th St., Milwaukee, Wis. ..... 1916
Stephenson, Leonard L., Buchtel, Ohio ..... 1934

Stifler, Mrs. James M. (Cloyd B.), 1360 East 58th St., Chicago, Ill. ..... 1935
Stoddard, Mrs. Ralph, 156–26 Oak Ave., Flushing, L. I., N. Y. 1938
Stone, Miss Edna L., 3216–44th St. N.W., Washington, D. C. 1928
Storey, Oliver W., 924 Gulf Lane, Wheaton, Ill. ..... 1934
Stratton, Mrs. G. W., 1004–20th Ave., Altoona, Penna. ..... 1916
Svenson, Dr. Henry K., Brooklyn Botanic Garden, Brooklyn, N. Y. ..... 1931

Tanger, Mrs. Charles Y. (Louise F. A.), 318 No. President Ave., Lancaster, Pa. ..... 1930
Taylor, Dr. Aravilla M., Lake Erie College, Painesville, Ohio... 1923
Taylor, Lucian B., Farm Street, Dover, Mass. ..... 1933
Taylor, Prof. Thos. M. C., Dept. of Botany, Univ. of Toronto, Toronto, Canada ..... 1932
Thompson, J. W., Cleveland High School, Seattle, Wash. ..... 1928
Thurston, Edward D., Jr., Sharon, Conn. ..... 1937
Tilley, Trenor P., 1356 Northampton St., Holyoke, Mass. ..... 1921
Topping, D. LeRoy, Box 2356, Honolulu, T. H. ..... 1896
Tracy, H. H., Fullerton Union High School, Fullerton, Calif. 1931
Trudell, Harry W., 303 Highland Ave., Abington, Penna. 1919
Tryon, R. M., Jr., 5432 Woodlawn Ave., Chicago, Ill. ..... 1932
Turner, Mrs. H. M., 88 Barnet St., New Haven, Conn. ..... 1930

Upham, Alan W., East Woodstock, Conn. ..... 1926
Uphoff, Mrs. Emma, 88 Prospect St., Little Falls, N. J. ..... 1937

Van Meter, Miss Mary G., 1757 K St., N.W., Washington, D. C. ..... 1923
Vincent, Mrs. Myron H., Chilmark, Mass. ..... 1917

Ware, Robert Allison, 81 Pinckney St., Boston, Mass. ..... 1903
*Waters, Dr. Campbell E., 5812 Chevy Chase Parkway, Washington, D. C. ..... 1893
Weatherby, Mrs. C. A. (Una F.), 27 Raymond St., Cambridge, Mass ..... 1914
Weatherby, Charles A., 27 Raymond Street, Cambridge, Mass. 1912
West, Russell, 113 Edgewood St., Wheeling, W. Va. ..... 1934
†Wheeler, Leston Ansel, R. D. 2, Bethel, Maine ..... 1914
Wherry, Dr. Edgar T., Univ. of Pennsylvania, Philadelphia, Penna. ..... 1918
Whitehead, Jack, Box 1022, Santa Barbara, Calif. ..... 1936
Whitney, Mrs. Elsie G., 342 New Scotland Ave., Albany, N. Y. ..... 1930
Wiggins, Ira L., Dudley Herbarium, Stanford University, Calif. ..... 1932
Wiley, Miss Farida A., Museum of Natural History, 77th St. & Columbus Ave., New York, N. Y. ..... 1927
Wilkens, Hans, 241 South 11th St., Reading, Penna. ..... 1927
Williams, Ernest C., 965 So. Mariposa Ave., Los Angeles, Calif. ..... 1937
Wilson, Miss Antoinette, 89 North Main St., Spring Valley, N. Y. ..... 1935

Wilson, Mrs. Millar, Fort George, Florida ..... 1935
†Winslow, Evelyn James, Chesterfield Rd., Brattleboro, Vermont ..... 1902
Woodelton, Mrs. Helen S., 454 Seventh St., Brooklyn, N. Y. ..... 1929
Wright, Miss Mary F., Ambler, Penna. ..... 1925
Wright, S. Fred, 52 South Jefferson St., Orange, N. J. ..... 1926

Yang, Mrs. M. S. (Yang Chen Gin O), Ingtai, Foochow, China 1936
Young, John P., Ithaca, New York ..... 1920

Cystopteris montana, North of Hoosier Pass, Summit Co., Colorado.

# American Fern Journal

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## Colorado Ferns[1]


EDGAR T. WHERRY


During the Summer of 1937 the writer was invited to teach field botany in Colorado, and took the opportunity to make a survey of the ferns of the state, which have never been specially written up. Before starting west, the literature was abstracted, and lists were made of the specimens from Colorado preserved in several eastern herbaria. During the trip those in the Rocky Mountain Herbarium (Laramie, Wyoming), the State University herbarium (Boulder), and the Colorado College herbarium (Colorado Springs) were also listed.[2] As many localities as practicable were visited and collections made, the specimens being placed in the herbarium of the Academy of Natural Sciences of Philadelphia.

When Rydberg's Flora of Colorado was published, in 1906, only 40 species of Pteridophytes were known in the

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[1] Contribution from the Rocky Mountain Biological Laboratory, Gothic, Crested Butte P.O., Gunnison Co., Colorado.

[2] Herbaria are indicated in the text by obvious abbreviations. Caution proved necessary in interpreting labels. Some sheets labelled "Denver," "Colorado Springs," etc., bear ferns which obviously came from points several thousand feet higher than these places, or many miles away. Others have been seen bearing labels on which is printed "Flora of Colorado," the attached plants representing eastern species, and the data written in designating eastern localities. Only reasonably trustworthy records are considered in the present article.


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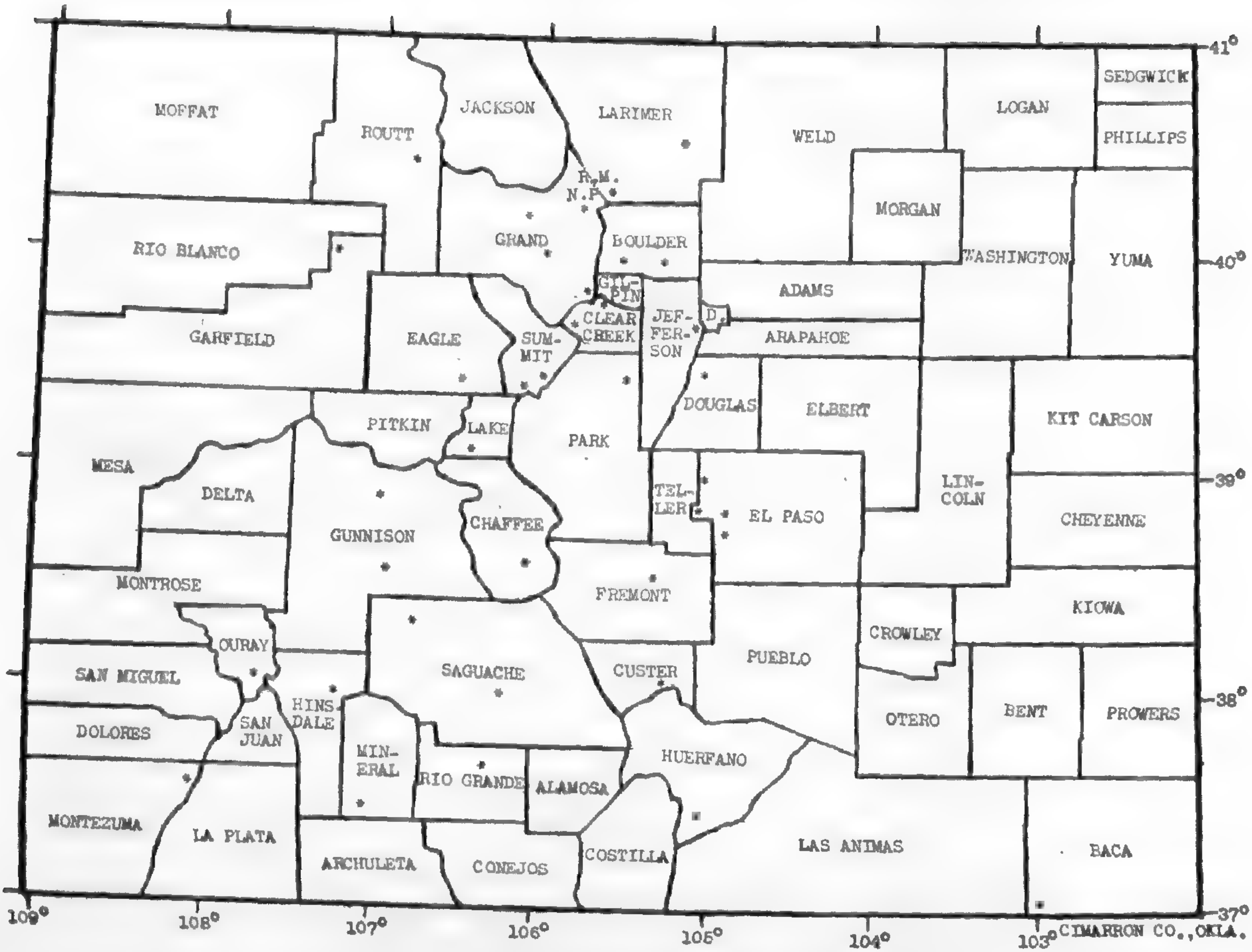


FIG. 1. COUNTY MAP OF COLORADO.

state, and the author commented on the smallness of this number. Subsequent studies have raised the total to at least 56, although Colorado is far from being "ferny," and one can travel there for a hundred miles without seeing any of these plants except perhaps an *Equisetum* (*E. arvense* in the uplands, *E. kansanum* on the plains); or can climb 5000 feet and encounter only *Cystopteris fragilis*. Discussions of the species and varieties now known here are presented below, in alphabetical sequence. For simplicity the ranges are mostly stated by counties, the map on the opposite page showing the positions of these. Stations where especially notable collections of Pteridophytes have been made are indicated on this map by asterisks (*).

ADIANTUM CAPILLUS-VENERIS.—The Southern Maidenhair, which grows in moist calcareous situations throughout the world's subtropics, enters Colorado from the southwest, and is known from two stations 100 miles apart. As recorded by Durand[3] it was at one time abundant in the Box Canyon at Ouray; the flood of 1929 largely destroyed this colony, and in 1937 but one small plant could be found. The other station is at Cliff Palace Springs on the Dolores River 35 miles northwest of Naturita, in Montrose Co. (R.M.H.). In Rydberg's Flora of the Prairies and Plains (1932), *Adiantum modestum* is attributed to southern Colorado, but this supposed species is only a minor variant of the Southern Maidenhair, and does not grow in the prairie portions of the state.

ASPLENIUM ADIANTUM-NIGRUM.—This circumboreal fern was discovered along Boulder Creek 10 miles northeast of Boulder by Mr. Darwin M. Andrews, and named *Asplenium andrewsii* by A. Nelson;[4] its real identity was pointed out by Maxon.[5] Mr. Andrews kindly took me to

[3] Field-book of Common Ferns: 96. 1928.

[4] Proc. Biol. Soc. Wash. 17: 174. 1904.

[5] Contr. U. S. Nat. Herb. 16: 1. 1912.

the locality in 1937, but successive droughts had reduced the colony to a few small clumps high on an inaccessible sandstone cliff. The species has been found in North America in but two other places, Zion National Park, Utah (U.S.N.H.), and northern Arizona (report, not authenticated by specimens), and Marion Co., Florida.

ASPLENIUM PLATYNEURON.—One of the few eastern ferns which enter Colorado. It is attributed to Baca and Pueblo cos., and specimens from the former have been identified by Dr. Maxon.

ASPLENIUM SEPTENTRIONALE.—A circumboreal species, known in Colorado at 15 stations, from the Wyoming line in Jackson to Ouray (found in the Box Canyon in 1937) and to Baca cos. It grows in dry crevices of granite and sandstone, in subacid soil.

ASPLENIUM TRICHOMANES.—Circumboreal, but rare in our western states. Grows in sheltered crevices of granite and sandstone at 10 stations in Colorado, from Jackson to Fremont cos.

ASPLENIUM VIRIDE.—Also circumboreal, but requiring still cooler conditions than the preceding, as well as more calcareous soils. Reported by Rydberg (Flora Colo., 1906) without locality. Three stations are now known: at 10,750 feet 2 miles northeast of Gothic, Gunnison Co.; at 11,900 feet in the Ice Lake Basin west of Silverton, San Juan Co. (C.C.herb.); and at 10,000 feet on south side of Lewis Creek, La Plata Mts., La Plata Co. (U.S.N.H.).

ATHYRIUM AMERICANUM.—This west-American representative of the circumboreal *A. alpestre* is a cool-climate rock-slide plant. It is known in Colorado at 7 stations above 10,000 feet, Larimer to Gilpin cos.

ATHYRIUM ANGUSTUM var. RUBELLUM.—Along a brook 8 miles southwest of Sedalia, Douglas Co., Mrs. Claire Norton showed me a colony of a lady-fern which unex-

pectedly proved to have the horizontal rootstock and long, obscurely ciliate indusia of this northeastern plant, not previously known beyond the Black Hills of South Dakota.

ATHYRIUM FILIX-FEMINA.—The circumboreal Lady-fern occurs at 15 stations in Colorado from 11,000 down to 6000 feet, Larimer south to Mineral and El Paso cos.

ATHYRIUM FILIX-FEMINA var. CALIFORNICUM.—This west-American endemic, characterized by its dark scales and large, blackish-reticulate spores, has been collected at two Colorado stations, one each in Montrose and Routt cos. Search for it in 1937 proved unavailing.

BOTRYCHIUM LANCEOLATUM.—The typical variety of this circumboreal grape-fern is known at 10 stations in Colorado, from 12,000 to 8000 feet, Larimer to Chaffee and El Paso cos. It grows in subacid soil on thinly wooded gravelly slopes; none could be found in 1937 in areas where in moister years it is said to have been abundant.

BOTRYCHIUM LUNARIA.—Although morphologically like the European and northeast American representatives of this circumboreal species, the Colorado plant is physiologically dissimilar in that it grows in non-calcareous, acid soils. There are 15 records for the state, in the same habitats and over much the same range as the next-preceding, except for extending west to Trappers Lake, Garfield Co. and (doubtfully) to Ouray, Ouray Co.

BOTRYCHIUM MATRICARIAEFOLIUM SSP. HESPERIUM.—The Colorado representative of this circumboreal species has the leaves less toothed than the east-American one. It is listed in Rydberg's Flora of the Prairies and Plains, but is not in these provinces in Colorado. Instead its 8 known stations, Larimer to Gunnison and El Paso cos., are at altitudes of over 10,000 feet.

BOTRYCHIUM MINGANENSE.—Material from Boulder

to Chaffee (and perhaps Ouray) cos., represents this boreal-American species (or variety of *B. lunaria*).

BOTRYCHIUM MULTIFIDUM ssp. COULTERI.—The circumboreal Leather Grape-fern is represented from Colorado only by a specimen of this subspecies from Steamboat Springs, Routt Co. (U.C.herb.).

BOTRYCHIUM SIMPLEX var. CORDATUM (TYPICUM).—Another circumboreal, cool-climate species misleadingly attributed by Rydberg to the Prairies and Plains of Colorado. Material from high altitudes in Gilpin Co. and on Pikes Peak, El Paso Co., represents the original variety and in part also var. *compositum*.

BOTRYCHIUM VIRGINIANUM var. EUROPAEUM.—The common east-American variety of this circumboreal species is not known in Colorado, but the rarer European one has been found at 5 stations, from Boulder to Custer cos. In 1937 it was collected in moist minimacid soil on a steep wooded slope just southeast of Green Mountain Falls, El Paso Co.

CHEILANTHES EATONI.—A southwest-upland species, segregated from *C. tomentosa* on the basis of bearing lanceolate scales as well as woolly hairs. It grows in crevices under granite and sandstone rocks at 7 known stations from Baca up to Custer, Fremont, and El Paso cos.

CHEILANTHES FEEI.—This widespread west-midland species occurs in many parts of Colorado, though rarely above 8000 feet. It grows in circumneutral soils in dry crevices in cliffs of limestone and porous igneous rocks.

CHEILANTHES FENDLERI.—A southwestern fern, with fronds bearing sparse brown scales but lacking wool. It is known at 15 foothill stations from Fremont to El Paso and north to Larimer Co., on shaded ledges of granite and sandstone.

CHEILANTHES WOOTONI.—This densely ciliate-scaly southwestern species grows in Cimarron Co., Oklahoma,

and follows sandstone ledges into Baca and Prowers cos., Colorado.

CRYPTOGRAMMA CRISPA var. ACROSTICHOIDES.—The American representative of this circumboreal species is one of Colorado's commoner high-altitude ferns. It is known from Routt to Larimer, south to Montezuma and Huerfano cos., in subacid soil on cliffs and rock-slides, down to about 8000 feet.

CRYPTOGRAMMA STELLERI.—While likewise circumboreal, this Rockbrake requires cooler, moister, and limier conditions than its relative, and is one of the state's rarities. The 5 known stations are: below Breckenridge, Summit Co.; northeast of Gothic, Gunnison Co.; west of Ouray, Ouray Co.; La Plata Falls and Lewis Creek, La Plata Co.

CYSTOPTERIS FRAGILIS var. GENUINA.—The variety of this world-wide species which is well-known in Europe is confined to the more northern portions of eastern North America, but is the commonest fern in Colorado. It occurs on and around rocks of every description, whenever there is a moderate amount of moisture available. In sunny situations it may be but 5 cm. tall and 1.5 cm. wide, but in damp shady places becomes up to 6 times as large. Though correspondingly varying markedly in aspect, it uniformly exhibits the characteristic features of long rootstock with blunt mass of frond-buds at the tip, brown stipe, glabrous rachis, and ovate indusium with fringy tip.

CYSTOPTERIS MONTANA.—In marked contrast with the preceding, this circumboreal brittle-fern has but two known stations in Colorado. It was collected by Brandegee many years ago at 10,500 feet on a "Chrysolite Mountain" near Mt. Antero, Chaffee Co., but this locality is now unidentifiable. In 1937 Mrs. G. R. Marriage found a colony north of Hoosier Pass in Summit Co., where the

photograph reproduced in Plate 12 was taken by the writer. It grows in subacid soil over rocks beneath which icy water continually trickles, on a thinly wooded, steep, north-facing slope at 10,900 feet. The only other known station in the United States is in Glacier National Park, about 800 miles away.

DRYOPTERIS DILATATA.—Reports of *D. spinulosa* from Colorado really refer to this circumboreal species, as evidenced by a specimen from Dream Lake at 10,000 feet, in Rocky Mt. National Park (R.M.H.). It apparently does not extend south of Larimer Co.

DRYOPTERIS FILIX-MAS.—Morphologically our western representative of this circumboreal fern seems identical with the northeastern one, but physiologically there is a difference: the more eastern plant prefers limy soil and cool Summer temperature, while the western one thrives in subacid soils under moderately warm climatic conditions. The Colorado form can be successfully grown in gardens far beyond its native region, and has been sought out and largely exterminated here by dealers in native plants. Herbarium records show it to have formerly ranged from Jackson and Larimer south to Ouray, Mineral, and El Paso cos., and even to Cimarron Co., Oklahoma.

EQUISETUM ARVENSE.—This circumboreal Horsetail is the most abundant Pteridophyte in Colorado. It grows in profusion through the mountains, along streams, in meadows and swamps, also invading ditches, road and railroad banks, and waste places generally. In response to different environmental conditions it takes on various forms, some of which may be mistaken for other species. An aquatic form found in Meridian Lake, Gunnison Co., has stems 20 or 30 cm. tall, with scattered green ascending branches and terminal cones maturing the spores in early August.

EQUISETUM HYEMALE (typical variety).—A few herbarium specimens from Larimer to Grand and to Douglas counties seemingly represent this circumboreal species.

EQUISETUM KANSANUM.—This widespread west-American species, characterized by the blunt cone, is common in the lower-altitude portions of Colorado. It grows typically in damp depressions in prairies, but also invades ditches and road banks.

EQUISETUM LAEVIGATUM.—Many reports of this, another west-American plant, refer to the next-preceding species, but 5 specimens seen, from Larimer to El Paso cos., have the more slender stems and apiculate cone of the present one.

EQUISETUM PREALTUM.—Although this is the most widespread of the unbranched species in the United States, it is rare in Colorado, there being but 8 records, from Boulder to Mesa and Huerfano cos. It grows in circumneutral soil along wooded stream-banks.

EQUISETUM VARIEGATUM.—A circumboreal species, previously known from 5 stations, Boulder to Alamosa cos. In 1937 it was found in moist circumneutral soil along East River at Gothic, Gunnison Co. (See remarks on *E. nelsoni*, below.)

ISOETES BOLANDERI.—A northwest-American endemic, which has been collected in 7 ponds or lakes at 9000 to 11,000 feet from Routt to Boulder, Garfield, and Gunnison cos. At the head of Glacier Lake, Boulder Co., it was found to be submerged early in the season, but by August became emersed, the leaves then being thicker and more twisted so that the tufts had a markedly different aspect.

ISOETES BRAUNII.—The American representative of the circumboreal *I. echinospora* is common in our eastern states, but very rare westward. Dr. Norma E. Pfeiffer has recognized it in a collection from Seven Lakes, El Paso Co., at 11,500 feet.

ISOETES OCCIDENTALIS.—This northwestern endemic, also known as *I. paupercula*, has likewise been found but once in the state, in Grand Lake, Grand Co., at 8150 feet.

LYCOPODIUM ANNOTINUM.—The circumboreal Bristly Clubmoss has been collected at 20 stations from Jackson and Larimer down to Ouray, Gunnison, and Chaffee cos., from 11,000 to 9000 feet. It grows in subacid soil on hummocks of humus in moist spruce forests. Some of the strobili remain in an immature condition over winter, and shed their spores the following Spring.

LYCOPODIUM SELAGO.—The only other Clubmoss in the state, likewise circumboreal, is much rarer, being recorded from but 5 high-altitude cliffs, Larimer to Clear Creek cos. The southernmost known occurrence is on Gray's Peak (U.C.herb.).

MARSILEA VESTITA.—This widespread western Four-leaf Fern grows in circumneutral muddy hollows in grassland, and has been collected at 7 stations in Colorado, from Saguache and El Paso up to Boulder and Weld cos.

NOTHOLAENA FENDLERI.—One of the state's commoner ferns, locally abundant in dry crevices of all sorts of rocks at moderate elevations. It is a southwestern upland species, and has been collected in many counties, from Montrose to Rio Grande and Huerfano, north to Grand and Larimer.

NOTHOLAENA STANDLEYI.—Another southwestern-upland fern, characterized by its yellow-backed ternate fronds. It grows on dry south-facing sandstone ledges, extending from Cimarron Co., Oklahoma, into Baca Co., Colorado. In dry weather its fronds roll up into clusters of yellow globules.

PELLAEA ATROPURPUREA.—The Hairy Cliffbrake, chiefly a midland and eastern species, extends sporadically into the Rocky Mountain region. There are four Colorado

records: Paradox, Montrose Co.; Box Canyon, Ouray Co.; and South Cheyenne Canyon and Glen Eyrie, El Paso Co. Here as elsewhere it grows on limestone or calcareous phases of other rocks.

PELLAEA GLABELLA var. OCCIDENTALIS.—Smooth Cliffbrake, a north-midland species, is represented by a small variety at Loma, Rio Grande Co., as discussed by Maxon.[6] Search for it in 1937 was unsuccessful.

PELLAEA LONGIMUCRONATA.—This bipinnate southwestern-upland Cliffbrake has usually been recorded as *P. wrightiana*, but the real identity of the Colorado plant was pointed out by Maxon.[7] It is known here only along the Arkansas River in Fremont Co. In 1937 a single small plant was found near the north end of the Royal Gorge bridge, in a sunny crevice in granitic rock.

PHEGOPTERIS DRYOPTERIS.—A circumboreal plant, found at 10 stations from Larimer south to Park and El Paso cos. It grows in moderately acid, humus-rich soils from 11,000 down to 8000 feet.

POLYPODIUM HESPERIUM.—A west-American representative of the circumboreal *P. vulgare*, often placed under it as var. *columbianum*. It grows in subacid soil in damp crevices of granite and other firm siliceous rocks, and has been collected in 15 places in Colorado, from Larimer down to Ouray and Huerfano cos.

POLYSTICHUM LONCHITIS.—This circumboreal Hollyfern, rare in northeastern North America, is more frequent in the west, and has been found at 12 Colorado stations, from Routt to Larimer and south to Montezuma and Gunnison cos. It grows in slightly acid soil on cool moist cliffs and shaded rock-slides at 12,000 down to 8000 feet altitude.

PTERIDIUM AQUILINUM var. LANUGINOSUM.—The west-American representative of the wide-ranging Bracken,

[6] This JOURNAL 8: 91. 1918.

[7] Proc. Biol. Soc. Wash. 30: 182. 1917.

with pubescent, ovate fronds and ciliate indusia seems to be rare in this state. Material corresponding more or less to this characterization has been seen from a few places, Routt to Boulder and down to Montrose, Archuleta, and El Paso cos.

PTERIDIUM LATIUSCULUM.—From the preceding, the eastern Bracken is considered to differ in having glabrate deltoid fronds and non-ciliate indusia, although there are more or less pubescent forms. Specimens from at least 15 places in Colorado, Larimer to Routt and south to El Paso, Archuleta, and Montrose cos., appear to belong here. The relations between these two Brackens need further study, for their intergradation in this region is so marked as to cast doubt on their specific distinctness.

SELAGINELLA DENSA.[8]—This Spike-moss, a moderate-altitude Rocky Mountain species, is characterized by the conspicuous long white awns and elongate strobili. In 1937 special attention was given to this group of plants, and the present one proved to be the commonest in Colorado. It grows on rocky and gravelly slopes from 5000 to 10,000 or rarely 12,000 feet, the soil reaction being most often subacid. The known range is from Moffatt to Larimer and south to San Juan, Costilla, and El Paso cos.

SELAGINELLA MUTICA.—A southwestern-upland plant, with obtusish awnless leaves, forming sheets and festoons on dry cliffs of both igneous and sedimentary rocks, circumneutral in reaction. It is known at 20 stations in the state, from 7000 to 13,000 feet, Montrose to Fremont and north to Clear Creek and Larimer cos.

SELAGINELLA SCOPULORUM.—This western-alpine species differs from *S. densa* in having shorter awns into which

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[8] Identifications in this genus were kindly checked by Dr. William R. Maxon.

the leaves taper. It grows in circumneutral soil on various types of rock, from 13,000 down to 10,000 or exceptionally 8000 feet. Collections have been made at 2 or 3 stations each in Garfield, Gunnison, and El Paso cos.

SELAGINELLA STANDLEYI.—A Rocky Mountain alpine endemic, forming mats in circumneutral gravelly soil at 14,000 to about 11,000 feet. The obtusish leaves are abruptly tipped with dull, moderately long awns, and the whole plant tends to have a bronzy hue. It was first found in Colorado on Pikes Peak, El Paso Co., and in 1937 turned up also in Routt and Gunnison.

SELAGINELLA UNDERWOODII (formerly known as *S. rupestris* var. *fendleri*).—The last Spike-moss in the list is a southwestern-upland plant which forms tufts, festoons and sheets on all sorts of rocks, the reaction ranging from minimalkaline to subacid. It varies considerably in aspect, the leaves spreading widely on young shoots but becoming appressed on older ones; in exposed situations the branches are numerous and crowded, while in sheltered places the growth is vine-like and the branches are remote. Throughout these habital variations, it retains the characteristic features of moderately long white awns and brilliant deep green color of the leaves. In Colorado it is fairly common, from Ouray to Baca and north to Jackson and Larimer cos.

WOODSIA OREGANA, variety.—One of the commonest ferns in this state is a small Cliff-fern which grows in damp to rather dry circumneutral soil on rocks and rockslides. It ranges from 11,500 down to 4500 feet, and has been collected from Larimer to Montrose, Rio Grande, and Baca cos. It is obviously related to *Woodsia oregana*, but differs from the typical phase of that in being consistently and often rather densely glandular, as in *W. cathcartiana*, as well as in a tendency to-

ward thickened margins, in which respect it approaches *W. mexicana*. Detailed study of a large series of specimens will be necessary before its relationship can be established, so no attempt is here made to assign it a name.

WOODSIA SCOPULINA.—A northern North American fern, which extends south both in the eastern and western mountains, though far more frequent in the latter. It differs from the next-preceding in bearing rather numerous long septate hairs, and in preferring subacid soil, growing mostly in crevices of granite and other firm, siliceous rocks. In Colorado, where the species was first recognized, it ranges from 11,000 down to 5000 feet, and from Larimer to Archuleta and Pueblo cos.

## DOUBTFUL OR ERRONEOUS RECORDS

*Equisetum pratense*.—While this species is circumboreal, there is no evidence that it extends south of the Canadian Rocky Mountains in western North America. Every specimen so labelled from Colorado and neighboring states, including those on which published reports by Porter and by Rydberg were based, has proved on critical examination to represent *E. arvense*.

*Equisetum variegatum* var. *nelsoni*.—Material from Alamosa and Boulder cos. tentatively referred to the typical phase of *E. variegatum* approaches the variety or possibly independent species known as *nelsoni*. It deserves further study.

*Pellaea breweri*.—A far-western Cliff-brake, with more or less mitten-shaped pinnae. It has been reported successively by Jones (Ferns of the West, 1882), Rydberg (Flora Colo., 1906), and Ashton (Plts. R. M. N. P., 1933) yet in no case has a definite locality been assigned or a specimen preserved, so that its occurrence in Colorado is questionable.

*Pellaea wrightiana.*—As above noted, reports of this species in Fremont Co. refer to another, which should bear the name *P. longimucronata.* However, true *P. wrightiana* occurs in Cimarron Co., Oklahoma, within a few miles of the Colorado line, and will no doubt be found in Baca Co. some day.

*Selaginella rupestris.*—The plant formerly listed under this name, or as a var. *fendleri,* is now regarded as the distinct species *S. underwoodii.*

*Selaginella selaginoides.*—This circumboreal member of the genus was reported by Rydberg (1906) from an undesignated station. No specimens appear to have been preserved, however, and its occurrence here seems improbable.

*Selaginella wallacei.*—Specimens from El Paso County supposed to represent this northwestern species appear to be one of the phases of *S. underwoodii* instead.

*Woodsia mexicana.*—This southwestern-upland species, characterized by thick, divergently-toothed margins and conspicuous indusium-segments, was reported by Rydberg (1906) from several Colorado stations. All the specimens in herbaria which he so annotated, however, represent phases of *W. oregana.*

## GEOGRAPHIC RELATIONS

The 56 ferns and fern-allies definitely known in Colorado can be divided from the geographic standpoint into two main groups, a cool-climate or northern, and a mild-climate or southern one. These are further subdivisible as follows:

### Cool-climate Group

| | |
|---|---|
| Circumboreal plants growing also in Eurasia | 23 |
| Northern North American derivatives | 8 |
| Rocky Mountain endemics | 2 |

| Mild-climate Group | |
|---|---|
| Southwestern-upland plants | 9 |
| Pacific-slope plants | 4 |
| Midland or eastern plants | 5 |
| Widespread species of western North America | 5 |

The members of the first group occur in the state chiefly at high elevations, and evidently came in from the north along the Rocky Mountain chain in pre-Glacial times. Those of the second have come in chiefly along river valleys at relatively low elevations. About 20 of the cool-climate species reach a southern limit here, being so far as known lacking in New Mexico. Of the mild-climate ones, 6 reach a northern, 4 an eastern, and one a western limit in Colorado.

PHILADELPHIA, PA.

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# Notes on American Ferns—XXII[1]

WILLIAM R. MAXON

CYSTOPTERIS BULBIFERA (L.) Bernh.—Although this wide-ranging species has been known to extend southwestward to Utah and central Arizona, it has not heretofore been reported from New Mexico. Specimens from that state were recently brought to the National Herbarium by Mr. Leslie N. Goodding, who collected them at Gray's Ranch, in the Guadeloupe Mountains, Aug. 29, 1937. Several plants were gathered. The fronds are about 40 cm. long and are freely bulbiferous.

ASPLENIUM EXIGUUM Bedd.—Of greater interest is Mr. Goodding's rediscovery of this very rare species in Arizona, his specimens being from a new locality—Sycamore Canyon, five miles south of Ruby, Santa Cruz County, Sept. 22, 1937. The only other Arizona mate-

[1] Published by permission of the Secretary of the Smithsonian Institution.

rial known to me is Lemmon's historic collection of August, 1882, in Conservatory Canyon, Huachuca Mountains, Cochise County. This was originally distributed as a "variety" of *Asplenium fontanum* and has usually since been called *A. Glenniei* Baker, a Mexican species. But *A. Glenniei*, of which half a dozen Mexican specimens are at hand, is apparently not to be distinguished from *A. exiguum* Bedd., of China and the Himalaya. This is the conclusion reached long ago by Hope,[2] who went into the question thoroughly. Like the material previously collected, Mr. Goodding's specimens are proliferous and radicant at the attenuate tip of the blades, in one instance giving rise to a young plant about 1 cm. high. The curious geographic distribution of *A. exiguum* is not quite unique among the ferns, being almost exactly matched by that of *Ceterach Dalhousiae* (Hook.) C. Chr., though the latter species has yet to be reported from Mexico.

× **Asplenium mixtum** Maxon, hybr. nov. (*Asplenium platyneuron* × *A. Trichomanes*).—Rhizoma deest. Folia rigide adscendentia, 18–27 cm. longa, stipitibus validis, 3.5–5 cm. longis, teretibus, non alatis, brunneo-castaneis, lucidis; lamina linearis, 15–22 cm. longa, medio usque ad 1.8 cm. lata, 1-pinnata, rhachi hinc inde fibrillosa, supra anguste concava; pinnae 20–25-jugae, patentes vel subreflexae, remotae, plerumque rotundato-deltoideae, denticulatae, infimae oppositae, breves, 1.5–2 cm. remotae, mediales subopppositae vel alternae, 6–9 mm. longae, 5–8 mm. latae, basi truncatae vel latissime cuneatae, apice rotundatae, superiores alternae, gradatim minores, supremae minutae sed omnes liberae; sori crebri, anguste lineares.

Fronds several, suberect, 18–27 cm. long, the stipes short (3.5–5 cm. long), about 1 mm. thick, terete, dark chestnut-brown, polished; blades linear, simply pinnate, 15–22 cm. long, up to 1.8 cm. broad at middle, the rachis

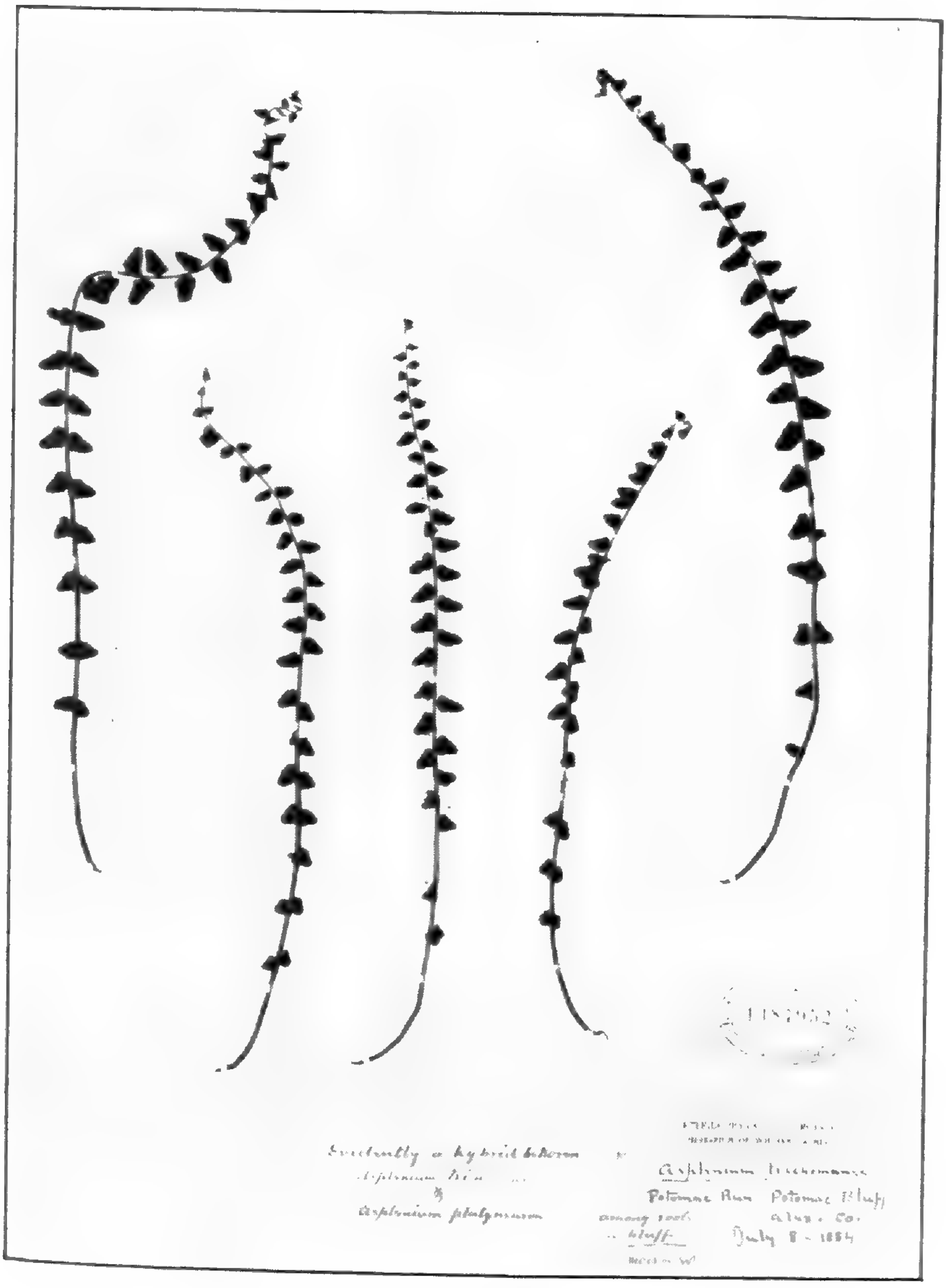
[2] "Note on *Asplenium Glenniei* Baker, in Synopsis Filicum, 2d Ed. p. 488," Bull. Torrey Club **26**: 58–62. 1899.

polished, sparingly fibrillose, grooved in front, with 2 low ridges; pinnae 20–25 pairs, horizontal or slightly deflexed, distant, mostly rounded-triangular, evenly denticulate, the lowest 1 or 2 pairs opposite, short, 1.5–2 cm. apart, the middle ones subopposite or mostly alternate, 6–9 mm. long, 5–8 mm. broad, truncate or very broadly cuneate at the broad base, rounded at apex, the upper ones alternate, gradually reduced, the uppermost minute, all free; sori numerous, close, narrowly linear, approaching the midrib, sporangia few.

Type in the U. S. National Herbarium, no. 1,487,952, collected "among roots" at Potomac Run, Alexandria Co., Virginia, on bluffs of the Potomac River, July 8, 1884, by William Palmer.

The specimen above described belonged to the private herbarium of William Palmer, by him bequeathed to the U. S. National Museum, and is matched by no other material in the National Herbarium. Though originally labelled *Asplenium Trichomanes*, it was subsequently annotated by Mr. Palmer as "evidently a hybrid between *Asplenium Trichomanes* and *Asplenium platyneuron.*" Recent study wholly supports this opinion.

*Asplenium mixtum* stands almost exactly midway between its parents, as might be expected. In stature it approaches *A. platyneuron*, as also in its stout, evenly terete, somewhat hollow stipes and its fibrillose rachis; in *A. Trichomanes* the darker and more slender stipe is definitely ridged laterally and the wiry rachis bears a pronounced scarious "flange" at either side above. It may be added that the stipe shows two fibrovascular bundles at the extreme base, these soon becoming fused, as in *A. platyneuron;* in *A. Trichomanes* the stipe has a single bundle throughout. In its spaced-out pinnae—the lower ones opposite, and all of them free, even to the minute uppermost ones—it resembles *A. Trichomanes,* and departs widely from *A. platyneuron;* in the latter they are all alternate and the upper ones are joined in a pinnatifid apex.




× Asplenium mixtum Maxon.

In the shape of its pinnae *A. mixtum* is truly intermediate, for whereas in *A. platyneuron* these are linear to linear-oblong or elliptical from a cordate, auriculate or subhastate base, which overlies the rachis (often widely so), and in *A. Trichomanes* are roundish-oval or oblong from a narrowly cuneate base, in the hybrid they are triangular, with a truncate or very bluntly cuneate base, which merely lies close to the rachis. Also the margins are evenly denticulate, being thus intermediate between the undulate-crenate or lightly bicrenate margins of *A. Trichomanes* and the serrate, biserrate, or variously incised condition shown by *A. platyneuron*. Furthermore, although the indusia are ample and perfectly formed, the fronds having been collected at the season of normal maturity, the sporangia are very few, nevertheless, and are apparently abortive.

The hybrid origin of *A. mixtum* seems to me beyond question.

WASHINGTON, D. C.

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# Pteridophytes of Sierra Ancha, Arizona

ELBERT L. LITTLE, JR.[1]

Specimens of 28 species of pteridophytes and 1 additional variety, including 24 species of true ferns and 4 species of fern allies, were collected on Sierra Ancha, Arizona, from 1935 to 1937. As Arizona has no published State flora, possibly this relatively large local list may be of interest to students of distribution.

Sierra Ancha is located in the central part of the State, by air line about 25 miles north of Globe and 15 miles

[1] Assistant forest ecologist, Southwestern Forest and Range Experiment Station, which is maintained at Tucson, Ariz., by the Forest Service, U. S. Department of Agriculture, in co-operation with the University of Arizona.

northeast of Roosevelt Reservoir in the Tonto National Forest, Gila County. It rises gradually from about 2,100 feet above sea level at Roosevelt Reservoir to about 7,800 feet at the highest point. In origin it is not volcanic, as are many of Arizona's mountains, but is composed mainly of quartzite with intrusions of diabase. There are also some small outcrops of sandstone and limestone.

