American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

VOLUME XXI — 23

1 9 3 1 — 1933

LANCASTER, PENNSYLVANIA

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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American Fern Journal

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RALPH C. BENEDICT 1819 Dorchester Road, Brooklyn, N. Y.
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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.

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American Fern Journal

Vol. 21 JANUARY–MARCH, 1931 No. 1

Notes on a New Jersey Fern Garden—I.

W. Herbert Dole

The fern garden, a portion of which is shown in the accompanying illustration, is located in West Orange on the eastern slope of First Orange Mountain. The garden was of slow development and became a fern garden largely because of changing conditions.

A new house built close to the south lot line and the growth of trees set out some years earlier made it necessary to find plants suitable for a shady location.

The natural slope was accentuated by removing the soil for a depth of from two to four feet from the central portion of the plot to give a sunken garden effect, with banks on three sides and the middle part sloping gradually toward the east.

The fern garden is on the shady south side facing north, while the other two sides facing east and south are being developed as a rock garden. The central portion has been seeded as a lawn, but it is planned ultimately to include a small irregular pool for water plants and additional flower beds.

The illustration shows the southwest angle where rock and fern gardens meet and a path of flat stones. Rustic steps lead up at the right and turn to the left around

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[Volume 20, No. 4 of the Journal, pages 129–164, plates 7–9, was issued Jan. 6, 1931.]

Part of the Fern Garden.

the flowering cherry tree, of which only the dark trunk and branches are visible in the photograph.

Along the lot line at the back, a cleft chestnut fence makes an attractive back-ground for the ferns and helps to conceal the lower portions of the neighboring house. In fact the house is almost non-existent as far as the garden is concerned, as the cherry tree, a white pine, mountain ash and other trees and shrubs almost completely screen it and give the effect of a bit of woodland. A large flat stone marks the entrance to the path through the "woods."

On the right is a royal fern (*Osmunda regalis*); this was found six or seven years ago, an old and stunted little fern growing in the middle of a dry field—probably a survival of a departed wooded tract. It was moved to its present position, which it found to its liking, and each year it grows larger and taller until it has become a fine specimen with fronds three feet six inches, or more, in height. A number of royal fern sporelings have come up near by which will have to be moved before they grow so large that they will crowd their neighbors.

At the center and to the left of *Osmunda regalis* is a marsh fern clump (*Dryopteris Thelypteris*) which has to be watched lest it get out of bounds. It is an attractive fern when kept as a specimen, but its numerous sporelings must be weeded out, as together with the sporelings of lady fern (*Athyrium angustum*) and of bladder fern (*Cystopteris bulbifera*) they would soon take possession of all available space. Generally these young ferns are permitted to grow where they come up, for a year or two as, while small, they make beautiful little rock ferns.

Other ferns along the path are fragile bladder (*Cystopteris fragilis*), rusty woodsia (*Woodsia ilvensis*), Christ-

mas fern (*Polystichum acrostichoides*), and ebony spleenwort (*Asplenium platyneuron*).

Around the trunk of the cherry tree is a thriving colony of *Dryopteris spinulosa* and *Dryopteris intermedia*. These also sow themselves freely; *spinulosa* especially has appeared here and there among the other ferns.

In the distance against the fence may be seen a tall Silvery Spleenwort (*Athyrium acrostichoides*) in company with marginal shield fern (*Dryopteris marginalis*), lady fern (*Athyrium angustum*), New York fern (*Dryopteris noveboracensis*) and others.

The stones are local field stones found on the place or dug up in the process of grading. They were not ideal material for the purpose, being mostly too round, but were used, as they were at hand, and have been arranged to give as nearly as possible the appearance of a natural outcropping. To begin with there was nothing but the red clay soil so typical of northern New Jersey, but gradually this was removed to a depth of eight inches to a foot and as stones were set in place new soil was put in consisting of varying mixtures of black wood-mold, loam, peat-moss, sand and gravel.

In moving ferns it is found a good plan to observe the conditions under which they grow—exposure, soil, drainage, etc.—and to try to reproduce as nearly as possible the same conditions in the garden.

Of the forty odd ferns so far tried, all have done well except some of the Botrychiums. The latter have continued to grow over a period of several years, but have up to date produced only undersized sterile fronds. Further experimenting will no doubt solve the problem of their requirements.

Besides the varying shades of green displayed by the ferns, this corner of the garden is brilliant with other

colors, especially in the spring when the double flowering cherry is loaded with its clusters of rose-like flowers.

Above the large stone at the center is a group of white trillium (wake-robin) and the pink flowers of *Daphne cneorum* and in the shadow to the left are fine clumps of hepaticas—pink and blue. Above to the left is a dwarf magnolia with large white blossoms that lighten up the garden for several weeks in the early spring.