The collection was made mainly in and in the vicinity of Sierra Ancha Experimental Forest, branch station of the Southwestern Forest and Range Experiment Station, located at an elevation of about 5,000 feet on the southwest side of the mountain. Pteridophytes of all the species listed grow within 5 miles of this station but in a wide altitudinal distribution from about 3,000 feet up to 7,800 feet above sea level. Members of all except 5 species have been found inside the drainage of Parker Creek Canyon.

The vegetation of Sierra Ancha will be summarized briefly as the basis for notes on the zonal distribution and habitat of pteridophytes. Three climatic or life zones are represented: (1) semidesert, or Lower Sonoran life zone, from Roosevelt Reservoir to an elevation of about 3,500 feet; (2) chaparral-woodland, or Upper Sonoran zone, roughly from 3,500 feet to 6,000 feet; and (3) pine-fir forest, or transition zone, above 6,000 feet. While precipitation varies greatly from year to year within each zone, the annual precipitation is about 18 inches in the semidesert area, 25 inches in the chaparral-woodland zone, and 30 inches in the pine-fir forest.

The semidesert vegetation, which varies locally in composition, is characterized by scattered xerophytic shrubs and trees with weeds and grasses between them. Dominant woody plants include jojobas or "coffeeberries" (*Simmondsia californica*), paloverdes (*Cercidium* spp.),

and cacti (*Opuntia* spp.). In the Upper Sonoran zone the vegetation-type is chaparral of broad sclerophyll shrubs with some open areas occupied by perennial grasses. Dominant chaparral species are shrub live oak (*Quercus turbinella*), mountain-mahogany (*Cercocarpus breviflorus*), and Gregg hornbush (*Ceanothus greggii*). On the more moist sites are oak-woodland stands of broad sclerophyll trees, in which Emory oaks (*Quercus emoryi*) and Arizona white oaks (*Quercus arizonica*) are dominant. The pine-fir forest has as its dominant species ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga taxifolia*). Small stands of aspens (*Populus tremuloides* var. *aurea*) occur near the mountain top.

The pteridophytes of Sierra Ancha are most numerous both as individuals and species in the chaparral-woodland zone, but, in general, are not common. Species of the list most commonly represented in the semidesert zone are *Selaginella arizonica* and *Pellaea longimucronata*. In chaparral vegetation *Cheilanthes wrightii* and *Pellaea longimucronata* are perhaps the most commonly represented species. *Pteridium aquilinum* var. *lanuginosum* is abundantly represented in both oak-woodland and pine-fir zones, and *Cheilanthes fendleri* is characteristic also of the latter zone.

Usually the pteridophytes occur on rock outcrops, in crevices of quartzite cliffs and in the shade of boulders. Around rocks the supply of soil moisture is probably greater and conditions are more favorable for growth, especially of gametophytes. The presence of extensive areas of cliffs and stony soils is probably an important factor in the occurrence of a wide representation of pteridophyte species on Sierra Ancha but is supplementary, of course, to the great range in elevation.

Of special interest are the adaptations of pteridophytes of various xerophytic species to limited water supply in

dry seasons. Lipferns (*Cheilanthes* spp., with the exception of *C. wrightii*) have mats of scales and hairs over the fronds which probably aid both in reduction of transpiration and in absorption of water. Absorption of water directly through the leaves seems to be rather common in xerophytic ferns. These ferns exhibit hygroscopic movements, such as curling parts of their fronds into compact masses when dry and unrolling them into flat blades when wet. A curled or rolled frond will unroll when water is added directly to the frond. A detached frond will even unroll when inverted with only the blade in water. Ferns of Sierra Ancha that exhibit hygroscopic movements and adaptation for absorption of some rain water directly through their leaves include *Cheilanthes* spp., *Notholaena* spp., *Bommeria hispida*, and *Pityrogramma triangularis* var. *maxoni*. Similar adaptations were observed in selaginellas (*Selaginella arizonica*), in which the scalelike leaves are tightly appressed when dry and widely spread when moist. Gray, dry selaginella mats quickly become green as the leaves absorb rain water.

For assistance in checking the determinations of specimens, the author is indebted to Jack Whitehead, of the Boyce Thompson Southwestern Arboretum, and to Dr. William R. Maxon, curator of the United States National Herbarium. Duplicate sets of specimens have been deposited in those institutions, also in the herbarium of the University of Arizona, and in the U. S. Forest Service herbaria at the Sierra Ancha branch station and in Washington, D. C.

The pteridophytes of Sierra Ancha represent 24 species and 1 additional variety of *Polypodiaceae*, 3 species of *Equisetaceae*, and 1 species of *Selaginellaceae*. The largest genera are *Cheilanthes* (lipferns, 6 species), *Notholaena* (cloakferns, 5 species and 1 variety), *Pellaea* (cliffbrakes, 4 species), and *Equisetum* (horsetails, 3 species).

The remaining 10 species are distributed among an equal number of genera.

In distribution, the members of these species are principally those of the semiarid Southwest. Only 8 of the species are represented in the eastern part of the United States: *Adiantum capillus-veneris, Asplenium resiliens, Cystopteris fragilis, Pellaea atropurpurea, Pteridium aquilinum, Equisetum arvense, E. kansanum,* and *E. praealtum.* On Sierra Ancha all except the first one of these 8 species are confined to the higher mountain zones, where the flora is more nearly related to that of the North and East.

Still fewer species of the list are distributed on the Pacific Coast. The record of one of these, *Dryopteris arguta,* represents the second locality of the species reported in Arizona.

The list of species with notes on abundance, habitat, and zonal distribution follows:

## POLYPODIACEAE

ADIANTUM CAPILLUS-VENERIS L. Found only at the lower end of Parker Creek Canyon in the semidesert zone. Here the plants are common on constantly moist and shaded deposits of calcium carbonate on the canyon walls.

ASPLENIUM RESILIENS Kunze. Rare on a shaded limestone cliff in an oak-woodland.

BOMMERIA HISPIDA (Mett.) Underw. Common on exposed rocky slopes in the chaparral-woodland zone.

CHEILANTHES EATONI Baker. Uncommon in rock crevices in the chaparral-woodland zone.

CHEILANTHES FEEI Moore. Rare on dry limestone outcrops in the chaparral zone.

CHEILANTHES FENDLERI HOOK. Common among rocks in chaparral-woodland and pine-fir forest zones.

CHEILANTHES LINDHEIMERI Hook. Uncommon in rock crevices in the chaparral-woodland zone.

CHEILANTHES WOOTONI Maxon. Uncommon on rock outcrops in the chaparral-woodland zone and rare in the semidesert zone.

CHEILANTHES WRIGHTII Hook. Common on open, rocky areas in the chaparral-woodland zone and rare in the semidesert zone.

CYSTOPTERIS FRAGILIS (L.) Bernh. Uncommon on shaded soil and rock outcrops in the pine-fir forest along Workman Creek.

DRYOPTERIS ARGUTA (Kaulf.) Watt. A single large plant was found at the base of a boulder in the oak-woodland along Parker Creek Canyon. This is the second Arizona locality for the species, specimens of which have been found in Devil's Canyon near Superior, about 35 miles south. The Arizona specimens have recently been cited by Dr. William R. Maxon, Notes on American Ferns —XXI. AMER. FERN JOURN. **27**: 109–111. 1937.

NOTHOLAENA BONARIENSIS (Willd.) C. Chr. Rare in rock crevices in the chaparral zone.

NOTHOLAENA LIMITANEA Maxon. Rare at one station on limestone rock at the upper border of the semidesert zone.

NOTHOLAENA PARRYI D. C. Eaton. Uncommon at a single station on limestone rock at the upper border of the semidesert zone. These minute, very hairy ferns represent an extreme in xerophytic appearance.

NOTHOLAENA SINUATA (Sw.) Kaulf. Uncommon in rocky soil in the chaparral-woodland zone and rare at the upper edge of the semidesert zone.

NOTHOLAENA SINUATA (Sw.) Kaulf. var. INTEGERRIMA Hook. Uncommon on rocky soil in the semidesert zone. Although generally found here at a lower elevation, in one place members of the variety were growing associated with those of the species proper.

NOTHOLAENA STANDLEYI Maxon. Uncommon in rock crevices of the semidesert and chaparral-woodland zones. Individuals of this species with their pentagonal fronds and yellow lower surfaces are among the most beautiful of the small southwestern xerophytic ferns and should be worthy of cultivation as ornamentals.

PELLAEA ATROPURPUREA (L.) Link. Uncommon in rocky soil of chaparral-woodland and pine-fir forest zones.

PELLAEA INTERMEDIA Mett. Uncommon in rocky soil in the chaparral-woodland zone.

PELLAEA LONGIMUCRONATA Hook. Rather common among rocks in semidesert, chaparral-woodland, and open pine zones.

PELLAEA WRIGHTIANA Hook. Uncommon in rocky soil in the chaparral-woodland zone.

PITYROGRAMMA TRIANGULARIS (Kaulf.) Maxon var. MAXONI Weatherby. Rare in rock crevices of the chaparral-woodland zone.

PTERIDIUM AQUILINUM (L.) Kuhn var. LANUGINOSUM (Bong.) Fernald. Abundant on soil sites in the undergrowth of oak-woodlands, pine-fir forests, and aspen forests. In these areas individuals of this species are far more numerous than those of all other pteridophyte species combined. The largest ferns of the area, they average 1½ to 2 feet in height but reach a maximum height of 4 to 5 feet.

WOODSIA MEXICANA Fée. Uncommon in rock crevices of oak-woodlands and pine-fir forests.

WOODWARDIA FIMBRIATA J. E. Smith. Rare in moist soil near stream, pine zone.

## EQUISETACEAE

EQUISETUM ARVENSE L. Common along streams and abundant in a cleared field in the pine-fir zone.

EQUISETUM KANSANUM Schaffner. Uncommon along Rose Creek in the pine-fir forest zone.

EQUISETUM PRAEALTUM Raf. Common in moist soils at borders of streams in the pine-fir forest zone.

## SELAGINELLACEAE

SELAGINELLA ARIZONICA Maxon. Common in the semi-desert and chaparral zones, where the plants form extensive mats on exposed rock outcrops and stony soils.

FLAGSTAFF, ARIZONA

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# The Longevity of Osmunda Cinnamomea with Notes on Some Fern-Feeding Larvae

HENRY BIRD

Four very diverse ferns serve as food-plants for an equal number of conspicuous lepidopterous larvae of endophytic, or boring habit, the latter however belonging to a single, compact genus. The adult insects maturing therefrom find a place systematically in the Noctuid group of moths generically known as *Papaipema*.

They should not be classed as particular enemies of the ferns because their work does not cause the demise of the plant, only the loss of a frond or two, or a section of the root as the case may be. In a way they are beneficial because they act as hosts for a great diversity of parasites which affect other species also, thus serving to work out that wonderful and little appreciated balance that occurs in the insect world.

While the ferns possess such a background of antiquity geologically, this *Papaipema* group suggests a new branch on its phylum, being confined to temperate North America and not very fixed in certain of its fifty-odd species. In most cases each confines itself to a preferred food-plant, often of a genus confined to America, and their unerring choice of a certain species of *Solidago*, *Aster*, *Laciniaria* and of other large genera brand them as belonging in good botanical company.

The four ferns involved are the Osmundas, *O. regalis* and *O. cinnamonea; Onoclea sensibilis; Anchistea virginica;* and *Pteridium aquilinum.* Their individual larvae mine in the lower stems and root-stocks and secrete themselves so astutely that many years of patient searching have been required for their discovery. The adults, moths with a wing expanse of 30 to 46 mm., had been previously known, but what plant concealed their larvae was a problem, since a choice might occur through the whole floral gamut to, and including the Composites.

Considering only the one species which bores in Osmunda, *Papaipema speciosissima,* its larva is largest of all, attaining a size of 55 mm., and caused the writer thirteen years of diligent searching to discover with the aid of a New Jersey protégé. It becomes a bulky, pinkish caterpillar that might be suspected to work seriously against longevity of the host plant.

This is not the case, however, notwithstanding old plants are invariably chosen by the female moth for placing her ova. These adults live for about a fortnight in the later days of September, their ova overwinter and the young larvae hatch forth in late May, bore down through the stems of young fronds and continue mining the rootstock until late July when they change to a pupal form, from which the adults emerge in mid-September, thus completing the life cycle.

*P. speciosissima* as a moth was described in 1868 and occasionally came to light at various sources on the Atlantic seaboard through the years, but it was not until 1913 that its larval history was known and described. Finally it had become evident a larval colony must be flourishing within the fastnesses of the "Jersey Meadows," that great semi-tidal marsh west of Jersey City and Hoboken, and here it was eventually run down. In the upper and less saline reaches of this marsh, scattered

through the Typha and some invading arboreal types, occurs an antiquated growth of Osmundas with their nodes arising to an unusual height to surmount the wetness, and which furnish sustenance and retreat for a most thriving colony of *Papaipema*.

One is at once struck by the apparent age of these ferns and knowing with what tenacity the moths cling to the haunts of their ancestors in a manner not exceeded by a certain celestial race, it becomes evident that here we have a commingling which may well go back for centuries. Although regal and cinnamon ferns are common to any swamp, this is the only station known hereabouts; the annual burnings which such areas suffer has resulted in extermination at such points elsewhere as they once occurred.

These entomological details are cited to show observational familiarity with what follows since no claim is made to botanical authority, the literature has not been sifted and the deductions have only the weight of individual surmise. Of late years *O. cinnamomea* has been particularly observed since its *Papaipema* infestation has always been associated with root-clumps of much age. So far as root growth indications go, *O. regalis* does not attain so great an age, neither does the third species, *O. claytoniana*.

Restricting the discussion to Westchester County, N. Y., indications of the present-day flora would proclaim *cinnamomea* one of the climax species of open swamp and even brackish borders of marshland. However, it does not appear to be reproducing itself in this area at present. The writer has failed to observe what could be called a first or second year growth after the prothallium stage and botanists interrogated have been vague or noncommittal in the matter. The reason need not be obscure, for the drained swamps and lack of

primitive moist conditions necessary to the development of prothallia is doubtless the answer.

It is commonly observed that extremely large root-stocks of *O. cinnamomea* are frequently met throughout this state, many of them centenarians. A certain individual root-clump near Rye, N. Y., is 3.74 meters (12.3 feet) across, while several nearby are almost as large. It would be of interest if the age of such a patriarch could be determined since likely it outdistances the oldest standing trees in that locality. My information is that the literature carries no definite data on the subject. Prof. W. N. Clute has suggested that an approximation of age in certain ferns might be secured by taking count of yearly frond growth and applying it against the frond growth as shown in a section of the rootstock.

But this could not be done with the specimen in question. Out of the writer's experience the following only can be suggested.

A number of *Osmunda cinnamomea* ferns were planted along the north foundation wall of our residence at Rye, thirty years ago. All have made a subsidiary growth outward from the building while the original rhizomal node still flourishes at its first position. They have grown luxuriantly and the greatest advance made by any one is a trifle under 18 centimeters. Now if it is assumed hypothetically that our patriarch grew with equal celerity from its center (indicated by a dead sunken area and not quite the theoretical center) to the advanced margin, it would register about 310 years of growth per greatest radial measurement. Treated as a matter of mass, a much greater figure would be the presumptive age.

Other details of this large cinnamon fern may be worthy of note. The plant is located on sloping ground margined by a little rill; one edge touches the water-

An Old Cinnamon Fern Rootstock at Rye, New York, Over 12 Feet Across Its Greatest Axis.

course and capillarity affords moisture throughout. The land is a long-abandoned farm and for the past twenty years has suffered annual burning, so that there is no accumulation of humus at present. It is for this reason clear to see that this root-clump is but of a single plant. Overlying a clay substratum and with little fertility to draw on yet it seems not to lack vigor—the rank fronds would suggest full prime.

July 28, 1927, sterile fronds to the number of 534 were arising from 77 rhizomal nodes; June 6, 1928, 177 fruiting fronds arose from 80 nodes; September 19, 1928, 430 sterile fronds were ascending from these 80 nodes. Since there were no small examples reflecting seedling growth in the near vicinity, interest was felt as to the reproductive potentialities of such a plant. The fruiting fronds seemed especially vigorous, reaching a height of 70 centimeters for the maximum average, and with the sporangia-total for such a frond estimated at 32,300. The largest, lower pinna bore about 1568 spore cases, the fourteenth, 708; one midway about 1100, which latter figure was considered an approximate average. Beyond the fourteenth including the tip there were 1500. To overcome their hairiness, they were dissected out in water, on glass, and it was not difficult to make this count.

To arrive at a summary which might be accorded the spores was a more tedious matter. After several schemes, it was found that a spore case placed in a hollow cavity slide, with the cover glass in position, showered out its contents so as to permit an enumeration. Over a white surface ruled to minute squares and using low magnification, these individual spore showers were found to number 306 to 328 in several counts and a few were yet remaining in the gaping sporangium. Assuming 300 to be a fair index, the plant would be sending

down around a billion and a half spores as a yearly contribution to *cinnamomea* posterity.

Dr. Arthur Hollick has informed us *Osmunda* species trace back to the lower Cretaceous. Having survived such an interval and yet in their present productivity, we may rest assured they will find a way for long continuance.

RYE, NEW YORK.

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## Shorter Notes

HART'S-TONGUE IN TREES?—As I understand there are not a large number of English subscribers to your FERN JOURNAL, and as none of them may comment on your note on pages 69 and 70, vol. 28, no. 2 on Hart's-tongue, I am doing so. In my experience, a hollow or even a fork of a tree is most unusual as a home for this fern; I have never seen one in such a place, although in Devon I have seen hundreds of these plants; and there are plenty of opportunities in that county for "epiphytal" growth, if it were usual. *Polypodium vulgare* does sometimes run along mossy branches and occasionally roots in *dry* crevices in trees.—E. A. ELLIOTT, *South Stoke, Nr. Reading, Berkshire, England.*

THE STATUS OF DRYOPTERIS CELSA.—I notice that Dr. Wherry in his fern book considers *Dryopteris celsa* Wm. Palmer a hybrid; this amuses me. All through the Dismal Swamp we get this peculiar type of fern which is always the same and we get nothing else there, as far as I have been able to discover. Therefore, why call the thing a hybrid? It may have been of hybrid origin in the days gone by, but it certainly at the present time is a perfectly pure strain, extending for miles and countless miles. Furthermore, I have had it in my garden for years. Its appearance in the spring differs from that

of Goldie's, Clinton's and *D. cristata.* The scales, too, and the whole habit are different. I have these ferns close together, so have a splendid opportunity to compare them.—PAUL BARTSCH, *Washington, D. C.*

FERNS IN DETECTIVE FICTION.—Some day, someone is going to write a mystery story in which the criminal is traced because there happens to be a fern expert present who identifies microscopically the spores of *Ophioglossum vulgatum* and thus proves, despite an alibi, that the miscreant had passed through the bog meadow when he claimed to be at home asleep. Hitherto, the mystery story has not made the pages of the JOURNAL, only such near classics as "Jude the obscure" and "And so, Victoria." Today we admit "Crime in corn weather" by Mary M. Atwater (Houghton Mifflin). It is a good story. The denouement comes in a wooded limestone region, which serves as a picnic place and "where they hunted the elusive walking fern" and didn't find the "corpus delicti," nor catch the murderer.—R. C. B.

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Whitehead, Jack, Box 1022, Santa Barbara, Cal.

Milton S. Baxter, a member of the Society since 1912, died at Rochester, New York, October 15, 1938, aged 83. He was born in a log house at Hamlin, New York, received a normal school education and immediately on graduating entered the employ of the Bell Telephone Co. He was soon sent to Europe where he spent eleven years installing telephone systems in Holland, Belgium, Switzerland, and Russia. He was married at Riga to Julia Henko; they had one daughter, who survives him.

On his return to the United States he took a position with the Rochester Telephone Co. and was its plant superintendent when he retired after 52 years' service in the industry. He had always been interested in natural history, particularly botany, and had been active in local scientific societies. His retirement gave him more time to devote to what had been his hobby; he became curator of the herbarium at the University of Rochester, for ten years taught field botany in its summer school, and up to the present season continued to lead field excursions. Indeed, until his last sickness he had never been seriously ill; and his death was the first break since 1876 in a family of seven brothers and sisters. His personal herbarium of some 6000 sheets will go to the Rochester Academy of Sciences.

Modest, lovable, kindly, competent and an effective teacher, Mr. Baxter will be missed not only in Rochester, but among a wide circle of botanical acquaintances and correspondents.

# Index to Volume XXVIII

## ERRATUM

Page 21, line 1. For Osmunda regalis L., read Osmunda regalis of American authors, not L.

The following should be added to the errata for volume 27.

Page 124, line 15. For 83–84, read 82–83.

Page 126, line 3. For 83–84, read 82–83.

Page 130, line 24. For Am. Mor., read Ann. Mo.

# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

C. A. WEATHERBY

R. C. BENEDICT W. R. MAXON

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# American Fern Journal

VOL. 29 JANUARY–MARCH, 1939 NO. 1

## Notes on the Ferns of Wisconsin

R. M. TRYON, JR.

As the result of a year's study on the ferns of Wisconsin and an extensive collecting trip in the northern part of the state last summer, the author has found many species and varieties new to the state. In the course of preparation of a book on the ferns of Wisconsin it seems desirable to list the species not previously reported and to clarify the usage of certain names. All of the species, varieties and forms listed are new to the state and unless otherwise stated are in the Herbarium of the University of Wisconsin.

The typical *Pteridium latiusculum* (Desv.) Hieron. in Wisconsin may be characterized as follows: blade triangular, often ternate, lax, usually pubescent beneath along the midribs of the pinnules and ultimate segments, and on the margin of the segments, glabrous elsewhere; rachis glabrous or, less often, pubescent; pinnae remote, spreading, the basal exceeding the second pair and about twice as wide; sterile outer indusium most commonly non-ciliate or rarely more or less ciliate; usually a plant of damp and dry shaded places, although it is sometimes found in the sun. A form of the Bracken that is quite frequent in northern Wisconsin is apparently distinct enough to warrant formal or varietal distinction, but since its relationship is not yet entirely clear it will be discussed here but not named. It may be briefly contrasted with the typical

[Volume 28, No. 4 of the JOURNAL, pages 125–164, plates 12–14, was issued December 15, 1938.]

form as follows: blade obovate, oval or broadly lanceolate, rarely long-lanceolate, erect, pubescent beneath, at least along the midribs of the pinnules and ultimate segments and sometimes between the margin and the midrib, also pubescent on the margin; rachis usually pubescent; pinnae crowded, ascending, the basal not exceeding the second pair and but slightly wider; sterile outer indusium usually ciliate in various degrees or sometimes non-ciliate; a plant of dry, sunny places, often in pastures, fields, railroad right-of-ways and recently burnt-over land. Some specimens agree essentially with *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fernald f. *decipiens* (Lawson) Fernald, *Rhodora* **37**: 248 (1935) and thus the actual identity of that form is involved. Until more information is available on the behavior of the Eastern Bracken at the northern limit of its range, the identity of the Wisconsin and similar material cannot be settled.

ADIANTUM PEDATUM L. var. ALEUTICUM Rupr.—This typically Western variety of Maidenhair has been collected in two localities: Drummond, Bayfield Co., and Osceola, Polk Co. The Osceola plant shows a relationship to the typical form in that two of the fronds are var. *aleuticum* and the other two are perfectly typical. Perhaps it is a genetical offshoot indicating something of the origin of var. *aleuticum*.

PELLAEA ATROPURPUREA (L.) Link.—The only record we have of this species is a specimen in the Gray Herbarium collected by N. C. Fassett at Mill Bluff, near Prairie du Sac, Sauk Co., in 1925. This station is in the Driftless Area.

ATHYRIUM THELYPTEROIDES (Michx.) Desv. f. ACROSTICHOIDES (Sw.) Gilbert.—Scattered throughout the state; we have specimens from Ashland, Iron, Waushara, Columbia and Milwaukee counties.

DRYOPTERIS CRISTATA (L.) Gray var. CLINTONIANA (D. C. Eaton) Underw.—This variety has been collected only at Lake Mills, Jefferson Co.

DRYOPTERIS CRISTATA × SPINULOSA.—Rare in the northern part of the state: Solon Springs, Douglas Co., Three Lakes, Oneida Co., and Alvin and Laona, Forest Co.

DRYOPTERIS SPINULOSA (Muell.) Watt var. FRUCTUOSA (Gilbert) Trudell.—Scattered throughout the state; we have collections from twenty-one counties.

Sometimes specimens are found that do not fit any of the named varieties of *Dryopteris spinulosa* (Muell.) Watt but have some characters of one and some of another. The spores are often abortive. These may be interpreted as hybrids or they may only be intermediate forms. The characters of these and their relationship to the *D. spinulosa* complex may best be indicated by the following key which has been adapted and revised from Fernald, *Rhodora* **28**: 146 (1926) and Weatherby, AMERICAN FERN JOURNAL **26**: 65 (1936):

Indusium and often the blade glandular, especially along the rachis and midribs of the pinnae; inner lower pinnules on the basal pinnae not exceeding the adjacent pinnules.
  Pinnae tending to be set obliquely to the main rachis, gradually tapering to the tip ..... var. *fructuosa*.
  Pinnae tending to be set at right angles to the main rachis, narrowed rather abruptly to a long tip ..... var. *intermedia*.
Indusium and blade glabrous or glandular; inner lower pinnules on the basal pinnae exceeding the adjacent pinnules.
  Indusium and the blade glandular.
    Pinnae tending to be set obliquely to the main rachis, tapering gradually to the tip.
      *D. spinulosa* > var. *fructuosa*.
    Pinnae tending to be set at right angles to the main rachis, narrowed rather abruptly to a long tip.
      *D. spinulosa* > var. *intermedia*.
  Indusium and blade non-glandular.
    Basal pinnules on the basal pinnae sub-opposite, usually not more than 4 mm. apart, the inferior usually not more than twice as long as the superior; most of the scales at the base of the stipe light brown, many broad, mucronate ..... *D. spinulosa* (typical).
    Basal pinnules on the basal pinnae usually remote, at least 5 mm. apart, rarely sub-opposite, the inferior usu-

ally more than twice as long as the superior; most of the scales at the base of the stipe dark brown, at least in the center, many long-acuminate ..... var. *americana*.

DRYOPTERIS SPINULOSA (Muell.) Watt >[1] var. INTERMEDIA (Muhl.) Underw.—This intermediate has been collected at twenty localities in fifteen counties.

DRYOPTERIS SPINULOSA (Muell.) Watt > var. FRUCTUOSA (Gilbert) Trudell.—This intermediate has been collected eight times in six counties.

DRYOPTERIS LINNAEANA C. Chr. f. **glandulosa,** n. f., rachi glanduloso. Rachis glandular.—WISCONSIN: Barron Hills at Lehigh, Barron Co., May 27, 1933, *Fassett and Schmidt*, no. 15,816; July 18, 1938, *R. M. Tryon, Jr.*, no. 4,154 (TYPE in the Herbarium of the University of Wisconsin, COTYPE in the Gray Herbarium); Amnicon Falls, Douglas Co., July 12, 1938, *R. M. Tryon, Jr.*, no. 4,079; Pattison State Park, Douglas Co., July 12, 1938, *R. M. Tryon, Jr.*, no. 4,091; Drummond, Bayfield Co., June 24, 1896, *Cheney*, no. 4,222; 2 miles north of Mountain, Oconto Co., June 29, 1938, *R. M. Tryon, Jr.*, no. 3,835. WASHINGTON: Spokane and Stevens counties, July 18, 1902, *Frank O. Kreager*, no. 212; Foothills of the Olympic range, 1902, *John M. Grant*, no. 218.

The rachis varies in glandularity, some specimens having only a few glands while others have relatively many and rarely the blade is slightly glandular. At Lehigh, Barron Co., the type locality, there is great variation in glandularity. This form may be separated from *Dryopteris Robertiana* (Hoffm.) C. Chr. by its ternate blade and comparatively slight glandularity. A species of Eastern Asia, *Dryopteris remoti-pinnata* Hayata, is closely related but distinct. It has the leaf-form of *D. Robertiana* and is glabrous or only slightly glandular on the rachis at the base of the pinnae.

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[1] This sign means *varying toward.*

DRYOPTERIS ROBERTIANA (Hoffm.) C. Chr.—Very rare. A few small plants are growing on calcareous rock at Orienta Falls, Bayfield Co. Typical material was collected in a White Cedar swamp, on limestone bedrock, east of Ephraim, Door Co.

PTERETIS NODULOSA (Michx.) Nieuwl. f. PUBESCENS (Terry) Fernald.—Rachis with a fine whitish pubescence on the back or sides. We have collections from fifteen counties throughout the state. This form has been difficult to separate in Wisconsin; of 55 specimens only 8 could be called glabrous. The pubescence varies on different parts of the rachis. The most pubescent specimens are pubescent all over the rachis, others are pubescent only on the sides and front and practically all of them are slightly pubescent along the groove on the front of the rachis. If the form is separated on pubescence alone, 90 per cent of our material would be identified with it. I am making the separation on the basis of the place the pubescence occurs on the rachis. I am referring all material that is glabrous on the back and sides, but pubescent along the groove on the front to the typical species, and all material that is pubescent on the back or sides to the form.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. LAURENTIANA Weatherby.—Rare; growing on damp, calcareous rock at Amnicon Falls, Douglas Co., Orienta Falls, Bayfield Co., Washington Island, Gills Rock, Ellison Bay and south of Jacksonport, Door Co., and Verona, Dane Co. The station at Verona, Dane Co., is on a very small limestone outcrop but it has persisted for at least fifty years, having been collected there first by Prof. E. Kremers in 1888.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. MACKAYII Lawson.—This variety has been collected in twenty-six counties, mostly in the southern half of the state.

CYSTOPTERIS FRAGILIS (L.) Bernh. var. PROTRUSA

Weatherby.—This variety, frequent throughout the state, has been collected in seventeen counties.

WOODSIA OREGANA D. C. Eaton.—This species was first found in Wisconsin this year at Manitou Falls, Pattison State Park, Douglas Co., where it grows on damp and dry igneous rock. All of the material collected there was slightly glandular.

WOODSIA SCOPULINA D. C. Eaton.—Dr. George H. Conklin and Mrs. Mary M. Somerville added this species to the state flora this summer when they collected it on igneous rock at Manitou Falls, Pattison State Park, Douglas Co.

OSMUNDA CINNAMOMEA L. f. INCISA (Huntington) Gilbert.—This form has been collected in Douglas, Bayfield, Sawyer, Langlade and Sauk counties.

OSMUNDA CINNAMOMEA L. f. FRONDOSA (T. & G.) Britton.—This form has been collected in Douglas, Oneida, Langlade, Waushara and Columbia counties.

BOTRYCHIUM SIMPLEX Hitchc. var. LAXIFOLIUM Clausen.—This variety usually grows in dry sandy places but it is sometimes associated with typical *B. simplex* in damp situations. It has been collected at two localities in Douglas Co., two in Bayfield Co., and one each in Washburn and Oconto counties.

BOTRYCHIUM SIMPLEX Hitchc. var. TENEBROSUM (A. A. Eaton) Clausen.—This variety usually grows in rich, damp, shady woods but occasionally is found in more open situations with typical *B. simplex*. It has been collected in Bayfield, Ashland, Iron, Lincoln, Wood and Sheboygan counties.

BOTRYCHIUM DISSECTUM Spreng.—Known only from Devil's Lake, Sauk Co.

BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr. f. **dentatum,** n. f., segmentis dentatis. Segments toothed. Fig. 2.—WISCONSIN: Oak Island, Apostle Islands, Ashland Co.,

July 9, 1938, *N. C. Fassett*, no. 19,457; Sand Lake on county trunk H just north of junction with N, Douglas Co., July 14, 1938, *R. M. Tryon, Jr.*, no. 4,100 (TYPE in the Herbarium of the University of Wisconsin, COTYPE in the Gray Herbarium); on road 27, 4½ miles west of the Sawyer Co. line, Washburn Co., July 16, 1938, *R. M. Tryon, Jr.*, no. 4,122. VERMONT: Bristol, Sept. 18, 1880; Cobble Hill, New Haven, Sept. 5 and Sept. 8, 1899, *Ezra Brainerd.*

This is similar to typical *B. multifidum* in every respect except that the segments are toothed rather than entire. Figures 1, 2, and 3 show the typical leaf-margins of *B. multifidum*, f. *dentatum* and of var. *intermedium.*

At Sand Lake, the type locality, f. *dentatum* is associated with the typical form, both being common. Here there is little or no intergradation, the two plants could be distinguished at a glance by their general "aspect." Dr. George H. Conklin made some observations at Sand Lake late this summer and wrote me that "each form is often in small separate colonies with older larger plants and small fruiting plants around the base. These were found not only in shade but in full exposure to the sun—the two kinds—apparently sun or shade had nothing to do with the shape and form of the sterile blade. Some of the springs in the bank (the lake shore) are colored red with iron and near those the cut form is tinged notably with red." F. *dentatum* seems to be genetically distinct from the typical form, at least at the type locality. The following key places f. *dentatum* in the *Botrychium multifidum-dissectum* complex:

Margins of the segments finely serrate with pointed teeth, toothed, or deeply dissected; t/v[2]—.67 or more.

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[2] t/v, this character is the quotient of the number of teeth, serrations or lobes on a segment divided by the number of veins at the margin of the segment. I have found this very useful in sepa-

Fig. 1 (above)
Fig. 2 (right)
Fig. 3 (below)

Forms of Botrychium multifidum

Margins of the segments toothed; pinnae ending with a broad wedge-shaped segment; segments rounded or slightly pointed, not more than twice as long as broad.
*B. multifidum* f. *dentatum.*

Segments deeply dissected; or margins of the segments finely serrate; pinnae ending with an ovate or lanceolate segment; segments pointed, mostly more than twice as long as broad ..... *B. dissectum* and *forms.*

Margins of the segments entire, wavy or finely serrate with rounded teeth; t/v variable.

Many of the ultimate segments lanceolate, more than twice as long as broad; pinnae and pinnules not lobed near their tips, ending with an ovate or lanceolate segment; inner inferior pinnule on the basal pinnae oblong-ovate or lanceolate if they are entire; t/v—.67 or more ..... *B. dissectum* forms.

Most of the ultimate segments ovate, not more than twice as as long as broad; pinnae and pinnules lobed nearly to their tips, ending with a broad wedge-shaped segment; inner inferior pinnules on the basal pinnae ovate if they are entire; t/v—.62 or less.

Blade small, less than 8 cm. long; segments broad to ovate, rounded or broadly pointed, entire or rarely somewhat finely serrate; segments few, usually crowded; growing in damp places ..... *B. multifidum* (typical).

Blade larger, up to 15 cm. long, segments ovate to broadly lanceolate, mostly pointed, finely serrate or rarely entire; segments many, remote; growing in dry places.
*B. multifidum* var. *intermedium.*

The author is indebted to Mr. C. A. Weatherby and Prof. N. C. Fassett for help in the preparation of this paper.

UNIVERSITY OF WISCONSIN, MADISON, WIS.

## EXPLANATION OF FIGURES

Fig. 1. *Botrychium multifidum* (×1½). Fig. 2. *B. multifidum* f. *dentatum* (×2). Fig. 3. *B. multifidum* var. *intermedium* (×1½).

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rating certain forms of *B. dissectum*, especially f. *oneidense*, from *B. multifidum*. All specimens that I have examined of these two species that were similar in leaf-cutting were easily separated by this character.

# Notes on Elaphoglossum—I[1]

C. V. MORTON

One of the common tropical American species has long been known under the name *Elaphoglossum Lindenii* (Bory) Moore, founded on *Acrostichum Lindenii* Bory ex Fée (1845). Recently, Christensen[2] has taken up the name *Elaphoglossum squamatum* (Swartz) Moore for this species. This was based on *Acrostichum squamatum* Swartz (1806), a new name given to *A. squamosum* Cav. (1799), not *A. squamosum* Swartz (1801). However, since the species of Cavanilles is the older, there was no need for any change in its name. Therefore, by Article 60, Section 2, of the International Rules of Nomenclature, the name *A. squamatum* Swartz is illegitimate and the combination *Elaphoglossum squamatum* is equally illegitimate. Thus the correct name still remains *E. Lindenii*, because, although *Acrostichum squamosum* Cav. is the oldest specific name for the group, that specific epithet may not now be transferred to *Elaphoglossum* because of the existence of the name *E. squamosum* (Swartz) J. Sm. The synonymy may be summarized as follows:

**Elaphoglossum Lindenii** (Bory) Moore, Ind. Fil. XVI. 1857.

*Acrostichum squamosum* Cav. Anal. Hist. Nat. **1**: 104. 1799. Not *Elaphoglossum squamosum* J. Sm. (1841).

*Acrostichum squamatum* Swartz, Syn. Fil. 11. 1806. (Illegitimate.)

*Acrostichum Lindenii* Bory ex Fée, Mém. Foug. **2**: 48. 1845.

*Elaphoglossum squamatum* Moore, Ind. Fil. 15. 1857. (Illegitimate.)

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] Dansk Bot. Arkiv. **9**: 9. 1937.

ELAPHOGLOSSUM **proliferans** Maxon & Morton, sp. nov. *Condyloneura, Petiolosa.* Rhizoma erectum breve, dense paleaceum; stipites dense paleacei, paleis sordide albidis acutis denticulatis; folia sterilia utrinque paleacea, dimorpha, minora late ovata vel orbicularia, majora oblonga, apice retusa prolifera; venae remotae, ex angulo 50–60° egredientes, apice valde incrassatae; folia fertilia longe stipitata, lamina parva, triangulari-ovata vel ovata, utrinque paleacea.

Rhizome erect, short, about 15 mm. long and 3 mm. thick, densely clothed with linear-lanceolate, pale-stramineous, acuminate, membranous scales, these 2–2.5 mm. long and 0.5 mm. wide at base, the cells elongate-hexagonal with mostly straight walls; fronds subcespitose, few. Sterile fronds dimorphic, the stipes slender, greenish, those of the smaller fronds 0.8–2 cm. long, of the larger ones 4–7 cm. long, densely paleaceous, the scales dirty white, triangular-lanceolate, 1–2 mm. long, 0.4–0.5 mm. wide at base, acute, membranous, remotely denticulate, subcordate at base; smaller leaf blades broadly ovate or orbicular, 1–2.5 cm. long, 1–2.1 cm. wide, rounded at apex, truncate or subcordate at base, spongiose, chartaceous in drying, pale green, sparsely but conspicuously paleaceous above, the scales deciduous, similar to those of the stipe, more inconspicuously paleaceous beneath, the scales of the costa large, similar to those of the upper surface, those of the mesophyll much smaller, only 0.25–0.5 mm. long; larger blades oblong, 4.5–5.5 cm. long, 1.5–1.8 cm. wide, deeply retuse at the proliferous, radicant apex, obliquely rounded at base, otherwise similar to the smaller blades; veins visible by transmitted light, arising at an angle of 50–60°, simple or once forked, terminating in conspicuous hydathodes, 6–8 on either side in the small blades, 13–20 in the larger ones. Fertile fronds 3.5–8.5 cm. long, the stipes densely paleaceous; blades triangular-ovate or ovate, 1–1.8 cm. long, 1.2–1.4 cm. wide, rounded at apex and base, densely paleaceous on both surfaces; sporangia about 0.3 mm. wide, the annulus 12- or 13-articulate; spores subglobose, about 40 μ in diameter, roughly tuberculate.

Type in the U. S. National Herbarium, no. 1,643,047, collected at El General, Province of San José, Costa Rica,

altitude 975 meters, December 1936, by Alexander F. Skutch (no. 2970).

A member of the group of small species called subsection Petiolosa by Christ, among which it is readily distinguished by its retuse, proliferous, and radicant sterile fronds.

ELAPHOGLOSSUM **Maxonii** Underw. in sched. *Stenoneura, Conformia.* Rhizoma longe repens, crassum, dense paleaceum; folia approximata erecta, longe stipitata, stipitibus stramineis, vix paleaceis, basi subteretibus, sursum leviter ancipitibus; lamina sterilis elliptica vel anguste elliptica, acuminata, basi decurrens, chartacea, margine cartilaginea, supra epaleacea, subtus paleis minutis stellato-partitis parce instructa; venae liberae, ex angulo 60–80° egredientes, semel vel bis furcatae, apice non incrassatae, marginem attingentes; lamina fertilis oblonga, acuta vel obtusa, basi rotundata, epaleacea, margine integra revoluta, quam sterilis multo brevior.

Rhizome long-creeping, 5–10 mm. thick, densely paleaceous, the scales linear-lanceolate, 6–12 mm. long, castaneous, shining, membranous, fibrillose-margined, filiform at apex, the cells elongate, scarcely contorted; fronds approximate, erect, distichous. Sterile fronds 12–40 cm. long, long-stipitate, the stipes commonly equalling or exceeding the blades, pale stramineous, subterete at base, lightly marginate toward apex, slightly sulcate above, nearly naked, the few scales scattered, dark castaneous, toothed, not over 2 mm. long; phyllopodia 6–11 mm. long, dark brown; blades pointed-elliptic, often narrowly so, 8–24 cm. long, 1.6–4.5 cm. wide, evenly and equally acuminate at apex and base, slightly decurrent, chartaceous, cartilaginous-margined, pale green, epaleaceous above, very inconspicuously and minutely paleaceous beneath, the scales castaneous, about 0.5 mm. long, stellately parted to base, the rays 3–6, unicellular, the terminal cell bulbous and glandular; veins free, arising at an angle of 60–80°, once or twice forked, about 7–9 per cm., reaching the margin, not thickened at apex. Fertile fronds 8–20 cm. long; blades oblong, 4–8.5 cm. long, 1.5–2.8 cm. wide, acute or obtuse, rounded at base, epaleaceous, the margin entire

and revolute; annulus 11-articulate; spores subglobose, about 40 μ in diameter, roughly tuberculate.

Type in the U. S. National Herbarium, no. 520,963, collected at Troy, Jamaica, altitude 600–660 meters, June 30, 1904, by William R. Maxon (no. 2961).

Additional specimens examined:

CUBA: La Prenda, *Hioram & Maurel* 2623, 4700, 4702. Sierra de Nipe, *Shafer* 3712; *Ekman* 5968. Loma San Juan, *Hioram* 7012, 7013, 7040. Loma del Gato, *Clément* 1101, 1725; *Hioram* 7039, 7057, 7059; *Hioram & Clément* 6357. Monte Verde, *Wright* 969; *Hioram & Maurel* 2459. Gran Piedra, *Maxon* 4032. Santa Ana, *Maxon* 4174a. Without specific locality, *Wright* 1070, 3958.

HISPANIOLA: Massif du Nord Bayeux, *Ekman* H 2989.

JAMAICA: Mansfield, *Maxon* 1795, 2393, 2418. Hollymount, *Maxon* 2262, 2271, 2288, 2295. Between House Hill and Cuna Cuna Gap, *Maxon* 8921. House Hill, *Maxon* 9075. West of Troy, *Maxon* 2915, 2924. Above Tweedside, *Maxon* 947. Mount Diabolo, *Maxon & Killip* 538. Mount James, *Maxon* 8609. Cuna Cuna Gap, *Fredholm* 3217. Without specific locality, *Hart* 301.

PUERTO RICO: Sierra Luquillo, *Sintenis* 1805. Adjuntas, *Sintenis* 4724. Sierra de Naguabo, *Shafer* 3315, 3667. Maricao, *Chase* 6209a; *Hess* 353. Without specific locality, *Eggers* 1335.

This West Indian species, which is abundant at elevations of 350 to 1150 meters, has commonly been identified as *Elaphoglossum pteropus* C. Chr. (*Acrostichum alatum* Fée, not Roxb.), which was described from the Guianas. The writer has examined two specimens of *Schomburgk* 449, one of the collections originally cited by Fée, and believes that Underwood was correct in regarding the Greater Antilles plant as specifically different. The fertile blades exceed the sterile in length in *E. pteropus*, an important specific character in *Elaphoglossum;* the reverse is true in *E. Maxonii.* Also, in *E. pteropus* the sterile blades are long-decurrent and form a wing nearly to the base of the stipe, whereas in *E. Maxonii* the blades

are slightly decurrent, the stipe being non-alate for most of its length. The rhizome of *E. Maxonii* is thick and bears a conspicuous apical tuft of scales. The scales throughout the rhizome are mostly persistent. On the other hand, the rhizome of *E. pteropus* is relatively slender, and the scales are smaller, fewer, and more readily deciduous.

The following specimens referable to *E. pteropus* have been studied, some of which were kindly lent by the Botanisches Museum, Berlin:

?HISPANIOLA: *Meyerhoff* in 1859.
TRINIDAD: Mora Forest, *Hombersley* 304.
TOBAGO: Caledonia, *Broadway* 4638.
BRITISH GUIANA: *Schomburgk* 262a, 449.
FRENCH GUIANA: Gabaret, *Leprieur*. Without specific locality, *Jelski*.

UNITED STATES NATIONAL MUSEUM, WASHINGTON, D. C.

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# Our Southwestern Resurrection-Plants[1]

C. V. MORTON

Three species of *Selaginella* of the group commonly known as resurrection-plants are found in the United States, namely, *S. lepidophylla* (H. & G.) Spring, *S. pilifera* A. Br., and *S. Pringlei* Baker. All three are native in western Texas. The first, which has recently been recorded from New Mexico[2] is readily distinguished by its white-margined, obtuse leaves. The other two species, which have leaves bearing a long terminal seta, are very closely related. In attempting to identify a specimen recently collected in the Guadalupe Mountains,

1 Published by permission of the Secretary of the Smithsonian Institution.

2 Maxon, in AMER. FERN JOURN. 13: 74. 1923.

New Mexico, by Dr. Leslie N. Goodding, it was found that these had been much confused in the herbarium. The distinctions given by Hieronymus[3] are as follows:

Branches about 3 mm. wide including the lateral leaves; terminal seta about one-half as long as the leaf blade ..... *S. pilifera.*
Branches about 4 mm. wide including the lateral leaves; terminal seta about as long as the leaf blade ..... *S. Pringlei.*

These characters are true in the type specimens, but the abundant additional material at hand shows all degrees of intergradation. The writer observed, however, that in *S. pilifera* the outer margin of the lateral leaves is serrulate at apex, and that in *S. Pringlei* it is quite entire. In both, the outer margin is strongly ciliate toward base. Inasmuch as no other constant differences are found, the writer considers that *S. Pringlei* should not be held specifically distinct.

Except for the type of *S. pilifera,* which was kindly lent for study by the Botanisches Museum, Berlin, the specimens cited below are in the National Herbarium.

SELAGINELLA PILIFERA A. Br. Ind. Sem. Hort. Berol. App. 20. 1857.
TEXAS: El Paso, El Paso Co., *Wright* in 1849 (type).
TAMAULIPAS: San José, *Bartlett* 10176.
COAHUILA: Saltillo, *Arsène* 10677; *E. Palmer* 321.
NUEVO LEON: Monterrey, *Pringle* 11276; *Dodge* 120. Montemorelos, *Nelson* 6700.

SELAGINELLA PILIFERA var. **Pringlei** (Baker) Morton, comb. nov.
*Selaginella Pringlei* Baker, Handb. Fern Allies 88. 1887.
TEXAS: Chisos Mountains, Brewster Co., *Bailey* 801. Marfa, Presidio Co., *Ferriss* 5a. McKittrick Canyon, Guadalupe Mountains, Culberson Co., *Moore & Steyermark* 3502; *Standley* 40549; *Mrs. Slater.* Pine Canyon, Guadalupe Mountains, Culberson Co., *Young.* Van Horn, Culberson Co., *Ferriss.*

[3] Engler & Prantl, Pflanzenfam. 1: 676. 1902.

NEW MEXICO: Guadalupe Mountains, Eddy Co., *Goodding* 803 G.

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 271 (type); *Wilkinson.*

SAN LUIS POTOSÍ: *Parry & Palmer* 1008.

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# Ferns of Lake Shehawken and Vicinity, Wayne County, Pennsylvania

W. L. DIX

Lake Shehawken is a small glacial lake of about sixty acres, situated in the extreme northeastern corner of Pennsylvania, seven miles from New York State on the north and six miles from the Delaware River on the east. According to geologists the lake was formed by deposits of glacial material closing the natural drainage basin. This glacial ridge on the west rising only forty or fifty feet above the lake has reversed the drainage system here, and is all that prevents the flow of water into the basin of the Susquehanna River through Starrucca Creek. As it is, the lake makes an outlet in a series of falls over a rocky ridge at the east into the Delaware River down Shehawken Creek, exactly at the junction of the east and west branches of the river.

The lake has an elevation above sea level of 1795 feet. The hills on the north, locally known as the Barrens, rise to height of 2100 feet. On the southeast is a small, rocky, wooded hill a few hundred feet above the lake.

Preston Township, in which Lake Shehawken is situated, though less than eight miles square, contains over twenty small lakes.

The territory adjacent to Lake Shehawken is part of an uneven plateau varying from 1800 to 2200 feet above

sea level, and about 1000 feet above the level of the Delaware and the Susquehanna rivers. It is broken up by a succession of narrow, steep-sided valleys, indicating the presence of rocks that have resisted glaciation and the later erosion. From the top of these hills can be seen the Catskills—Slide Mountain and more distant Peekamoose—less than twenty miles from the Hudson River. A few miles to the southeast are the peaks of Sugarloaf, Ararat, and the Elks. They are from 2500 to 2700 feet above sea level, and during the glacial period were islands in the *mer de glace*.

The rocks of this region are entirely sedimentary sandstone of the Upper Devonian Period. A few quartzite erratics occur on the hillside south of the lake. Another peculiar rock locally called "niggerhead" occurs in great numbers ranging in size from two to ten feet. None of these apparently occur in beds, but have been scattered glacially. They consist of small angular fragments of quartz, and often contain numerous small pockets of a dark gray shale. When weathered, these rocks are black, and have a curious pockmarked appearance due to uneven decomposition. Geologically they are known as calcareous breccias.

Although Lake Shehawken is in the same latitude as the Massachusetts-Connecticut line, on account of the elevation it has a climate more like that of northern New England. Frosts occur in some seasons during all summer months, and winter brings temperatures of twenty to thirty degrees F. below zero.

Fossil ferns occur in some of the quarries of this region. They consist of impressions on the surfaces of the sandstone laminae. In some places one finds large pockets of irregularly formed shale with cleavages indicating disturbance during formation. Some of these, only a few inches in extent, are covered on both sides with im-

pressions of four or five ferns. Those found locally belong to the genus *Archaeopteris*.

One hundred years ago the shores of this lake were covered with a heavy growth of white pine flanked and interspersed with virgin native hemlock. It was known to early settlers as the Great Pine Lot. One lone survival of the hemlocks cut last year showed an age of over two hundred years. Before the advent of the chestnut blight, the hill on the north contained several thousand chestnut trees. The woods now consist of beech, red maple, sugar maple, red oak, white oak, white ash, red birch, black birch, and basswood, with only an occasional hickory, butternut, and elm. Among the smaller trees are hop hornbeam and American hornbeam, quaking aspen, mountain ash, shadbush (*Amelanchier canadensis*), fire cherry (*Prunus pennsylvanica*), striped maple, and mountain maple. Neither dogwood (*Cornus florida*) nor sassafras are found in the vicinity of the lake.

The most characteristic flowering shrub is the mountain laurel. At the northeastern side of the lake it covers acres to the exclusion of all other growth. Rhododendron (*R. maximum*) does not grow on the lake shores, but is found in a swamp at the source of the small inlet of the lake. Great quantities of azalea (*A. nudiflora*) cover the Barrens. Among other shrubs are *Viburnum alnifolium*, *Taxus canadensis*, *Ilex montana*, *Ilex verticillata tenuifolia*, and in a near-by bog *Kalmia glauca*, *K. angustifolia*, *Andromeda glaucophylla*, and *Vaccinium Oxycoccos*.

Typical flowers of more or less restricted distribution are *Xyris caroliniana*, *Cornus canadensis*, *Clintonia borealis*, *Trillium undulatum*, *Pogonia ophioglossoides*, *Habenaria orbiculata*, *Rosa rubiginosa*, *Oxalis Acetosella*, *Circea alpina*, *Scutellaria galericulata*, *Veronica americana*, *V. scutellata*, *Campanula rotundifolia* (High

Rock), *Lobelia Dortmanna* (Island Pond), *Aster phlogifolius, A. prenanthoides,* and *Hieracium pilosella.*

## LIST OF FERNS

BOTRYCHIUM MATRICARIAEFOLIUM A. Braun. Occasional. On hill-side north-east of lake.

BOTRYCHIUM SIMPLEX var. TENEBROSUM (A. A. Eaton) Clausen. Collected two miles north of Lake Shehawken at Lake Hiawatha by Dr. Wherry and the author in August, 1938.

BOTRYCHIUM OBLIQUUM Muhl. Occasional at Lake Shehawken. Grows with the two following forms.

BOTRYCHIUM DISSECTUM Spreng. Somewhat rare at Lake Shehawken. Specimens not finely divided. This and the preceding species grow in great numbers on a hillside above Lake Hiawatha.

BOTRYCHIUM OBLIQUUM var. ONEIDENSE (Gilbert) Clute. This is the common form here, and in suitable localities can be found in great numbers. All the Botrychiums seem to prefer light shade, especially this variety. Clearings or the edges of woods furnish the most likely spot for these ferns. Forms growing in deeper shade are sparsely foliaged; in open sunshine some of them are so densely foliaged that pressed specimens are solid with overlapping segments. Right conditions for germination determine their occurrence. On dry hillsides a bank of moss often contains scores of plants; in other places the base of small rocks seems a favorite spot for their growth.

BOTRYCHIUM MULTIFIDUM (Gmel.) Ruprecht ssp. TYPICUM. Collected by the author at Lake Hiawatha, and between Lake Shehawken and Lakewood, Pa., in August, 1938. This is the first and only authoritatively reported occurrence of this species in Pennsylvania. It is also a southerly range extension of about one hundred and fifty

miles. In both localities the plants were growing in open pasture; at Lake Hiawatha at an elevation of 1600 feet and in thick beds of moss (*Polytrichum commune*), near Lakewood in heavy pasture grass at an elevation of nearly 1900 feet.

BOTRYCHIUM MULTIFIDUM ssp. SILAIFOLIUM (Presl) Clausen. Found by Dr. Wherry and the author in August at Lake Hiawatha. Aside from the specimen reported from the "Pocono Plateau" by Dr. Harshberger, this is the only reported occurrence in Pennsylvania. This specimen and those of *B. multifidum* ssp. *typicum* were examined and identified by Dr. Clausen.

BOTRYCHIUM LANCEOLATUM var. ANGUSTISEGMENTUM Pease and Moore. Occasional. Grows with *B. matricariaefolium.*

BOTRYCHIUM VIRGINIANUM (L.) Sw. Common in moist woods.

OPHIOGLOSSUM VULGATUM L. Shore of Lake Shehawken. June 21, 1938; spores not ripened. In association with *Drosera rotundifolia* in sphagnum-bottomed grass.

OSMUNDA REGALIS L. Occasional. Bennett's swamp. Grows in an open field in one locality.

OSMUNDA CINNAMOMEA L. Common in swamps and wet fields. Only occasional around the lake. The forms *incisa, auriculata,* and *bipinnatifida* are found in the swamps and bogs near-by, sometimes with segments of all three forms on the same ferns. Red-stemmed forms are occasional.

OSMUNDA CLAYTONIANA L. Common. On drier ground than *O. cinnamomea.*

ONOCLEA SENSIBILIS L. Everywhere in moist soil.

ONOCLEA STRUTHIOPTERIS (L.) Hoffm. Infrequent. Above the inlet at Island Pond and site of old mill at Preston Center.

CYSTOPTERIS BULBIFERA (L.) Bernh. Known only

from northern side of Shrawder's Mountain along and below the road to Kniewasser's, two miles north of Lake Shehawken. Contrary to its usual habit, it grows on a *dry* rocky hillside.

CYSTOPTERIS FRAGILIS (L.) Underw. Outlet of lake. Common on moist shaded hillsides about rocks. Plants covered with a rare rust (*Hyalospora polypodii*) have been found on boulders below High Rock near highway.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. Grows everywhere. A pest to the farmers, sometimes covering acres of pasture and underwoods and excluding all other vegetation. To the eyes of a fern lover, however, it is a beautiful sight in sunlit shadows.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Very common in rocky woods. Incised forms are common. One forked form was found on Shrawder's Mountain near the stone quarry.

POLYSTICHUM BRAUNII (Spenner) Fée. In two localities only. One on Shrawder's Mountain near the stone quarry. One frond measured 34 inches long. These are the only reported localities in Wayne County.

DRYOPTERIS NOVEBORACENSIS (L.) A. Gray. Common in moist woods. On the Barrens.

DRYOPTERIS THELYPTERIS (L.) A. Gray Very common on lake shore.

DRYOPTERIS SIMULATA (Davenp.) Underw. Found only in marsh near Poyntelle five miles south of Lake Shehawken. Only reported occurrence in Wayne County. Dr. Wherry tells me that he found a few plants near Orson, Pa., in 1936. Occurs at Poyntelle in great abundance.

DRYOPTERIS CRISTATA (L.) A. Gray. Occasional about the lake; also in Bennett's swamp.

DRYOPTERIS BOOTTII (Tuckerm.) Underw. Occasional. A few plants scattered about the lake shore. On the

margin of the cranberry bog two miles south. Outline of fronds quite variable.

DRYOPTERIS GOLDIANA (Hook.) A. Gray. A few plants in four localities. A single plant near the outlet of the lake; three or four in open pasture above Bennett's swamp; six to eight near quarry on Shrawder's Mountain.

DRYOPTERIS MARGINALIS (L.) A. Gray. Not very common; mostly among rocks at outlet of lake. It is difficult to account for the scarcity of this fern in this locality. In the four or five hundred acres of woods north of the lake there are scarcely twenty plants. Its place is taken by *D. intermedia* and *Polystichum acrostichoides.*

DRYOPTERIS SPINULOSA (Muell.) Kuntze. Not uncommon. Occasional on lake shore, and on the dryer spots in marshes.

DRYOPTERIS INTERMEDIA (Muhl.) Gray. Very common in all woods where the shade is not too heavy. Grows best among rocks.

DRYOPTERIS PHEGOPTERIS (L.) C. Chr. In suitable localities. Common at falls at Scott Center, four miles north of Lake Shehawken.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. Not uncommon; several spots on hillside northeast of lake.

DRYOPTERIS LINNAEANA C. Chr. Common in suitable conditions, especially at the base of north-facing hills or in deep shaded gullies.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Few plants in scattered localities; usually on loose boulders on north-facing hillsides. Outlet of lake.

ASPLENIUM PLATYNEURON (L.) Oakes. Not common. I have seen only about a dozen plants in all this territory. I cannot account for the scarcity of this fern here

unless it is due to almost complete absence of lime in the soil.

ASPLENIUM TRICHOMANES L. Occasional. None near the lake. Found on moist rocks east of High Rock and Shrawder's Mountain.

ASPLENIUM PYCNOCARPON Spreng. Very rare. Only known locality is at the inlet to Lobez' Pond, one mile west of Lake Shehawken. This is the only reported station for Wayne County.

ATHYRIUM THELYPTEROIDES (Michx.) Desv. Occasional. Damp spots in deep woods. Bank of Shehawken Creek above O. & W. reservoir.

ATHYRIUM FILIX-FEMINA (L.) Roth. Common, with many forms. Red-stiped forms occasional. Probably both the southern and the northern forms occur here, if one could separate them.

ADIANTUM PEDATUM L. Common in rich organic mold.

PTERIDIUM AQUILINUM (L.) Kuhn. Common, especially on the Barrens.

POLYPODIUM VULGARE L. Common on large rocks in shade.

EQUISETUM ARVENSE L. Common; on the Barrens.

EQUISETUM SYLVATICUM L. Only one known locality —Barrens along Travis-Holbert line.

EQUISETUM FLUVIATILE L. Common in shallow water and on the shore of the lake. Forms here have *air cavities* under ridges in lower third of stems, contrary to the usual description.

LYCOPODIUM LUCIDULUM Michx. Frequent in all woods.

LYCOPODIUM OBSCURUM L. Common in light shade in moist woods.

LYCOPODIUM OBSCURUM var. DENDROIDEUM (Michx.) D. C. Eaton. Not so common as the true species. On the Barrens northwest of the lake.

LYCOPODIUM ANNOTINUM L. One known station only on south shore of Lake Como (elevation 1520 ft.), four miles south-east from Lake Shehawken.

LYCOPODIUM CLAVATUM L. Occasional in light woods and thickets.

LYCOPODIUM COMPLANATUM L. var. FLABELLIFORME Fernald. Common. The four common lycopodiums are found growing together in some places on the Barrens.

LYCOPODIUM TRISTACHYUM Pursh. Side-hill north of the lake. Apparently somewhat rare. The cord-like branchlets usually separate this species from *L. complanatum* var. *flabelliforme* with flattened branchlets.

ISOETES BRAUNII Durieu. Common in lake, submerged from 8 to 16 inches. Found also in practically all the lakes of this region.

The above list represents the work of the author alone during vacations of the last four or five years. It will be found to be nearly a complete list for this locality, although I feel confident that five or six other ferns will eventually be found. I have found several plants that resemble very closely *Dryopteris dilatata* and *Dryopteris Clintoniana* that might be included in the above list. *D. dilatata* has been reported from Sugar Loaf Mountain near Orson[1]. Among others likely to be found later are *Woodsia ilvensis* and *W. obtusa*, and *Selaginella apoda*. There are also probably many unnamed varieties and forms among these reported species.

It is remarkable that some of the rarer ferns are found here at all in view of the methods used by settlers in clearing the land. Huge windrows of treetops and brush were piled at intervals of forty to sixty feet. After these were burned in the spring, all remaining logs and unburned limbs were tumbled into high piles and again burned. Then the whole ground was thoroughly har-

[1] Flora of North-eastern Pennsylvania. Alfred Twining.

rowed and sown to either buckwheat or oats. It is difficult to imagine how as many ferns as there are outlived this castigation. All of the forests have been cut here within the last one hundred years, and much within the memory of the writer.

MORRISVILLE, PENNSYLVANIA

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## Recent Fern Literature

Unlike its predecessor, the Flora of the Southeastern States (1903), Small's Manual of the Southeastern Flora (1933) covered only flowering plants, its author feeling that the Pteridophytes deserved an independent volume. The manuscript for this was prepared, but by the time it was set in type, the author's heart had weakened to such an extent that he was confined to his room; but his sight and mind were as keen as ever, and he succeeded in correcting the proofs, missing only a very few minor errors. Now, nine months after his death, the work has been published.[1] The plan conforms closely to that of the same author's Ferns of the Vicinity of New York (1935), although there is one noteworthy addition: a key to the orders, families, and genera with each descriptive paragraph accompanied by a skillful little drawing to bring out the features referred to. The 400-page systematic treatment includes full-page illustrations of practically every species, as well as several varieties. The text of the complex genus *Thelypteris* was prepared by Robert P. St. John, that of *Ophioglossum* by Edward P. St. John. Notes on the cultivation of many of the species covered were contributed by William A. Knight; and the taxo-

[1] Small, John K. Ferns of the Southeastern States. Science Press Printing Co., Lancaster, Pa. 1938. 517 pp., over 200 ill. $3.50.

nomic list with citations of numerous synonyms, as well as the table of authorities cited, is the work of Dr. John Hendley Barnhart.

Nearly 200 species and varieties of ferns and their allies are included, about 25 of them being here reported for the first time in our southeastern states. A few of these represent garden escapes, some are West Indian species whose presence in Florida had not previously been observed, and 14 species in 4 genera are described as new. Several apparent varieties are also partially described and illustrated, but not named. Finally, there are 13 new combinations made.

The novelties deserve brief discussion here. All 4 Aspleniums named as new by E. St. John (*A. plenum, scalifolium, suave,* and *subtile*) grow in a single sink-hole and connecting cavern. Their aspect suggests that they may be ecological forms of *A. verecundum* or hybrids between it and *A. curtissii;* one is, indeed, sterile.

One of the most acceptable segregates of the supergenus *Dryopteris* as monographed by Christensen is the group to which the genus name *Thelypteris* belongs. Several southeastern representatives of this group have already been formally assigned to this genus, and 5 more are similarly treated here (*T. gongylodes, patens, serra, submarginalis* and *tetragona*). In addition, five species (*T. ovata, saxatilis, unca,* and *versicolor* R. St. John, *T. reducta* Small) are described as new, 3 being segregated from *T. normalis,* and 2 from *T. dentata.* The fact that these are mostly members of continuous intergrading series is noted, but the possibility of their being hybrids or ecological forms is perhaps not given sufficient consideration. At any rate, in view of their intergradation, they will no doubt some day be reduced to varietal status.

In *Dryopteris,* now restricted to the Woodfern group, 15 species are recognized as occurring in the region cov-

ered. *D. boottii* is included, although its occurrence here is rather doubtful. The reviewer is unable to accept Small's assignment of *D. celsa* to localities in N. C., Tenn., etc., all the material he has seen from other than the original Dismal Swamp, Virginia, area showing the features of the variable *D. clintoniana*. The first new species proposed in this group is *D. atropalustris*, four localities, one each in Delaware, Ohio, South Carolina, and Virginia being noted. This plant is close to *D. goldiana* in frond and pinna-outline, and to *D. celsa* in veining, but has sori much further from the midveins than either of them. It strongly suggests a hybrid of *D. goldiana* and *D. cristata* in which the sorus-position of the latter has been retained.

On raising to species rank the fern originally described as *D. clintoniana* var. *australis*, Small has redefined this as a plant with "dimorphism between sterile and fertile portions abrupt and conspicuous," whereas in its description the weakness of such dimorphism had been emphasized. An interesting discovery, here first published, is the fact that the species name *floridana* for our most dimorphic woodfern is antedated by 11 years by *ludoviciana*. The second new fern of this group is assigned the name *D. separabilis* in allusion to its being bipinnate with the pinnules conspicuously separated; its sori lie rather near midveins. The type specimen has glandular indusia, and gives every indication of being a hybrid of *D. goldiana* and *D. intermedia;* the material from Arkansas which is mentioned is, however, eglandular, and probably represents a hybrid between some other pair.

Novelties next appear in the genus *Ophioglossum,—O. dendroneuron, O. mononeuron,* and *O. pumilio* E. St. John. These differ to some extent in rootstock-shape, leaf-outline, and veining from one another as well as from *O. tenerum* and *O. crotalophoroides,* long known species. However, in view of the variability of members of this

genus, caution is needed before accepting them. In any case the new names may not hold since names have already been given in other warm countries to plants which lie rather close to these. In Clausen's recent Monograph of the Ophioglossaceae such material is referred to varieties of *O. nudicaule* L. fil.

Small's liking for small even if poorly differentiated genera has led to the raising of two subgenera to genus rank: *Botrychium virginianum* becoming an *Osmundopteris,* and *Selaginella apoda, eatoni,* and *ludoviciana* appearing under *Diplostachyum,* innovations not likely to be followed by anyone else. On the other hand, in a few cases species sometimes regarded as distinct have been lumped together.

Miss George's illustrations are mostly good, although those of the larger ferns represent such small fragments of the fronds that they fail to convey any idea of the aspect of the plant. A few, such as *Pellaea atropurpurea,* are based on atypical specimens. There are in the text very few misprints or technical errors, in pleasing contrast to several recent books on ferns. The book is well printed and attractively bound, although the page-margins seem unnecessarily wide. From every standpoint it is a most worth-while work.—E. T. W.

Margaret McKenny writes agreeably in "Natural History" of her experiences in raising native ferns from spores and growing them, both indoors and out. Her method (it will not work with Osmundas) is to gather fruiting fronds in summer and keep them wrapped in waxed paper in a cool, dry place until fall. The spores are then sown on sterilized, unglazed flower-pots filled with sphagnum moss, inverted in saucers of water, and covered with glass bell-jars to prevent evaporation. The prothallia, when about six weeks old, are transplanted, in clumps, to pots filled with a mixture of leaf-mold, loam,

and sand in equal parts and again kept covered with glass. Later, individual plants can be pricked out and given each its own pot.

As candidates for cultivation out of doors, Christmas fern, ostrich fern, all three Osmundas, hart's-tongue (which needs lime), walking fern, *Dryopteris intermedia, marginalis,* and *noveboracensis,* maidenhair, *Cystopteris bulbifera, Dennstaedtia,* polypody, and *Asplenium Trichomanes* are recommended. Most of us will find some of them, particularly the last two, rather difficult subjects; but they can be grown.

The article is illustrated with several excellent photographs, though that of *Asplenium Trichomanes* is mislabeled *A. platyneuron.* It is immediately followed by another in which Henrick Hodge describes and pictures some tropical epiphytic ferns—"flag-pole sitters," he calls them.[1]

Those interested in the soil-preferences of ferns should consult Nathan H. Woodruff's series of articles on "Soil Acidity at the Roots of Some Tennessee Pteridophytes." Thirty-nine species of true ferns and eleven of fern-allies were investigated. In all, 240 soil-samples were tested, and the results are given in detail.

On the whole, they are what would be expected from previous investigations, but a few are both interesting and surprising. *Equisetum arvense,* for instance, is recorded as occurring only in neutral or alkaline soils. Anyone familiar with its weedy behavior and its liking for sandy roadsides and railroad embankments in New England knows that it is there far from exclusively calcicolous. Presumably the explanation is that plants are physiologically adaptable and that the same species may do best in one kind of soil in a given area under the con-

[1] Ferns the Adaptable. Nat. Hist. 42: 284–297. Nov., 1938.

ditions there found, and in another soil in another, and different, region.[2]

Although the Index Filicum, with its supplements, provides a complete record of all species of ferns which have been proposed, it does not include categories of lower rank—subspecies, variety or form—nor does it cover the Fern Allies. Both of these gaps have now been filled, for North America north of Mexico, by the publication of Broun's Index.[1]

This work comprises alphabetical lists of all accepted species, varieties and forms, with long lists of equivalents or synonyms, and references to the places of publication of each. Full habitat and range data are appended. The compilation has been thoroughly and conscientiously done, and only a few minor errors have crept in. On line six of the Foreword, the term "volume" has somehow got inserted instead of equivalent. On page 52, "Engelm." appears instead of Engler. And a few letters have been transposed in other places. *Pellaea Wrightiana* has been accidentally omitted. Not everyone will agree with all the choices made as to which name shall be accepted and which reduced to synonymy. It is not in accord with the best modern opinion to retain the Marshfern group under *Dryopteris*, but at the same time segregate the Beechfern group under *Phegopteris*—both should be treated alike. On the other hand, most of the new combinations made in the book will be welcomed, especially where monstrosities formerly designated varieties are reduced to the status of form.

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[2] Journ. Tennessee Acad. Sci. **10**: 276–290; **11**: 31–52; **13**: 180–187.

[1] Index to North American Ferns. By Maurice Broun. 217 pages, 1938. Published by the author. Route 1, Orwigsburg, Penna. $2.50.

The great value of such a compilation to everyone who has to look into the taxonomy and nomenclature of our native ferns will be evident, and Mr. Broun deserves the sincere thanks of us all for the vast amount of effort he has expended in gathering this bibliographic material and presenting it in so useful a form.

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## Shorter Notes

AN ABNORMAL CONE ON EQUISETUM TELMATEIA EHRH. —There are several localities within a few miles of the Stanford Campus where *Equisetum telmateia* Ehrh. grows luxuriantly. In the early spring, during March or early April, the fruiting stems appear several weeks ahead of the sterile shoots, grow rapidly to a height of 3 to 6 decimeters, produce cones, shed enormous numbers of spores, wither, and disappear. The sterile, photosynthetic shoots with their whorls of lateral branches break through the soil at about the time the fertile ones begin to collapse, and remain active until late fall.

Each spring for eight or ten years I have watched these plants and admired the pale beauty of the erect, formal shoots arising from the black soil against a rich green background of broad-leaved flowering plants. But not until last season had a branching cone come to my attention.

In April, 1938, after most of the fertile stems had passed their prime, one plant bearing a fasciated cone was found growing on the steep bank of a small brook high in the Coast Range a few miles west of the campus. The basal part of the cone was quite normal, bearing sporophylls of normal size in regular whorls. The terminal part of the cone had given rise to fourteen dwarfed cones of varying size, upon which the sporophylls also were stunted. The

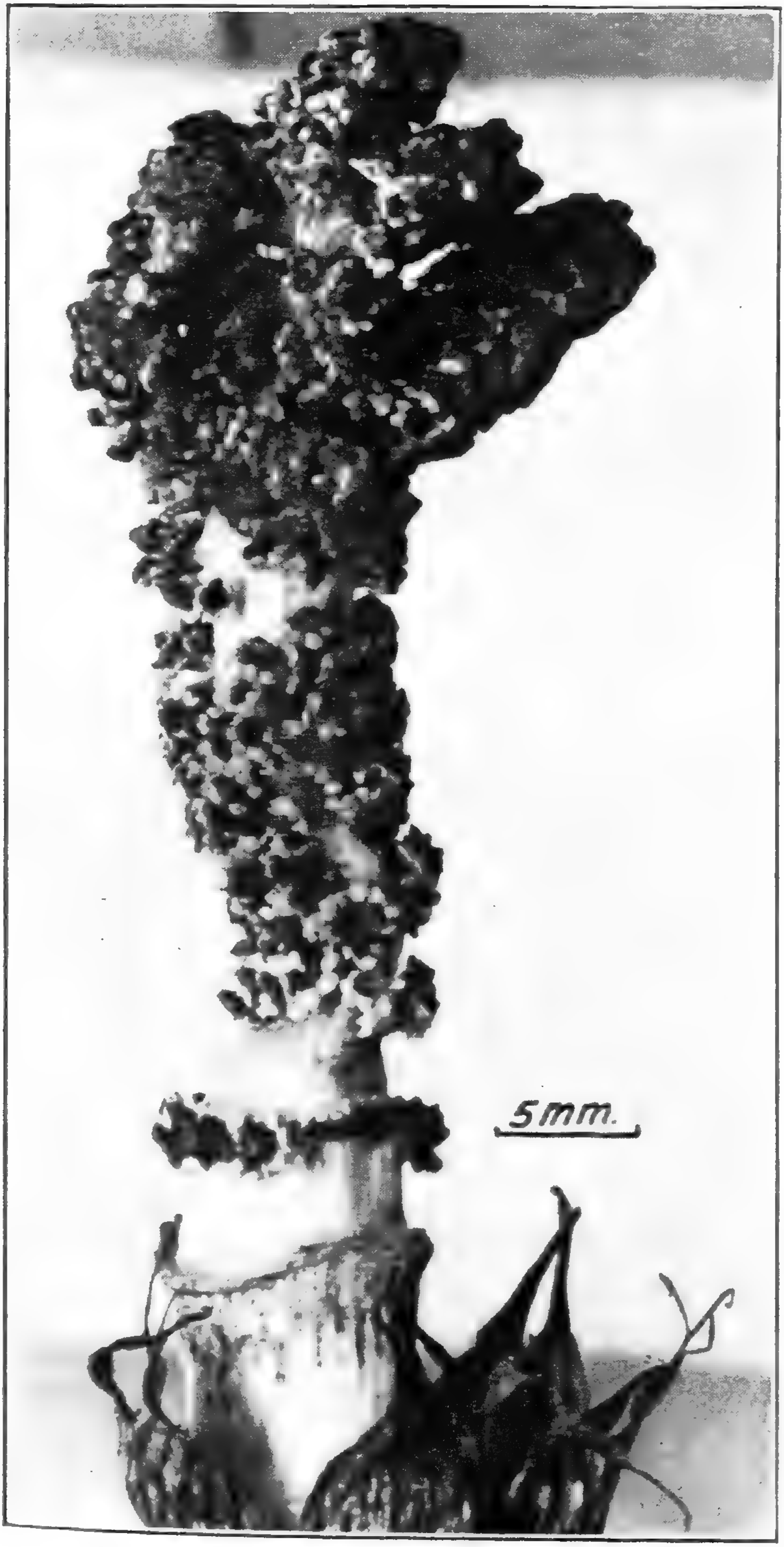
sporangia on these smaller cones seemed normal except that each sporophyll bore fewer sporangia than the larger ones, and apparently normal spores were being produced by most of these sporangia. The sporophylls from the base up to the abnormal part of the cone bore normal sporangia and an abundance of spores.

The accompanying photographs show something of the size and arrangement of the small cones and their relationship to the main axis of the fruiting branch. The collapse of the axis near the base was caused by rapid desiccation during the three or four hours that elapsed between collecting and photographing of the specimen.

Similar abnormalities, but of less striking degree, are common on plants of *Equisetum laevigatum* A. Br. growing on the levees along the Sacramento River. But in the latter species normal cones are much smaller than in *E. telmateia,* so a branching fruiting axis rarely gives rise to more than three or four small cones.—IRA L. WIGGINS, *Dudley Herbarium, Stanford University.*

AN UNUSUAL HABITAT FOR PELLAEA GLABELLA.—The accompanying photograph shows a growth of *Pellaea glabella* on the wing-walls of a railway culvert in Montgomery County, Virginia, which is very unusual both in the number of plants in a given area and in the size and density of the individual clumps. I have had this station under observation for several years, but until quite recently I have never happened to be in its vicinity at a time when it was possible to secure photographs. The print here reproduced is from a negative made on July 19, 1938, by H. J. Longhead of Asheville, North Carolina.

An interesting feature of this station is that, though the plants evidently developed from spores of plants on a natural limestone cliff a few hundred yards away, the growth at the latter place is in no way comparable to that on the culvert walls, either in the number of plants in a similar



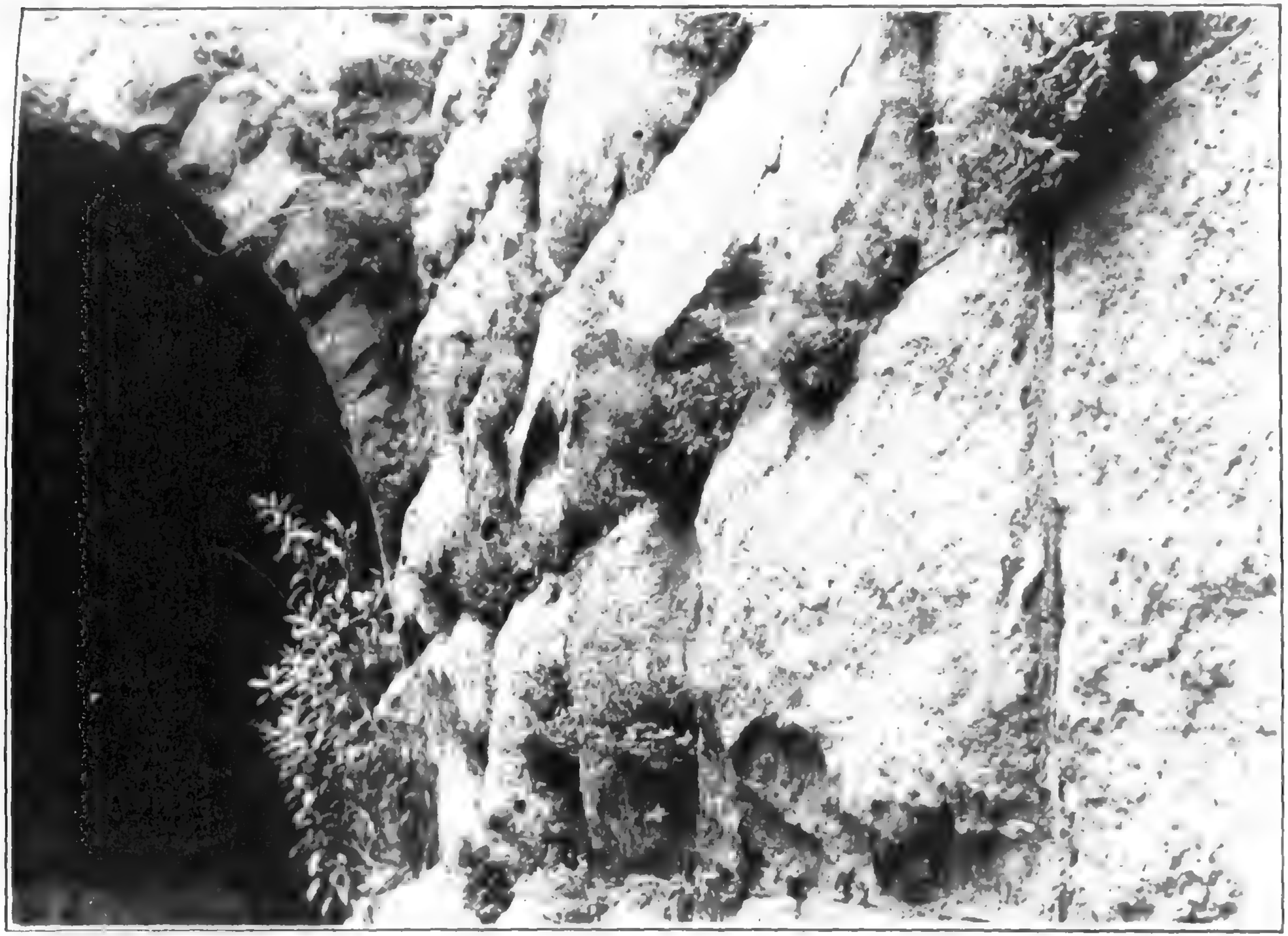

Abnormal Cone of Equisetum telmateia

area or in size of individuals. The culvert is quite an old one and the concrete in the seams has loosened in many places, so that a good root-run is provided. As the near-by cliff is of rather dense formation and with rather minute crevices, this may account for the marked difference between the two stations.—WILLIAM R. KNIGHT, *Biltmore, North Carolina.*

A FLORIDA FERN IN NEW YORK CITY.—Two years ago Mr. Edward St. John was good enough to send me several plants of *Dryopteris floridana* (or *D. ludoviciana*), which I have since had under cultivation at the Brooklyn Botanic Garden. Last August, when a stay in a hospital was necessary, I was surprised to receive a considerable number of leaves of the same species used as a florist's garnishing of a bunch of asters. I am anxious to know how widely this Florida species is collected and shipped for this purpose.

The leaves of this Florida fern are well adapted in many respects for this use. They seem to resist wilting and are glossy and attractive in cutting, although not as gracefully delicate as our northern *Dryopteris intermedia*. The plants in the greenhouse have grown beautifully, and multiplied by rhizome branching. A plant or two is also being tried out-of-doors with a good leaf protection as a test of its possible hardiness.

The glossiness struck me as a distinct point of distinction between this fern and its relative, *D. cristata*. However, in a muck swamp in New Jersey recently I found plants of another northern relative, *D. clintoniana*, which were equally, but most unusually, glossy. These particular *clintoniana* fern plants had been covered six inches deep with muck thrown out of a drainage ditch, and perhaps this cultural condition was responsible. Incidentally, one may note a minor mistake in Clute's recent edition of his fern book where he refers to *Dryopteris floridana* as a relative of the marshfern.—R. C. BENEDICT.



Pellaea glabella on the Walls of a Railway Culvert

BOTRYCHIUM LANCEOLATUM IN ARIZONA.—A first Arizona record of *Botrychium lanceolatum* (S. G. Gmel.) Ångstr. may be worthy of mention, even in a genus noted for broken ranges. The author collected specimens of this species at different stations on San Francisco Mountain near Flagstaff, Coconino County, in northern Arizona, on August 21, September 4, and September 25, 1938. Dr. William R. Maxon has kindly verified the determination, and specimens have been deposited in the United States National Herbarium and Gray Herbarium.

On San Francisco Mountain, elevation 12,612 feet and the highest point above sea level in Arizona, *Botrychium lanceolatum* is limited to the upper part of the subalpine zone near the timberline at altitudes of about 11,000 to 11,500 feet. The plants are rare and scattered in open areas of spruce-fir forest (*Picea Engelmanni* and *Abies lasiocarpa* var. *arizonica*) and in subalpine meadows occupying burned areas formerly forested. A few plants were observed at the timberline on the edge of an alpine meadow, but none was seen above this zone. This peak is also the only known Arizona station of *Botrychium Lunaria* (L.) Sw. Plants of the two species frequently are found together in the same altitudinal zone and in one case were even touching one another.