Scattered about on the miniature cliffs are early saxifrages, mossy saxifrages in pink and white, wintergreen, partridge berries and other wood flowers. Yellow lady slippers (*Cypripedium pubescens*) seem well naturalized and have blossomed for a number of years.

At the upper right a group of *Azalea mollis* adds brilliancy in the late spring with a glowing mass of orange, yellow and salmon pink flowers and just below are clustered spikes of coral bells (*Heuchera sanguinea*).

At the foot of the rocks, below and in front of the ferns are groups of shade-loving dwarf irises—*cristata* in two shades of lavender and the white variety, *cristata alba*, *minuta* with yellow flowers and *gracilipes* with innumerable dainty flowers of pale lavender which remain in bloom over a long period of four weeks or more. This year *Iris verna* has been placed among the rocks; it has bloomed in another part of the garden and it is hoped it may be naturalized among the ferns.

Late in summer there are pink *Anemone hupehensis*—some may be seen in the picture against and to the left of the dark trunk of the cherry tree. The stones of the path itself are covered in places with patches of *Sedum acre* bright with its tiny yellow flowers and in the crevices are little yellow violets from western New York.

POLYPODIUMS

When the first stones were being arranged, preliminary to the planting of ferns, it was found that several of the

larger stones fitted together very snugly making a natural looking ledge with a long nearly horizontal fissure; just the place for rock ferns. It seemed to suggest *Polypodium virginianum*. A few days later a visit was made to a shady traprock hillside where polypody grows in abundance and after a short search I found just what was wanted, a long row of the ferns growing between layers of rock which, luckily, it was found could be easily separated. A flat mat of roots imbedded in black leaf mold, with the green fronds like a fringe all along one edge, was extracted without the need of any cutting or subdividing.

This polypody mat was rolled up, for convenience in carrying, and was, later, found to fit almost exactly into the place prepared for it. The upper stones were raised and the mat of roots set in place, the stones were put back carefully so as not to crush the plants and to make sure that all possible voids were packed with leaf mold and sand; then a good watering and so far as any one could tell it might have been a long established planting. It may be noted that the slope of rock face and the dip of the fissure permits rain water or spray from a hose to run down naturally into the fissure and to reach the roots.

This colony of polypody has now been in place six or seven years; it has received almost no care except for frequent watering during dry spells and a general cleaning up in the spring to remove old dry fronds and leaves that have lodged among the ferns during the winter.

Just below the polypody, as may be seen in the photograph, is a colony of maidenhair spleenwort (*Asplenium Trichomanes*). These were set in place about the same time as the Polypodium and are well established.

Polypodium virginianum, in Place about Seven Years.

The vertical fissure in which they grow seems, however, to be a favorite lodging place for spores of other ferns, and every once in a while it is necessary to remove intruding little plants of Lady, marsh or fragile bladder ferns.

Just to the right in a cool spot protected from the sun, is a thriving specimen of Hart's-tongue fern.

PHEGOPTERIS HEXAGONOPTERA

Broad Beech fern occurs locally in West Orange; it may be found in abundance within a few minutes' walk of my home and was therefore, naturally, one of the first to find a place in the fern garden.

It grows in a sunny open woods on the easterly slope of First Orange Mountain where the ground is quite wet in the spring but dry in summer. It is associated with Interrupted fern (*Osmunda Claytoniana*), New York and Lady fern all of which, are even more abundant than Broad Beech fern.

Gathering ferns for one's garden is not always as simple as might be expected. In this case I started out for a walk one Sunday afternoon, with my wife, intending to stop on the way for a few plants of *Phegopteris hexagonoptera*. We had found a fine specimen and as I was stooping to put aside the weeds and grasses growing around it, my hand evidently came in contact with a hornets' nest. The fiery insects swarmed at me and before I could beat a retreat they registered five stings. One of them made a beeline for my wife, who was some twenty feet away. She thought she had been hit by a red hot cinder, but soon realized what was up and put distance between herself and the hornets.

Not wishing to lose the fern I soon went back and strange to say, although the hornets flew about me they

Photograph by Peter Stone. Young Holly Fern, Oct. Year.

did not attack again and I obtained the fern without any more stings.

The Broad Beech fern is easily grown and no special preparation of soil was made. After planting, some compost and leaf mold was scattered in about the plants.

In the garden they have grown larger than they were in the woods and make a beautiful background for my bog garden, which was an addition made to the fern garden several years later. One of the fronds recently measured was twelve inches in length and fourteen inches wide. Including the stipe the total length was well over two feet.