Clausen[1] in a recent monograph lists *Botrychium lanceolatum* from only three states in western United States, Washington, Wyoming, and Colorado. The Arizona record apparently is the southernmost known station of the species in North America and nearly four hundred miles southwest of the nearest localities in central Colorado cited by Clausen. Occurrence of the two spore-borne species on this high, isolated volcanic cone, where all alpine and subalpine species are disjunct, is not sur-

[1] Clausen, Robert T. A Monograph of the Ophioglossaceae. Mem. Torrey Bot. Club 19 (2): pp. 1–177, illus. 1938.

prising. More unusual are the facts that *Botrychium lanceolatum* has been overlooked by the many botanists who have collected here in the past half-century and that there are only two previous records of *B. Lunaria* here, by J. G. Lemmon and by T. H. Kearney and R. H. Peebles. Arizona's third species, *Botrychium virginianum* (L.) Sw., is cited by Clausen only from C. G. Pringle's collection in Santa Rita Mountains near the southern border.—ELBERT L. LITTLE, JR., *Southwestern Forest and Range Experiment Station, Tucson, Arizona.*

EQUISETUM PRATENSE IN THE BLACK HILLS.—I have not seen any reference which mentions the presence of *Equisetum pratense* Ehrh. in the Black Hills of South Dakota. If there are such references, they have escaped my notice. During the summer of 1938, I found this species quite common along a brook a short distance south of Mt. Rushmore in Pennington County. It was growing along with *E. arvense* L. and *E. silvaticum* L. I have been collecting superficially in the Black Hills a number of times but never saw it before. No doubt it will be found in other parts of the Black Hills if search is made for it; although because of its delicate nature it can easily be overlooked when growing in grass with *E. arvense*.

I have collected six species in various parts of the Black Hills,—*E. praealtum* Raf., *E. hiemale* L., *E. kansanum* Schaffn., *E. silvaticum* L., *E. pratense* Ehrh., and *E. arvense* L.

I also have a small specimen of *E. scirpoides* Mx., collected by H. E. Hayward, and although I have never seen *E. laevigatum* A. Br. in the Black Hills region, it must certainly be there. In addition to these eight species, several others may possibly be present.—JOHN H. SCHAFFNER, *The Ohio State University.*

# American Fern Society

## Report of the Treasurer for 1938

### RECEIPTS

| | | | |
|---|---|---|---|
| Cash on hand Jan. 1, 1938 | | | $250.16 |
| 1934 Membership Arrears | $ 1.50 | $ 1.50 | |
| 1935 Membership Arrears | 1.50 | 1.50 | |
| 1936 Membership Arrears | 6.00 | | |
| 1936 Subscription Arrears | 1.25 | 7.25 | |
| 1937 Membership Arrears | 19.50 | | |
| 1937 Subscription Arrears | 7.60 | 27.10 | |
| 1938 Membership Renewals | 392.23 | | |
| 1938 New Members | 28.50 | 420.73 | |
| 1938 Subscription Renewals | 68.73 | | |
| 1938 New Subscribers | 17.35 | 86.08 | |
| 1939 Membership Susp. a/c | 17.50 | | |
| 1939 New Membership | 3.00 | 20.50 | |
| 1939 Subscription Susp. a/c | 35.82 | 35.82 | |
| Life Membership | 25.00 | 25.00 | |
| Sale of back numbers A.F.J. | 176.57 | 176.57 | |
| Sale of Hart's Tongue Fern | 8.25 | 8.25 | |
| Sale of "Var. and Forms of Ferns of E. N. Am." | .50 | .50 | |
| Gifts | 8.69 | 8.69 | |
| 1937 Advertising—Cambosco | 4.00 | | |
| 1938 Advertising—Cambosco | 4.00 | 8.00 | |
| Reprints | 6.50 | 6.50 | 833.99 |
| | | | $1,084.15 |
| Deduction a/c Life Membership[1] | | | 25.00 |
| | | | $1,059.15 |

### DISBURSEMENTS

| | | |
|---|---|---|
| Science Press | | |
| A.F.J. Vol. 27, No. 4 | $133.97 | |
| A.F.J. Vol. 28, No. 1 | 132.10 | |
| A.F.J. Vol. 28, No. 2 | 132.70 | |
| A.F.J. Vol. 28, No. 3 | 136.38 | $535.15 |
| Trade Discount | 11.85 | 11.85 |
| Agency Commission | 8.06 | 8.06 |
| Bank Charges | .25 | .25 |

[1] Transferred to a separate account.

| | | | |
|---|---|---|---|
| Purchase of back numbers A.F.J. (A. L. Dacy) | 15.00 | 15.00 | |
| Expense Treasurer | 41.31 | 41.31 | |
| Expense Secretary | 17.75 | 17.75 | |
| Expense Librarian | 3.50 | 3.50 | 632.87 |
| Cash on hand Dec. 31, 1938 | | | $ 426.28 |

H. K. SVENSON, *Treasurer*

**Report of the Judge of Elections**

Mrs. Elsie G. Whitney,
Secretary of The American Fern Society,
242 New Scotland Ave.,
Albany, N. Y.

My Dear Mrs. Whitney:

The results of the annual election of the American Fern Society were as follows:

89 Ballots were returned. One of these was marked. The remaining 88 are tabulated here.

For President

| | |
|---|---|
| Dr. Robert T. Clausen | 83 |
| Dr. Edgar T. Wherry | 3 |
| Dr. Henry K. Svenson | 1 |
| Dr. Ralph C. Benedict | 1 |

For Vice-President

| | |
|---|---|
| Mr. Arthur N. Leeds | 86 |
| Dr. Robert T. Clausen | 1 |

For Secretary

| | |
|---|---|
| Mrs. Elsie G. Whitney | 87 |
| Mr. W. L. Dix | 1 |

For Treasurer

| | |
|---|---|
| Dr. Henry K. Svenson | 87 |
| Mr. Arthur N. Leeds | 1 |

As Judge of Elections, I declare the regular nominees elected: Dr. Robert T. Clausen for President, Mr. Arthur N. Leeds for Vice-President, Mrs. Elsie G. Whitney for Secretary, and Dr. Henry K. Svenson for Treasurer.

Respectfully submitted,

Dec.15, 1938. JAMES L. EDWARDS, *Judge of Elections*

New members:

Dow, Dr. E. L., 8 Golf View Road, Palm Beach, Florida.
Pyron, Joseph H., Dept. of Botany, University of Georgia, Athens, Ga.
Richards, Donald, 7409 Bennett Ave., Chicago, Illinois.
Richards, E. H., 112 Watson Court, Frankfort, Kentucky.
Smith, A. V., Central High School, 13th & Clifton Sts., Washington, D. C.
Smith, Miss Ora, 821 Bergen Ave., Jersey City, N. J.
Van Schaack, Dr. Eva B., Dept. of Plant Physiology, Johns Hopkins University, Baltimore, Md.

Changes of address:

Dix, W. L., 801 Crown St., Morrisville, Pennsylvania.
Fessenden, G. Russell, 5130 Connecticut Ave., Washington, D. C.
Flett, J. B., R. D. 1, Bremerton, Wash.
Hall, Mrs. Carlotta C., 1633 La Loma Ave., Berkeley, Cal.
Rutherford, Joseph S., 3172 the Boulevard, Westmont, Montreal, Canada.
Van Meter, Miss Mary G., 1316 New Hampshire Ave., Washington, D. C.

Mr. Spawn's given name is Willman, not William, as misprinted in the recently issued list of members; and Mrs. G. W. Stratton should have been Mrs. G. W. Strattan.

Rev. E. A. Elliott writes that he plans to grow a number of hart's-tongue plants in his garden near Reading, England, next season "as some of your members might like to have a quantity of spores sent over."

Mr. W. A. Grace, 3 Swiss Ave., Wanganui, New Zealand, would like to obtain living plants or viable spores of North American ferns, and will give specimens of New Zealand species in return.

Vol. 29 April-June, 1939 No. 2

# American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY



## CONTENTS



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# The American Fern Society

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*ARTHUR N. LEEDS, Philadelphia, Pa. ..... *Vice-President*
MRS. ELSIE GIBSON WHITNEY, Albany, N. Y. ..... *Secretary*
HENRY K. SVENSON, Brooklyn Botanic Garden, Brooklyn, N. Y. *Treasurer*

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## American Fern Journal

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### CURATOR OF THE HERBARIUM

**L. S. HOPKINS ..... Culver-Stockton College, Canton, Mo.**

**A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.**

# American Fern Journal

VOL. 29 APRIL–JUNE, 1939 NO. 2


## The Identity of Aspidium ludovicianum

JOHN K. SMALL

Louisiana held an attraction for plant collectors at an early date. The Louisiana prior to 1803 comprised what is now the central United States west of the Mississippi River, except the territory that later became Texas. However, the part concerned in this note refers, evidently, to what is now known as the state of Louisiana. Although remote from the Atlantic Coastal region and thus less accessible, collections of plants made in the eighteenth century became the basis of floras published in the first decade of the nineteenth century. European collectors, French and German, ventured into that wilderness when the population was scant. The following note in Flora **6**: 336. 1823, records one fatality—the discoverer of the fern under consideration. "Vor ungefahr 30 Jahren meldeten politische Zeitungen aus Amerika, das ein Hr. Prof. Ludwig aus Leipzig, auf einer botan. Excursion in den dortigen Waldern von einer Klapperschlange gebissen worden und bald darauf als ein wahrhafter Martyrer der Botanik gestorben sey." Or, as translated: "Thirty years ago the newspapers of America informed us that a Herr Professor Ludwig of Leipzig, on a botanical excursion in the forests there, was struck by a rattlesnake, and soon thereafter died, a true martyr to botany."

The second stage in this fern's history began with the describing of the species *Aspidium* (*Polystichum*) *ludo-*

[Volume 29, No. 1 of the JOURNAL, pages 1–40, plates 1–3, was issued April 2, 1939.]

*vicianum*. This description was based on the Ludwig specimen from Louisiana by Prof. Kunze, who also records that he saw it growing in the Berlin Botanical Garden. Professor Kunze writes (American Journal of Science and Arts, ser. 2. **6**: 84–85, 1848): "A fine species, which cannot be confounded with any one known to me; in habit it approaches somewhat to *A.* (*Nephr.*) *marginale*; it is 1–2 feet high; the circumference of the entire fertile pinnulae varies from lanceolate to oblong; the veins are repeatedly furcate and the upper branch rarely; also the following bear the sori; the sterile branches of the veins end just before reaching the margin only slightly thickened."

The next stage in the career of this fern seems to have been where Mettenius (Über Einige Farngattungen 64. 1857) cites it as a synonym of *Aspidium canariense*—a most remarkable idea in geographic distribution.

Three years later D. C. Eaton (Chapman's Flora 595. 1860) quotes a description attributed to Mettenius. Following the Mettenius quotation occurs the statement, "Florida to Louisiana, Kunze." (The quotation marks are mine.) It is not certain who supplied the word Florida. (Curiously enough the same geographic range is given under *Aspidium Floridanum*, the description of which follows that of *A. ludovicianum*.) Eaton then quotes another line of description not attributed to any one and volunteers, "I have not seen this Fern which has more recently been referred by Mettenius to *A. canariense* A. Br."

Later D. C. Eaton (Ferns of North America **2**: 162. 1880) records that "*Aspidium Ludovicianum* is unknown to me. It was placed in Polystichum by Kunze."[1]

Thus after a career of uncertainties in literature, except in one list, where Carl Christensen (Index Filicum 80.

[1] This is not quite correct, for Kunze placed it in *Aspidium* section Polystichum.

Type specimen of Aspidium ludovicianum Kze.

1906) records the fern as a subspecies of *Dryopteris Filix-mas*, one of our more well-marked species of *Dryopteris* dropped out of sight, as far as its original specific designation is concerned.

This long-drawn-out uncertainty has now been solved. A letter to Dr. L. Diels, General Director of the Berlin Botanical Garden and Museum, brought the following information: "I am enclosing a photo of *Aspidium Ludovicianum* Kz. as represented in our herbarium. The specimen comes from the herbarium of Mettenius which is now in our Museum. This writing is difficult, therefore I put it down here for you.

1. Uppermost label: Asp. Ludovicianum Kz.
Herb. Leonhardi h. Berl. 5/1. 59
Das Blatt lanzettlich, die unteren Abschnitten bedeutend verkurzt, fast wie bei *cristatum*, 3-seitig eiformig.
Excrescentiae pedicelli sporangii nullae
2. Middle label: ssp. *floridanum* Hk.
ist das echte *Ludovicianum* Kz.
ist mit *mas* zu vereinigen.
3. Lowest label written by G. Hieronymus; the synonymy = A. elongatum var. = A. Filix mas var. is from Hieronymus."[1]

After the stormy career and tossing about as is recorded on the herbarium sheet above referred to, it turns out that this fern, *Dryopteris ludoviciana*, is an excellent and thoroughly distinct species identical with the one which eleven years later was named *Aspidium cristatum floridanum* and for many years has been known as *Dryopteris floridana*.

The geographic distribution of this species is somewhat peculiar. From peninsular Florida it ranges up through

[1] Not all of this shows in the photograph. Some of it is cut off; the faded ink in another part has failed to register on the negative.

the Atlantic coast region to North Carolina. Apparently it does not follow the Gulf Coast but, skipping Alabama and Mississippi, it reappears in Louisiana. Specimens recorded from Alabama represent a different species.

Another curious circumstance is that although the fern was collected in Louisiana several times in the earlier part of the past century, for example, Louisiana, 1837, without collector's name, Hale, Alexandria (the first mentioned specimen perhaps sent to Durand by Hale), it was not found there again until last spring by Clair A. Brown, near Baton Rouge.

NEW YORK BOTANICAL GARDEN

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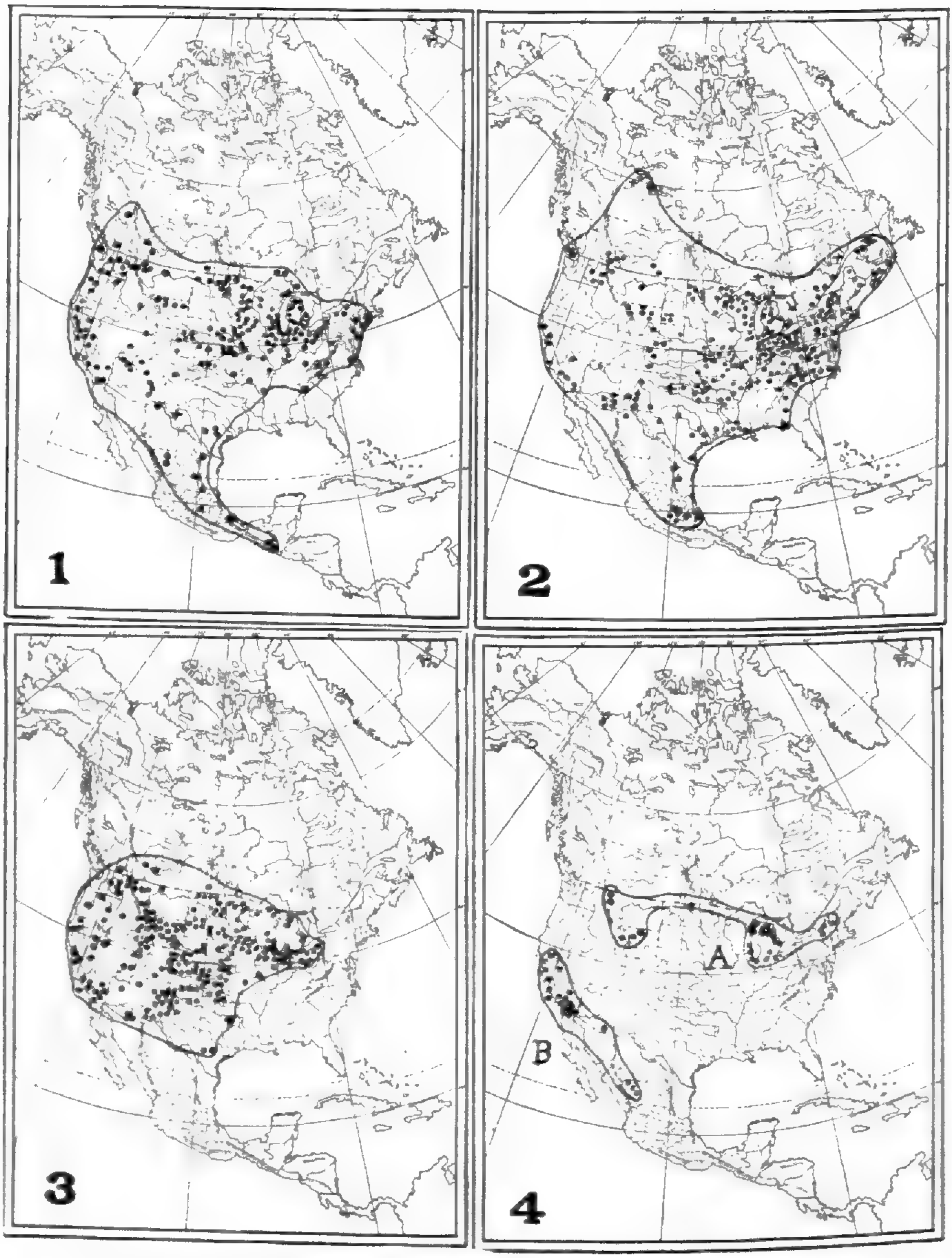
# The Distribution of the Exclusively North American Species of Equisetum *

JOHN H. SCHAFFNER

Of the twenty-three living species of *Equisetum* so far recognized by the writer, five are confined to North America and three of these are among the common herbaceous plants of the central United States. During many years of field work on *Equisetum* and study in the larger American and European herbaria, large numbers of geographic distribution records of these species have been accumulated, which are presented in the accompanying maps. Each black dot on the maps indicates that one or more specimens of the species have been studied by the writer, either herbarium specimens or specimens collected in the field, from the indicated locality. A few apparently authentic published records have been included, which are marked by a plus (+) sign. The maps, therefore, represent the actual distribution of the species as ascer-

* Papers from the Department of Botany, The Ohio State University, No. 401.




Exclusively North American Species of Equisetum.

tained by the writer up to the present time. It was thought best to keep within the definitely known limits for the present, and the distribution boundaries can then be expanded in the future when authentic records become available.

There has been much confusion in the naming of *Equisetum* species in the past, so it is useless to depend on published records. The first catalog of Kansas plants, for example, published in 1872, contained the names of three species of *Equisetum*. But not one of these is a member of the state flora.

In the literature, one finds the most extreme mistakes in the identification of species made by reputable systematists. Thus *E. arvense* L. has sometimes been confused with *E. telmateia* Ehrh., *E. trachyodon* A. Br. with *E. moorei* Newm., *E. ramosissimum* Desf. with *E. trachyodon* A. Br., etc. These are among the most easily recognized species, so it is not surprising to find a great amount of confusion among the difficult ones. Part of this is due to the imperfect keys which have been perpetuated from the past in our common manuals.

## EXPLANATION OF PLATE

Map 1. *Equisetum laevigatum* A. Br. Rhode I. to Ga., Ark., Tex., Guatemala, Calif., Br. Col., Alberta, and Ont.

Map 2. *Equisetum praealtum* Raf. Nova Scotia, to W. Fla., south central Mex., Calif., Br. Col., Great Slave Lake of Mackenzie, Ont., and Quebec.

Map 3. *Equisetum kansanum* Schaffn. Ohio to Mo., Tex., Ariz., Calif., Wash., Alberta, and Mich.

Map 4a. *Equisetum nelsoni* (A. A. Eat.) Schaffn. Vt. to Ill., Wis., N. Dak., Ky., and Mont.

Map 4b. *Equisetum funstoni* A. A. Eat. Northern Calif. to Ariz., and Mex.

COLUMBUS, OHIO

# On Some Pteridophytes of South-Central New York

R. T. CLAUSEN AND S. J. SMITH

The general area covered by these notes includes the counties of Tompkins, Schuyler, Steuben, Chemung, and Tioga. The pteridophytes of this region have been considered in recent times by House (1924) and, in part, by Wiegand and Eames (1926). Records included in the present discussion are to be considered as supplementary to those already published in these previous papers. In a few instances, notes from outside the area defined above are also included in order to clarify or to bring up to date the knowledge of certain species whose status has been imperfectly known. Names of collectors most frequently cited are abbreviated as: *C*, R. T. Clausen; *S*, S. J. Smith; *T*, Harold Trapido, and *W*, W. C. Wilson.

LYCOPODIUM SELAGO var. PATENS (Beauv.) Desv. Rich woods across road from Brelsford Farm, Park Hill, Erin, Chemung Co., *S 162*. This collection has the entire leaves, broadened at the base, and the large spores (40 + μ) characteristic of *L. Selago*, but we have been unable clearly to make out the details of spore-coat architecture as given by Wilson (1934).

LYCOPODIUM LUCIDULUM var. OCCIDENTALE (Clute) Wilson. Woods, valley of South Owego Brook, two miles northeast of South Owego, Tioga Co., *C & W 3398*. Specimens of this collection have been submitted to Dr. L. R. Wilson, who has kindly verified the determination.

LYCOPODIUM ANNOTINUM var. ACRIFOLIUM Fernald. Although reported as rare by Wiegand and Eames (1926), who list it from three stations in the Cayuga Lake Basin, this variety seems to be rather widely distributed in

swampy woods at the southern part of the watershed. In addition to the stations already published, we may cite the following recent collections: wooded knoll at edge of marsh southwest of South Cortland, Cortland Co., *C, W, & E. Lawn 2383;* southern end of Michigan Hollow, near northeast base of Ball Hill, Danby, Tomkins Co., *C & C. M. Beal 1471;* and in pine woods, Ringwood, Tompkins Co., *C & W. T. Winne 1554.* From the area south and west of the Cayuga Lake Basin, several collections also may be cited: swampy woods about one mile south of Halsey Valley, Tioga Co., *C, T, & W 2473;* woods, valley of South Owego Brook, two miles northeast of South Owego, Tioga Co., *C & W 3406,* also observed at three other new stations in Tioga Co.; wooded slope of Laurel Hill, Erin, Chemung Co., *S 163,* also four other stations at Erin; woods southwest of South Erin, Chemung Co., *C &W 2423;* wooded south slope of ravine one mile north of Alpine, Schuyler Co., *C & W 3408;* Arnot Forest, Cayuta, Schuyler Co., *S 165;* and Tobehanna Lake, Schuyler Co., *C 145.* This variety also occurs in the valley of Carter Creek, Newfield, and on Walker Hill, Cayuta.

LYCOPODIUM OBSCURUM var. DENDROIDEUM (Michx.) D. C. Eaton. Moist field east of McDonough, Chenango Co., *C & W 2039;* Park Station, Chemung Co., *S 174;* also observed by the junior author on Redfern Hill, Erin, at Oakley Corners near Newark Valley, and on Connecticut Hill, Newfield. Reported as the common form of the species in New York by House (1924), but we consider this to be a rather rare plant in the central part of the state, while it is still unknown from the Cayuga Lake Basin.

LYCOPODIUM COMPLANATUM var. FLABELLIFORME Fernald. Common and widely distributed. Occasional specimens closely approach the var. *typicum* and demonstrate

that the population of eastern North America should not be separated as a species from typical *L. complanatum.*

LYCOPODIUM TRISTACHYUM Pursh. Laurel Hill, Erin, Chemung Co., *S 253*, and *C & K. W. Hunt 2040.* Tolerably common in Van Etten Township, Chemung Co.; in Cayuta Township, Schuyler Co.; in Caroline and Newfield Townships, Tompkins Co.; and in Lapeer Township, Cortland Co.; and in this region with the distinctness of a reasonably good species.

ISOETES ECHINOSPORA Dur. In our area this was first reported by Clute (1901) from Cinnamon Lake, Barbour. McVaugh (1938) listed the species from Loon, Cinnamon and Cranberry Lakes, also from Cayuta Lake, *W. C. Muenscher 16803.* A collection, *C & T 3467,* from Cinnamon Lake is of interest because the leaves of these plants were mostly reddish-olive. As Iversen (1928) has demonstrated that the characters used for separating *I. Braunii* from *I. echinospora* are not satisfactory, the senior author prefers to employ for this circumboreal species only the binomial designation.

ISOETES EATONI Dodge. Cayuta Lake, Schuyler Co., *W. C. Muenscher 17657.* Other New York collections represented in the herbarium at Cornell University are: in eight inches of water, near outlet of Lower Chateaugay Lake, Franklin Co., *W. C. Muenscher & B. Maguire 666;* emersed on sandy shore, West Branch Reservoir, Carmel, Putnam Co., *W. C. Muenscher & O. F. Curtis, Jr. 5397;* shore of Glass Lake, Rensselaer Co., *W. C. Muenscher & C 4129;* and sandy shore of Tackawasick Lake, Rensselaer Co., *W. C. Muenscher & C 4128.* The megaspores of these specimens show the crowded crests characteristic of the species and match those of one of the cotypes examined by the senior author.

ISOETES ENGELMANNI A. Br. Cayuta Lake, Schuyler Co., *W. C. Muenscher 16805* & *17658;* mill pond south of Lake Como, Groton City, Tompkins Co., *W. C. Muenscher* & *V. M. Lefler 18230.* Apparently rare in south-central New York.

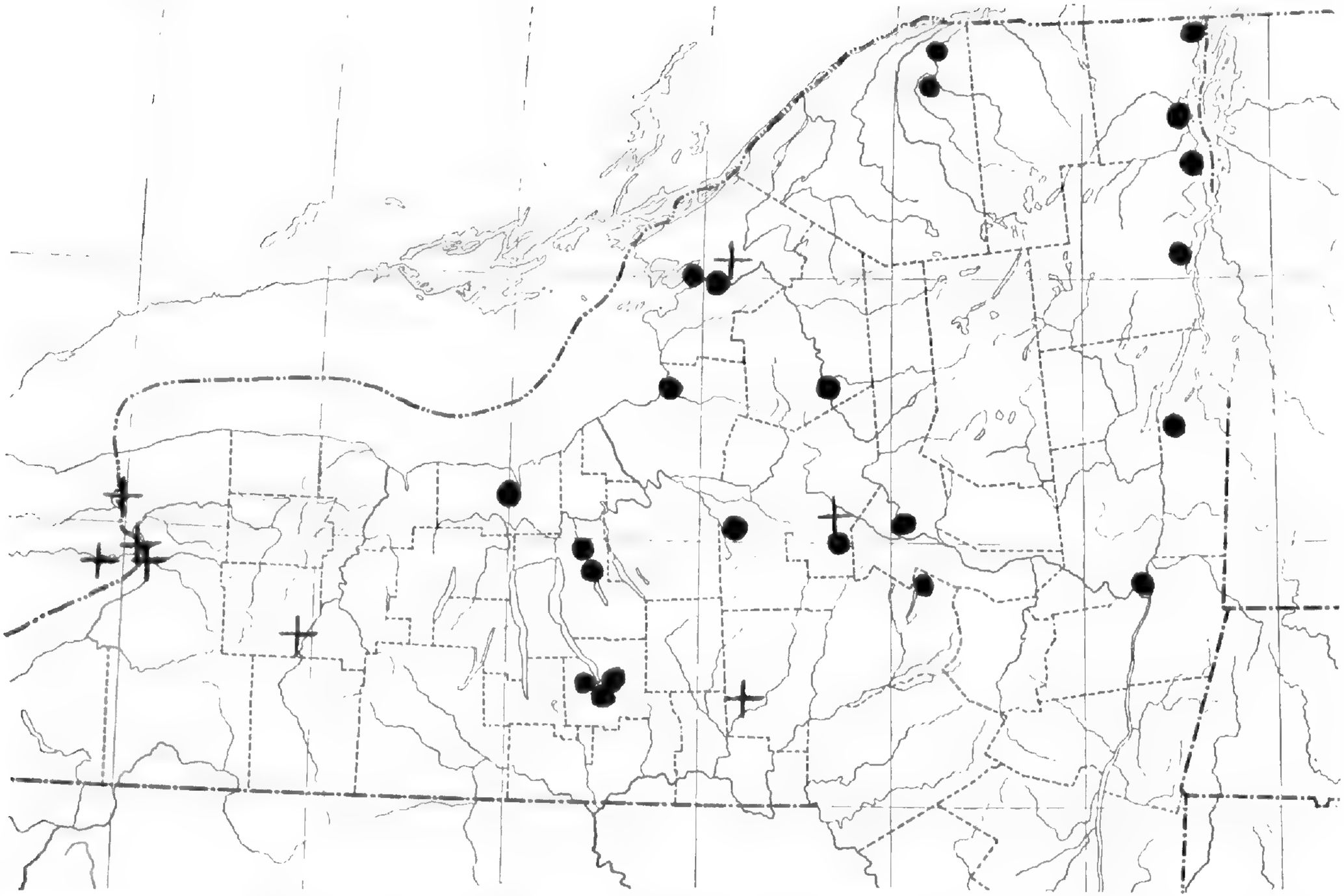
EQUISETUM LAEVIGATUM A. Br. Known from three stations in the Cayuga Lake Basin: along railroad and Cayuga Lake shore north of Esty Glen, Ithaca, Tompkins Co., *A. R. Bechtel* & *K. M. Wiegand 7423;* calcareous shore of Cayuga Lake, Farleys, Cayuga Co., *C* & *S 3513;* sandy beach, Howland Point, Springport, Cayuga Co., *A. J. Eames* & *A. Gershoy 9071.* Also in the herbarium at Cornell University is a collection from Jefferson Co.: roadside by Tributary 25, Black River, two miles above Carthage, *W. C. Muenscher* & *B. Maguire 1508.* The specimens from Cayuga and Tompkins counties have rather smooth stems with long funnel-shaped green sheaths, as is characteristic for the species, while the plants from Jefferson Co. differ in having the stems roughly tuberculate.

The specimens obtained by the writers at Farleys on August 7, 1938, had well-developed strobili. Although, like the other two collections cited from the Cayuga Lake Basin, these fertile shoots seemed definitely to represent *E. laevigatum*, yet, attached to the same rootstocks, were the remains of shoots of *E. hyemale* var. *affine.* Such evidence would seem to indicate that, at least in central New York, *E. laevigatum* is a seasonal and ecological form of *E. hyemale* var. *affine*, represented on lake and river shores by the shoots of the year which develop rapidly in the late spring and summer. The senior author is at present engaged in a study of this problem.

EQUISETUM VARIEGATUM Schleich. Wet open ground along Trumansburg Road near Williams Brook, Ithaca,

Tompkins Co., *S & Doris Murray;* steep northern slope of Old Buttermilk Ravine, Ithaca, *C & T 3268;* springy south bank of Six Mile Creek, just below Green Tree Falls, Ithaca, *C 3430* (station discovered on April 2, 1938, by L. Bernstein and G. R. Mandels). These three collections represent the first records of this species from the Cayuga Lake Basin. At the first station, the plant occurs in association with several locally unusual species which might indicate a disturbed habitat, but the *Equisetum* seems well established and must have been there for many years. At the second station, the habitat is entirely natural and undisturbed, in a ravine which also harbors other northern plants, as *Equisetum scirpoides* and *Viola Selkirkii;* while at the last station, the habitat also appears undisturbed.

Since many collections of this species have come into the herbarium at Cornell University during recent years, it now seems desirable to review its distribution in the state in the light of these new records (see pl. 6). In the citations which follow, only one collection is listed from each county. Cayuga: Auburn, *C. Atwood.* Clinton: Valcour, *M. Pladeck 17078.* Essex: Willsboro Bay, Lake Champlain, *W. C. Muenscher, W. E. Manning,* & *B. Maguire 14.* Herkimer: Herkimer, *J. V. Haberer 2677.* Jefferson: Dexter, *M. L. Fernald, K. M. Wiegand,* & *A. J. Eames 14067.* Lewis: Lyons Falls, *J. V. Haberer 2537.* Madison: Sullivan Station, *H. D. House 16685.* Oneida: Sauquoit, *J. V. Haberer.* Oswego: Selkirk, *W. W. Rowlee* & *K. M. Wiegand 10.* Otsego: Summit Lake, *W. C. Muenscher* & *O. F. Curtis, Jr. 4790.* St. Lawrence: Brasher Falls, *W. C. Muenscher* & *B. Maguire 641.* Saratoga: Waterford, *S. H. Burnham.* Washington: W. Fort Ann, *S. H. Burnham.* Wayne: Sodus Center, *W. C. Muenscher 1844*8. All of the above collections represent var. *typicum,* the variations of which in this state seem unworthy



Range of Equisetum variegatum in New York. Dots Indicate Collections Examined by the Writers; Crosses, Literature Records.

of further nomenclatorial distinction. The species is also reported from Erie, Niagara, and Wyoming Counties by Zenkert (1934), and from Greene County by Coville (1889).

Although *Equisetum variegatum* sheds spores from mid-June to mid-September, strobili at various stages of development may be found at almost any time of the year.

BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr., ssp. TYPICUM. Field on westward facing slope southwest of Labrador Pond, alt. 1850 feet, northern Truxton Township, Cortland Co., *C & T 3728*. This has been previously definitely recorded by the senior author (Clausen, 1938) only from northern New York. At the locality cited, this subspecies was growing in association with *Lycopodium sabinaefolium* and six other species of *Lycopodium*. Nearby were other plants of *B. multifidum* which were intermediate towards ssp. *silaifolium*.

BOTRYCHIUM MULTIFIDUM ssp. SILAIFOLIUM (Presl) Clausen. Hilltop field and wooded slope, Laurel Hill, Erin, Chemung Co., *S 186, C & K. W. Hunt 2035*, and *C, W, & E. Lawn 2036;* field on slope southeast of South Erin, Chemung Co., *C & W 2429;* hillside field near Cohocton, Steuben Co., *T 235;* field on slope northwest of Willseyville, Tioga Co., *W & R. H. Wilson;* field north of Ringwood Preserve, Tompkins Co., *C & R. Smith 1469*. This subspecies also occurs at Cayuta, Schuyler Co., and in Cortland Co., in the northwest corner of Lapeer Township.

BOTRYCHIUM DISSECTUM var. ONEIDENSE (Gilbert) Farwell. Although not listed from the Cayuga Lake Basin by Wiegand and Eames (1926), nor recorded from this part of the state by House (1924), the var. *oneidense* really is fairly common and rather widely distributed in

dry woodlands in the hill country of the south-central counties: Chemung Co., Erin and South Erin; Cortland Co., Lapeer and Truxton townships; Schuyler Co., Cayuta; Steuben Co., west side of Waneta Lake; Tioga Co., South Owego and Campville; and Tompkins Co., Newfield, Caroline, Ringwood, and Groton. In the above area, this population produces fertile segments less frequently than do any of the other varieties of *B. dissectum*. The sterile blades regularly remain green throughout the winter, when they may be decidedly conspicuous, particularly if there is a light blanket of snow upon the ground. This makes it relatively easy to locate the plants during the winter and early spring, when most vegetation is brown and drab.

BOTRYCHIUM SIMPLEX Hitchcock, var. TYPICUM. Cayuta Lake, Schuyler Co., *W. R. Dudley.*

BOTRYCHIUM SIMPLEX var. LAXIFOLIUM Clausen. Rich woods along brook on north side of Laurel Hill, Erin, Chemung Co., *S*, also *C & G. H. M. Lawrence 2625;* Sabin Farm, Danby, 1882, *F. C. Curtice;* Newfield, *A. Gershoy 7405.* The Curtice specimens previously have been designated as *B. Lunaria* var. *onondagense*, but are definitely to be referred here.

BOTRYCHIUM SIMPLEX var. TENEBROSUM (A. A. Eaton) Clausen. Moist woods along brook, Park, Chemung Co., *C 3487;* Odessa, Schuyler Co., *O. E. Pearce;* edge of Overflow Swamp, Ringwood, Tompkins Co., *C 83 & 84.* This seems to be rare in the south-central part of the state. At Ringwood, the number of plants found during any season has varied from six to twelve, and these grow in association with *Thuidium, Liparis Loeselii, Malaxis brachypoda,* and *Mitella nuda.*

BOTRYCHIUM MATRICARIAEFOLIUM A. Br. Common on dry woodland slopes and in old fields throughout the

south-central counties. Plants which grow in shaded woodland situations usually mature spores two or more weeks later than do those which grow in open fields. Specimens collected in woods at Ringwood, Tompkins Co., on the same day when plants in the fields were at the height of shedding spores, were just coming up, with the sporangia still green. Field-inhabiting forms have a more compact habit and are more inclined to be leathery or fleshy, while shade forms may be rather tall and slender. During June, 1933, the senior author collected plants in the low rich woods north of Spring Lake, Cayuga Co., which attained a height of almost three decimeters and were extremely slender. On June 11, 1936, in woods at Newfield, Tompkins Co., W. C. Wilson and the senior author found a plant, furnishing an apparent example of a branching rhizome, which bore nine leaves from a single base.

BOTRYCHIUM LANCEOLATUM ssp. ANGUSTISEGMENTUM (Pease and Moore) Clausen. Common in rich moist or dry woods, particularly on slopes, also sometimes in grassy fields, and often occurring in association with the preceding species. Plants in good condition have been found as late as October 25, at which time the buds were greatly enlarged and exposed, having burst through the base of the surrounding leaf-stalk.

OPHIOGLOSSUM VULGATUM L. Open swale in white oak woods, Comfort Hill, Ashland Township, Chemung Co., *S & H. Scudder 936;* open swaly field ½ mile south of Park, Chemung Co., *S 920;* in meadow two to three miles southeast of McDonough, Chenango Co., *C & W 2166;* alder thicket along Bowman Creek, East McDonough, Chenango Co., *C & J. L. Edwards 2585;* meadow on hilltop east of Waneta Lake, Schuyler Co., *C 1307;* boggy hillside meadow, headwaters of Doolittle Creek, two miles

east-northeast of Perryville, Tioga Co., *C & S 2641;* mossy turf of field, Lounsberry, Tioga Co., *C 3456.* The junior author has also collected this species in Cortland Co., in Lapeer Township, and in Tompkins Co., at Michigan Hollow, Danby.

CRYPTOGRAMMA STELLERI (Gmel.) Prantl. Wet shaly cliffs of Watkins Glen, Schuyler Co., *S 967;* Havana Glen, Schuyler Co., *E. J. Pickett* in 1884. Specimens of the latter collection are preserved in the Buffalo Museum.

DRYOPTERIS PHEGOPTERIS (L.) C. Chr. South side of ravine west of Waneta Lake, Steuben Co., *C 26 & 27;* wooded slope in small ravine one mile west of Newark Valley, Tioga Co., *C & S 3492;* moist ledges, Buttermilk Ravine, Tioga Township, Tioga Co., *C 3507;* cliffs along Carter Creek, Tompkins Co., *S 235,* also *C & W 2102.* Also observed at Candor, Elmira, Erin, and Newfield Junction.

DRYOPTERIS SPINULOSA var. AMERICANA (Fischer) Fernald. Ravine on slope southwest of Cascade, Cayuga Co., *C & W 2399.* One large clump with basal pinnules on upper and lower sides of basal pinnae 5 mm. apart, and with those on the lower side farthest from the main rachis and mostly exceeding the others. Plants in the same ravine showed various stages of intergradation into the vars. *intermedia* and *typica:* in some the lowermost basal pinnules much exceeded the others and were long-attenuate, but less than 4 mm. from the upper basal pinnules; in others, the basal pinnules were shorter and blunt, but more distant from each other.

WOODSIA ILVENSIS (L.) R. Br. Exposed ledges on High Point northwest of Naples, Ontario Co., *C & W 1198.* At this station, the species was growing on the ledges in association with *Arabis lyrata* and *Clematis verticillaris.*

According to House (1924), it has not been reported from west of Cayuga and Tompkins Counties.

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# Distributional Notes on and a Key to the Species of Cheilanthes in the Sonoran Desert and Certain Adjacent Regions

IRA L. WIGGINS

Owing to meager locality data on herbarium labels it is often difficult to determine whether a particular specimen is from within the limits of the Sonoran Desert or from adjacent mountains at elevations above those commonly reached by the true desert flora. The key presented herewith includes, therefore, several species of *Cheilanthes* that probably never occur within the floristic confines of the Sonoran Desert. It includes all of the species of this genus known by me to grow in Arizona, Sonora, and Baja California, but only those Californian representatives that occur definitely within the floristic limits of the Colorado Desert, a phytogeographic subdivision of the Sonoran Desert. The extra-desert species are included because heretofore no key including all the species involved has been available for the ready identification of specimens, and the privilege of examining the large collections in the United States National Herbarium afforded an unusual opportunity for the preparation of such a key. The distributional notes are based on herbarium specimens in the National Herbarium and in the Dudley Herbarium of Stanford University, and upon field observations made during numerous trips into all of the political divisions represented within the limits of the Sonoran Desert.

Dr. William R. Maxon kindly placed all of the fern material of the National Herbarium at my disposal and gave me much valuable aid in selecting characters that might be used in the key. My sincere thanks are due and gratefully given to Dr. Maxon for this and other greatly appreciated advice.

## KEY TO THE SPECIES

Rhizome massive, multicipital, the divisions erect, decumbent, or short-creeping.
Segments of blade densely glandular-viscid or glandular-puberulent above.
Rhizome-scales thin, soft, crinkly-sinuate, light cinnamomeous; blades narrowly oblong; glands sessile or essentially so.
1. *C. viscida.*
Rhizome-scales rigid, straight, black and shining; blades deltoid or ovate-pentagonal, the basal pinnae longest; glands obviously stalked.
2. *C. Kaulfussii.*
Segments glabrous above, or if pubescent not glandular.
Ultimate segments 3–6 mm. broad; stipes very fragile at base, with several transverse zones of weakness marked by distinct constrictions.
3. *C. Brandegei.*
Ultimate segments 1–2 mm. broad; stipes less easily fractured, without weakened constrictions.
Fronds glabrous above; ultimate segments ovate to linear-elliptic, acute to short-subulate at the apex; rhizome-scales rigid, heavily sclerotic and dark colored to the margins.
Pinnules serrate; sori solitary, with distinct, reniform to short-lunate indusia.
4. *C. californica.*
Pinnules entire; sori contiguous, with a common, crenate, or shallowly lobed, linear indusium.
Indusia densely long-ciliate; rachis-wings and segments not red-dotted beneath.
5. *C. pyramidalis.*
Indusia eciliate; rachis-wings and segments red-dotted beneath.
5a. *C. pyramidalis* subsp. *arizonica.*
Fronds hairy on the upper surface; ultimate segments broadly ovate to orbicular, obtuse or rounded at the apex; rhizome-scales sclerotic and dark colored centrally, the margins lighter and thinner.
Rachis-scales few or wanting; stipes hairy or sparingly scaly near base and apex.
Segments arachnoid-villous on both surfaces, not densely tomentose; stipe nearly glabrous; rachises of pinnae sparingly scaly.
6. *C. Parishii.*
Segments arachnoid-villous above, densely tomentose beneath; stipe hairy full length; rachises of pinnae scaleless.
7. *C. Feei.*

Rachis-scales numerous, imbricated, tangled; stipes scaly full length.
Scales of rachises broadly ovate-cordate, 1–2.4 mm. wide, acute to short-acuminate, closely imbricated, obscuring lower surface of segments.
8. *C. villosa.*
Scales of rachises narrowly lanceolate to linear, rounded to shallowly subcordate, 0.2–0.8 mm. wide, attenuate-acuminate, slightly imbricated or tangled, not obscuring segments.
Segments densely tomentose and canescent above; rachis-scales light rusty to white, lanceolate.
9. *C. Eatoni.*
Segments sparsely arachnoid-villous and green above; rachis-scales cinnamomeous to castaneous.
Scales narrowly linear, light cinnamomeous; ultimate segments 0.5–1 mm. in diameter.
10. *C. tomentosa.*
Scales narrowly lanceolate, deep castaneous; ultimate segments 1–2.5 mm. wide.
11. *C. castanea.*

Rhizome slender, widely creeping, or if multicipital the divisions short-creeping.
Blade and upper part of stipe densely glandular-puberulent; rhizome heavy, 3–5 mm. in diameter, its branches short-creeping.
2. *C. Kaulfussii.*
Blade and other parts not glandular; rhizome slender, 1–2.5 mm. in diameter, mostly widely creeping.
Ultimate segments ovate to elliptic, with comparatively broad bases, not bead-like; scales or hairs on lower surface of rachises few or lacking, not projecting conspicuously beyond margins of segments.
Rachises clothed with loosely imbricated scales, these ovate-lanceolate, attenuate at apex, shallowly cordate at base; stipes paleaceous with linear-lanceolate scales.
12. *C. Pringlei.*
Rachises glabrous, sparsely hairy, or bearing a few scattered scales, these narrowly linear-lanceolate to hair-like, rounded at the base; stipes glabrous, hairy, or sparingly scaly.
Stipes moderately hairy and sparingly scaly; margins of fruiting segments faintly revolute, scarcely at all metamorphosed.

Segments glabrous; rachises sparsely scaly; pinnules 0.5–1.5 mm. wide, deeply dentate.

13. *C. peninsularis.*

Segments sparingly hairy with short, coarse hairs; rachises hairy, bearing a few linear scales; pinnules 1–3.5 mm. wide, shallowly crenulate-dentate.

14. *C. microphylla.*

Stipes glabrous, scaleless except at the base; margins of fruiting segments strongly revolute, distinctly metamorphosed to form membranaceous indusia, these obscuring the sporangia.

Sori subcontinuous along margins of segments; indusia linear, slightly lobed; stipe atropurpureous, shining.

15. *C. alabamensis.*

Sori distinct, borne at tips of ultimate segments; indusia reniform, or if subcontinuous on terminal segments then deeply lobed; stipe brown or ochroleucous, dull.

16. *C. Wrightii.*

Ultimate segments orbicular to broadly obovate, strongly concavo-convex, rounded and bead-like in fruit, their bases narrow; scales or hairs on lower surfaces of rachises numerous, projecting conspicuously beyond margins of segments.

Stipes and rachises densely arachnoid-villous beneath, devoid of scales; margins of segments strongly metamorphosed to form a continuous membranaceous indusium.

17. *C. lendigera.*

Stipes and rachises scaly; margins of segments slightly metamorphosed, thickish, green.

Segments canescent, densely arachnoid-villous above, the hairs of adjacent segments intertangled.

18. *C. Lindheimeri.*

Segments green, glabrous or sparsely villous above, hairs of adjacent segments not intertangled.

Rachis-scales ciliate, at least at the base; rhizome-scales persistent.

Rhizome-scales light reddish brown to rusty, scarcely sclerotic; rachis-scales firmly attached, rounded or faintly subcordate at the base.

19. *C. Wootoni.*

Rhizome-scales atropurpureous, shining, heavily sclerotic; rachis-scales

lightly attached, distinctly cordate at the base.

Pinnae 5–12 pairs; rachis-scales ciliate on basal portion, paler at tip than at base.
20. *C. Covillei.*

Pinnae 12–19 pairs; rachis-scales ciliate to apex, deep cinnamomeous to castaneous full length.
21. *C. Clevelandii.*

Rachis-scales eciliate; rhizome-scales soon deciduous.
22. *C. Fendleri.*

1. CHEILANTHES VISCIDA Davenp. Bull. Torrey Club **6**: 191. 1877.

The glands on the upper surfaces of the fronds have a decided whitish cast when young, but as they become older and burst, thus liberating the viscid material, the varnish-like substance covers the whole frond and the "bloom" disappears. The glands on the lower surface are of a more yellowish tinge, and show a tendency toward being borne on short stalks.

This delicate fern grows in rocky situations, usually under overhanging ledges, in the Lower Sonoran Zone, in the Panamint Mountains, Inyo County, California, along the desert slopes of the San Bernardino Mountains, and on the western margins of the Colorado Desert in Riverside, San Diego, and Imperial Counties. It has been collected at the base of the Mountain Springs grade, Imperial County, within a few miles of the Mexican border (*Wolf 1897*). Though not yet reported from northern Lower California it certainly should be found at various points along the desert slopes of the Sierra del Pinal, and possibly as far south as the Sierra San Pedro Martir.

2. CHEILANTHES KAULFUSSII Kunze, Linnaea **13**: 145. 1839.

A somewhat more robust fern than *C. viscida.* The

glands are yellowish or brownish, and therefore not covered with the "bloom" characteristic of the young fronds of *C. viscida*. The exudate from the glands is extremely abundant and rather oily when fresh, staining the pressing papers a light brown.

This fern has its center of distribution to the south of our region. Collected at La Mina Verde, 31 kilometers west of Cumpas (about Lat. 30° 20′ N.) in 1934, (*Wiggins 7404*) and reported by Mr. Whitehead.[1] It had previously been collected in Sonora by *Rose, Standley & Russell, no. 12861,* at Alamos, near the Sinaloa border. Other specimens in the National Herbarium come from Chihuahua, Durango, Jalisco, San Luis Potosí, Mexico, Colima, Morelos, and Oaxaca.

3. CHEILANTHES BRANDEGEI D. C. Eaton, Bull. Torrey Club **17**: 215. *pl. 104.* 1890.

Known previously from Cedros and Magdalena Islands, but collected in 1935 on the peninsula of Lower California between Punta Prieta and Los Angeles Bay, (*Wiggins 7649*) and near the head of Escondido Canyon, 11 miles south of Punta Prieta, (*Wiggins 7716*).

4. CHEILANTHES CALIFORNICA (Nutt.) Mett. Abh. Senckenb. Ges. Frankfurt **3**: 88. 1859.

On cliffs and sides of canyons, mainly in the Transition and Upper Sonoran Zones, from Butte and Humboldt counties, California, southward to the vicinity of Ensenada, Lower California. The species is doubtfully included on the basis of a sheet in the National Herbarium bearing the label, "Southwestern part of the Colorado Desert, San Diego Co., C. R. Orcutt." It probably does not occur within the Sonoran Desert.

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[1] AM. FERN JOURN. 27: 51. 1937.

5. CHEILANTHES PYRAMIDALIS Fée, 7th Mem. 38. *pl. 25. f. 3.* 1857.

The National Herbarium contains one specimen of this species from Lower California, collected in the Sierra de la Laguna, Cape Region, (*M. E. Jones 27,024*). All other specimens of the species are from regions in Mexico to the south and east of the Sonoran Desert.

5a. CHEILANTHES PYRAMIDALIS subsp. ARIZONICA Maxon, AM. FERN JOURN. 8: 116. *pl. 6.* 1918.

Difficult to separate from the species in sterile material, but distinct in fruiting fronds. The reddish dots are present in sterile specimens, but may fade in older collections.

Above the desert in the Huachuca and Chiricahua Mountains in Arizona, and in the Mapela Mountains, Chihuahua, Mexico. In the latter area there are intermediate forms between the typical *C. pyramidalis* of the south and the subspecies.

6. CHEILANTHES PARISHII Davenp. Bull. Torrey Club 8: 61. *pl. 8.* 1881.

A very rare, delicate fern known only from Andreas Canyon, near Palm Springs, California. I have seen no specimens of this species collected since 1908!

7. CHEILANTHES FEEI Moore, Ind. Fil. XXXVIII. 1857.

An inhabitant of the Transition Zone, and does not enter the desert. It occurs in British Columbia, Washington, and from thence eastward to Illinois and southward into Arizona, Missouri, Texas and the Mexican Border area.

8. CHEILANTHES VILLOSA Davenp. Cat. Davenp. Herb. Suppl. 45. 1883.

Ledges and under overhanging rocks, Sierra Estrella, near Phoenix, Arizona, (*Peebles, Harrison & Kearney 3296*), Santa Rita, Huachuca, and Mule Mountains, southern Arizona, to Texas and Chihuahua. It occurs mostly above the desert.

9. CHEILANTHES EATONI Baker, in Hook. & Baker, Syn. Fil. 140. 1867.

The anomalous situation of a name being more descriptive of a different species than of the one to which it has been applied exists in the case of *C. Eatoni* and *C. tomentosa*. The former species is much more densely tomentose on the upper surface of the segments than is *C. tomentosa*. The result has been that *C. Eatoni* has frequently been determined as *C. tomentosa*.

*C. Eatoni* ranges from the eastern edge of the Sonoran Desert in Arizona into Oklahoma, New Mexico and Texas. I have no records for it from Sonora.

10. CHEILANTHES TOMENTOSA Link, Hort. Berol. **2**: 42. 1833.

This species occurs in the Baboquivari Mountains in western Pima County, Arizona, and from the Santa Catalina and Santa Rita Mountains south and east through Sonora to Tamaulipas and San Luis Potosí.

11. CHEILANTHES CASTANEA Maxon, Proc. Biol. Soc. Wash. **32**: 111. 1919.

Separated from *C. tomentosa* by minute but apparently constant characters, as indicated in the key. It grows on rocky ledges in the Baboquivari Mountains, and in the mountains east of Tucson. It probably rarely reaches the true desert.

12. CHEILANTHES PRINGLEI Davenp. Bull. Torrey Club **10**: 61. *pl. 34.* 1883.

One of the most attractive, if the commonest, of the desert ferns, ranging from the northern edges of the Sonoran Desert in Arizona into Sonora as far south as Guaymas. There is one specimen in the National Herbarium labeled "Los Angeles Bay, Lower California, *Ed. Palmer 265*, 1887," but since it is known that there was some confusion of specimens and labels in Palmer's 1887 collections this locality is to be looked upon with suspicion. I failed to find *C. Pringlei* at Los Angeles Bay during a brief stay in that vicinity in the spring of 1935.

13. CHEILANTHES PENINSULARIS Maxon, Contr. U. S. Nat. Herb. **10**: 496. 1908.

Rather close to *C. Pringlei*, but the smaller segments, less scaly stipes and rachis, and the rounded bases of the rachis-scales set it apart from the mainland plant. It has been collected at Comondú, and at several points in the Cape Region of Lower California.

14. CHEILANTHES MICROPHYLLA Swartz, Syn. Fil. 127. 1806.

The short, stout, somewhat crinkled hairs on the segments furnish a ready character for the identification of this species among the southwestern representatives of *Cheilanthes*.

Collected on the walls of a rocky gorge 23 miles south of Divisadero, Sonora, (*Wiggins 7494C*), and known from several earlier collections southward through Sonora and Chihuahua to Oaxaca and Yucatan.

15. CHEILANTHES ALABAMENSIS (Buckl.) Kunze, Linn. **20**: 4. 1847.

Not readily distinguished from *C. Wrightii* in the sterile state, but easily separated when indusia are present. It is known from Arizona only from a single collection in

Conservatory Canyon, Huachuca Mountains, (*Lemmon*, 1882).

16. CHEILANTHES WRIGHTII Hook. Sp. Fil. **2**: 97. *pl. 110A*. 1852.

Rather generally distributed along the Mexican Border region from western Pima County, Arizona, to Texas, and southward into Sonora at least as far as La Mina Verde (*Wiggins 7405*), whence Whitehead reported it in 1937.

17. CHEILANTHES LENDIGERA (Cav.) Swartz, Syn. Fil. 128, 328. 1806.

Chiricahua and Huachuca Mountains, Arizona, and southward.

*Pomatophytum pocillatum* Jones, Contr. West. Bot. **16**: 12. 1930, is a synonym. Jones' type was collected in Ramsey Canyon, Huachuca Mts.

18. CHEILANTHES LINDHEIMERI Hook. Sp. Fil. **2**: 101. *pl. 107A*. 1852.

This species is represented by a large number of specimens in the National Herbarium, and, aside from slight variations in size, is remarkably constant throughout its range. It occurs at moderate altitudes from the Superstition Mountains and Apache Pass, Arizona, southeastward through Sonora and Chihuahua into San Luis Potosí and Querétaro, and eastward into Texas.

19. CHEILANTHES WOOTONI Maxon, Proc. Biol. Soc. Wash. **31**: 146. 1918.

At moderate elevations from southern Colorado and Oklahoma to Texas and the margins of the Sonoran Desert in Arizona and northern Sonora. The only locality for this fern from within the limits of the Sonoran Desert

proper is Diablo Canyon, Ajo Mountains, Western Pima County, Arizona, (*Kearney & Peebles 10,854*).

20. CHEILANTHES COVILLEI Maxon, Proc. Biol. Soc. Wash. **31**: 147. 1918.

A common fern in rocky canyons of the Colorado Desert. It ranges from Ventura and Inyo Counties, California, to southern Utah, and southward into Arizona and to Los Angeles Bay, Lower California.

21. CHEILANTHES CLEVELANDII D. C. Eaton, Bull. Torrey Club **6**: 33. 1875.

Included here because it extends southward along the coastal hills to the vicinity of Ensenada. It is not known from the desert side of the range.

22. CHEILANTHES FENDLERI Hook. Sp. Fil. **2**: 103. *pl. 107B*. 1852.

This fern grows in the oak belt, but, so far as I know, does not come down into the desert—not even along the streams. It has been collected in the Baboquivari Mountains, but above the desert, (*M. French Gilman 24*). Generally distributed throughout the mountains of Arizona east of Tucson, and into New Mexico and western Texas, northward to Colorado.

STANFORD UNIVERSITY

# Notes on American Ferns—XXIII[1]

WILLIAM R. MAXON

CHEILANTHES KAULFUSSII Kunze.—First reported[2] as a United States plant in 1937, this species has again turned up in Texas. The present specimen, sent to the National Herbarium for identification, was collected "near Flying Eagle Mountains, Musquiz Canyon, Jeff Davis Co., July 28, 1938," by Barton H. Warnock (no. 604).

CHEILANTHES LENDIGERA (Cav.) Sw.—Though not uncommon in Mexico, and widely distributed through Central America southward to Venezuela and the Andes of Ecuador, this remarkable species has been known in the United States only from southern Arizona, chiefly upon collections made in the Huachuca Mountains by Lemmon, Goodding, Kearney, and Jones and, more recently, in the Chiricahua Mountains by Peebles and Loomis (no. 4412). Not long ago, however, Texas specimens were received from Prof. O. E. Sperry for identification, and subsequently so listed.[3] They were collected on a northern rocky exposure of Crown Mountain, Chisos Mountains, Brewster Co., Aug. 23, 1937, by B. H. Warnock, and agree very well with Mexican material from the States of Sonora and Chihuahua. This singular and beautiful species was formerly in cultivation.

ADIANTUM TRICHOLEPIS Fée.—First described by Martens and Galeotti[4] as *A. fragile* var. *pubescens* M. & G.,

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] AMER. FERN JOURN. 27: 109. 1937.

[3] SPERRY, O. E. "Check list of the ferns, gymnosperms, and flowering plants of the proposed Big Bend National Park of Texas." Published in Bulletin of Sul Ross State Teachers College, Vol. 19, no. 4, Dec. 1938.

[4] Mém. Acad. Brux. 15[5]: 72. 1842.

upon specimens collected in the vicinity of Guadalajara, Jalisco, Mexico, by Galeotti (no. 6445). Some 15 years later Fée,[5] having the same collection in hand, described it as a new species, *A. tricholepis*, citing the Martens and Galeotti variety as a synonym and contrasting the plant with *A. tenerum* Sw., with which, of course, it has no real affinity. *A. tricholepis* has since been found to have a rather wide range in Mexico, and numerous specimens have been collected, among which Pringle's no. 1843, from the barranca near Guadalajara, may be regarded as thoroughly typical. It is a strongly marked species, being especially noteworthy for the close pubescence of simple whitish hairs, which though minute are readily seen to extend freely over both sides of the segments of the quadripinnate blades. This character is invariable in Mexican specimens, and is equally constant in the plants recently collected along the border in Texas by Mr. G. M. Soxman.

Under the circumstances, the identity of *A. tricholepis* forma *glabrum* Clute[6] becomes of special interest. This was described briefly upon specimens said to have been collected near the mouth of the Pecos River, Texas, by James H. Ferriss. The actual type, Mr. Clute writes, can not now be found in his own herbarium. He suggests that the specimens must have been returned to Mr. Ferriss, and this probably is right, inasmuch as there is in the National Herbarium a specimen bearing Mr. Ferriss' characteristic small red-bordered label, upon which he has written "*Adiantum tricholepis glabrum* Clute. Mouth Pecos Riv., Tx. 1903. J. H. F. 6. Cotype." This specimen, which is one of a small collection of ferns presented to the National Museum by Mr. Ferriss in 1914, is referable to *A. capillus-Veneris* L., being that form of

[5] Mém. Foug. 8: 72. 1857.

[6] Fern Bull. 12: 44. 1904.

the species which Underwood described upon New Mexican specimens as *A. modestum* Underw. It lacks a rhizome, but its lax habit, very slender stipe and rachis, delicate narrow blade, and deeply denticulate segments (the veins running out to the tip of the acuminate teeth) identify it beyond doubt.

× **Asplenium virginicum** Maxon, nom. nov. (*Asplenium mixtum* Maxon, AMER. FERN JOURN. **28**: 141. *pl. 13.* 1938; not Roxb. 1844).—In describing recently from Virginia a hybrid between *Asplenium platyneuron* and *A. Trichomanes* the writer used the name *mixtum,* entirely overlooking *Asplenium mixtum* Roxb., described nearly a hundred years ago from Amboina and now referred to *Diplazium silvaticum* (Bory) Sw. A new name is therefore given to our United States plant, as above.

DRYOPTERIS ARGUTA (Kaulf.) Watt.—To the two Arizona localities previously known[7] a third may now be added: North side of Superstition Mountain, Pinal County, Aug. 12, 1937, *Goodding* 6151. This lies about 25 miles west of the original station at Superior, which also is in Pinal County.

ONOCLEA SENSIBILIS L.—The suggestion offered some time ago[8] that members of the Society make an effort to add to the small list of ferns parasitized by dodder (*Cuscuta* spp.) has yielded a single addition, viz. *Onoclea sensibilis* L. An excellent specimen of this species, parasitized by *C. Gronovii* Willd., has recently been received from Prof. T. G. Yuncker, who has long been engaged in a monographic study of the family Cuscutaceae. It was collected in a marsh near Murray Lake, Kent Co., Michigan, Aug. 31, 1938, *Yuncker* 8856. Evidently ferns are

[7] AMER. FERN JOURN. 27: 110. 1937.

[8] AMER. FERN JOURN. 27: 136. 1937.

not very commonly affected by dodder; yet the number of species can presumably be somewhat increased, if special effort is made whenever even our commonest lowland ferns are observed carefully.

WASHINGTON, D. C.

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## Recent Fern Literature

FILMY FERNS IN THE CAROLINAS.—While two representatives of the filmy-fern genus *Trichomanes* have long been known in our southeastern states, none of the genus *Hymenophyllum* had ever been reported until 1938. Mrs. Mary S. Taylor[1] now announces her discovery of it "in a deep ravine in Pickens County, South Carolina." Elsewhere in the article she cautiously discloses that it grows along a stream, near a series of beautiful waterfalls, and at a place that can only be reached after many hours of hard walking and climbing, wading in cold water, etc., but fails to furnish the details as to its exact site, which in the interest of science should be placed on record. It is so abundant that such disclosure would not lead to its extermination. *Trichomanes petersii*, new to the state, also grows along this stream.

Earlier in 1938 a new state, West Virginia, was added to the known range of *Trichomanes Boschianum* (this JOURNAL **28**: 122) and now there is another, North Carolina. Professor W. C. Coker,[2] exhibiting the proper scientific spirit, has published its exact location: along "Crow Creek, under the largest falls, not far from U. S. G. S. bench mark no. 520 and about a quarter of a mile below the high Cullasaja Falls, altitude about 3000 feet." The discoverer was Dr. Herbert Hechenbleikner.

Photographs of two new West Virginia fern records,

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[1] Science **88**: 402. 1938; Journ. Elisha Mitchell Sci. Soc. **54**: 345. 1938.

[2] *Ibid.*, p. 348.

the *Trichomanes* just mentioned and *Cryptogramma stelleri* (this JOURNAL **28**: 123) have been published along with records of several minor range extensions in this state by Edgar T. Wherry.[3] The previous find of *Pteretis nodulosa* (this JOURNAL **9**: 1) proves to have been attributed to the wrong county, really lying in Randolph; but the species-range has now been extended to latitude 37° 56′ in Greenbrier Co. *Woodsia ilvensis* is now known in both Grant and Pendleton counties, and the eastern relative of *W. scopulina* in Mercer Co.—E. T. W.

In *Castanea* for January, 1939, Frank Bell discusses the ferns of Greene County, Pennsylvania. Thirty-three species are mentioned and the habitats of the rarer ones described.—*Lycopodium inundatum*, new to West Virginia, is recorded by Prof. E. L. Core.

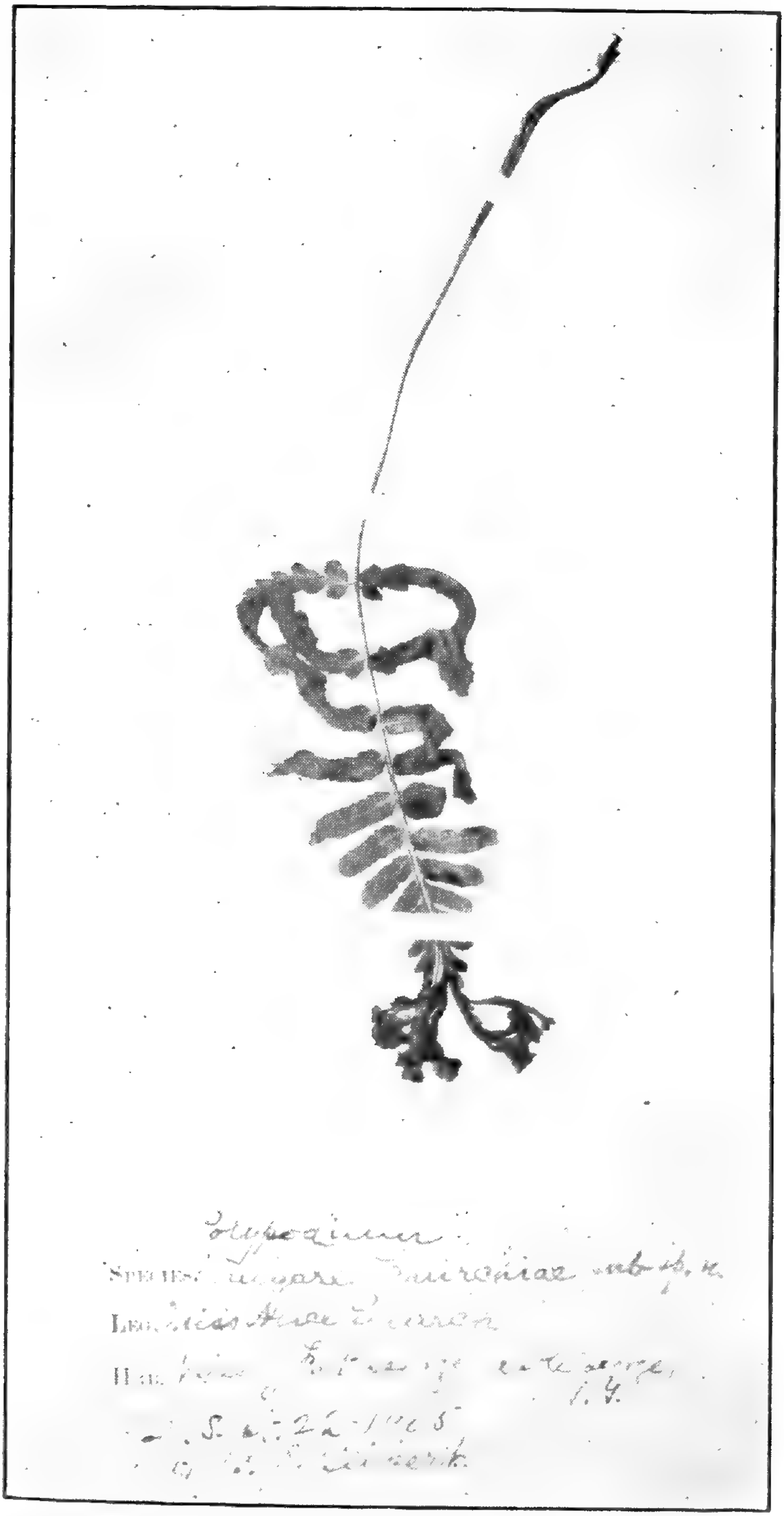
Prof. Ivey F. Lewis, Proc. Virginia Acad. Sci. for 1938, p. 45, reports that plants of *Osmunda cinnamomea* and *O. regalis* covered with sawdust to the depth of a foot or more, sent up through it fronds which bore sporangia on the vein-tips at the margins of foliage leaves.

## Shorter Notes

LOCATION OF B. D. GILBERT'S HERBARIUM.—In looking over old Fern Bulletins last September, Mrs. M. L. Chisholm, of Proctor, Vermont, noted that B. D. Gilbert's herbarium had been left to the Utica Public Library,[1] and on impulse she wrote that institution to learn if that was true, or just another surmise. In reply the Librarian said the herbarium had been left to them, but at present was in the Library of Hamilton College. As the type specimens of Gilbert's ferns would naturally be in his herbarium, and Mrs. Chisholm was particularly interested in his *Poly-*

[3] Castanea 4: 1. 1939.

[1] *The Fern Bulletin*, 17: 115. 1909.



Type Specimen of Polypodium vulgare, var. Churchiae Gilbert.

*podium vulgare* var. *Churchiae*,[2] because of the plant found in Florence, Vermont, in October, 1929,[3] she wrote to Hamilton College, asking if the herbarium and the type in question were there. To her great joy she learned that they are, and that the specimens are accessible to properly qualified investigators. The locating of the herbarium, after its reported destruction had been mourned for so many years, is of interest to all fern students, but to us the greatest interest centers in the type specimen of *Churchiae*, which by the way was in excellent condition, the sheet unmarred in any way—good evidence that it, and so presumably the entire collection, had been well cared for.

A remarkable fact in connection with the identification of the Florence plant with Gilbert's, is that the frond seen second from the right in the illustration of our plant,[4] and now preserved in my herbarium, is almost an exact duplicate of the type specimen. The fronds of later years have been larger and much more forked and contorted.—E. M. KITTREDGE, *Vergennes, Vermont.*

VARIATION IN THE PERIOD OF RIPENING SPORES.—A recent writer on the subject of ferns used the terms "ripening of spores" and "fruiting time" as if they were synonymous. If fruiting time is used to refer to the appearance of the sporangia, it should not be confused with the ripening of the spores. There is a great variation in the length of the period of spore ripening. *Osmunda cinnamomea* matures its spores within a very few days after it unrolls its fertile frond. But in *Botrychium dissectum* this period may last as long as sixty to eighty days. Its "fruiting time" begins in July, but the spores do not ripen till September and October.—W. L. DIX, *Morrisville, Pennsylvania.*

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[2] *The Fern Bulletin*, **14**: 39. 1906.

[3] AMERICAN FERN JOURNAL, **20**: 124. 1930.

[4] AMERICAN FERN JOURNAL, **20**: 124. 1930.

# American Fern Society

## Report of the President for 1938

The undersigned was elected President of the Society for the year 1934, and reelected each successive year up to 1938. But feeling that the work of directing the Society's affairs should be shared by various members, and especially by younger ones, he declined renomination for 1939. The present report may well be a summary of progress made during the five-year period.

The serious loss which the Society sustained through the unauthorized use of our money by the former Treasurer has been fully discussed in the JOURNAL. All that need be stated further at this time is that not a cent of principal or interest on his note has as yet been received. A member who still prefers anonymity generously loaned us enough money to pay back printers' bills, and by certain economies such as curtailing the size of the JOURNAL and lengthening the period between publication of membership lists we have been able to repay this loan out of our current income. Now we are gradually increasing the number of pages per volume again, so that only a few months need elapse between receipt of manuscript and publication of articles.

In 1935 the 25th volume of the JOURNAL was completed. A cumulative index was then compiled, but our funds have as yet been insufficient to justify its publication. However, it is hoped that this may be accomplished during 1939.

With the feeling that the Society might benefit from the legal and the financial standpoint by being incorporated, steps were undertaken to carry this out. Finding that it could be done most advantageously and appropriately in the District of Columbia, five members of the Society resident there met and signed the necessary papers, which were duly placed on record on October 10,

1936. Shortly thereafter we received a bequest of $500 from the widow of a former active member, and the legal formalities in connection with this were considerably simplified by our status as an incorporated organization.

Throughout the five-year period the membership list of the Society has been gradually increasing. Many members having resigned early in the 1930's, there were in 1934 only slightly over 300. The list published toward the end of 1935 showed 325 on the rolls, and that of 1938 contained 337 names. Since we lose annually through death or resignation a considerable number, even this small net increase is gratifying. The publication of the writer's "Guide to Eastern Ferns" did not lead to as many new membership applications as had been hoped for; but the edition is as yet only half sold out, so results may still be expected from future sales.

In conclusion I wish to express my deepest appreciation of the way in which the other officers and various members have cooperated in making my five-year term as President so pleasant and so helpful in bringing the Society into its present flourishing condition.

Respectfully submitted,

EDGAR T. WHERRY, *President.*

**Report of the Secretary for 1938**

The American Fern Society started the year with a membership on the books of three hundred and forty-five names. We have lost by death, resignations and otherwise thirty-one members. Two who were lost by death were known in a wide field of natural history beside their fern interests. Of these Raymond H. Torry had been a Fern Society member for but a short time, while Milton S. Baxter's name had been listed for a quarter of a century. In the death of Miss Dora A. Radlo the Society lost its last representative of the members who joined in

1894. Hers was one of the early names added to the list of charter members of the Linnaean Fern Chapter of the Agassiz Association,—the first title of the present American Fern Society. In her passing a membership of nearly half a century is broken.

Twenty-seven new members have joined our number during the year, so 1938 closes with the membership just a little less than it was in January.

A revised Membership List has been prepared and printed, going to the members with Number 4 of the JOURNAL.

Respectfully submitted,

26 December, 1938. ELSIE G. WHITNEY, *Secretary*

Mr. Arthur N. Leeds, a member of the Society since 1921, and Vice-President for 1938 and 1939, died at his home in Germantown, Philadelphia, on January 26th, 1939. He was born in Philadelphia in 1870, graduated from Haverford College (B.S. 1889; A.M. 1890) and then engaged in business. Retiring in 1925, he spent two years in a trip around the world, and then started looking for some activity to occupy his time. All his life he had been an amateur naturalist, and was familiar with the native ferns in a general way. At the suggestion of Mr. T. Chalkley Palmer, long an active member of this Society, and of Dr. Francis W. Pennell, Curator of Botany at the Academy of Natural Sciences of Philadelphia, he decided to take charge of the fern herbarium of that institution.

While the herbarium of the Academy of Natural Sciences contained a considerable number of ferns, including collections of historic interest made by Nuttall, Pursh, Short, Porter, and others, these had never been arranged in modern order, and indeed many of them were unmounted. Employing at his own expense a clerk to type labels and mount the specimens on standard sheets, he

succeeded in putting the fern collection into splendid shape. Finding that in order to bring the nomenclature and classification up to date he needed reference works, he proceeded to purchase books on ferns and related plants, ultimately assembling an unusually complete library upon them. He also purchased, in part with the aid of friends, a number of sets of ferns from various parts of the world, until the collection has become one of the best in the country.

In working over the specimens to get the nomenclature into shape, Mr. Leeds gained a familiarity with the plants which made him able to make identifications even in the more difficult genera, and he spent considerable time in naming up material for others. Finding that Mexican ferns were especially in need of study, he took two trips to make collections there, and also encouraged other naturalists to do likewise, so that the Academy of Natural Sciences now has an unusually full representation of the species of that country.

Being of a modest and retiring disposition, he felt disinclined to publish the results of his studies, and contributed but three brief articles to the FERN JOURNAL: Is Polypodium vulgare L. var. Churchiae Gilbert a Polypodium? (**23**: 8); The Harts-Tongue in Maryland (**26**: 122); and Asplenium ebeneum var. Hortonae (**27**: 30). But through his careful, critical work in annotating specimens in the herbarium, his influence on fern study will be felt by all who consult this collection for many years to come.—EDGAR T. WHERRY

## Report of Meetings

The Society has held two meetings recently. The first was on the morning of December 31st, 1938, at Richmond, Virginia, in connection with the annual convocation of the American Association for the Advancement of Science. Its features were an exhibition of unusual and often very

fine photographs of ferns, some by H. E. Ransier, taken during his journeys to various parts of the country, and some by Rutherford Platt; and an informal symposium on ferns of Virginia, led by Profs. Wherry and Massey.

For the second meeting, on Feb. 11th, 1939, we were the guests of the Brooklyn Botanic Garden. This was an all-day affair, with a social aftermath extending well into the evening, and was attended by all the officers of the Society except one editor and the curator, and by a good representation of local members. After a hospitable greeting from Dr. Gager, Director of the Garden, the morning session was devoted to a general discussion of the Society's affairs. Following a pleasant lunch together at the Brooklyn Museum nearby, the party spent the afternoon in a tour of the green houses to see the tropical ferns there and Dr. Benedict's experiments in growing *Nephrolepis*, in an inspection of the exhibits, and, last but not least, in conversation. The same photographs as at Richmond were on display, reinforced by another series by Dr. Benedict and by a number of unlabelled pictures and specimens which those present were invited to name. Several made creditable records in this competition.

Later, a party of some fifteen repaired to one of Dr. Benedict's favorite Chinese restaurants where, after more or less weak attempts to wield chopsticks, most of the company fell back on the more familiar fork and spoon and with their aid regaled themselves on a long succession of the insinuating and often delectable dishes which the Chinese alone know how to prepare. Finally, after a brief visit to a joss-house and the purchase of some water-chestnuts and like curiosities, the party broke up with reluctant good-nights and thanks and congratulations, not at all reluctant, to our hosts.

The Society will hold a meeting in Milwaukee in June, at the time of the Summer Meetings of the American

Association for the Advancement of Science. Professor W. N. Steil, head of the Department of Biology and Professor of Botany at Marquette University, is in charge of arrangements. There will be an informal meeting at 2:30 P.M. on Friday, June 23, in the Trustees' room in the Administration Building of Marquette University. The Administration Building is at 165 N. 11th Street, Milwaukee. Professor Steil has stated that the Trustees' room in that building will be available to the Society for the full time of the A.A.A.S. meeting. Members who may wish to do so might display there photographs and specimens or meet informally at times other than that of the regular meeting. No formal program has been planned for the Friday meeting. Members will have opportunity to become acquainted and discuss their problems. Those who wish to display specimens or other material should make necessary arrangements by writing to Professor Steil.

There will be an all day field-trip on Saturday, June 24, to Gibraltar Rock, about 125 miles from Milwaukee. The party will leave the city at 8 A.M. Transportation will be provided, so far as possible. Those attending should bring lunch. Return in the evening will be on time for dinner in Milwaukee.

Members who can not get to Milwaukee are invited to spend June 15th to 17th at Mountain Lake Biological Station, Virginia. A circular giving details will be sent, on request, by Dr. A. B. Massey, Virginia Polytechnic Inst., Blacksburg, Va.

The regular winter meeting will be held in Columbus, Ohio. Members who expect to attend may consider the possibility of presenting papers or exhibiting specimens. A symposium on the pteridophytes of Ohio might be desirable. Members who would be interested to participate in such a symposium should inform the President.

Two trips with the Torrey Botanical Club have been arranged. On August 6, Dr. Wherry will lead a group to the Bowman Hill Flower Preserve, New Hope, Pennsylvania. On August 20, Mr. V. L. Frazee will guide a party to various places in the New Jersey pine-barrens, where there will be opportunity to study the pteridophytes characteristic of the region. "The Barrens," Sims Place, Penn State Park, Martha, and Harissa will be visited. *Habenaria integra, H. cristata, Xyris, Eriocaulon,* and *Schizaea* may be seen. Owing to uncertainties of train service, definite plans can not yet be completed. For directions, write to leader, V. L. Frazee, Allenwood, New Jersey, about the first of August. State whether coming by train or auto. It will be nearly 100 miles round trip from the starting place, Point Pleasant, N. J. Reasonable auto transportation will be arranged by the leader for those asking for it.

Mr. W. L. Dix of Starrucca, Pennsylvania, will lead the members of the Society in trips to see the interesting ferns of the region of Lake Shehawken, in Wayne County, Pennsplvania, on the week-end of Labor Day. Complete details are announced below.

Saturday, September 2. Assemble during the afternoon at the cottage of Mr. W. L. Dix, on northwest side of Lake Shehawken. This lies five miles east of Starrucca on State Route 570 (or about ten miles southeast of Hancock, New York). Lodging and meals can be arranged for at local boarding houses, but advance reservation will be desirable. Mr. Dix has kindly offered to make such reservations; write if practicable two weeks in advance to W. L. Dix, Lake Shehawken, Starrucca, Pennsylvania. Camping-out is also possible.

Sunday, September 3. All-day trip to Shrawder Mountain, Lake Hiawatha, and other nearby places, to see localities of rare northern ferns, including *Polystichum braunii* and *Botrychium multifidum* ssp. *typicum.*

Monday, September 4. Trips around Lake Shehawken, to see additional ferns and fern-allies, ending by noon to permit return home the same day.—ROBERT T. CLAUSEN

The colony of the apparent hybrid *Asplenium stotleri* is now practically extinct, but I have a number of young plants raised from its spores, which faithfully reproduce the parental features. These will be gladly sent to any members who know of situations in which it might be naturalized and preserved, preferably ledges of sandstone with pockets of intensely acid soil.—EDGAR T. WHERRY, University of Pennsylvania, Philadelphia, Pa.

New members:

Coxon, Mrs. Fred W., Ranier, Minn.
Epps, William P., 14 James St., Somerville, New Jersey
Sullivan, Miss S. Hazel, 201 St. Paul St., Brookline, Mass.

Changes of address:

Oliphant, Roy L., 124 Sunnyside Ave., Oakland, California.
Whitehead, Jack, 2505 Virginia Ave., Berkeley, Cal.
Williams, Ira, Drawer 831, Borger, Texas

We are saddened by the knowledge that two of the contributors to this number of the Journal, Dr. J. K. Small and Prof. J. H. Schaffner, will write no more. Prof. Schaffner's article, however, may be only the beginning of a series to be carried on by others. It was prepared in response to a suggestion at the Indianapolis meeting that one line of work which could profitably be fostered by the Society would be the accurate working out and mapping of the ranges of North American ferns. It is earnestly hoped that those who can will go on with the project begun by Prof. Schaffner.

Dr. Benedict reports that *Dryopteris ludoviciana* seems to have wintered very successfully in Mr. W. H. Dole's garden in West Orange, New Jersey.

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# American Fern Journal

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**L. S. HOPKINS ..... Culver-Stockton College, Canton, Mo.**

**A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.**

# American Fern Journal

VOL. 29 JULY–SEPTEMBER, 1939 NO. 3

## Forcing a Collection of Native Ferns of New England and the Middle Atlantic States for Exhibition

SUSAN H. THURSTON

In September, 1937, my husband and I were asked to exhibit a collection of hardy native ferns as the Millbrook Garden Club's entry at the International Flower Show in New York the following March. We had just made an exhibit of forty-three species of native ferns collected in nearby localities and arranged in a naturalistic setting at the Flower Show of the Millbrook Club in Millbrook on September 15th, and with this collection as a nucleus we decided to add as many additional species native to New England and Middle Atlantic States as we could procure and force into good growth in this short time.

With the aid of fern nurseries and through the kindness and generosity of fern collectors we were able at last to assemble a collection of sixty species, and, in most cases, a considerable number of each to insure our being able to present the ferns in naturalistic groupings.

The following is a copy of the folder of which over five thousand were distributed to visitors at the exhibit. In this folder was given a list of the ferns exhibited, each numbered to correspond with the labels in the planting, thereby insuring the identification of the fern species. A paragraph was also included urging the public to grow ferns in the interest of conservation.

[Volume 29, no. 2 of the JOURNAL, pages 41–84, plates 4–7, was issued May 29, 1939.]