The illustration shows also some plants of Braun's Holly fern (*Polystichum Braunii*). These were sent to me from Massachusetts so I am not familiar with their natural habitat, but I assumed they needed good drainage and planted them in a raised bed of stones well packed with sand and gravel mixed with a little humus and near the surface a richer mixture composed of sand, humus and peat moss. They are in a position to get a little morning sun and they seem perfectly at home as they keep in fine condition and have grown much larger than when first received in the spring of 1929.

WEST ORANGE, NEW JERSEY

A List of Tennessee Ferns

W. A. Anderson, Jr.

(Continued from Vol. 20, p. 150.)

Dennstaedtia punctilobula (Michx.) Moore

Syn. *Dicksonia punctilobula* (Michx.) Gray.

Cold Springs Knob, Greene County, June 23, 1928, Anderson and Jennison, 1137.

Near Top of Gregory's Bald, Cades Cove, Blount County, July 6, 1928, Anderson, 1378.

Foot of Gregory's Bald, Cades Cove, Blount County, June 14, 1928, Anderson, 969.

Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 947.

Mt. Le Conte, Gatlinburg, Sevier County, Oct. 2, 1927, Anderson, 610.

Elkmont, Sevier County, Aug., 1921, A. R. Bechtel.

White Cliff Springs, Monroe County, June 29, 1890, Scribner.

Frog Mountain, summit, Polk County, ————, 1878, Gattinger.

Mts. of East Tennessee, head of Piney River, Rhea County, ————, 1887, Mrs. Bennett (in Gattinger's collection).

Athyrium angustifolium (Michx.) Milde

Syn. *Asplenium angustifolium* Michx.

Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 949.

Lemon's Gap, Cocke County (4000 ft.), July 15, 1892, Ruth, 557.

Tullahooma Cataract, Coffee County, ————, 1867, Gattinger.

Near Post Oak Springs, Roane County, Maxon, Fern Bulletin, 1901.

Eagleville, Rutherford County, ————, 1893, Bain.

Athyrium acrostichoides (Sw.) Diels

Syn. *Asplenium acrostichoides* Sw.

I collected this fern at two places along the Tennessee-North Carolina state line ridge. These places were several miles apart, but both were in deciduous forest at an altitude of about 5000 ft.

Near gap on state line ridge, Gregory's Bald, Cades Cove, Blount County, July 6, 1929, Anderson, 1373.
Indian Gap Trail near state line, Gatlinburg, Sevier County, July 21, 1929, Anderson and Jennison, 1420.
Walden's Ridge, ————, Mrs. Bennett (in Gattinger's collection).
Tunnel Hill, Hamilton County, ————, 1884, Gattinger.
Missionary Ridge, Chattanooga, ————, J. H. Ferriss.

ATHYRIUM FILIX-FEMINA (L.) Roth

Syn. *Asplenium Filix-femina* (L.) Bernh.

When "The Ferns of Tennessee" was published in 1929, the specimens at hand seemed to fit *Athyrium angustum* (Willd.) Presl, according to Butters' revision, (1917), though Butters states that this species does not occur so far south. Much of the material I examined was old and the sori were not well preserved, so I based my determinations for the most part on shape of fronds and length of stipes. A number of specimens were collected during the summer of 1929 for the purpose of settling the question of the identity of the lady ferns in that region. All of these have been critically examined with the help of Mr. Weatherby, and all proved to be the form separated by Butters as *Athyrium asplenioides* (Michx.) Desv. One set of specimens collected in the balsam woods at the top of Clingman's Dome is a possible exception. The specimens of lady fern from Tennessee show a great diversity of form and habit, and it is only upon spore and indusium characters that they may be successfully separated as *A. asplenioides.*

Near Camp Jerry, Cold Spring Knob, Greene County, Tenn.-N. C. line, June 23, 1928, Anderson and Jennison, 1086.
In balsam wood near top of Clingman's Dome, Sevier County, Tenn.-N. C. line (6600 ft.), July 21, 1929, Anderson and Jennison, 1415.
Mt. Le Conte, Gatlinburg, Sevier County, Oct. 2, 1927, Anderson, 602.

Sugarland Mountain, Sevier County, Aug. 21, 1921, A. R. Bechtel.

Pinnacle Mountain, near Greenbrier, Sevier County, Oct. 9, 1927, Anderson, 689.

Near Gap on State Line Ridge, (5000 ft.) Gregory's Bald, Cades Cove, Blount County, July 6, 1929, Anderson, 1374.

Near end of Forked Ridge, Gregory's Bald, Cades Cove, Blount County (2000 ft.), July 6, 1929, Anderson, 1357.

Frog Mountain, Polk County, ————, 1878, Gattinger.