## NATIVE FERNS OF NEW ENGLAND AND MIDDLE ATLANTIC STATES

### Common and Botanical Names

### Authority, Dr. Edgar T. Wherry

| | | |
|---|---|---|
| 1. | Evergreen Woodfern | *Dryopteris intermedia* |
| 2. | Toothed Woodfern | *Dryopteris spinulosa* |
| 3. | Mountain Woodfern | *Dryopteris campyloptera* |
| 4. | Marginal Woodfern | *Dryopteris marginalis* |
| 5. | Giant Woodfern | *Dryopteris goldiana* |
| 6. | Male-fern | *Dryopteris filix-mas* |
| 7. | Broad Swamp-fern | *Dryopteris clintoniana* |
| 8. | Narrow Swamp-fern | *Dryopteris cristata* |
| 9. | Glandular Swamp-fern | *Dryopteris boottii* |
| 10. | Northeastern Marsh-fern | *Thelypteris palustris* |
| 11. | Bog-fern (Massachusetts Fern) | *Thelypteris simulata* |
| 12. | Tapering Fern (New York Fern) | *Thelypteris noveboracensis* |
| 13. | Northern Beechfern (Long Beech Fern) | *Phegopteris polypodioides* |
| 14. | Southern Beechfern (Broad Beech Fern) | *Phegopteris hexagonoptera* |
| 15. | Oak-fern | *Phegopteris dryopteris* |
| 16. | Rockcap Fern | *Polypodium virginianum* |
| 17. | Resurrection Fern | *Polypodium polypodioides* |
| 18. | Christmas Fern | *Polystichum acrostichoides* |
| 19. | Eastern Holly Fern | *Polystichum braunii* |
| 20. | Dwarf Chainfern | *Lorinseria areolata* |
| 21. | Giant Chainfern | *Anchistea virginica* |
| 22. | Northern Lady-fern | *Athyrium angustum* |
| 23. | Silver-stripe Fern (Silvery Spleenwort) | *Athyrium thelypteroides* |
| 24. | Glade Fern | *Athyrium pycnocarpum* |
| 25. | Ostrich Fern | *Pteretis nodulosa* |
| 26. | Bead-fern (Sensitive Fern) | *Onoclea sensibilis* |
| 27. | Cinnamon Fern | *Osmunda cinnamomea* |
| 28. | Interrupted Fern | *Osmunda claytoniana* |
| 29. | Royal Fern | *Osmunda regalis* |
| 30. | Hay-scented Fern | *Dennstaedtia punctilobula* |
| 31. | Northern Maidenhair | *Adiantum pedatum* |
| 32. | Eastern Bracken | *Pteridium latiusculum* |
| 33. | Bulblet Fern | *Cystopteris bulbifera* |
| 34. | Upland Brittle Fern | *Cystopteris fragilis* |
| 35. | Blunt-lobe Cliff-fern | *Woodsia obtusa* |
| 36. | Rusty Cliff-fern | *Woodsia ilvensis* |
| 37. | Mountain Cliff-fern | *Woodsia scopulina* |
| 38. | Waterclover Fern | *Marsilea quadrifolia* |
| 39. | Hairy Lipfern | *Cheilanthes lanosa* |
| 40. | Smooth Cliffbrake | *Pellaea glabella* |

| | | |
|---|---|---|
| 41. | Hairy Cliffbrake | *Pellaea atropurpurea* |
| 42. | Curly-grass Fern | *Schizaea pusilla* |
| 43. | Climbing Fern (Hartford Fern) | *Lygodium palmatum* |
| 44. | Adderstongue Fern | *Ophioglossum vulgatum* |
| 45. | Rattlesnake Fern | *Botrychium virginianum* |
| 46. | Laceleaf Grapefern | *Botrychium dissectum* |
| 47. | Coarse-lobe Grapefern | *Botrychium obliquum* |
| 48. | Leather Grapefern | *Botrychium multifidum* |
| 49. | Daisyleaf Grapefern | *Botrychium matricariaefolium* |
| 50. | Maidenhair Spleenwort | *Asplenium trichomanes* |
| 51. | Blackstem Spleenwort | *Asplenium resiliens* |
| 52. | Brownstem Spleenwort | *Asplenium platyneuron* |
| 53. | Cliff Spleenwort | *Asplenium bradleyi* |
| 54. | American Wall-rue Spleenwort | *Asplenium ruta-muraria* |
| 55. | Mountain Spleenwort | *Asplenium montanum* |
| 56. | Lobed Spleenwort | *Asplenium pinnatifidum* |
| 57. | Walking Spleenwort | *Asplenosorus ebenoides* |
| 58. | Pinnate Spleenwort | *Asplenium trudelli* |
| 59. | Walking Fern | *Camptosorus rhizophyllus* |
| 60. | American Harts-tongue Fern | *Phyllitis scolopendrium* |

## WE URGE YOU TO GROW FERNS

**All the native ferns in this collection from the largest to the smallest may be grown from spores by simple methods which are possible for every one to follow. An unlimited number of these lovely species may then be established in suitable places on the rocks or in the woods and open spaces of your private grounds or in the protected areas of our State Parks. Let us urge you, then, in the interest of conservation as well as for your own pleasure to grow ferns.**

A few of the species in the foregoing list were not received until February and so were put into the greenhouse under forcing conditions as soon as they arrived, as they were in a well-developed state of growth. They were, namely:

| | | | |
|---|---|---|---|
| *Phyllitis scolopendrium* | received | Feb. | 5th |
| *Marsilea quadrifolia* | " | " | " |
| *Schizaea pusilla* | " | " | 23rd |
| *Asplenium bradleyi* | " | " | " |
| *Asplenosorus ebenoides* | " | " | " |
| *Asplenium trudelli* | " | " | " |

As soon as the ferns were collected they were planted in pots and flats. Two types of soil were used: one a mixture consisting of 4 parts maple-leaf mold, 1 part garden loam and 1 part sand for all ferns not requiring lime; and the other a mixture consisting of 3 parts maple-leaf mold, 1½ parts garden loam and 1½ parts sand together with a generous amount of powdered limestone and small bits of limestone for additional drainage. To the soil used for *Lygodium palmatum* a small sprinkling of aluminum sulphate was added to increase the acidity. The pots and flats were then buried in cold frames and protected by slatted covers made of lath which were raised enough above the frames to allow a good circulation of air with protection from wind and sun. Here the ferns grew and ripened naturally as the season advanced. Before freezing weather the ferns were protected from field mice with covers of ¼ inch mesh wire which fitted tightly over the cold frames. When the ground began to freeze in November the ferns were covered with dry oak leaves, and the depth of cover was gradually increased until it reached the tops of the frames under the wire.

At this time, however, the following species were removed to a cool shaded greenhouse, as it was feared that they would not be entirely hardy in this northern Connecticut climate. Here they remained until placed under forcing conditions on January 9th:

*Polypodium polypodioides*
*Cheilanthes lanosa*
*Pellaea glabella*
*Asplenium resiliens*
*Asplenium pinnatifidum*

At this same time the flats in which *Botrychium dissectum*, *Botrychium obliquum*, and *Botrychium multifidum* were growing were placed in a dark corner of a cool potting shed where it was planned to keep them in a slightly moist state, hoping by this method to preserve their fronds in good condition until they were exhibited,

as it was feared that new growth could not be expected by March. This was perfectly successful; the fronds both sterile and fertile kept in perfect form and ten days before the ferns were to be exhibited they were taken into the greenhouse and the sterile fronds turned from bronze to a beautiful fresh green; the fertile fronds although standing erect were dry and powdery.

Also one half of the *Camptosorus rhizophyllus* (4 flats full) and one half of the *Asplenium trichomanes* (3 flats full) and all of the *Lygodium palmatum* were taken into the cool greenhouse and kept moist to keep the old fronds in as good a condition as possible, as it was thought that the new forced growth would not give fully developed, characteristic fronds.

This plan was also successful and when these three species were put under forcing conditions on January 9th and the fronds kept well sprayed during the entire period that they were in the greenhouse the old fronds were fresh and green at the time of the exhibition, although the new growth of *Camptosorus rhizophyllus* and *Asplenium trichomanes* was not as luxuriant and strong as that on the plants of the same species that had been allowed to freeze in the frames. In the case of *Camptosorus rhizophyllus*, however, it proved most valuable to have treated specimens in these two ways as it resulted in having some plants with splendidly preserved old fronds covered with sori, and some rooting from the tips with small plants well formed as well as plants with luxuriant but immature new growth. The *Lygodium palmatum* put out splendid new growth and developed good fertile fronds in time for the exhibit, as well as retaining most of the previous year's growth in a good state of preservation.

The covering of the ferns was completed the first week in December with about a two-foot thickness of maple

leaves on top of the wire, hemlock boughs on the leaves and a glass sash placed on top of these and raised on blocks at top and bottom, four to six inches, for ventilation, and hemlock boughs again on top of all to keep off the sun. The outside walls of the frames were banked with straw as a further protection. This depth of covering was considered necessary, as the pots and flats of ferns were to be dug out by January 1st and could not be allowed to freeze too deeply.

On December 28th the first pots and flats of ferns which were frozen hard were brought in from the frames to a dark potting shed where the temperature was between 40 and 50 degrees, and on December 30th the moving was completed and the ferns were left undisturbed to thaw out slowly until January 4th.

In the meantime our small greenhouse had been prepared for them. As the dimensions of this were only 16 by 25 feet the space was entirely inadequate for the collection, so three tiers of benches were arranged, one below and one above the existing benches, thereby tripling the space ordinarily in use. Dark green bamboo porch screens had been supplied for the sides and south end of the greenhouse. These were fitted over light wooden frames so that by means of draw cords they could be raised and lowered at will and were of sufficient length to protect either side and the top of the side benches at the same time, so that complete protection was possible for these benches as the sun moved. The greenhouse had been kept empty for three weeks before bringing in the ferns, thoroughly cleaned, and fumigated several times at intervals of three or four days with nicofume. Two or three inches of earth were left on the benches on which the pots and flats were to be placed, to prevent them from drying out too much. During the entire time that the ferns were in the greenhouse no fumigation or spray of

any kind was used and the only pest encountered was a leaf-roller on three fronds of *Dryopteris goldiana.*

An orange-colored mold appeared on a few fronds of *Cystopteris fragilis* and a mold causing silvery spots on some fronds of *Woodsia obtusa.*

On January 4th all the ferns except those whose treatment has been described heretofore were brought into the greenhouse in which the temperature was about 55 degrees in the day time and 40 to 45 degrees at night. The arrangement of the various species in the greenhouse was a problem, for in the very limited space available it took careful planning to give each fern the place best suited to its requirements. The ferns most tolerant of sun were put on the top deck of the center bench with nothing over them but the glass roof—flats with such ferns as *Athyrium angustum, Thelypteris palustris, Thelypteris simulata, Thelypteris noveboracensis, Dennstaedtia punctilobula, Lorinseria areolata, Anchistea virginica, Pteridium latiusculum, Woodsia ilvensis, Lygodium palmatum, Pellaea atropurpurea,* and *Cheilanthes lanosa.* The very large ferns such as *Pteretis nodulosa, Onoclea sensibilis, Osmunda cinnamomea, Osmunda claytoniana,* and *Osmunda regalis* were placed at the extreme north and south ends of the house where a space had been made for them without any overhead bench, so providing plenty of head room and full light. All the other ferns were given places on the remaining benches where they could be fully protected by the adjustable shades.

On January 9th the temperature in the greenhouse was raised to 70 degrees in the daytime and allowed to drop to 50 degrees at night, and on this day the first fern of the collection started growth, the *Woodsia ilvensis.*

Watering was done twice a day with water warmed to a 70 degree temperature, and great care was taken as the ferns developed to keep all water off the fronds except in the case of *Camptosorus rhizophyllus, Asplenium*

*trichomanes*, *Lygodium palmatum*, *Polypodium virginianum*, *Polypodium polypodioides* and *Phyllitis scolopendrium*, the fronds of all of which were sprayed at frequent intervals. Special care was found necessary in watering *Woodsia obtusa* and *Cystopteris fragilis* in order to prevent the silvery spots of mold on the fronds of the former and the orange mold on the latter. Water was applied carefully around the edges of the pots and care taken not to allow any water to flow over the root-crowns of these ferns.

After two weeks in the greenhouse it was found best to remove *Polypodium polypodioides* to the cool potting shed and to grow it there in cool shade at a temperature of 40 to 50 degrees, keeping it well sprinkled.

The humidity in the greenhouse was kept at not less than 80 per cent, being measured by a wet bulb hygrometer. This result was accomplished by frequently wetting down the concrete floor and the ground under the heating pipes, as well as the earth on the benches between the pots and flats. As the season advanced and the ferns made rapid growth it was found necessary to shade some of them more completely and screens of double cheese-cloth of a close quality were fastened just under the roof over the sun-loving ferns. These met the need for a short time only and as the sun gained power it was soon necessary to white-wash the entire greenhouse on the outside, making the light a very subdued one.

Giving ventilation without draft was difficult and was accomplished by opening the roof ventilators on the opposite side from the prevailing wind for frequent short periods under careful supervision.

On February 15th the temperature in the greenhouse was reduced to between 55 and 60 degrees in the day time and ten degrees cooler at night. The purpose of this was to harden the ferns so that they would stand the one hundred mile motor trip from Sharon to the

Grand Central Palace. This treatment seemed to be just the right one, for by the first week in March the ferns were all in a splendid state of growth and did not look at all as if they had been forced, but like ferns that had been taken from their native haunts in late Spring—big, vigorous fronds, and on the greater number fully developed fertile fronds, and all with good dark green color.

It was especially gratifying to be able to exhibit specimens of *Ophioglossum vulgatum* and *Botrychium virginianum* with well developed fertile fronds and also one small specimen of *Botrychium matricariaefolium* with a fertile frond. *Polystichum braunii* proved to be a difficult fern. Although it grew rapidly when forced, the fronds were not perfect but rather irregular and some undeveloped. *Asplenium montanum* also gave trouble. The greenhouse atmosphere was apparently too hot for it, for after growing well for a time one plant after another wilted and it was only with the greatest difficulty that two plants were kept in good condition for the exhibit. The attempt to grow *Woodsia glabella* proved to be a complete failure, as it did not endure the greenhouse conditions and it was impossible to save a plant for exhibit.

Measurements of the ferns as recorded on the accompanying table were taken early in the morning on the dates given, but from casual observation and measurements, unfortunately not recorded, it was interesting to note that the ferns made by far the greater part of their growth at night.

A few roots of *Osmunda claytoniana* were brought in from out of doors on February 12th, allowed to thaw out for two days and brought into the greenhouse on February 14th, to supply some uncoiling crosiers to add to the planting.

On March 7th the packing of the ferns was started. Each pot and flat was protected by a single wrapping

of brown paper completely enclosing it. The very tall ferns such as the Osmundas *Pteritis nodulosa* and *Dryopteris goldiana* were tied in columns and wrapped about with soft paper. The packing was completed and the ferns put into two large closed but unheated vans on the morning of March 11th. The temperature out of doors on that morning was just ten degrees above zero, but the ferns arrived at the Grand Central Palace in the early afternoon in perfect condition.

The ferns were left undisturbed in their pots and flats and arranged in natural groupings on a platform giving an area of 220 square feet and built up high at the back with a natural slope to the front and sides. Damp peat moss was packed between them to hide the containers and keep them moist and to give a foundation for the planting of the woodland plants, ground covers and mosses. Three thousand pounds of moss and lichen covered rocks, and some limestone rocks and talus for the planting of Harts-tongue ferns were used to complete the picture. A thorough spraying with a fog nozzle spray night and morning daily kept the ferns in a perfectly fresh state during the six days of the Flower Show.

It was clearly demonstrated by this project of forcing ferns for exhibition that large, well developed and well established roots were essential for the best results under forcing conditions. The success achieved in presenting an exhibit of these sixty species of hardy native ferns, out of their season, so far from their native habitat and under such unnatural conditions, was due, first, to allowing them to follow their natural habit in having a frozen period of rest, and then to the unremitting care and watchfulness of the heat, light, humidity, and ventilation given them, and to the correct judgment of the amount of water required by each species when growing under forcing conditions.

SHARON, CONN.

TABLE SHOWING THE RATE OF GROWTH OF THE FERNS Figures apply to the best specimen of each individual species.

| | New Growth | Feb. 9 | Feb. 13 | Feb. 18 | Feb. 19 | Feb. 21 | Feb. 22 | Feb. 23 | Feb. 24 | Feb. 25 | Feb. 26 | Feb. 27 | Feb. 28 | Mch. 1 | Mch. 2 | Mch. 3 | Mch. 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Dryopteris intermedia* | Feb. 9 | | | 22 in. | 22 in. | 26 in. | 27½ in. | 28½ in. | 28½ in. | 28½ in. | 29½ in. | 29½ in. | 29½ in. | 30 in. | 31 in. | 31½ in. | | Fertile fronds |
| *Dryopteris spinulosa* | Feb. 9 | | | 12 in. | | 20 in. | 20 in. | 21 in. | 21 in. | 21½ in. | 22 in. | 22 in. | 22½ in. | 23 in. | 24 in. | 25 in. | | Fertile fronds |
| *Dryopteris campyloptera* | Feb. 9 | | | 3 in. | 3 in. | 5½ in. | 7½ in. | 10 in. | 12½ in. | 15 in. | 17 in. | 18½ in. | 19½ in. | 21½ in. | 24 in. | 25 in. | 30 in. | Fertile fronds |
| *Dryopteris marginalis* | Feb. 5 | 8 in. | 17 in. | 22 in. | 23 in. | 24 in. | 24½ in. | 25 in. | 25 in. | 26 in. | 27 in. | 27 in. | 28 in. | | | 29 in. | | Fertile fronds |
| *Dryopteris goldiana* | Feb. 5 | 5 in. | 19 in. | 36 in. | 37½ in. | | | | 40 in. | 42 in. | | | | | | | | Fertile fronds |
| *Dryopteris filix-mas* | Feb. 15 | | | 3 in. | 3 in. | 8 in. | 9 in. | 10½ in. | 11½ in. | 13 in. | 15 in. | 15 in. | 15 in. | 16 in. | 16 in. | 18 in. | | Fertile fronds |
| *Dryopteris clintoniana* | Feb. 1 | 14 in. | 23 in. | 31 in. | | | | | | 32½ in. | | | | | | | | Fertile fronds |
| *Dryopteris cristata* | Feb. 9 | 1 in. | 5 in. | 10 in. | | | | 11 in. | | | 14 in. | | 16 in. | | 18 in. | | | Fertile fronds |
| *Dryopteris boottii* | Feb. 10 | | | 2 in. | 2 in. | 7½ in. | 8½ in. | 10½ in. | 13 in. | 14 in. | 15½ in. | 17 in. | 18 in. | 19 in. | 20 in. | 21 in. | | Fertile fronds |
| *Thelypteris palustris* | Jan. 15 | 16 in. | | 16 to 18 in. | | | | | | | | | | | | | | No fertile fronds |
| *Thelypteris simulata* | Jan. 10 | 14 in. | | | | 15 to 16 in. | | | | | | | | | | | | Fertile fronds |
| *Thelypteris noveboracensis* | Jan. 28 | 14 in. | | 16 in. | | | 18 in. | | | | | | | | | | | Fertile fronds |
| *Phegopteris polypodioides* | Jan. 20 | 5 in. | | | 6 in. | | 7 in. | | | 9 in. | | | | | | | | Fertile fronds |
| *Phegopteris hexagonoptera* | Feb. 7 | 3 in. | | | 5 in. | | 6 in. | | | | 8 in. | | 9 in. | | | 10 in. | | Fertile fronds |
| *Phegopteris dryopteris* | Jan. 12 | 2 in. | | | | 3 to 4 in. | | | | | | | | | | | | Fertile fronds |
| *Polypodium virginianum* | Jan. 26 | | | 4 to 6 in. | | | | | | | | | | | | | | Fertile fronds |
| *Polypodium polypodioides* | Received grown | 3 to 4 in. | | | | | | | | | | | | | | | | Fertile fronds |
| *Polystichum acrostichoides* | Jan. 30 | 4 in. | 9 in. | 15 in. | | | | | | 19 in. | | | | | | | | Fertile fronds |
| *Polystichum braunii* | Jan. 30 | 16 in. | 19 in. | 20 in. | 20 in. | | | | | 21 in. | | | | | | | | Fertile fronds |
| *Lorinseria areolata* | Jan. 15 | 9 in. | | 12 in. | | | | 13 in. | | | 15 in. | | | | | | | No fertile fronds |
| *Anchistea virginica* | Jan. 30 | 12 in. | | 13 in. | | | 16 in. | | 17 in. | | 20 in. | | | 22 in. | | | | No fertile fronds |
| *Athyrium angustum* | Jan. 26 | 13 in. | 23 in. | 30 in. | 32 in. | | | | | | | | | | | | | Fertile fronds |
| *Athyrium thelypteroides* | Feb. 9 | 1 in. | 5 in. | 13 in. | 13 in. | 16½ in. | 17½ in. | 18½ in. | 18½ in. | 20 in. | 20 in. | 20½ in. | | | | 22 in. | | Fertile fronds |
| *Athyrium pycnocarpum* | Feb. 5 | 6 in. | 13 in. | 21 in. | 21 in. | 22½ in. | 23 in. | 23 in. | 24 in. | 24 in. | | | | | | | | Fertile fronds |
| *Pteretis nodulosa* | Jan. 20 | 40 in. | 46 in. | 54 in. | | | | 58 in. | | | | | | | | | | Fertile fronds |
| [1]*Onoclea sensibilis* | Feb. 5 | 8 in. | 16 in. | 20 in. | 22 in. | | | | | | 29 in. | | | | | | | Fertile fronds |
| *Osmunda cinnamomea* | Jan. 26 | 10 in. | 19 in. | 32 in. | | | | | | 36 in. | | | | | | | | No fertile fronds |
| [2]*Osmunda claytoniana* | Jan. 15 | 34 in. | 36 in. | 40 in. | | | | | | 42 in. | | | | | | | | Fertile fronds |
| [3]*Osmunda regalis* | Jan. 15 | 42 in. | 43 in. | 46 in. | | | | | | | | | | | | | | Fertile fronds |
| *Dennstaedtia punctilobula* | Jan. 26 | 14 in. | 18 in. | | 20 to 22 in. | | | 24 in. | | | | | | | | | | Fertile fronds |
| *Adiantum pedatum* | Feb. 1 | 10 in. | 17 in. | 18 in. | | | | | | 19 in. | | | | | | | | Fertile fronds |
| [4]*Pteridium latiusculum* | Jan. 15 | 18 in. | 18 in. | 19 in. | | | 21 in. | | | | | | | | | | | Fertile fronds |
| *Cystopteris bulbifera* | Jan. 20 | 9 in. | 12 in. | 14 in. | | | | | | 15 in. | | | | 18 in. | | | | No fertile fronds |
| *Cystopteris fragilis* | Jan. 15 | 10 in. | | | | | | | | | | | | | | | | Fertile fronds |
| *Woodsia obtusa* | Jan. 10 | 6 to 8 in. | | | | | | | | | | | | | | | | Fertile fronds |
| [5]*Woodsia ilvensis* | Jan. 9 | 3 to 6 in. | | | | | | | | | | | | | | | | Fertile fronds |
| *Woodsia scopulina* | Jan. 30 | 3 to 4 in. | | | 6 in. | | | | | 7 in. | | | | | | | | Fertile fronds |
| *Marsilea quadrifolia* | Received grown | | | | | | | | | | | | | | | | | Fertile segments |
| *Cheilanthes lanosa* | Jan. 26 | 4 in. | 6 in. | | | 8 in. | | | | 12 in. | | | | | | | | Fertile fronds |
| *Pellaea glabella* | Jan. 15 | | | 2 to 4 in. | | | | | | | | | | | | | | Fertile fronds |
| *Pellaea atropurpurea* | Jan. 15 | 2 to 4 in. | | 3 to 7 in. | | | | | 8 in. | | | | | | | | | Fertile fronds |
| *Schizaea pusilla* | Received grown | | | | | | | 2½ in. | | | | | | | | | | Old fertile fronds |
| *Lygodium palmatum* | Feb. 1 | 8 in. | | 12 in. | | | | 15 in. | | | | | 20 in. | | 22 in. | | | Fertile fronds |
| *Ophioglossum vulgatum* | Jan. 18 | | | 6 in. | | | | | | | | | | | | | | Fertile frond |
| *Botrychium virginianum* | Feb. 9 | 1 in. | | 3 in. | | | 5 in. | | | 6 in. | | | | 9 in. | | | | Fertile frond |
| *Botrychium dissectum* | Old growth | 5 to 6 in. | | | | | | | | | | | | | | | | Old fertile fronds |
| *Botrychium obliquum* | | | | | | | | | | | | | | | | | | Old fertile fronds |
| *Botrychium multifidum* | preserved | | | | | | | | | | | | | | | | | Old fertile fronds |
| *Botrychium matricariaefolium* | Jan. 18 | | | ½ in | | | | | | | | | | | | | | Fertile frond |
| *Asplenium trichomanes* | Jan. 20 | 3 in. | | | | 4 to 5 in. | | 1 in. | | | | | | 1½ in. | | | | Fertile fronds |
| *Asplenium resiliens* | Jan. 15 | 5 in. | | | | | | | | | | | | | | | | Fertile fronds |
| *Asplenium platyneuron* | Jan. 20 | 5 in. | | | 6 in. | | | | 6 in. | 7 in. | | | | | | | | Fertile fronds |
| *Asplenium bradleyi* | Received grown | | | | | | | 2 to 3 in. | | | | | | | | | | Old fertile fronds |
| *Asplenium ruta-muraria* | Jan. 10 | ½ in. | | | | | | | | | | | | | | | | |
| *Asplenium montanum* | Feb. 5 | ½ in. | | 1 in. | | 1 in. | | | | 2 in. | 1½ in. | | | | 2 in. | 2½ in. | | Fertile fronds |
| *Asplenium pinnatifidum* | Jan. 30 | 1 in. | | | | | | | | | 2 to 3 in. | | | | | | | Fertile fronds |
| *Asplenosorus ebenoides* | Received grown | | | | | | | | | | | | | | | | | Old fertile fronds |
| *Asplenium trudellii* | Received grown | | | | | | | 3 in. | | | | | | | | | | Started to root at tips |
| *Camptosorus rhizophyllus* | Jan. 30 | Old fronds 6 to 8 in. | New fronds 2 to 3 in. | | | | | 2 to 3 in. | | | 4 to 5 in. | | | | | | | No fertile fronds |
| *Phyllitis scolopendrium* | Received grown | 8 to 10 in. | | | | | | | | | | | | | | | | Fertile fronds |

[1] *Onoclea sensibilis* had fronds 18 inches broad and 29 inches tall.
[2] *Osmunda claytoniana* had 16 fronds.
[3] *Osmunda regalis* had 31 fronds, the greater number fertile.
[4] *Pteridium latiusculum* had fronds 15 inches broad and 21 inches tall.
[5] *Woodsia ilvensis* was fully grown on Jan. 23rd.

# Growing Ferns from Spores

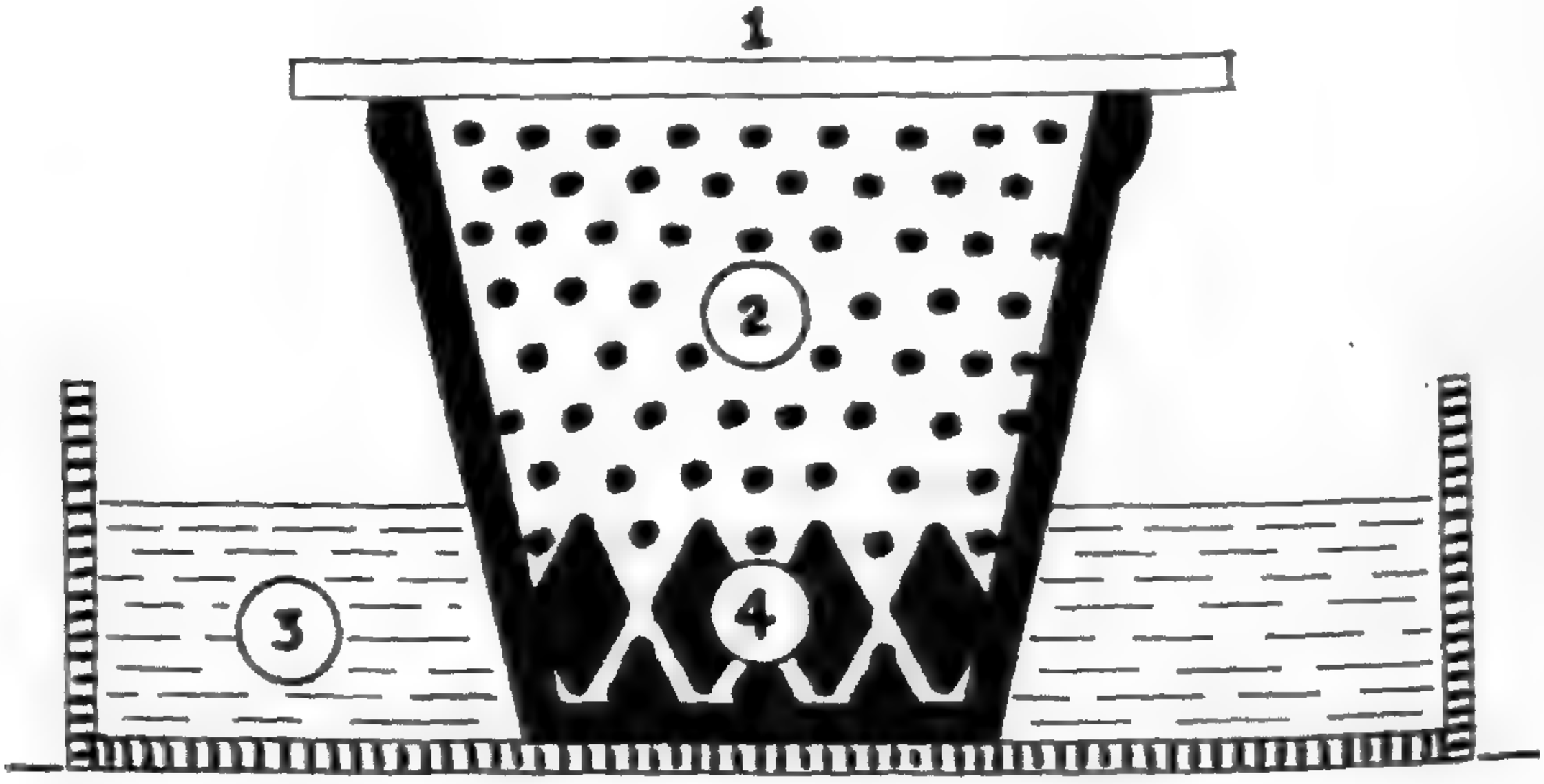
R. C. BENEDICT

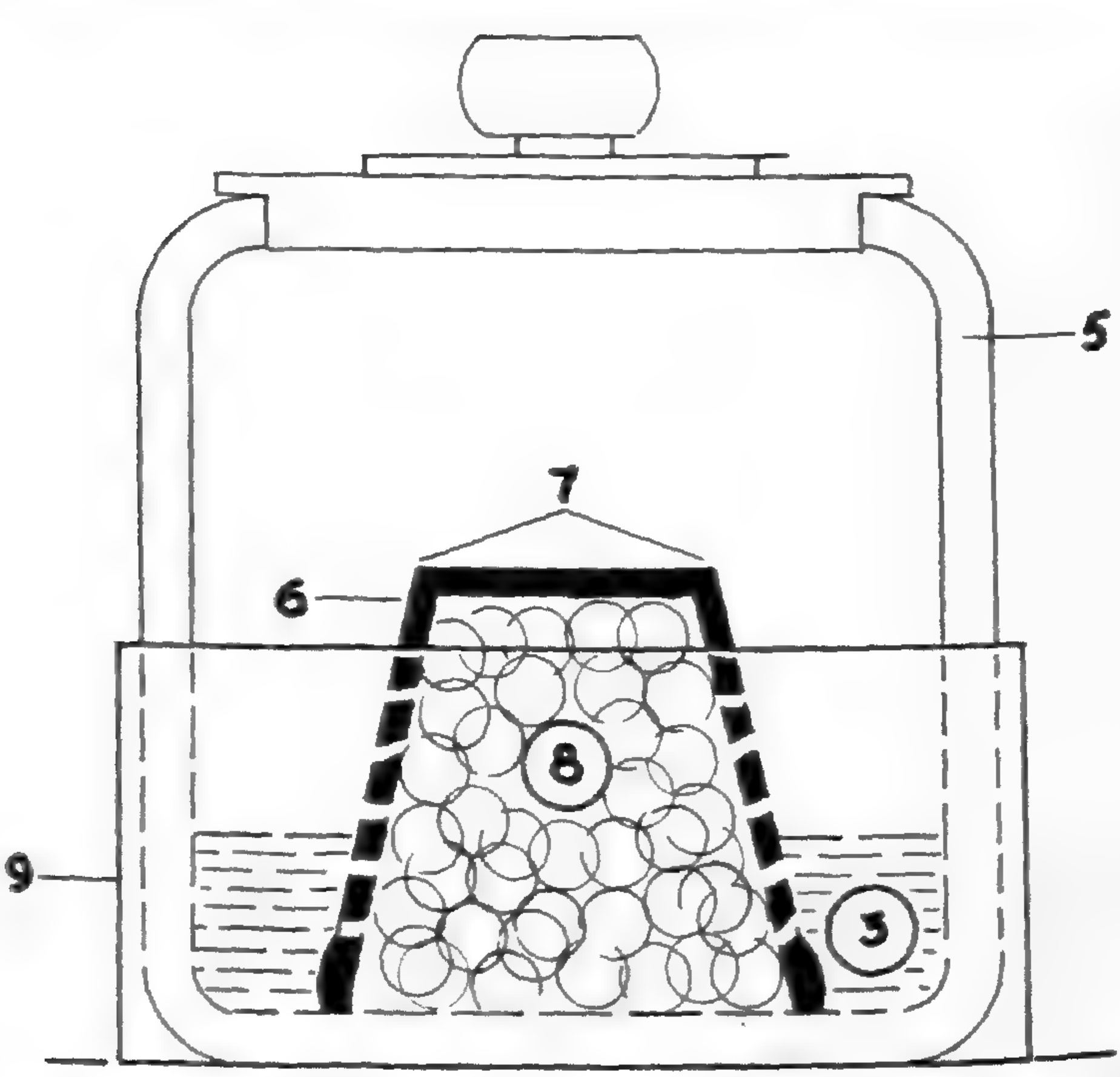
Most common ferns are easy to raise from spores, and in the early stages they do not require much space or an elaborate setup. For some time I have had it in mind to prepare a fairly extensive account of different methods, technical and otherwise, which may be used. So far, it has not been possible to complete that, but, in response to not infrequent letters, I have boiled down the essentials of two practical processes as described below.

The simplest media on which to raise ferns from spores are (1) soil and (2) clay pots. It is a good plan to try both ways at the same time, and to start more than one culture at one time. Two general conditions should be noted. (1) In most fern species the spores will germinate best if sown fairly soon after ripening; (2) spore cultures require a good light. Except in summer when the sun is high and the temperature also likely to be high, the lightest window in the house is not too bright. Regarding the first point, the spores of some species remain viable for months, or even years; others, like those of *Osmunda*, must be sown immediately.

1. SOIL CULTURE. Finely sifted soil, consisting of a mixture of sand and light loam, is placed in pots with an excess of drainage at the bottom. The pots are kept with the bottoms immersed in water, and for each pot a cover of clear glass. Before planting the spores, it may be profitable to sterilize the pot and soil by subjecting to low oven heat, or in a steam pressure cooker for a half hour. Additional water should be supplied entirely from below.

2. CLAY POT CULTURE. The diagram sufficiently illustrates the simple setup. Sterilization of the pot and moss will prevent the advent of mosses and some algae. The prothallia may take somewhat longer to mature than when




1. GLASS PLATE. 2. SOIL. 3. WATER. 4. DRAINAGE–GRAVEL OR BROKEN POTS. 5. COOKY JAR. 6. ¾ INCH POT. 7. SPORES SOWN ON TOP AND SIDES. 8. SPHAGNUM MOSS PACKED IN. 9. PAPER COLLAR TO KEEP WATER DARK AND TO KEEP DOWN ALGAE GROWTH.

grown in soil, but they can easily be transferred to soil when partly grown, by scraping from the surface of the pot.

Spores should not be sown too thickly, else the prothallia will be spindling. For watering, spring water or nutrient solution has advantages over ordinary water supplies because the latter are usually chlorinated. It is a good plan to boil water before using it.

The glass jar indicated is sold at five and ten cent stores under the name of a "cooky jar" at a cost of 15¢.

The following formula for Knop's nutrient solution may be used. It should be used in a dilution of about .2 of 1%.

*Knop's Solution*

| | |
|---|---|
| Water | 1 liter |
| Acid Potassium Phosphate | 0.25 g. |
| Magnesium Sulphate | 0.25 g. |
| Potassium nitrite | 0.25 g. |
| Calcium nitrate | 1.00 g. |
| Ferric Chloride | trace |

Three other good media may be mentioned. (1) Water: Spores may be sown directly on the surface of shallow water, and the prothallia lifted off as soon as they grow large enough to manipulate. If the bottom of a cooky jar is barely covered with water and the cover sealed with vaseline, the culture can be left without disturbance for long periods. (2) Slabs or uneven chunks of Osmunda roots, including whatever soil they naturally contain, furnish excellent cultural conditions for many species. A cooky jar or an aquarium bowl with a glass top makes a good container. (3) An uneven chunk of old porous brick is another good medium and may be used in place of a flower-pot in a cooky jar.

3. PESTS. With all the precautions taken, spore cultures are still liable to the invasion of certain pests in the way of fungi, algae, and mosses. FUNGI: The least fre-

quent seem to be fungi. Sometimes, on sterilized surfaces, patches of a "mould" appear in advance of the germination of the fern spores. This fungus, however, does not seem to cause any trouble, as it disappears, apparently without trace. Occasionally, at later stages, when prothallia have advanced considerably, one or more other fungi will develop and form dense fruiting masses. ALGAE: The worst pests in fern cultures are several kinds of algae which find pot surface exactly suited for their growth. A blackish-green form, probably *Oscillatoria*, may start and spread over a whole growth of prothallia, blighting the prothallia. MOSSES: One particular kind of moss may appear in parallel development with the fern prothallia. Its chief harm is that it overtops the prothallia, and may spread enough to preempt most of the growing surface. PRECAUTIONS: The moss plants may usually be pulled out without much difficulty. The algae will respond to a treatment of a homeopathic dose of copper sulphate solution, a dilution of one part in ten million parts of water, touched to the algal colonies. Copper sulphate will also take care of the later fungus growth, if it has not advanced too far.

BROOKLYN BOTANIC GARDEN

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## Our Way with Ferns

JOSEPHINE EDSON AND GRACE GRIFFETH

In raising ferns from spores, by our method, a terrarium should be secured, rectangular in shape. The necessary cover may be a pane of glass, cut to size, to fit over the top.

In the bottom of the tank should be placed a half-inch layer of fine charcoal, and a two-inch layer of aquarium gravel which has first been scalded. Next four-inch pots are prepared, being scrubbed and scalded even if they are newly purchased.

In the bottom of each pot are put fragments of crock, a wad of spaghnum moss (to keep the contents of the pots from seeping out and to help retain the moisture), a layer of fine charcoal, one of scalded aquarium gravel and, if desired, a thin mat of peatmoss. Lastly, the soil.

Careful preparation of the soil-mixture is essential. One part each of sifted, acid, woods earth, sharp sand and granulated peat moss we have found to be satisfactory. *Sterilization* of all materials used is *most important*. The combined materials may be purified either by steaming or boiling, to destroy any seeds, insect-eggs or worms that the soil may contain. When the steaming compost has cooled, squeeze out the water and fill the pots to within one-half inch of the tops. To be certain that both pots and contents are thoroughly sterilized, it is well to pour boiling water through them after they are full. When the soil is cool, the spores may be sown and the pots then placed in the terrarium.

Empty, inverted pots may be placed on the gravel, in the terrarium, and the filled pots set upon their bases. If the tank is too low to permit of this procedure, the filled pots may be nested within others.

The spores should be carefully scraped from the fronds onto a piece of waxed paper, then shaken over the surface of the prepared soil in the pots. If too much leafy matter is allowed to remain upon the earth, mold is apt to form and cause endless trouble. Spores should not be sown too thickly. Those from one pinna are enough for one four-inch pot.

We have discovered that it is impossible to obtain a pure sowing. Where the other spores come from is a mystery, unless they have fallen on, and clung to, the fronds of the ferns being used.

The gravel, in the bottom of the tank, should be kept continuously moist. It is never advisable to water the

pots from the top. Remove them from the tank and set in a pan of water that has been boiled and cooled (to prevent the formation of algae), so that the water reaches nearly to their rims. Allow them to remain until the soil appears moist; then drain and return to the terrarium.

The terrarium should be stored in a fairly light place, although not in direct, strong sunlight. A northern exposure is best. If this is impossible of attainment, the tank may be shaded with heavy paper.

Care must be taken that the terrarium is kept moist, but not sloppy, so that no condensation troubles occur. If drops of moisture collect upon the cover it is best to remove it, carefully, wipe and replace. We have had less trouble with damping-off and black-rot when the cover-glass is raised a trifle. This also does away, largely, with the condensation of moisture. A little air will be of benefit to the ferns, though they will require watering a little oftener.

Germination takes place in from ten days to six weeks; depending upon the species of fern sown. For example, the Pellaeas and rock spleenworts usually germinate in about ten days' time.

When growth has begun, and frequently before, mold may make its appearance in the pots. Should this occur, it is expedient to remove the affected ones immediately. If this is neglected the mold will spread, very rapidly, and ruin the entire sowing. Black-rot may be checked by removing the infected areas with tweezers. However, this will not always avail, and it may be necessary to remove the pot to prevent spread of the disease.

It is well to keep on hand pots of sterilized soil, as there is no telling when the primary leaves will appear. Then, when the baby ferns in the original pots show a couple of leaves they may be transplanted without delay, thus being given more root-room. Place them a half or quarter inch

apart—according to their size. It may be necessary to transplant them as they grow larger, several times before they are placed in their permanent locations.

After the prothallia appear it is usually five or six weeks before fertilization takes place and the sporophytes begin to grow. Then the little ferns should be from one to two years old before being planted outside. The ferns, accustomed to the humid air of a terrarium, should not be set unprotected into the garden. They must be gradually inured to the altered conditions under which they are expected to live.

Set them in a soil to their liking, invert tumblers or panes of glass over them and leave for a day or so. Raise the glasses by degrees, day after day, until they may be removed altogether. If, at any time during the procedure, the ferns show signs of wilting, lower the covers and begin over again.

Should it be the intention to set them into crevices, it is more practical to acclimatize them, first, in a place where the ground is level. They may thus be hardened-off more readily, it being well nigh impossible to cover a fern, planted in a crevice, with a tumbler or pane of glass. When they have become accustomed to the out-of-doors they may be removed to their permanent locations.

In raising ferns from spores one, armed with patience, may secure many different species not native to his locality. This may be done by exchanging with others interested in ferns, or by obtaining fruiting fronds from friends, or botanists, in other parts of the country.

ROCHESTER, NEW YORK

# Some Fern Notes

DONOVAN S. CORRELL

×ASPLENIUM VIRGINICUM IN PENNSYLVANIA. When I visited the National Herbarium in September, 1938, Dr. Maxon showed me the sheet of ×*Asplenium virginicum* Maxon which he later described as *A. mixtum* (AM. FERN JOURN. **28**: 141) and recently (**29**: 72) renamed as above. Later in the year, while going through some material in the Brown University Herbarium, I found a specimen of the hybrid.

The specimen originally belonged to the private herbarium of William Stout. It was labeled as follows: "*Asplenium Trichomanes* L., Hab. Delaware Water Gap, Pa., Legit R. Stout, Aug. or Sept., 1878." Another label on the sheet gives Stout's opinion concerning the probable status of the plant: "*Asplenium Trichomanes*, L. or perhaps a hybrid between *A. Trichomanes* and *A. ebeneum* [*A. platyneuron* (L.) Oakes] or *A. parvulum* [*A. resiliens* Kunze]—W. S." Still another label has the following data: "*A. Trichomanes*, an interesting form, much like some Florida specimens that have passed for *parvulum*—G. E. D." This last annotation was by Davenport.

Dr. Maxon and Mr. Weatherby have seen the specimen. We conclude that it agrees very closely with the Virginia plant. Although the rhizome is present in the material at hand, it does not seem to be different from its parents. It is short, erect, and partially covered by dark brown, narrowly lanceolate-attenuate scales. The fronds are crowded among the remains of old stipes of previously existing fronds. The blades are decidedly geniculate at their bases and are somewhat curved throughout as in *A. Trichomanes*, although they are essentially erect as in *A. platyneuron*.

TRICHOMANES MEMBRANACEUM IN MISSISSIPPI? Recently, while going through some orchid specimens from the New York Botanical Garden, I came across a sheet of *Habenaria blephariglottis* (Willd.) Torr. which had been collected by F. E. Lloyd and S. M. Tracy (no. 315) and labeled: "Biloxi, Mississippi, Sept. 6, 1900." While examining this specimen, I found a single small fern frond which Mr. Weatherby identified as *Trichomanes membranaceum* L. The fern was somewhat loosely attached by its slender rootstock to some of the dried soil on one of the upper roots of the orchid. The small amount of soil which had been dried with the plants appeared to be muck which contained much sand.

I have since corresponded with Dr. Lloyd. He was unable to give me the exact location of the collection. However, he kindly sent me the following information: "... the *Habenaria* you speak of must have been collected in the open piney woods north of Biloxi, where we found *Sarracenia Drummondii* and *psittacina*. ... We did not exchange [specimens] with any tropical people. The *Trichomanes* must have occurred with the *Habenaria*."

*Trichomanes membranaceum* is found as far north as Cuba. It is generally found throughout the West Indian Islands, where it grows in mountain ravines, on tree trunks, at the base of trees, and on rocks. Although its introduction into this country might be expected, its actual occurrence here must remain questionable until the station of the present "accidental" collection is verified or until it is discovered in Florida or elsewhere along the Gulf—or in the mountains of South Carolina!

CHEILANTHES ALABAMENSIS IN FLORIDA? There is a specimen of *Cheilanthes alabamensis* (Buckl.) Kunze in the Gray Herbarium which was collected by Walter

Faxon on "limestone cliffs, Indian River, Florida, July 12, 1875." This species has not heretofore been reported southeast of Georgia, and its occurrence on the Florida east coast is most unusual. Indian River extends, as an inland waterway route, parallel to the mainland from Mosquito Lagoon in northern Brevard County south to St. Lucie Inlet in northern Martin County, a distance of about 90 miles.

In an effort to check the authenticity of this collection, I extracted fragments of a small moss which grew entwined in the rhizome of the fern. Dr. L. E. Anderson identified the moss as a depauperate form of *Campylium chrysophyllum* (Brid.) Bryhn, which, according to Grout (Moss Flora of North America (1928) 82), ranges "south to Georgia and Texas." The fact that neither the fern nor moss have previously been reported from Florida does not necessarily mean that they may not occur there. This station is only one of the innumerable botanically interesting regions of the south that have never been thoroughly explored by any botanically-minded individual.

Since I had not collected in this part of Florida and am therefore not very familiar with the region, I wrote to Dr. Bob Schlernitzauer, Mayor of Rockledge, Florida, for information concerning the possibility of there being "cliffs" along the Indian River. He writes as follows: "The shore of Indian River thru most of the six mile shore of Rockledge is of coquina rock formation and the soil of Rockledge is mostly formed above the rock foundation from which it rises to a height of about 60 ft. in some places." He writes further in "The Miamian" (March, 1938, p. 3): "The highest point on the East Coast lies along the Indian River two miles north of Rockledge where Carleton Terrace rises to a height of 60 feet, . . . ."

The recently discovered gorge of tropical ferns in the mountains of South Carolina is but a glimpse into one

of the many unexplored regions of the floristically rich Southeastern United States where, in spite of decades of collecting, species still remain hidden from all but the keenest eye!

BOTANICAL MUSEUM, HARVARD UNIVERSITY

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## Some Ferns of Mount Shasta

WILLIAM BRIDGE COOKE

The first formal expedition to collect the flora of Mount Shasta was that led by Dr. C. Hart Merriam for the United States Bureau of Biological Survey in 1898. Prior to that time occasional visits had been paid to the mountain by various botanists and collectors, who finally became interested in the more luxuriant flora of the granitic Mount Eddy across Strawberry Valley and left few records of their visit to Mount Shasta in herbaria.

Pringle, Copeland, Lemmon, and Brewer, however, left specimens of ferns collected on the mountain. The collections which Miss Alice Eastwood made in 1896 were lost in the San Francisco fire. When she revisited the mountain in 1912 her collections show more interest in flowering plants than ferns, as specimens. H. E. Brown reported a visit to Mount Shasta's north slopes between 5000 and 9000 feet from June 11 to June 16, 1896. It is doubtful if Mr. Brown got much collecting done at those elevations, since melting snow probably still covered the ground. To my knowledge he reported no ferns.

The Merriam expedition[1] covered the mountain fairly well during their stay of four weeks at Wagon Camp.

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[1] C. Hart Merriam. Results of a Biological Survey of Mount Shasta, Northern California. North American Fauna No. 16, Oct. 1899.

In addition they made two trips encircling the peak. Seven species of ferns were reported as a result of their efforts. So far as I have been able to find material and publications, this expedition was the only attempt until 1936 to collect and report the Flora of Mount Shasta as a single unit.

## THE GENERAL AREA COVERED

During the summers of 1936, 1937, and 1938, the writer has had the rare privilege of living for seven months at Horse Camp, near timberline on the southwest slope. Horse Camp is one of the stops along the route to the summit of Mount Shasta. At this point climbers usually camp for a night before trying the ascent.

In my spare moments during those months I have tried to assemble a collection of the flora of the peak. The limits of the area are roughly based, on the southwest, west, and north sides, at least, on the 4000 foot line of the topographic map—Dunsmuir Quadrangle, U.S.G.S. Above this point there is naturally a more native flora, with fewer introduced weeds. This area coincides in general with the Mount Shasta Recreation Area of the Shasta National Forest. While 4000 feet is the lower limit, 14,161 feet is the upper. Ferns rarely grow above timberline, however, so the true elevational upper limit is between 8000 and 9500 feet.

Ferns on Mount Shasta are found at very scattered and isolated stations. Mount Shasta is one of the volcanoes in the Cascade Range. It is probably the driest of all and has the poorest flora—about 375 species of vascular plants. It is the most isolated, being separated from Mount McLoughlin to the north by about 70 miles and from Mount Lassen to the south by 75 miles. In both cases the intervening country is made up of a

plateau region, which lies mainly in the Upper Sonoran and Transition zones. It is believed by some geologists to be the youngest peak in the Cascade range.

## LIST OF FERNS AND FERN ALLIES COLLECTED OR REPORTED ON MOUNT SHASTA

### POLYPODIACEAE

1. ATHYRIUM AMERICANUM (Butters) Maxon. Mountain Lady Fern.

This fern is probably the best known species on the mountain. Prior to 1918 at least four records from the same location had been reported. The species grows in a small ravine south of Horse Camp at about 7800 to 8000 feet. It is found also along stream beds in the lava flats above Panther Creek Meadows at the same elevation. The zone is definitely Hudsonian.

2. ATHYRIUM FILIX-FEMINA (L.) Roth var. CALIFORNICUM Butters. California Lady Fern.

Merriam reported this species as occuring in places near the border of the Transition and Canadian zones. I have never seen it in what I should consider a native habitat. It grows along the stream formed by Widow Spring, on the southeast slope of the mountain. From the generally disturbed appearance of this Forest Service Camp Ground it is assumed that the species has been planted at that point by some one who wished to beautify the natural forest.

3. CHEILANTHES GRACILLIMA D. C. Eaton. Lace Fern.

Probably the most common, at least the most widely distributed, fern on the upper parts of the mountain. It was reported by Merriam. I have found it on exposed rock slopes in both the Hudsonian and Transition zones. In the Transition zone it occupies a small area among the rocks on one of the more recent lava flow ridges near

the Sisson Southern Trail, at 4500 feet. In the Hudsonian zone it is common in cracks and among chunks of lava on the southwest slopes above Horse Camp, between 8000 and 8500 feet.

4. CRYPTOGRAMMA ACROSTICHOIDES R.Br. Rock Brake, American Parsley Fern.

On the rocky slopes and in some of the draws between them above Horse Camp and between 8000 and 8500 feet. To the observant visitor the two types of fronds, fertile and sterile, form a striking contrast. It grows in moister situations than does *Cheilanthes gracillima*, but in the same general area in the Hudsonian zone.

5. CYSTOPTERIS FRAGILIS (L.) Bernh. Brittle Fern.

This delicate fern has been collected in two locations. One is in a small spring just off the Sisson Southern Trail, in the Canadian zone at 6500 feet. The other is at Wagon Camp, in the large marshy spring area. The fern grows on a bank near the junction of two of the spring outlet creeks. The area is on the border between the Transition and Canadian zones, at 5700 feet. For the past two years the Wagon Camp plant has been infected with the rust *Hyalopsora Polypodii* (Diet.) Magn.

6. PELLEA BRACHYPTERA (Moore) Baker. Sierra Cliff Brake.

This is a stiff, grey-green fern which has been found only on the lava flow outcropping along the Sisson Southern Trail at 4500 feet. The plant is easily taken by the casual passerby on horseback for scrubby specimens of the occasional rabbit brush, *Chrysothamnus nauseosus* (Pall.) Britt.

7. POLYSTICHUM LEMMONI Underwood. Shasta Fern.

This species was based on material collected by Lem-

mon in "the vicinity of Mount Shasta, California." It was distributed under the name *Dryopteris mohrioides* (Bory) Kuntze. Since the species has been commonly collected on Mount Eddy just across the valley, it is possible that Lemmon did not get it on Mount Shasta itself.[2] Several species have been based on specimens from "the vicinity on Mount Shasta," such as the Brewer Spruce, *Picea Breweriana* Wats., which have never been actually collected on the mountain. Neither the Merriam expedition nor myself have found *P. Lemmoni* on the mountain.

8. POLYSTICHUM MUNITUM (Kaulf.) Presl var. IMBRICANS (D. C. Eaton) Maxon. Imbricated Sword Fern.

This Sword Fern grows in short stiff clumps on the same lava-flow ridge mentioned for *Pellaea brachyptera* and *Cheilanthes gracillima*. The location is in the Transition zone and the local chaparral grows around the base of the ridge. Although the three ferns grow in the same location on the ridge, their ranges do not overlap.

9. POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon. Shield Fern.

This fern was reported as growing in the vicinity of the heather meadows by Merriam, who called it *Dryopteris aculeata scopulina* (Eaton). I have not yet found it.

10. PTERIDIUM AQUILINUM var. PUBESCENS Underwood. Bracken.

This is the commonest fern of the Transition zone, including the chaparral belt. It grows up as far as the

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[2] See on this point L. C. Wheeler in FERN JOURN. 27: 121 (1937).—Ed.

Canadian zone, although I have not seen it in the Shasta Fir (*Abies magnifica* Murr. var. *shastensis* Lem.) forest. Where the Shasta Fir forest has been cut on the southwest slope, the chaparral invades the openings and bracken inevitably accompanies the chaparral. Bracken is common in the open forest, where it even grows in decaying stumps.

11. WOODSIA SCOPULINA D. C. Eaton. Rocky Mountain Woodsia.

One collection of this species was made during the summer of 1938. The plant was growing in crevices in a large mass of lava on a ridge north of Horse Camp. At this point, 9500 feet, one is above timberline on the ridges. At the same point large plants of *Polemonium shastense* Eastwood and *Erigeron lonchophyllus* Hook. were growing in the cracks in the lava. The surface of the lava was covered with a yellow lichen. *Woodsia scopulina* was observed at a second location. On the north slope of Red Butte, 8200 feet, is a small community of plants normally found above timberline, such as *Oxyria digyna* (L.) Hill and *Polemonium shastense* Eastwood. While a small bit of Hudsonian forest grows on top of the Butte and at a somewhat higher elevation on the main flanks of the mountain in the vicinity, this community has been classed as Arctic-Alpine.

## EQUISETACEAE

12. EQUISETUM ARVENSE L. Horsetail.

In a small pool of water in a depression along a stream flowing from the Mount Shasta City reservoir near Howard, at 4000 feet, I found a small community of *Equisetum*. Because this is near the McCloud River Railroad fill, it is possible that this species has no place in the native flora of Mount Shasta.

OPHIOGLOSSACEAE

13. BOTRYCHIUM LUNARIA (L.) Sw. Moonwort.

This is the first record of this fern in Siskiyou County, California. It was found in the small spring along the Sisson Southern Trail, at 6500 feet. The zone is Canadian and the forest is strictly Shasta Fir. In two successive years, 1937 and 1938, I have found one frond a year. It grows near the base of the permanently moistened portion of the spring.

A complete set of Mount Shasta ferns collected during the past three years is on file at the herbarium of the University of Cincinnati, Cincinnati, Ohio.

The writer is indebted to Dr. Helen M. Gilkey, Oregon State College, Corvallis, Oregon, for assistance during preparation of this report.

DEPARTMENT OF BOTANY, OREGON STATE COLLEGE,
CORVALLIS, OREGON

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## Shorter Notes

LYGODIUM JAPONICUM IN TEXAS.—*Lygodium japonicum* has been reported from Georgia, North Carolina, South Carolina, Alabama, Florida, Mississippi and Louisiana. To this list Texas may be added. June 28, 1937, the writer received from Beaumont some immature foliage of a climbing fern found between Cow Bayou and the Neches River, Orange County, located in the southeast corner of the State. A specimen was sent to Dr. W. R. Maxon who identified it as *Lygodium japonicum* (Thunb.) Swartz.

The writer has been informed that the property on which this station was found has been cleared of timber and the station destroyed, but that another station has been found in Jefferson County closer to Beaumont.—G. M. SOXMAN, *Dallas, Texas.*

OBSERVATIONS ON BOTRYCHIUMS.—Botrychiums find such a fertile territory in northern Wayne County in Pennsylvania that I am reporting some observations from an unusual station in a pasture above Lake Hiawatha two miles north of Lake Shehawken. In this field of about ten acres a conservative estimate would place the number of Botrychiums there at over a thousand plants. In a section staked out where they were thickest, of about two acres, or the size of an ordinary city block, I counted over 400 Botrychiums, all *B. obliquum* and *B. dissectum*, with the possible exception of three or four *B. obliquum* var. *oneidense*. They were most prolific in patches of moss which seem to provide unusually suitable conditions for germination.

The count was made the last week of September. Most of the spores were ripe, and a slight tap on the stem was followed by a dusty shower.

Ninety-three per cent of the plants were *B. obliquum*, only thirty were *B. dissectum*. Of *B. obliquum* eighty per cent were fertile; about sixty-seven per cent of *B. dissectum*. In regard to autumn coloration, eighty per cent of the fertile *B. obliquum* were colored. A slightly smaller percentage of the sterile plants were colored, but this is due perhaps to the fact that the fertile plant is more easily seen. Only four *B. dissectum* were uncolored, about the same percentage as with *B. obliquum*.

Of the 70 or 80 plants which had remained green, with the exception of a very few, all were either not yet mature, as indicated by the unopened spore cases, or were quite protected by other vegetation. Whether the few definitely green plants were immature, or may have been influenced by some undetermined conditions, or whether the green color was a permanent characteristic of the individual plant, cannot be satisfactorily and definitely determined. Although it is apparent that on rare occa-

sions a plant of *B. obliquum* and *B. dissectum* will remain green all winter under conditions that appear similar to those of bronzed plants, it is quite evident that the autumn coloration is a permanent characteristic of these species.

I do not believe that *B. obliquum* var. *oneidense* ever changes its color in autumn, although many plants of this variety in open fields, not their ordinary habitat, have a slight fringe of bronze color on the edges of the pinnules.

Whether the variety *oneidense* belongs with the *multifidum* group, as Graves believed, or should be classified as a variety of *B. dissectum*, according to Clausen, depends largely on what is used as a basis of classification. Its late fruiting time, used by Clausen to support his classification, may be the result of the fact that its usual habitat is shade, and that it belongs to a more northerly range. Either of these conditions will materially retard the period of fructification.

As no tabu of the mores in the plant world has prevented extensive promiscuity, family characteristics there are not easily traceable and relationships have never been recorded in vital statistics. Accordingly a systematist runs no risk of being challenged by documentary proof of his error.—WILLIAM L. DIX, *Morrisville, Pa.*

TRICHOMANES PETERSII A. GRAY IN NORTH CAROLINA.[1]—*Trichomanes Petersii* A. Gray was recently found, for apparently the first time, in North Carolina during the course of an ecological survey in the vicinity of Calderwood Lake on the Little Tennessee River. Specimens were collected in Graham County, two miles northwest of Tapoco, North Carolina, halfway between Slick Rock Creek (state line) and Yellow Hammer Creek. The fern

[1] Contribution from the Botanical Laboratory, The University of Tennessee, N. Ser. 33.

was found growing on a rock projecting from the north side of the mountain, about one hundred and fifty feet above the level of the lake, at an elevation of approximately 1,050 feet.

The writer had previously found two other stations along the lake. One is in Monroe County, Tennessee, from which place the fern has not been reported before. The other station is in the southern end of Blount County. Previous collections have been made from the northern part of Blount County and from Sevier County.[2] These are the only stations reported for Tennessee.

Specimens from the Calderwood Lake stations are in the herbaria of the following institutions: The University of Tennessee, Duke University, Harvard University, U. S. National Museum, New York Botanical Garden, and the University of North Carolina.—A. RANDOLPH SHIELDS, *University of Tennessee.*

## TRICHOMANES BOSCHIANUM STURM IN EAST TENNESSEE.[1]

—During a collecting trip, February 19, 1939, on Calderwood Lake, the writer came upon a small, but luxuriant colony of fertile *Trichomanes Boschianum* Sturm. Ordinarily, this fern is found in very moist habitats, frequently in the spray from rushing water. However, this colony seemed to be doing very well on a siliceous rock which was not particularly moist, even after recent, heavy winter rains.

The earliest record of this fern for Tennessee is that of the collection made near Sewanee, Franklin County, by

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[2] Sharp, A. J.: *Trichomanes Petersii* A. Gray in Tennessee. AM. FERN JOURN. **21**: 75. 1931.

———.: Notes on the Ferns of the Southern Appalachians. Journ. Tenn. Acad. Sci. **12**: 186. 1937.

[1] Contribution from the Botanical Laboratory, The University of Tennessee, N. Ser. 34.

Gattinger in 1878.[2] A recent communication from Dr. J. T. McGill, Vanderbilt University, states he collected "*T. radicans* (*Boschianum*)" near Sewanee in 1881. These are, as nearly as can be determined, the only records of its occurrence in Tennessee. It is believed that the station at Sewanee no longer exists. The eastern Tennessee station is in Monroe County near a nameless small creek emptying into Calderwood Lake, about one-half mile from the North Carolina boundary. The elevation is approximately 1,000 feet.

The McGill collection is in the herbarium of Vanderbilt University. The present collection has been distributed to the University of Tennessee, Duke University, Harvard University, U. S. National Museum, New York Botanical Garden, and The University of North Carolina.—ROBERT K. ZUCK, *University of Tennessee.*

LYGODIUM PALMATUM (BERNH.) SW. IN NEW YORK.—On September 28, 1938, my daughter, Miss Phoebe E. Phelps, while hunting for black alder (*Ilex verticillata* (L.) Gray) in low woods thick-set with gray birch (*Betula populifolia* Marsh.), came upon a large colony of the climbing fern, *Lygodium palmatum* (Bernh.) Sw. There were hundreds of fronds, many heavily fruited and some more than five feet in length; the plants formed an almost solid growth covering more than 100 square feet.

The climbing fern has long been regarded as one of the rarest of ferns in New York State. Indeed until 1938 only two stations for it have been known, one long ago exterminated and the other lost. Beyond our borders the climbing fern occurs in widely scattered localities from New Hampshire and Massachusetts southward to Tennessee and Florida.

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[2] Anderson, W. A.: A List of Tennessee Ferns. AM. FERN JOURN. 20: 143–150. 1930.

(Photograph by New York State Museum)

LYGODIUM PALMATUM FROM SARATOGA COUNTY, N. Y.

Torrey (Flora New York **2**: 504. 1843) includes the climbing fern, but states that (at that time) no definite locality for it was actually known within the borders of the State. During the season of 1873 it was found near Hunter, Greene county by Miss Mary C. Reynolds (Bull. Torrey Bot. Club **5**: 5. January, 1874), but before the season of 1874 was over the plants there were destroyed by vandalism (Bull. Torrey Bot. Club **5**: 39. September, 1874).

In Chenango county, the fern was found by Mrs. D. B. Fitch near McDonough (46th Ann. Rept. N. Y. State Museum, Bot. Ed. p. 53. 1893), and two sheets of it collected there and deposited in the New York State Museum are dated August 9, 1892. The knowledge of the exact location of this station apparently died with Mrs. Fitch. The late Edward W. Davis, of Norwich, and Dr. H. D. House, State Botanist, have searched the region several times without finding it, and it is possible that the disastrous floods of recent years have destroyed the fern if it grew along the banks of the Genegantslet creek below McDonough, as has been stated by a friend of Mrs. Fitch's who sometimes accompanied her on her botanical excursions. At least it may be said that considerable search for the fern in that region has been without result.

The present station is in the northern part of Saratoga County. It is more than a hundred miles from the nearest reported station in New York (Greene County, 1873) and is at present the northernmost locality known for the species. Specimens collected by Dr. House (No. 26344, November 8, 1938) have been distributed to several institutions and several more specimens are available for those who may desire them. No roots have been taken and it is hoped that none will be taken for any purpose, since this now constitutes the only known locality for the fern in New York State. *Qua de causa nemo roget ubi habitat.*

I am indebted to Dr. House for details regarding the early stations.—ORRA PARKER PHELPS, *Gansevoort, New York.*

"FAIRY RINGS" IN FERNS.—I suppose that we are all more or less familiar with the circular growth of fungi, known as fairy rings, which, in the olden times, were supposed to be the dancing places of the pixies. But the fairy rings of ferns and fern allies appear to have received little attention, although the rhizome in a way behaves like the mycelium. However, there are two recent articles on the subject of such rings of ferns, having particular reference to their age. One of these, Longevity of *Osmunda cinnamomea* by Mr. Bird, appeared in a recent number of our JOURNAL (**28**: 151–157, 1938) and another entitled L'Age des Ronds-de-Sorcière de Fougères by Rousseau, Simard and Gauvreau is in French and is printed in the Contributions du Laboratoire de Botanique de l'Université de Montréal, **29**: 91–99, 1937 (Extract from Naturaliste canadien, **64**: 234–242, 1937).

The Canadian work describes particularly certain fairy rings of *Osmunda Claytoniana* at Laprairie, Quebec, and in the case of three such rings tabulates the data as a basis to determining their age. While the calculation may vary in accordance with the annual number of fronds produced by the shoot, it would appear that the average age may roughly be measured by allowing for a growth of one centimeter of rhizome in two years. As the rings are really irregular polygons, the shortest radius was generally taken; it would not do to take merely the diameter in centimeters.

Mr. Bird, in his article, describes a clump of *Osmunda cinnamomea* near Rye, N. Y., 3.74 meters across. Evidently, Prof. Clute had suggested to him that an approximate age might be reached by a method similar to that employed by the Canadians. But this could not be done

with the specimen in question, so Mr. Bird ingeniously took the age of some known plants and ascertained that a 30-year luxuriant growth showed a greatest advance of a trifle under 18 centimeters; this would be 1.20 centimeters in two years as against the Laprairie average for *O. Claytoniana* of one centimeter in the same time. Accordingly, Mr. Bird reaches an age of 310 years for his clump per greatest radial measurement.

This greatest radial measurement would probably approximate about 2 meters (as shown by the plate), so that the short radius would be only 1.74 meters. Using the Canadian formula of age, we would get 348 years, a very close approximation to Mr. Bird's figure; this without taking into consideration perhaps slower growth of *O. Claytoniana,* difference in climate and growing conditions. Again, Mr. Bird counted 534 sterile fronds from 77 nodes in 1927 and 430 from 80 nodes in 1928. Adding to each 177 for fruiting fronds, we get 9.1 and 7.6 fronds per node, or an average of 8.35, as against the Canadian average of 8.1 for three circles.

I think our congratulations should go to the authors of both articles for bringing up coincidently the interesting subject of fairy rings in ferns, and in arriving independently at such close conclusions.—F. W. KOBBÉ, *New York City.*

DISTRIBUTION OF ADIANTUM TRICHOLEPIS IN TEXAS.—Coulter in his "Botany of Western Texas" (1891–94) credits Bigelow with finding *Adiantum tricholepis* at the Pecos River, and B. F. Bush in his "List of the Ferns of Texas" in 1903[1] gives the location as at the mouth of the Pecos, Val Verde County. It was probably found by Bigelow during his connection with the Mexican Boundary Survey (1850–53).[2] In *The Fern Bulletin*[3] Willard N.

[1] Bull. Torrey Bot. Club, **30**: 350. 1903.

[2] "Naturalists of the Frontier," by S. W. Geiser, 1937.

[3] Fern Bull., **12**: 44. 1904.

Clute described specimens collected by James H. Ferriss near the mouth of the Pecos, that were said to agree with specimens in the National Herbarium in every particular except pubescence, the Ferriss specimens "being absolutely glabrous."[4] So far as I can find, no other collection was made in the United States until, in 1934, Dr. Edgar T. Wherry[5] discovered a station in northern Medina County, 130 miles east of the Pecos location.

While visiting in San Antonio, Nov. 18, 1936, I made arrangements to search for Dr. Wherry's station. It was not found; but my wife discovered a group of four small plants in the vicinity of Medina Lake Dam, and later in the day another small station of 27 plants or clumps was found. These appeared to be the species sought, and specimens were sent to Dr. William R. Maxon, who identified them as *Adiantum tricholepis* Fée.

During the first part of October, 1938, I found a large colony near the base of a high cliff, and a few days later (Oct. 13th) Mr. H. B. Parks and I discovered two other large stations. On December 26th, further scattered plants or clumps were found, all within a radius of five miles from that first discovered. Future search will no doubt disclose other colonies, but enough have been located to prove the species abundant in this part of Medina County.

The region is exceedingly rough and broken, with deep ravines fringed with steep slopes and bluffs faced with hard, gray, flint-bearing limestone ledges and boulders of Lower Cretaceous age. It is on these dry slopes, in the shelter of rocks, brush, small mountain cedar, and scrub oak, that this species appears at home. Its immediate fern associates belong to the cliff and semi-arid

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[4] See, however, AMER. FERN JOURN., 29: 70–72. 1939. The Ferriss plant is *Adiantum capillus-Veneris*.—ED.

[5] AMER. FERN JOURN., 24: 97. 1934.

groups, such as *Anemia mexicana*, *Pellaea ovata* (*P. flexuosa*), *Cheilanthes alabamensis*, and to a lesser extent *C. horridula* and *Pellaea atropurpurea*. Association with its moisture-loving near relative *Adiantum capillus-Veneris* is not normal. Only at one place was the latter found growing near by, but in this instance at a different level—a wet, dripping, limestone ledge below an exposed dry upper level.

In conclusion, I wish to thank Dr. Maxon for identifying the different specimens submitted and Dr. Henry K. Svenson for furnishing a copy of Mr. Clute's notes in the *Fern Bulletin* on "New and Rare Ferns from the Southwest."

Specimens have been furnished the United States National Museum, the University of Texas, and the Texas Agricultural and Mechanical College.—G. M. SOXMAN, *Dallas, Texas.*

THE TIME OF FRUITING OF SOME FERNS.—My records show that the fertile fronds of *Onoclea* appeared July 5–10. The sterile fronds appeared mainly from April 25 to May 4, but some continued coming in June or even in July. It is possible, however, that some fertile fronds appeared in my fern bed at a later time without attracting my attention.

One peculiarity about my cinnamon fern may be mentioned. The original plants were set in my fern bed without any extra supply of moisture; and though the fronds they produced were rather narrower and not nearly so tall as those of plants growing in their natural habitat, yet from 1912 to 1937 they continued to produce typical fronds. Then, in 1937, one clump presented me with seven excellent fronds of forma *frondosa*. This year this clump had three fronds of *frondosa*. The other fronds in this clump were of the usual form.

I have lately had experience with Lycopodiums which may be of interest. Most of my work among ferns is confined to the ferns and fern allies in the vicinity of Kutztown and Fleetwood, Berks Co., Pennsylvania; but on October 30, 1938, I had occasion to make a trip to northeastern Carbon County, Pa., considerably farther north than Berks County, and in a mountain ravine about two miles west of Albrightsville I found large beds of *Lycopodium annotinum* L., with the fruiting cones fully discharged. I never found this species in Berks County.

I found also *Lycopodium obscurum dendroideum* (Michx.) D. C. Eaton in fruit, but each plant had only one cone. I found a few stations for *L. obscurum dendroideum* near Kutztown and Fleetwood, Berks Co., Pa., but could not find fruiting plants.

My especial find in this ravine, however, was *Lycopodium tristachyum* Pursh (*L. chamaecyparissus* A. Br., *L. complanatum chamaecyparissus* (A. Br.) Clute). The fruiting cones were dry and some more or less decrepit and had evidently discharged their spores some weeks previously, perhaps more than a month. Somewhere I have read that the statement that *L. tristachyum* fruits earlier than its near relative, *L. flabelliforme* (Fernald) Blanchard, may require more investigation and the earlier fruiting may be the result of difference in environment; but not ten feet away from my stand of *tristachyum* was a fine stand of *L. flabelliforme* with the spores not yet ripe. This should be good proof of the difference in the time of fruiting.—C. L. GRUBER, *Fleetwood, Pennsylvania.*

PTERIS MULTIFIDA IN WASHINGTON, D. C.—In the summer of 1936 or 1937, for the purpose of filling temporarily several vacant rocky spaces in my small fern garden that are rather dry, I set out three or four plants of *Pteris multifida* (probably still better known to most of us by the

singularly appropriate name *serrulata*) and thereafter gave them no attention during the summer, other than an occasional watering. They were not of the befrizzled varieties that are so dear to horticulturists and our British brethren, but good healthy plants of the typical form of the species. I had obtained them from a greenhouse of the U. S. Department of Agriculture, where they were growing as volunteers under the benches devoted to cactuses and Crassulaceae. They grew well and came through the winter with only a handful of protective leafy covering, and one of them is still flourishing, though the conditions seem far from good.

That this tropical or subtropical fern is actually hardy and self-perpetuating here is evident from my recent discovery of a fine plant, growing naturally in the crevices of a rough pebble-cement outer retaining-wall of a neighbor's yard 25 feet away, which evidently had developed from a wind-blown spore of my plant. The wall has a northern exposure and is moderately damp. Its crevices are ideal for spore germination and the development of prothallia, but only the merest film of earth for the nurture of the sporophyte is present in the interstices among the cemented small pebbles. Nevertheless, the plant (which appears to be two years old) has flourished amazingly this summer, with an occasional flooding of the upright wall by garden hose, and at present bears five healthy, wholly or partially fertile fronds. The largest of these is a foot long.—WILLIAM R. MAXON, *Washington, D. C.*

## Recent Fern Literature

It is not often that scientific societies are mentioned directly in textbooks, but in Dr. Benedict's recent "High School Biology"[1] we find our society appearing in print (p. 52) as follows: "The American Fern Society is largely composed of people who are engaged in other occupations but who like to get into the woods, along streams and cliffs, where ferns grow best. They often exchange pressed specimens with each other, so that they gradually acquire a collection of all the species in their particular State, in the United States, or even in a wider field." The statement is merely a fragment showing the trend toward human interest in our recent textbooks. Those who feel that they are not well grounded in such questions as "What is a species?" "What is a genus?" or in the general classification of the plant and the animal kingdoms, or on modern ideas on heredity, would do well to read the chapters in which these problems are discussed. Incidentally, there are a large number of good fern illustrations with accompanying explanatory texts.—H. K. S.

"Horticulture" for May, 1939, also prints an account of the Fern Society, part of an alluring article by Dr. Benedict on "The Study of Ferns as a Hobby."

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## American Fern Society

Members are invited by Mr. Frank H. Sprague to visit his fern garden, 416 Belmont St., Wollaston, Mass.

New members:

Helsell, Mrs. F. P., Hunts Point, Bellevue, Washington.
Houck, William G., Jr., 231 East 54th St., New York City.
McArthur, Mrs. W. E., 3547 Richmond St., Jacksonville, Fla.

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[1] Benedict, R. C., Knox, W. W., and Stone, G. K. Macmillan, 1938.

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# American Fern Journal

VOL. 29 OCTOBER–DECEMBER, 1939 NO. 4

## Finding Ferns

C. E. WATERS

About two years ago the Society unexpectedly and graciously put me upon the shelf. Although this friendly act is greatly appreciated, the shelf will not be entirely comfortable without some sort of swan song. The first impulse was to write something about forking fronds, which was the subject of a short note in the second number of the Linnaean Fern Bulletin, in 1893, and about which many other members of the Society have published in that Bulletin as well as in this Journal. The immediate impulse came from seven fronds of *Pellaea atropurpurea* taken from a single plant growing in a six-inch flowerpot with two or three others. Back of that was the idea of telling of some experiences in finding new ferns in territory that had apparently been well searched by ourselves or by other botanists.

These plants of *Pellaea* came from a little steeply-sloping bank, of much weathered, crumbling limestone, that had been examined closely several times a year from 1891 to 1904, and much less often since then. A colony of medium-sized plants was first seen on this bank in 1935, when they were so small that they could not have been more than two or three years old. If this colony of a favorite fern had been there in the earlier period, it could not possibly have been overlooked, because the little bank was known almost to the point of acquaintance with the individual plants growing on it.

[Volume 29, No. 3 of the JOURNAL, pages 85–124, plates 8 and 9, was issued August 12, 1939.]

It is this kind of discovery that helps to keep our interest active, unless we are satisfied with having once for all identified a new fern and checked it off the list of species to be looked for. Fortunately not many of our ferns are as common as yarrow or goldenrod or poison ivy. Each new colony or even each single plant we come across has the power to stir us, and the day is one to be marked with a red letter. My days of botanizing within walking distance of Baltimore began in the fall of 1890, when one of the numerous Chapters of the Agassiz Association was organized in our high school. As most of us know, this Society began as the Linnaean Fern Chapter of the Association. The region had been well combed for flowering plants, as well as ferns and their allies, by earlier botanists, and in 1888 Basil Sollers published a "Check List of Plants Compiled for the Vicinity of Baltimore." In this list there are 41 ferns, including two varieties of *Aspidium spinulosum* in addition to the typical form, and what are now named *Botrychium obliquum* and its variety *dissectum*.[1] With appropriate symbols to distinguish them, Sollers included the 26 species that were in Aikin's "Catalogue" of 1837, and with fine hopefulness added the 36 ferns in Ward's "Guide to the Flora of Washington and Vicinity," 1881, with additions in 1884 and 1886. Up to 1888, Sollers had found only 26 species, but found others afterwards.

Four of the ferns listed by Aikin were not reported by later botanists: *Asplenium Ruta-muraria, Aspidium spinulosum dilatatum, Phegopteris polypodioides* and *Cystopteris bulbifera.* The present writer made a special search for the *Phegopteris* over a period of several years, without success. Ward reported *Aspidium Filix-mas,* clearly an impossibility. While looking over some of the

[1] In this article the names in the seventh edition of Gray's Manual are used, because the majority of them are also used in the Check List.

ferns in the herbarium of Capt. John Donnell Smith, a specimen collected and so named by Ward was found. It was a sterile frond of *A. cristatum,* which is now in the United States National Herbarium. The remaining 35 species in Ward's list were reported by later botanists. With the Check List as an added incentive the writer found all the ferns in it except Aikin's four and Ward's *Filix-mas,* and collected other species and varieties which made his total 45. These were not all independent discoveries, and a few of the varieties had not been named when Sollers published his Check List. *Asplenium Bradleyi,* for instance, was found by J. H. Brummell, a florist with a wide knowledge of flowering plants, but not dependable in naming ferns. He called this one *Woodsia glabella.* As it was, *Bradleyi* was not in the Check List, and *A. montanum,* which grew in the same crevices, had been reported only by Ward. So a trip to see a fern that could not have been there added two species to the local list. Some years later Maxon was taken to this station. He gave me my first lesson in collector's ethics by asking permission to collect specimens for the National Herbarium.

Only Aikin and Sollers listed *Woodsia ilvensis,* and Sollers was the only one who did not report *Cheilanthes lanosa,* which leads to the perhaps unworthy suspicion that he mistook one fern for the other. There are several stations for the *Cheilanthes,* but it would be a great surprise to find the other species. My own first real chance to misname a fern came with the finding of *Aspidium spinulosum* in 1891. It was bad enough to become confused with those glands on the indusia—or were there any glands?—without having the botany say that the type is rare in America. Fortunately I had no copy of the Check List to consult, because neither Aikin nor Sollers had found the type. No mere beginner had the right to make such a discovery, and my identification could not be right.

That first specimen, twelve years later, served me as an illustration of the type form of the species,[2] and is now in the Society's herbarium.

Later in the day, after finding the *Aspidium spinulosum*, I had my first sight of the little bank on which the new colony of *Pellaea* was discovered in 1935. This is at Loch Raven, a part of the Gunpowder Falls[3] that has been dammed to form a lake for Baltimore's water supply. The Gunpowder, from the dam to a point more than six miles above, came to be my favorite and best-studied region, visited the year around. The erection of a much-needed new dam raised the level of the water 45 or 50 feet, and covered most of the more interesting places. It is hoped that the colony of *Cheilanthes lanosa*, first seen in 1891, and the only plants of *Selaginella rupestris*, which share the same little ledge, are still flourishing. They are now inaccessible, partly because of greater strictness about what visitors are allowed to do at Loch Raven, lest the water be polluted. They can be reached by row-boat, but at least one visitor would no longer venture to borrow the official craft, as he did in the old days.

My first real addition to the species in the Check List was about a dozen plants of *Onoclea Struthiopteris* in a shady spot not many feet above the level of the Falls. Some years later there came a greater surprise, when a flourishing patch of the ferns was found growing on the grassy slope, in full sunlight, between the water and the hedge which then grew beside the road along one side of the lake. These two places are now covered with many feet of water. Some years later more plants were found near Alberton, on Patapsco Falls, and on the rocky bank

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[2] Ferns, p. 215.

[3] In that part of Maryland a "falls" is a flowing stream of considerable size, while a "river" is a tidal arm of Chesapeake Bay. The Gunpowder River, about a mile wide where it is crossed by the Pennsylvania Railroad, is the "drowned" valley of the lower part of Gunpowder Falls.

a few feet above them was our second colony of *Cheilanthes lanosa.* The third and last station for this fern was in a field covered with scattered boulders, in whose deep crevices—on their south sides, of course—were many flourishing plants. A photograph of one of these boulders served me as an illustration to show how this attractive fern grows.[4]

There is good excuse for a botanist who wanders once over an area of a few acres and does not see all the species growing there. It is rather disgraceful if he visits an area no larger than a suburban lot, not once, but several times, before he sees a large, characteristic fern. It was not a single plant, but a few dozen plants in a clump, *Asplenium angustifolium,* this time. A few years later, when the banks of the Gunpowder were cleared of vegetation in preparation for the enlarged lake, the tops of these ferns were mowed down, while other plants a foot farther up the bank were not touched. This fern occurs in scattered spots along Patapsco Falls, and there are two or three huge beds of it beside a stream about twenty miles from Baltimore.

The rising water of the enlarged lake drowned our only plants of *Lycopodium clavatum,* barely half a dozen of them sprawling over a steep rocky bank overgrown with grass and other small plants. Not far away, at the foot of a cut bank composed of loose pieces of quartz schist mingled with rather sterile clay soil, was an unhappy colony of *Dicksonia punctilobula.* Some of their fronds were sent to B. D. Gilbert, because they were so freakish and unusual in appearance. He insisted on calling them forma *nana.*[5] In my opinion they hardly deserved a place in a herbarium, and certainly not a name. Their death under the rising waters is not regretted.

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[4] Ferns, p. 101.

[5] B. D. Gilbert, Linn. Fern Bull., 13: 101 (1905); C. A. Weatherby, Amer. Fern Journ., 26: 99 (1936).