Creek west of Daysville, Cumberland County, July 14, 1929, Anderson, 1384.

Sewanee, Franklin County, Sept., 1878, Gattinger.

Tullahooma, Coffee County, June, R. Brown (in Gattinger's collection).

Richland Station, Turner County, Aug. 27, 1883, Gattinger.

Hollow Rock Junction, (now Bruceton), Carroll County, Aug. 27, 1922, Svenson, 398.

Henderson, Chester County, 1892, Bain.

Memphis, May 12, 1920, E. J. Palmer, 17,461.

Phyllitis Scolopendrium (L.) Newm.

Syn. *Scolopendrium vulgare* Sm.

The hart's tongue fern has been reported from two stations in Tennessee, Post Oak Springs, and near South Pittsburg. The first was discovered by Gattinger in 1849, but the fern has since disappeared (Maxon, Fernwort Papers, 1900). The South Pittsburg station is a famous one and has been much visited by collectors (Maxon, 1900). Graves (1930) reports that only six plants were there in 1929, so it seems likely that the fern will disappear from this place also. There is no specimen from Tennessee in Gattinger's collection, and I had no opportunity to make a trip to South Pittsburg, so it was only after I came to the Gray Herbarium that I received definite information as to the occurrence of this rare fern in Tennessee. The one specimen I have seen is from

South Pittsburg, Marion County, A. A. Eaton collection. Collected by E. L. Lee, letter dated Sept. 18, 1906.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link

Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 952.
Knoxville, Sept. 20, 1897, Ruth, 559.
Near South Pittsburg, Marion County, J. H. Ferriss, Fern Bulletin, 1899.
Near Post Oak Springs, Roane County, W. R. Maxon, Fern Bulletin, 1901.
Carter County, Aug., 1891, E. E. Gayle.
Rock Island, Van Buren County, Sept., 1871, A. R. Crandall.
Nashville, Sept., 1888, Gattinger.
Nolensville Pike, Nashville, July 8, 1922, Svenson, 68.

ASPLENIUM PINNATIFIDUM Nutt.

We searched eagerly for this rare spleenwort, but were never so fortunate as to find it. All the specimens I have seen are from the Cumberlands, and from Lookout Mountain.

Lula Falls, Lookout Mountain, Hamilton County, June 4, 1911, J. R. Churchill.
Fentress County, Nov. 21, 1882, C. Lown.
Helenwood, Scott County, Nov., 1884, C. Lown.
Cavern near South Pittsburg, Marion County, J. H. Ferriss, Fern Bulletin, 1899.

ASPLENIUM TRICHOMANES L.

Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 958.
Cades Cove, Blount County, June 15, 1928, Anderson, 1020.
Falls, Bald Creek, Cherokee National Forest, Monroe County, Oct. 21, 1928, Anderson, 1035.
Hiwassee River, Monroe County, July 3, 1892, Scribner.
Wolf Creek, Cocke County, May 9, 1893, Kearney.
Piney Falls, Rhea County, ————, 1887, Mrs. Bennett (in Gattinger's collection).
Parksville, Polk County, Aug., 1878, Gattinger.

Asplenium Trichomanes L. forma *incisum* Moore is reported from "East Tennessee" by J. H. Ferriss, Fern Bulletin, VI: 54, 1899.

Asplenium resiliens Kze.

Syn. *A. parvulum* Mart. & Gal.

Bluffs: near Knoxville, Oct. 11, 1927, Anderson, 706.
Johnson County, July 8, 1880, J. D. Smith.
Post Oak Springs, Roane County, Aug. 6, 1900, Pollard and Maxon, 414.
Cleveland, Bradley County, July 4, 1880, Gattinger.
Wolf Creek, Cocke County, Aug., 1881, Gattinger.
Fentress County, Nov. 23, 1882, C. Lown.
Rocks near Nashville, Sept., ————, Gattinger.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1055.

Asplenium platyneuron (L.) Oakes

Syn. *A. ebeneum* Ait.

The genus Asplenium is well represented in Tennessee and this one is the most conspicuous species. In numerical abundance it ranks with the Christmas fern and the brittle fern. It is not particular in its soil requirements and grows equally well in the valley and in the mountains.

Tipton's Sugar Cove, Cades Cove, Blount County, June 14, 1928, Anderson, 985.
Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 939.
Banks of French Broad River, Wolf Creek, Cocke County, Oct. 7, 1928, Anderson and Jennison, 1117.
Bluffs near Knoxville, Oct. 11, 1927, Anderson, 705.
Bird Preserve, Knoxville, Mar. 25, 1926, Jennison.
White Cliff Springs, Monroe County, June, 1890, Scribner.
Lee's Spring, Grainger County, May 17, 1927, R. G. Henderson.
On sandstone by creek, Daysville, Cumberland County, July 14, 1929, Anderson, Jennison and Hesler, 1386.
Kingston Springs, Cheatham County, June 11, 1922, Svenson, 23.
Nashville, ————, 1878, Gattinger.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1056.
Jackson, Madison County, ————, 1893, Bain.
Edgefield, Bedford County, June 8, 1883, Gattinger.

× ASPLENIUM EBENOIDES R. R. Scott

With *Asplenium platyneuron* and *Camptosorus rhizophyllus* both plentiful in the state, it was inevitable that the hybrid *Asplenium ebenoides* should be found somewhere, so we were always watching for it but were never so fortunate as to encounter it. The honor of adding this interesting plant to the state list goes to Mr. E. W. Graves, who reports it from Beersheba Springs, August, 1929. I have not seen his specimen. (See Graves, 1930.)

ASPLENIUM BRADLEYI D. C. Eaton

In the original description of this fern Eaton (1873) cites the locality as "Top of Walden's Ridge, Cumberland Mts., near Coal Creek, East Tennessee." There is a specimen in the Gray Herbarium labeled "Mts. of E. Tenn. F. H. Bradley, 1873" which is undoubtedly a part of the type collection.

Asplenium Bradleyi is a rare fern. Its range extends through the southern Appalachians and north to New York, but it is to be found only by knowing exactly where to look. My only specimen is from the sandstone cliffs of Signal Mountain, above Chattanooga. Signal Mountain is the end of Walden's Ridge, which is the first ridge of the Cumberlands on the east. *Asplenium Bradleyi* is one of those ferns which grow in the Cumberland Mountains in Tennessee but not in the Alleghany range.

The following note from *Nature*, 61: 458, 1900, doubtless accounts for the report that *Asplenium viride* had been found in Tennessee.

"Linnean Society, Feb. 15, Mr. C. B. Clarke, F. R. S., Vice President, in the chair.

"Mr. R. Morton Middleton exhibited a series of specimens of *Asplenium Bradleyi* Eaton, one of the rarer

rock ferns from Tennessee, to show its extreme variability. The simplest fronds exhibited were found in a damp, cold, perpendicular rift, which no sunshine could enter, at an elevation of about 1700 feet; these fronds had the simple pinnate structure, with green rachis, and rounded, toothed pinnae of *A. viride* Hudson, but were more coriaceous than in that species. Dr. Gattinger, author of the "Tennessee Flora," was satisfied that the plant was *A. viride;* and General Kirby Smith, who had ample opportunity for studying *A. Bradleyi* on the eastern slopes of the Cumberland Plateau remarked that *A. viride* and *A. Bradleyi* were so much alike that they might be varieties. The other plants exhibited, however, showed a gradual tendency to become more and more compound, culminating in a luxuriant specimen with pinnatifid fronds 10 inches long, the green rachis becoming purple and shining in all plants exposed to the sun's rays."

Lookout Mountain, Hamilton County, Apr. 24, 1906, T. O. Fuller.

Signal Mountain, Hamilton County, June 22, 1929, Anderson, Jennison and Hesler, 1332.

South Pittsburg, Marion County, June 12, 1892, R. M. Middleton, Jr.

Tennessee and Virginia line, ————, 1875, W. Faxon.

Helenwood, Scott County, Nov., 1884, C. Lown.

Asplenium montanum Willd.

Asplenium montanum is of frequent occurrence, though its small size and its habit of growing only in crevices of sandstone cliffs makes it rather hard to find. The finest specimens I found were near the top of the Chimneys in the Smoky Mountains. I saw it growing also underneath the ledges where the guns are placed on Lookout Mountain, but did not collect any from that locality as it is a public park.

The original description of *Asplenium montanum* gives "Habitat in altis montibus Carolinae." Sp. Pl. 5: 342.

Sinks of Little River, Elkmont, Sevier County, June 30, 1929, Anderson, 1361.
Side of Chimneys, (4500 ft.), Gatlinburg, Sevier County, Apr. 21, 1929, Anderson and Jennison, 1179.
Cliffs, trail above Alum Cave, Mt. Le Conte, Gatlinburg, Sevier County, (5000 ft.), May 18, 1929, Anderson, 1251.
Top of House Mountain, Luttrell, Union County, Apr. 27, 1929, Anderson, 1186.
White Cliff Springs, Monroe County, June 29, 1890, Scribner.
Lookout Mountain, Hamilton County, ————, 1889, Gattinger.
Sandstone cliff, 2 miles west of Daysville, Cumberland County, July 14, 1929, Anderson, Jennison and Hesler, 1384.
Helenwood, Scott County, Nov., 1884, C. Lown.
Walden's Ridge, May 18, 1906, Fuller.