Among the odds and ends added to the ferns in the Check List was *Phegopteris Dryopteris*. A few plants were found in poor soil within five or six feet of the rails in a narrow railroad cut. During part of the afternoon they baked in full sunshine. Yet they looked thrifty, and they must have been there several years when found. They lasted two or three more years, when they were probably destroyed by trackmen, who got to the cut at last. No fast trains ran on this road.

The discovery of 25 or 30 plants of *Botrychium ramosum* scattered around among bushes in the woods, extended the range of this species from New Jersey to Maryland, but was no more surprising than Egerton's finding *B. simplex* near Baltimore. His station was destroyed by trampling cows, and *B. ramosum* was too near a rapidly growing small town to have survived very long.

*Asplenium ebenoides* is where you happen to find it, and only one plant was ever found, although its parents grew together in many places. It was an addition to the Check List. Some of the fronds of this plant bear a close resemblance to Miss Slosson's hybrids.[6]

*Ophioglossum vulgatum*, reported only by Ward, was found in four or five places. In this part of the country it seems to avoid the sunny pastures and meadows which are its favored home in the North. We find it in damp soil in the woods.

The Coastal Plain, to the south and east of Baltimore, is geologically quite different from the Piedmont where we have been walking—we never heard of hiking—and the two are botanically unlike in many respects. At one place a small stream flowed along its level valley, perhaps 200 feet wide, and in this low, wet soil, rich in humus, several ferns were abundant. The one that first attracted our attention was *Woodwardia areolata* in great beds. In many spots it could not be avoided, and we walked through

[6] Ferns, pp. 134 and 136.

it as if it were so much grass. Late in summer a little searching would disclose many fronds intermediate in form, color of stipe, and height between the normal sterile and fertile fronds. Most of these intermediate forms were sterile, but a few had some sori, or only indusia with aborted sporangia under them. A flourishing colony was afterwards found on the Piedmont, in a wet spot in the woods near the top of a ridge, at an elevation of about 500 feet. The plants on the Coastal Plain were about 30 feet above tidewater.

The Check List shows that only Ward had reported the two *Woodwardias*, but Sollers found *W. virginica* later, because he told me about a station four miles from the little stream. The plants, some of them four feet tall, were in a wet, sunny place close by a railroad track. After collecting specimens we went to the little stream, and almost the first fern noticed was *Woodwardia virginica*, growing plentifully among *Osmunda cinnamomea*. The two species look somewhat alike, but it seems inexcusable that the *Woodwardia* should have been overlooked for several years.

The first addition to the Check List from this area was a plant of *Aspidium Boottii* in the midst of the thicket. The plant, which had about a dozen crowns, had apparently developed these by repeated branching of the rhizome. The whole plant would have filled a 12-inch flowerpot. A small plant was found two miles away, and still later, one was seen twenty miles away on the Piedmont, growing in the midst of the miscellany to be found on a wet sunny roadside. *Aspidium cristatum* and *A. spinulosum* were not scarce by the little stream, but they were not seen at the other two stations.

Scattered in big beds along the little stream was a fern that had always been looked at casually, and taken for granted as *Aspidium noveboracense*. In October, 1894, a beginner in botany asked me the name of this fern, and

after veering back and forth I had to confess ignorance, because it was not a good *A. norcboracense,* nor could it be *A. Thelypteris.* Fortunately a few fronds were collected, because in December a description of *A. simulatum* was published, by George E. Davenport. He had been observing it for a number of years, and I have always been glad that I did not forestall him by publishing a note on the puzzling fern, or possibly a name for it.

While wandering around in this little fern garden, late in the summer of 1901, my attention was caught by numerous fronds of *Osmunda cinnamomea* that seemed to be badly infected with some rusty-looking fungus. It turned out to be f. *glandulosa,* my only real discovery. Many of the fronds of this Coastal Plain form are so thickly covered with glandular hairs that they adhere to the driers when they are pressed.

If it was fun to find ferns to be identified, it was excitement to open a book and to find in it new names for old ferns. My botanizing began in 1888, with the fifth edition of Gray's Manual. In this the ostrich fern was *Struthiopteris Germanica.* The sixth (1889) edition calls it *Onoclea Struthiopteris.* Although it is so different in appearance from *O. sensibilis,* even a beginner with some imagination can see a reason for putting these species in the same genus. In the sixth (1901) edition of Our Native Ferns and their Allies, Underwood called our fern *Matteuccia struthiopteris.* This seemed very advanced, for here was an unheard-of genus, and the specific name started with a small "s." Britton, in the first (1901) edition of his Manual followed the lead of his associate, and used the same name, except for a capital "S." Finally, unless somebody digs up another oldest name, we are all expected to follow the Flora of the District of Columbia (1919), which inflicted *Pteretis nodulosa* upon us.

WASHINGTON, D. C.

# A New Fern Hybrid—

## Asplenium cryptolepis × Camptosorus rhizophyllus

E. LUCY BRAUN

In October, 1937, when visiting one of the familiar stations for *Asplenium cryptolepis* Fernald in Adams County, Ohio, one plant of a remarkable fern, a hybrid between *Camptosorus rhizophyllus* (L.) Link and *Asplenium cryptolepis* Fernald, was found. The more or less rosette habit and the leaf texture at once suggested *Camptosorus*, one of the two ferns growing on the mossy dolomite rock on a steep north-facing slope or cliff. The cut leaves and marginal teeth suggested *Asplenium cryptolepis*, abundant on this rock, but not present elsewhere in a radius of several miles. Closer examination shows that this plant shares about equally the characters of the two parents. The specimen has been examined by C. A. Weatherby and William R. Maxon, who agree as to the hybrid nature of this fern. Some of the characters mentioned below were pointed out by them, to whom I am indebted for careful examination of the plant.

*Asplenium cryptolepis*[1] × *Camptosorus rhizophyllus* has fronds subcoriaceous, 3 to 8.5 cm. long, including stipe, deltoid in outline, the older or spore-bearing gradually tapering to an acuminate apex. Fronds pinnatifid to once pinnate at the base, the pinnae alternate to subopposite, sub-rhombic in outline and abruptly contracted

[1] **Asplenium cryptolepis × Camptosorus rhizophyllus,** hybr. nov. Frondes subcoriaceae, 3–8.5 cm. altae. Laminae deltoideae basi pinnatifidae vel pinnatae, vetustiores vel soriferae ad apicem acuminatum gradatim attenuatae. Pinnae alternae vel subopppositae subrhombeae, in petiolulum brevem abrupte angustatae, inciso-dentatae fere ut in *Asplenio cryptolepide*, pagina superiore pilis albescentibus sparse onustae, pagina inferiore sparsissime glandulosae. Sori irregulariter positi, sporangiis minus evolutis, sporis abortivis.—Ad rupem calcareum prope lacum Beaver Pond vocatum in comitato Adams, Ohio.

Hybrid between Asplenium cryptolepis and Camptosorus rhizophyllus. Photo by Courtesy of William R. Maxon.

to short stalks. Margins incised-toothed, closely similar to *A. cryptolepis.* Veins mostly free as in *Asplenium,* occasionally anastomosing. At the tips of a few veins are faint indications of hydathodes on the upper leaf surface, suggesting the hydathodes of *Camptosorus.* Scattered short whitish hairs on the upper surface resemble those of *A. cryptolepis.* Under surface with a few clavate, gland-tipped hairs similar to those of *Camptosorus.* Sori irregularly scattered, elongate, as much as 7 mm. long; indusium fringed as in *A. cryptolepis.* Sporangia poorly developed, spores abortive. Stipe brown at base, otherwise green, and bearing near base a few narrow dark brown scales. Rhizome between the leaf bases with abundant narrow long-acuminate brownish-black scales.

On a mossy north-facing dolomite cliff in company with *Camptosorus* and *Asplenium cryptolepis.* Locality: near Beaver Pond, Adams County, Ohio.

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## Some Southeastern Fern Notes*

DONOVAN S. CORRELL

Round Top Mountain, one of the higher outlying mountains of the Southern Appalachian Range in Pickens County, South Carolina, is located a few miles south of Sassafras Mountain, the highest peak in the state. On August 24, 1936, I visited this peak and botanized on its western slope and summit, looking primarily for orchids. The mountain proved to be not only interesting in regard to orchids but also rich in ferns. The following species

* In citing material in this paper, my collection number under which the specimens are distributed follows the name of the plant or, in some cases, the name of the county in which the specimen was collected. A specimen of each collection is deposited in the Duke University Herbarium and, in many instances, in the Gray Herbarium and National Herbarium.

of ferns and fern allies were collected: *Adiantum pedatum* L. (6726); *Asplenium montanum* Willd. (6709); *A. platyneuron* (L.) Oakes (6698); *A. Trichomanes* L. (6696); *Athyrium asplenioides* (Michx.) Desv. (6719); *A. thelypteroides* (Michx.) Desv. (6720); *Botrychium dissectum* var. *obliquum* (Muhl.) Clute (6685); *B. virginianum* (L.) Sw. (6684); *Dennstaedtia punctilobula* (Michx.) Moore (6722); *Dryopteris hexagonoptera* (Michx.) C. Chr. (6695); *D. marginalis* (L.) A. Gray (6725); *D. noveboracensis* (L.) A. Gray (6718); *Lycopodium lucidulum* Michx. (6689); *Osmunda cinnamomea* L. (6692); *Polypodium virginianum* L. (6690); *Polystichum acrostichoides* (Michx.) Schott (6691); *P. acrostichoides* forma *incisum* (A. Gray) Gilbert (6723); *Pteridium latiusculum* (Desv.) Hieron. (6707); and *Selaginella tortipila* A. Br. (6711).

Additional collections which I have made during various trips into South Carolina are as follows: *Anchistea virginica* (L.) Presl: Horry Co. (5216). *Asplenium platyneuron:* Georgetown Co. (5288). *Athyrium asplenioides:* Dorchester Co. (5381); Georgetown Co. (5291). *Botrychium dissectum* var. *obliquum:* Oconee Co. (8089). *Isoetes Engelmanni* A. Br.: Dorchester Co. (5367). *Lorinseria areolata* (L.) Presl: Horry Co. (5220). *Lycopodium adpressum* (Chapm.) Lloyd and Underw.: Charleston Co. (5396). *L. alopecuroides* L.: Georgetown Co. (282). *L. carolinianum* L.: Georgetown Co. (285). *L. prostratum* Harper: Charleston Co. (5395). *Lygodium japonicum* (Thumb.) Sw.: Dorchester Co. (5356). *Onoclea sensibilis* L.: Georgetown Co. (5289). *Osmunda regalis* L.: Horry Co. (5240). *Polypodium polypodioides* (L.) Watt: Horry Co. (5245). *Pteris multifida* Poir.: Charleston Co. (280). *Selaginella apoda* (L.) Fernald: Oconee Co. (8066).

The above records include 30 species, one variety, and

one form. This does not show, by any means, the true status of the pteridophyte flora of South Carolina. These citations are given as additional distribution data for the state. I might add, in passing, that I have seen some H. W. Ravenel specimens in the Brown University Herbarium of *Azolla caroliniana* Willd., *Asplenium heterochroum* Kunze, and *Dryopteris celsa* (W. Palmer) Knowlton, Palmer, and Pollard, from Santee Canal (Berkeley Co.), South Carolina. The last-named plant, previously unreported from South Carolina, was 10.5 dm. tall. There is also a specimen of *Psilotum nudum* (L.) Griseb. from Beaufort County, South Carolina, in the Brown Herbarium.

In 1929, W. A. Anderson (Ferns of Tennessee, p. 23) wrote: "The pinnatifid spleenwort [*Asplenium pinnatifidum* Nutt.] is a very rare fern. It was found in 1880 at Lookout Mountain [Marion Co.] by Gattinger and has not been reported as growing elsewhere in Tennessee." Later, 1931, Anderson (AM. FERN JOURN. **21**: 14) cited collections from three additional counties in Tennessee (Hamilton, Fentress, and Scott counties).

While collecting in Tennessee during September, 1937, my wife and I stopped along Piney Creek, which forms the boundary of Roane and Cumberland counties, for a short exploration of the peculiar rock formations which underlie the stream-bed and form ledges along its banks. On the Roane County side of the stream a short distance west of Rockwood and a few hundred feet away from the stream, we came upon some sandstone ledges in a rather dry pine-hardwood forest. Growing with a great many juvenile plants in sheltered crevices under the ledges were some mature plants of *Asplenium pinnatifidum* (8121). This new station for the species in Tennessee is located on the Cumberland Plateau about halfway between Marion and Hamilton counties (on the southern boundary of Tennessee) and Fentress and Scott coun-

ties (on the northern boundary of Tennessee), thus providing a connecting link along the Plateau between these counties in the range of this species in Tennessee.

Exploring further along Piney Creek, we observed *Lygodium palmatum* (Bernh.) Sw. (8120) climbing in profusion over the thickets bordering the stream, and *Lycopodium obscurum* L. (8130) was commonly found in the cushions formed by fallen leaves and peat moss under the thickets. Large clumps of *Asplenium platyneuron* (8125) were found in rather dry soil on the edge of dense woods nearby and *Selaginella apoda* (8140) grew sparingly in mud on the edge of the water. *Polypodium virginianum* (8122) was also seen growing abundantly on rotten logs and soil-covered rocks. Directly across the stream, in Cumberland County, *Asplenium resiliens* Kunze (8150) and *A. montanum* (8151) were found in the crevices of rock ledges, and *Selaginella apoda* (8155) grew in a mat on mud under a drip-rock ledge.

Continuing on a few miles west, we found some fine specimens of *Diplazium angustifolium* (Michx.) Butters (8161) in a deep, moist, wooded ravine near Double Springs, Putnam County. Other ferns collected during this trip in Tennessee were *Botrychium dissectum* var. *obliquum* (8110) in Loudon County, *B. virginianum* (8200) in McNairy County, *Cystopteris fragilis* (L.) Bernh. in Montgomery (8162A) and Obion (8163) counties, and *Woodsia obtusa* (Spreng.) Torr. (8179) in Gibson County.

Mississippi, next to Louisiana, is one of our least known Southern States from a floristic standpoint. This may be easily understood when one considers the difficulty and inconvenience of getting about in the state. In 1836, Rafinesque (New Flora of North America, p. 11) said that he had not been able to explore the Southern States because he had been "deterred by the bad roads,

unhealthy climate, scanty fare, heavy expenses and state of society," and "A pedestrian botanist is not always very welcome there." Of course, many of the difficulties which Rafinesque had to face more than 100 years ago do not exist today. However, "bad roads" do still exist in many parts of the South and they are, indeed, barriers to either a pedestrian or a motoring botanist! Of this, we feel well qualified to speak!

In 1937 we cut across the northeastern corner of Mississippi and plowed through mud from Corinth to Iuka in Alcorn and Tishomingo counties, respectively. Only a brief stop was made in each of these counties. Our first stop was one mile north of Strickland in Alcorn County. The country in this region is rolling, with many heavily-wooded ravines and seepage slopes, interspersed with dry, upland pinewoods. A hurried survey was made of the vegetation of a typical landscape which resulted in the collection of the following pteridophytes: *Adiantum pedatum* (8220); *Athyrium asplenioides* (8232); *Botrychium dissectum* var. *obliquum* (8226); *Dryopteris hexagonoptera* (8233); *D. noveboracensis* (8224); *Lorinseria areolata* (8241); *Osmunda cinnamomea* (8237); *O. regalis* (8240); *Polystichum acrostichoides* (8243); and *Pteridium latiusculum* var. *pseudocaudatum* (Clute) Maxon (8228). The stop in Tishomingo County netted only *Botrychium dissectum* var. *obliquum* (8251) and *Asplenium platyneuron* (8252). Later in the summer, while passing through Jackson County in southern Mississippi, a stop was made on the savannahs near Orange Grove, where *Lycopodium alopecuroides* (8512) and *L. carolinianum* (8511) were collected. Additional collections which we have made in Mississippi are: *Dryopteris normalis* C. Chr. (10550) in Lincoln County, *Lycopodium alopecuroides* (9095) in Hancock County, and *Onoclea sensibilis* (10549) in Lincoln County.

The first stop made in Alabama after leaving Iuka, Mississippi, was along a small tributary of the Tennessee River just east of Pride in Colbert County. Limestone bluffs lined the east bank of this stream upon which grew colonies of *Asplenium resiliens* (8254), *Cheilanthes alabamensis* (Buckl.) Kunze (8255), and *Pellaea atropurpurea* (L.) Link (8253). Later, a short stop was made near Muscle Shoals, also in Colbert County, where *Cystopteris fragilis* (L.) Bernh. (8256) and *Woodsia obtusa* (8257) were found growing together in shallow soil on rocks in a little wooded ravine. Two stops were also made in Morgan County, in the north-central section of Alabama. The first was in a pine-hardwood forest, in which were many exposed limestone rocks, about two miles north of Hartselle. Besides finding *Asplenium resiliens* (8267) and *Pellaea atropurpurea* (8266), we also found *Botrychium virginianum* (8269) and *Asplenium platyneuron* (8265). Further south, along Flat Creek, about one-half mile south of Lacon, *Asplenium pinnatifidum* (8277) and *A. Trichomanes* (8279) were found growing out of crevices in sandstone ledges above a small waterfall. The latter formed the finest colony of this species I have ever seen.

Additional collections which we have made at various times in Alabama are: *Asplenium platyneuron:* Lee Co. (6541); Macon Co. (8553). *Athyrium asplenioides:* Lee Co. (6553). *Botrychium dissectum* var. *obliquum:* Lee Co. (6558). *Botrychium dissectum* var. *tenuifolium* (Underw.) Farwell: Butler Co. (8543); Perry Co. (10557); Tuscaloosa Co. (8299). *Lorinseria areolata:* Lee Co. (6549). *Lycopodium alopecuroides:* Cunecuh Co. (8538). *L. prostratum:* Baldwin Co. (9085). *Onoclea sensibilis:* Lee Co. (6539). *Pellaea atropurpurea:* Blount Co. (8284). *Polypodium polypodioides:* Lee Co. (6552). *Polystichum acrostichoides:* Lee Co. (6555). *Pteridium latiusculum* var. *pseudocaudatum:* Chambers

Co. (6562). *Selaginella apoda:* Saint Clair Co. (8306) (8324). *Woodsia obtusa:* Blount Co. (8283); Macon Co. (8551).

The climax to our fern collecting in Alabama during 1937 was the finding of *Trichomanes Petersii* A. Gray (8340) about two miles west of Heflin in Cleburne County—a new station for this species in Alabama. The plants, which formed a mat over the surface of some large, moistened sandstone boulders, were found along a small stream in the spray of a small waterfall situated above a much higher waterfall located a few feet down stream. The surrounding country was rugged and steep, being covered with a dense hardwood forest. The plants, together with *Asplenium Trichomanes* (8351), grew in the dense shade of some of these trees. *Trichomanes Petersii* has previously been found in Alabama in Marion, Winston, Marshall, and Etowah counties (AM. FERN JOURN. **10**: 78). The finding of the species in Cleburne County, next to the Georgia line, forms, with the above-mentioned counties, an irregular line of distribution across the north-central section of the state.

*Trichomanes Petersii,* contrary to the belief of T. M. Peters, who first discovered it in Winston (Hancock) County, Alabama in 1872, is evidently not particularly rare. However, because of its small size the plant may be easily overlooked. The recent discovery of this species in Pickens County, South Carolina (*Science* **88**: 402), leaves North Carolina as the only southeastern state in which the species has not been found.[1] I have listed below, excluding those already mentioned, the stations, so far as I know, where *T. Petersii* is found in the southeast: FLORIDA: Hernando Co., "On limestone boul-

[1] Since this was written, I have seen in the Duke Herbarium a specimen of *T. Petersii* from North Carolina which was collected by A. R. Shields (4642) on the margin of Lake Calderwood in Graham County, Feb. 19, 1939.

ders in rather dry hammock, Annuttalagga, near Brooksville. March 8, 1936. E. P. St. John.'' GEORGIA: Walker Co., ''2.5 miles northwest of Lafayette, April 24, 1938, Pyron and McVaugh #2751'' (also from Dade County and Tallulah Falls). LOUISIANA: St. Tammany Parish, ''On magnolias, vicinity of Covington, Sulphur Springs, March 15, 1924, Bro. G. Arsène #14764.'' MISSISSIPPI: Simpson Co., ''Saratoga, Nov. 6, 1902, S. M. Tracy #8303.'' TENNESSEE: Blount Co., ''near Tremont; Sharp, Jennison, and Bishop, April 12, 1931.''

BOTANICAL MUSEUM, HARVARD UNIVERSITY

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## Vittaria lineata from Lincoln County, Georgia

JOSEPH H. PYRON AND WILBUR H. DUNCAN

While on a general collecting trip at Graves Mountain, in Lincoln County, Georgia, on October 16, 1938, the writers found two rather depauperate plants of *Vittaria lineata* (L.) J. E. Smith. They were growing in an exceedingly dry location near the summit of a rock cliff on the south side of the mountain. An intensive search of the other crags of the peak failed to reveal additional specimens. On the trail down the mountain, however, another colony was discovered some fifty or sixty feet directly below the first station. The second colony comprised some twenty or thirty plants which were more vigorous and better developed than the plants at the summit. They grew in a shaded situation between two large crags, and without exception the plants were anchored in small holes eroded in the vertical face of the rock. In order to preserve the colony, only eight specimens were collected. Most of these were in good fruiting condition.

The writers again visited the mountain three weeks later to make a more thorough search for *Vittaria* on the

steep crags on the northwest and southeast sides. Only two sterile plants were located. These were found on the southeast side less than a quarter of a mile from the first colony.

Graves Mountain, which is about forty miles northwest of Augusta, has long been of interest to geologists for its varied mineral specimens. It is conspicuous for miles as it rises about four hundred feet above the surrounding country. It is less than half a mile wide and about a mile long from northeast to southwest. The summit is 901 feet above sea level. The south side and parts of the east and west sides are almost vertical. According to Johnston (2) the rock is mainly quartzite with kyanite, lazulite, and pyrite mostly altered to haematite on the exposed surfaces, as lesser constituents. Lichens are abundant on the rocks and a few mosses occur in more protected places.

*Vittaria lineata* has not been previously recorded north of Duval County, Florida (Vail's collection (1) in N. Y. Bot. Garden Herbarium). The station recorded in the present paper is in the Piedmont of Georgia, which is 250 or more miles north of Vail's station. This is a remarkable extension of range of a fern heretofore thought to be restricted to tropical or subtropical regions. This range extension, the habitat, and habit suggested the possibility of a new species. The plants were growing in a peculiarly xeric situation as compared with the moist epiphytic habitat on the trunks of cabbage palm or palmetto where it usually occurs in Florida. The elevation of 900 feet at which the fern occurs at Graves Mountain as compared with the "usually not more than a few feet above sea level" as described by Small (3) seems significant. As to the plants themselves, the fronds are in no case as long as 20 cm., in contrast to the generally much longer fronds of Florida specimens. Serial sections of the rhizome and frond were studied and spores were measured

and compared with herbarium material. Having gained some idea of the variation in the species from correspondence with Dr. W. R. Maxon, and from study of a series of West Indian specimens selected by him from the National Herbarium, the writers are now convinced that the plants in question are *Vittaria lineata* (L.) J. E. Smith.

Several other ferns have been collected at Graves Mountain, including: *Asplenium Bradleyi* D. C. Eaton, *Asplenium montanum* Willd., *Asplenium platyneuron* (L.) Oakes, *Cheilanthes tomentosa* Link, *Lorinseria areolata* (L.) Presl, *Polypodium polypodioides* (L.) Watt, *Pteridium latiusculum* (Desv.) Hieron.

1. Correll, D. S. 1938. A County Check List of Florida Ferns and Fern Allies. AM. FERN JOUR. 28: 95.
2. Johnston, W. D. 1935. Kyanite at Graves Mountain. Geol. Survey of Ga. Bull. 46: 26–30.
3. Small, J. K. 1938. Ferns of the Southeastern States. Science Press, Lancaster, Pa.

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# A Note on the Occurrence of Ferns in Some Ohio Caves

WM. BRIDGE COOKE

Occurrence of plant life in caves is rarely if ever mentioned in recent literature on natural history of caves. The following notes were made during a period of several years beginning in June, 1932. At that time the writer was an undergraduate at the University of Cincinnati. From June, 1932, to June, 1934, he visited "The Seven Caves" at intervals of a week to one month, averaging a visit a month. The primary interest on these trips was the collection of fungi and the listing of

*Photograph by W. H. Duncan.*

VITTARIA AT GRAVES MOUNTAIN, GEORGIA.

¼ natural size.

observed plants. The fern prothallia to be discussed were noticed accidentally both by the owner of the hundred acre park and the writer in July, 1932.

The Seven Caves are located in eastern Highland County in southwestern Ohio in a privately owned reservation to which an admission fee is charged. They are fully described by White.[1] In order better to exploit the caverns themselves, especially for Sunday tourists, the management has put board walks and electric lights in all accessible passages. The electricity is generated on the place and is carried to 25-watt bulbs through 32-volt lines. Lights were first installed in the Cave of the Spring, the longest passage, in July, 1928. They were installed in Bear Cave in May, 1929, and in the other caves between 1929 and 1932. Green plants growing near the electric lights were first seen by the writer in the Cave of the Spring on July 31, 1932, while taking a party through the park. On the following day the manager found another green patch in Bear Cave. The position of the lights was changed in the Cave of the Spring in September, 1932. This caused the eventual death of the colony seen there. The lights were changed in Bear Cave in the spring of 1935, thus effectively destroying the colony seen there. Additional colonies of green growth have been noted (1932) in McKimie Cave and Phantom Cave. Additional colonies may have developed in advantageous locations since the caves were last visited.

The green growth found in the vicinity of the light bulbs includes three types. In places, particularly

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[1] White, George W. The Limestone Caves and Caverns of Ohio. Ohio Journal of Science **26**: 73–116. 1926. 17 maps. Names of the caves differ in Mr. White's article. The present management refers to the "Rocky Fork Caves" on his property as "The Seven Caves"; "Wet" Cave is now "Cave of the Spring"; and "Crescent" Cave is now "McKimie" Cave.

where the rocks are dry a portion of the year, there is an undetermined green one-celled alga which produces what is popularly known as "green marble." In most of the places, however, the rocks are continually moistened through seepage and condensation and here are green patches made up mainly of moss protonema. Mature moss gametophytes or even their beginnings have not been found. The most interesting growths found were fern prothallia. These were found in one place in the Bear Cave, near two lights in the Cave of the Spring, in one place in McKimie Cave, and in one place in Phantom Cave. The colony in the Bear Cave was observed for the longest period since it was the least disturbed. These prothallia, which grew on perpendicular rocks, assumed larger size than similar ones in crevices in the rocks outside in the gorges. The single ones measured from $\frac{1}{4}$ to $\frac{1}{2}$ inch cross, while several grew in clusters which gave the impression of a single prothallus of between $\frac{1}{2}$ and $1\frac{1}{2}$ inches in diameter. Occasionally one of these would produce a leaf, especially during the summer when light was available for longer periods. These leaves (some half dozen were produced) had stems 2–3 inches long and blades $1\frac{1}{2}$ inches long before they died. None produced spores. Because of the resemblance of the leaves and prothallia to the park's commonest fern (21 species of ferns and fern allies were seen in the park), and because more of its spores could be distributed, it was assumed that these were prothallia of *Cystopteris bulbifera* (L.) Bernh.

The conditions of growth are of interest. Between October 1 and April 1 the lights are never used. Between May 30 and September 10 the lights are used approximately 10–12 hours per day. Between April 1 and May 30, and between September 10 and October 1, the lights are used intermittently depending on repair work

on the trails and lighting system in the caves, and depending on the amount of business, mostly week-end, available. Thus the lights are on a possible 1900 out of 8760 hours per year. The temperature, taken by exposing a Fahrenheit thermometer to the conditions tested, varied considerably as follows: Cave of the Spring—atmosphere of passage 58 degrees, temperature of the rock surface 53 degrees, and temperature of the region within 3 inches of the light bulb 62 degrees; Bear Cave—atmosphere of passage 62 degrees, temperature of the rocks 53 degrees, and of the region within 3 inches of the light bulb 66 degrees. Differences in temperature between the two caves are accounted for by the fact that the tested passage in Bear Cave is only 100 feet from the entrance, whereas that in the Cave of the Spring is nearly 500 feet from the entrance. Temperatures are rather stable in the caves during the winter. They were not tested, but observation by experience in January and February showed the inside of the caves warmer than outside. Match-light and flash-light observations made during the winter showed that the prothallia remained green throughout the winter and no evidence was found to prove that the prothallia observed in the summers of 1933 and 1934 and the spring of 1935 were not the same as those seen in 1932. Neither did the size of the colonies appear to increase. The colonies developed only where light bulbs were placed close to a continually moistened wall. The radius of the largest colony was not more than six inches and this may have been limited by either temperature or light relationships or both.

It should be emphasized that such phenomena exist only after the interference of man in a natural region.

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# Recent Fern Literature

Mrs. Elsie McElroy Slater has published, in a well-printed little pamphlet, an account of the environs of El Paso, Texas, as seen by the eye of an amateur naturalist (and, one suspects, an artist and a maker of verse also) and in particular of thirteen of the commoner and more typical ferns which grow there. As would be expected in that place, they are all the small, rock-loving species characteristic of the arid regions of southwestern Texas, New Mexico, Arizona and northern Mexico. Each is given an informal and picturesque description, often containing some detail, such as the color of fresh fronds, not to be found in the usual books; various bits of information and comment; and an illustration. These last are mere sketches reproduced on rough-surfaced book-paper and show little more than outlines; but, with the exception of that of *Notholaena sinuata*, which is too much conventionalized, they catch the characteristic attitudes of the species concerned.

One bit of information is interesting. The waxy covering of *Notholaena Standleyi* is spoken of as "bone white." In practically all herbarium specimens it is a rather pale but quite distinct yellow. The author so obviously looks at color with the discriminating eye of an artist that one is not inclined to question her observation; one who, like the present writer, has never seen the fern in life wonders whether the yellow is a post-mortem feature, or the El Paso plant a local form.

The little book is very agreeably written, sometimes fanciful, sometimes poetic, always in unhackneyed phrase, and withal essentially accurate and embodying original observation. It is an attractive introduction to fern-hunting about El Paso.[1]

[1] Slater, Elsie McElroy. Thirteen ferns of the Mexican border at El Paso. 5 pp., paper. Published by the author, El Paso, Texas. 75¢.

The number of ferns which can be propagated vegetatively is small. It is therefore of interest to learn that Marattias will develop buds from the stipules or bases left on the plant after the leaves have fallen. They are removed from the rhizome and placed on some rooting material (refuse cocoanut fibre was used in the experiments described). The severed ends should not be in direct contact with the rooting medium; otherwise, they soon decay. With this precaution, the leaf-bases will continue to produce buds until the food material in them is exhausted.[1]

For a long time Dr. Christensen has maintained that the groups which he treated as subgenera in his monograph of *Dryopteris* are really good genera. But he did not take them up as such until 1938, in the Manual of Pteridology, and then only in brief and summarized form. Dr. Ching, in a series of articles extending over several years and particularly in volumes 6 and 8 of the Bulletin of the Fan Memorial Institute of Peiping, has made what is probably the first attempt to apply the new system to a considerable number of species. Some of his conclusions have been commented on before in the Fern Journal.[1] In this final installment he finds it necessary to add a few new genera to Christensen's list; the total number carved out of *Dryopteris* of the Index Filicum has now reached twenty, divided into two tribes,[2] for Asia alone.

The species considered are, of course, Asiatic; but several of the genera are also American, and students here may learn, from a perusal of Dr. Ching's introductory discussions, much about the characters of the

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[1] Kemp, E. E. An unusual method of vegetative propagation in Marattiaceae. Gardeners' Chronicle, ser. 3, **106**: 47, figs. 22, 23. (1939.)

[1] FERN JOURNAL **24**: 17; **25**: 14, 135; **26**: 70, 103.

[2] Dr. Ching mistakenly calls them subfamilies.

groups concerned and the methods and bases of the new classification which has grown out of the researches of Goebel, Bower and their fellow morphologists and phylogenists. One can readily imagine Hooker and Mettenius, who believed that only the reproductive organs could furnish reliable generic characters, writhing in their graves at some of those which Dr. Ching uses. But, in practical taxonomy, handsome is as handsome does; if two or more characters hold together through a long series of species, they are good group-characters, however trivial in themselves. Some of Dr. Ching's are not so handsome as he supposes, perhaps from lack of detailed knowledge of American species, perhaps from isolation due to the "undeclared," but very real, war in China. For instance, in the decompound species of true *Dryopteris* the basal pinnae are not "always . . . much the largest and deltoid, i.e. the posterior basal pinnule greatly basicopically lengthened out"—witness our *D. intermedia* and a half-dozen Mexican species. And if *D. dentata* and *D. gongylodes* are "uniform . . . in leaf texture" I do not know what that phrase means. But there can be no question that the observation and trained judgment in such work as this of Drs. Christensen and Ching has added immensely to our knowledge of the characters of the groups involved and of their real relationships.

There remains the question of how to label the presumably natural groups defined—genera, subgenera, or what? Probably only time and the gradual crystallization of judgment will produce unanimity. For the present we shall have to decide, as best we may, whether to call all our shield-ferns *Dryopteris* with Dr. Maxon; or *Dryopteris*, *Ctenitis* (*D. submarginalis*), *Thelypteris*, *Gymnocarpium* (*D. Linnaeana*), *Cyclosorus* (*D. dentata*), *Goniopteris* (*D. reptans*), and *Meniscium* (*D. reticulata*) with Drs. Christensen and Ching.

Incidentally, Dr. Ching, full of faith in his classification, is inclined to be severe on the "unnatural" action of those Americans who took up *Thelypteris* in place of *Dryopteris* in the broad sense. This is ancient history now, since *Dryopteris* is proposed for conservation and has received a unanimously favorable vote in committee. But it may be worth mentioning that when we used *Thelypteris*, we were, in taxonomy, merely following Christensen, who was then treating the whole series as a single genus. If the monographer of the group and a leading authority on ferns in general had too little confidence in his own segregations definitely to adopt them, certainly no one else was called upon to do so or, without special study, ought to do so.[3] Nomenclaturally, so long as the group was kept intact, we were not only perfectly correct in accepting *Thelypteris*, the earliest valid name for any part of it, for the whole, but were forced to do so by the rules. And it ought not to be forgotten that, for name-tinkers, we exercised a truly magnificent self-restraint. There was a gorgeous opportunity to turn out new combinations by the page after the manner of Otto Kuntze; we—even Dr. Nieuwland, who rather enjoyed upsetting nomenclature—made only such as were directly needed in our work. We deserve a bit of credit for that![4]—C.A.W.

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[3] Lest this be taken as a slur on Dr. Christensen I hasten to add that his reason for not taking them up was of the best—he felt that the Oriental species were then not sufficiently known to permit final judgment on the genera.

[4] Ching, R. C. A revision of the Chinese and Sikkim-Himalayan *Dryopteris* with reference to some species from neighboring regions. Bull. Fan Mem. Inst. Bot. **6**: 237–348 (1936); **8**: 157–263, 275–331, 363–507 (1938).

## Shorter Notes

FERNS AND SALT WATER.—My house and fern garden were flooded by a tidal wave during the hurricane of September, 1938. It is of possible interest that out of 34 species of ferns and fern allies two—*Osmunda cinnamomea* and *Dryopteris marginalis*—survived, and that, of a number of plants of *O. cinnamomea*, a specimen of the red-stiped form has apparently benefitted by the liberal dose of salt it received. I am unable to suggest an explanation.—GEORGE R. PROCTOR, *Fairhaven, Massachusetts.*

SCOTT'S SPLEENWORT IN OHIO.—I should like to report the finding of *Asplenosorus ebenoides* (R. R. Scott) Wherry in Washington County, Ohio, November 11, 1938. Subsequent discovery of several specimens in the same general area, some of them fertile, indicates that this fern is not at all rare in southeastern Ohio. I believe it has been reported before from Hocking County only. Dried specimens have been placed in the Marietta College Herbarium.—GEORGE R. PROCTOR, *Fairhaven, Massachusetts.*

FRAGRANT FERNS.—"The fronds of Polypodium Phymatodes are used by the South Sea Islanders for perfuming Cocoa-nut oil. About five years ago, a living plant and some dried fronds of this species were presented to Kew by Mr. Collins of the Strand, who stated that the fronds were employed in his house for placing amongst clothing, etc., to which they imparted an agreeable and lasting perfume. I have the dried leaves still, and they are as fragrant now as when I received them. The odour is exactly like that of the Tonquin Bean, Dipterix odorata, used for scenting snuff and other forms of Tobacco. Specimens of P. Phymatodes, which have been in the Kew Herbarium nearly thirty years, are very perceptible now, notwithstanding the strong dressing of corrosive sublimate

which they have received. An allied species, viz., P. nigrescens, proves quite as fragrant when dried; and a third one, also closely allied to P. Phymatodes, viz., P. pustulatum, a native of New Zealand, is even more fragrant than these. The natives of New Zealand employ the fronds of this species to scent their oil and food.

"In the *Daily News* for last Saturday there is a letter from a correspondent who has resided in the North West Provinces of India, where, he states, the fronds of P. normale are gathered and placed in rooms for the sake of their delicious hay-like scent. He also states that 'it is, of course, the naked seeds at the back of the strap-shaped leaves, which, being ripe at that season, give out the sweet smell which floats on the air in the golden pollen-like particles.'

"For one who begins by sneering at the Royal Botanic Society for its want of knowledge on the subject of sweet-scented Ferns, the belief that the fragrance is caused by the pollen-like particles is amusing. Certainly the spores have nothing to do with it, barren and young fronds being quite as fragrant as the fertile ones. There is no fragrance from these Phymatodes Polypodiums unless the leaves are dried or drying. The odour appears to be due to the presence of numerous oil glands in the fronds.

"Evidently the leader writers for the London daily papers are unacquainted with the several native species of Fern, the fragrance of which is well known. The scent of hay is so marked in Nephrodium (Lastrea) aemulum, that it is commonly known as the Hay-scented Buckler Fern, and one of its synonyms, viz., N. foenisecii, Lowe, means "hay-cutter." N. montanum emits, when bruised, a lemon-like odour, which is due to the presence of numerous minute glands on the under-surface of the fronds. N. fragrans, a native of the North Temperate zone, but not British, has a strong primrose-like odour, both when green and

when dried, herbarium specimens retaining the fragrance for many years. It is stated that, in Siberia, a decoction of the leaves of this species is a pleasant substitute for tea. N. odoratum, a widely distributed plant, has a pungent mustard-like odour and taste. A common plant in gardens, and represented by large tufts in the Temperate-house at Kew, is N. patens, a species similar to N. molle, and almost as widely distributed, and which emits when bruised a strong odour suggestive of very ripe Apples. Dicksonia punctiloba, a North American plant, is known in Kentucky as the Sweet-smelling Fern, on account of the fragrance of its fronds. Probably there are many other species possessed of fragrance; those here mentioned are, however, all that are known at Kew.''—From the Gardeners' Chronicle, ser. III, 7: 225–226 (Feb. 22) 1890.

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## American Fern Society

The John Burroughs Association desires to get in touch with all organizations in the United States and elsewhere formed in honor of John Burroughs. The purpose is to learn whether such groups would be interested in a yearly publication to contain reports from these various units, as well as articles about John Burroughs. Please communicate with Dr. Clyde Fisher, American Museum of Natural History, 77th St. and Central Park West, New York City.

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HAVE YOU A COMPLETE FILE OF THE AMERICAN FERN JOURNAL?—Several years ago (1930), with the above question in mind, reference was made to the status of the Society's files of the AMERICAN FERN JOURNAL at the end of the twentieth volume. Now, with the approach of the thirtieth, it seems appropriate to raise the same question again.

In connection with the building up of a college library, there has been occasion recently to make enquiries as to the cost of the back files of various biological publications, some much younger than the JOURNAL, some older. The estimates for different journals ranged from $50 to $750. The amount of matter in them varies, of course, almost as much as the prices; but it was notable that one reason for the higher prices was the fact that the early volumes of most of these journals have long been out of print and exist only as rare items to be supplied by dealers.

With the FERN JOURNAL, there is a very different story. It has been the policy of the Society to maintain stocks of all its back numbers. With this in mind, when the original supply of an early number is exhausted, it is reprinted. The reason for this policy is to make it possible, especially for recent members, to purchase back numbers at a moderate cost.

It may be noted that early numbers of the JOURNAL contain many articles of importance. The whole file of 29 volumes constitutes a library of fern literature of great interest and value to the fern-lover, comprising approximately 4,000 pages and 300 illustrations.

The usefulness and convenience of a complete file is now increased by the cumulative index to the first 25 volumes, compiled by Dr. Edgar T. Wherry with NYA and WPA assistance and issued with this number of the JOURNAL. Its four divisions—recording authors, subjects, geographic areas treated and scientific names mentioned—make it easy to find matter in which one is interested. And to those who do not have the JOURNAL, or not all of it, perusal of the index can hardly fail to suggest articles which they will want to see, and will, we hope, stimulate the demand for the back numbers which have proved one of the Society's most valuable assets.

The index is being distributed gratis to present members and subscribers; hereafter, it will be for sale at 50 cents a copy. A full set of the 29 volumes of the JOURNAL with the index, sells for $36.75, with 10% discount to members of the Society in good standing.

# Index to Volume XXIX

## ERRATA

Page 94, line 2, for *Pteritis,* read *Pteretis.*
Page 108, line 24, for PELLEA, read PELLAEA.

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# AUTHOR INDEX

# 2. SUBJECT INDEX

# 3. GEOGRAPHIC INDEX

# 4. TAXONOMIC INDEX

This index comprises chiefly names of living ferns, but a few fossil ferns and fern parasites are included. As a guide to spelling, C. Christensen's Index Filicum has been followed whenever practicable; however, epithets derived both from the names of persons and from earlier proper names are capitalized. When a species has been subdivided but no category is indicated in connection with the third epithet, the abbreviation ss. for subspecies is here inserted, in parentheses; variety, subvariety, and form are correspondingly designated by v., sv., and f. New names or combinations first proposed in the volumes indexed are placed in **bold-face** type, except when the new combination was made wholly inadvertently or in a mere list of plants in a garden, etc.