ASPLENIUM CRYPTOLEPIS Fernald

Syn. *A. Ruta-muraria* of authors in pt.

Since *Asplenium cryptolepis* is a true calciphile it is found only in the limestone regions of the state, and is not found in either of the mountain ranges.

Tennessee-Virginia Line, ————, 1875, W. Faxon.
Post Oak Springs, Roane County, Aug. 6, 1900, Pollard and Maxon, 412.
Holston River below Concord, Knox County, July, 1872, W. Faxon.
Rocks along Tennessee River, Knox County, May 30, 1897, Ruth, 556.
Carter County, July, 1891, E. E. Gayle.
Nashville, Sept., 1888, Gattinger.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1057.

WOODWARDIA AREOLATA (L.) Moore

Chilhowee Flats, (3000 ft.), Blount County, Aug. 29, 1891, Beardslee and Kofoid.
White Cliff Springs, Monroe County, July, 1890, Scribner.

Hollow Rock Junction, (now Bruceton), Carroll County, Aug. 27, 1922, Svenson, 418.
Hollow Rock, Carroll County, Gattinger.
Forked Deer Bottoms, Jackson, Madison County, Sept., 1892, Bain.

Pellaea atropurpurea (L.) Link

The purple cliff brake is abundant on limestone cliffs throughout East Tennessee.

Bluffs near Knoxville, Oct. 11, 1927, Anderson, 701.
Holston River, July, 1872, W. Faxon.
South Pittsburg, Marion County, Aug. 3, 1900, Pollard and Maxon.
Johnston County, July 8, 1880, J. D. Smith.
Post Oak Springs, Roane County, Aug. 6, 1900, Pollard and Maxon, 417.
Carter County, Aug., 1891, E. E. Gayle.
Snail Shell Cave, Rutherford County, July, 1890, Bain.
Lavergne, Rutherford County, Aug. 12, 1922, Svenson, 211.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1054.
Cedar Glades near Eagleville, Rutherford County, July, 1892, Bain.

Cheilanthes alabamensis (Buckley) Kunze

Cheilanthes alabamensis grows almost within the city limits of Knoxville but I never happened to find it. I have seen a number of specimens which other people have collected there, but the only place I found it was about 300 miles west along the Duck River.

Holston River near Knoxville, July, 1872, W. Faxon.
Tennessee River near Knoxville, July 11, 1893, Kearney.
Near South Pittsburg, Marion County, J. H. Ferriss, Fern Bulletin, 1899.
Mill Creek, Nashville, Sept., 1877, Gattinger.
Clarksville, Montgomery County, May 25, 1920, Palmer 17,636.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1053.

Cheilanthes lanosa (Michx.) Watt

Along cliff by railroad, Kinzel Springs, Blount County, May 8, 1929, Anderson, 1246.

Chilhowee Mountain, Blount County, July, 1881, Gattinger.
Dandridge, Jefferson County, July, 1872, W. Faxon.
Tellico Plains, Monroe County, Aug., 1882, A. G. Wetherby.
Near Knoxville, July 17, 1904, Ruth, 567.
Near Lookout Mountain, Hamilton County, May 6, 1906, Fuller.
Carter County, July, 1891, E. E. Gayle.
Cataract at Tullahooma, Coffee County, June, 1867, Gattinger.
Mill Creek Bluff, Nashville, Sept., 1878, Gattinger.
Erin, Houston County, May 24, 1920, Palmer, 17,609.
Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1052.

CHEILANTHES TOMENTOSA Link

Cliffs on French Broad River, May, 1893, Kearney.
Ocoee Valley, Aug., 1879, Gattinger.
Base of cliff by railroad, Kinzel Springs, Blount County, May 8, 1929, Anderson, 1247.
Gorge of Tellico River, Monroe County, Aug., 1882, A. G. Wetherby.
Lookout Mountain, Hamilton County, Apr. 25, 1906, Fuller.
Parkville, Polk County, ————, Gattinger.
South Pittsburg, Marion County, June, 1892, Middleton.

(To be continued)

Botrychium dissectum from Minnesota

E. W. GRAVES

In the spring of 1930 I wrote to Prof. F. K. Butters, of the University of Minnesota, asking him if the University herbarium contained any specimens of *Botrychium dissectum* or *Botrychium obliquum*, and about how many had been found in the state. He replied that their herbarium contained no specimen of *B. dissectum*, and while it had several sheets labeled *B. obliquum*, he felt that they were not determined correctly, and that they were in reality *B. ternatum* var. *intermedium*. Prof. Butters offered to lend me the specimens for my study. I accepted the offer, and after carefully looking them over, I decided that Prof. Butters was correct in his decision.

Shortly after I had returned the University specimens. Prof. Butters wrote me that Dr. Rosendahl had returned from the field with a plant of *Botrychium dissectum*, which he had collected in Rice County, Minnesota, 5 miles east of Faribault. He stated that it was a large plant but not fruiting and entirely typical. One statement that interested me was that he saw no other Botrychiums in the vicinity. This is one more point in favor of my theory that *B. dissectum* is a valid species. I believe that the Minnesota plant grew from spores of *B. dissectum* that had been carried there, perhaps in soil on the feet of birds.

The *Botrychium dissectum* station here at Bentonsport, Iowa, that I located in 1926, containing 31 plants, has continued to thrive and produce only *B. dissectum* plants. In the four years I have had it under observation no plants of *B. obliquum* have appeared at the station. Several small plants have come up at different times but all have developed into *B. dissectum* plants.

In 1926 one plant fruited and cast its spores. In the fall of 1927 about a dozen and a half young plants appeared, and those that survived now show that they are all *B. dissectum*. I counted 48 plants late in 1927. In 1928 I counted 51 plants. In 1929 there were only 38 plants, but that was due perhaps to the fact that the station had been disturbed by children. This year, 1930, I counted only 33 plants but this has been one of the driest summers Iowa has experienced for many years. I noticed two plants drying up in August, and the drouth was perhaps responsible for the decrease in number this year.

In 1928 I made a trip to St. Louis, Missouri, and called at the herbarium of the Missouri Botanical Garden. I obtained permission of Dr. Greenman, who has charge of the herbarium, to look over the Botrychiums deposited there. I found *B. dissectum* was represented by only four sheets from west of the Mississippi River. Two sheets by H. Eggert, from St. Louis County, were collected Sept., 1887. One sheet, by G. W. Letterman, was from Allerton, Missouri, a large specimen. One sheet, by Colton Russel, from Annapolis, Mo., collected Sept., 1900, growing with ternatum. I suppose he meant *B. obliquum*, as *B. ternatum* does not usually occur this far south. This is the only station that mentions *B. dissectum* growing with *B. obliquum* west of the Mississippi River. East of the river it grows quite commonly with *B. obliquum*. There were two other sheets that were of special interest to me. One, of two specimens of *B. dissectum*, was collected by Miss Sadie Price, at Chipley, Florida, in 1896. One sheet of four specimens was by Eaton, from Cades Cove, Tennessee. Cades Cove is about twenty miles southeast of Knoxville. I made a statement in Vol. 17, page 18, that I knew of no *B. dissectum* being collected south of the 36th parallel; this is to correct that statement.

Recently I wrote to Dr. W. N. Steil, of the University of Wisconsin, asking him if *B. dissectum* grew in Wisconsin, and he replied he has never known of a single plant being found there. I have in my possession the specimens of the *B. ternatum* group from the Public Museum of Milwaukee, and I found no *B. dissectum* in the material. Strange as it may appear, *B. obliquum* is represented by only one specimen. Strange also that *B. dissectum* has not been found there. West of the Mississippi River Minnesota has one station, Iowa has one and Missouri has three. All of these stations are about the same distance west of the Mississippi River, that is, around fifty miles. As the Mississippi River bears to the east in its course southward it makes the station at Faribault, Minnesota, the farthest west of all the stations. The Missouri stations are near the 91st meridian, the Iowa station is on the 92nd, the Minnesota station is just west of the 93rd.

More than a year ago I wrote Mr. E. J. Palmer, who has done considerable collecting in the Mississippi River valley region, asking him if he had found *B. dissectum* west of the river. His reply was that he had not, but that in Illinois he had found it quite commonly, but always with *B. obliquum*.

It has always been a question with me why *B. dissectum* usually grows with *B. obliquum*.

There is a theory that has been advanced that Botrychium spores are dependent on symbiotic fungus for germination. To prove whether this theory holds good or not I have been making some experiments in sowing *B. dissectum* and *B. obliquum* spores. The first two or three years I sowed the spores without inoculating the soil, and I have failed to get them to grow. Now I am doing it differently. I sow spores of *B. dissectum* on soil inoculated from the parent station. I have also tried

sowing *B. obliquum* spores on soil from the parent station. Then I sowed *B. dissectum* spores on soil from the *B. obliquum* station and *vice versa*. The result is yet to be obtained. The idea came to me that perhaps *B. dissectum* will grow with the same bacteria from either station. It that be true then we might be able to solve the problem why *B. dissectum* and *B. obliquum* are usually found growing together. Undoubtedly neither *B. obliquum* nor *B. dissectum* grow well with *B. ternatum* var. *intermedium*, else we would find them growing in Wisconsin and Minnesota more plentifully. This will be taken up more fully in another paper I am preparing on the Botrychiums of the Mississippi River valley region.

BENTONSPORT, IOWA

Recent Fern Literature

Ching, R. C., "The Studies of Chinese Ferns—I," contribution from the Metropolitan Museum of Natural History, Academia Sinica I: p. 43–46, pl. 1–7, April, 1930.

This paper, "The Studies of Chinese Ferns—I," is published as the first of a series designed to present a record of new or little understood fern species in China. Mr. Ching describes new species in *Cyrtomium*, *Polypodium*, *Coniogramme*, *Diplazium*, *Adiantum*, *Lindsaya* and *Elaphoglossum*, and discusses a considerable number of other forms about which there has been some uncertainty of identification. He reports in addition, as footnotes, two interesting facts. First, for five years he has been engaged on a "Monograph of Chinese Ferns" which he expects to have completed in the near future. Second, he makes known that Dr. Christensen is working on the preparation of a list of the known species of Chinese ferns.

It will be interesting to recognize, when these lists are published, any possible resemblances between the fern flora of temperate northern China and our American conditions. Such publications as those indicated will also serve as the basis for further exploratory study in the field. It is certain that the hinterland of China still harbors many fern species as yet unknown to science.

Shorter Notes

AN ISLAND VARIETY OF CHEILANTHES PENINSULARIS.—A small collection of ferns from the Revillagigedo Islands was recently submitted to me for examination. It consisted for the most part of wide-ranging tropical species; but in some instances the island specimens were of interest as showing, in slight variations from the usual types, the beginnings of endemism in their isolated habitat—200 to 350 miles from the nearest point on the mainland, the tip of Lower California. In one case, of a species itself rather local, the variation had progressed so far as, I think, to justify taxonomic recognition. The plant in question is accordingly here proposed as:

CHEILANTHES PENINSULARIS Maxon, var. INSULARIS. In habit, outline and structure of the lamina like the typical form, but generally stouter. The rachis and costae bear articulate fibrils and linear-attenuate, entire scales, which arise from projecting clusters of sclerotic cells which persist as pustulate roughenings after the scale has fallen; or they are, in age, glabrate.[1]—SOCORRO ISLAND: without definite locality, *C. H. Townsend*, 1889 (U. S. Nat. Herb.); *A. W. Anthony*, March–June, 1897

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[1] CHEILANTHES PENINSULARIS, var. **insularis**, var. nov., habitu et laminae structura ambituque formae typicae simillima, sed saepius robustior, rachibus costisque paleis e basi prominulo sclerotico sicut papilla persistente lineari-attenuatis integris ornatis vel aetate glabratis.—SOCORRO ISLAND, *Mason* no. 1616, TYPUS in herb. Academiae Scientium Californianae.

(Herb. Univ. of California); on north-facing rock wall above Grayson's Cove, very dry habitat, alt. 1000 ft., May 4, 1925, *H. L. Mason*, no. 1616 (TYPE, in Herb. California Acad. Sci.).—CLARION ISLAND: just below the summits of the hills, where it is locally abundant in the brush, April 27, 1925, *Mason*, no. 1571.

The specimens from Clarion Island are much larger than those from Socorro, the fronds reaching 3 dm. in height, and the rachises are nearly glabrous. But occasional persistent fibrils and scales of the kind described above, and numerous pustulate bases of scales which have weathered off indicate that they bore an indument similar to that of the type specimens.

In typical *Ch. peninsularis* the scales of rachis and costae are linear-lanceolate with dilated, erose-serrulate bases and more or less papillate-serrulate blades. Specimens from Comondu, Lower California, collected by *Brandegee*, Feb. 6, 1889, are intermediate in their indument between typical form and variety, in some individuals approaching the latter rather closely.

The Townsend and Anthony collections here cited were determined as "near Cheilanthes Wrightii" or unqualifiedly as that species. This seems to me correctly to express their general relationship. *Ch. peninsularis* is near *Ch. Wrightii*. The latter, however, has usually a narrower (lanceolate) lamina. All but the upper pinnae are deltoid (instead of oblong-ovate, as in *Ch. peninsularis*), and the pinnules are commonly rather narrowly oblong (instead of oblong-ovate). Rachis and costae are usually glabrous; in the infrequent cases where they bear a sparse paleaceous indument, its scales are smaller, more delicate, and smaller-celled than in *Ch. peninsularis*.—C. A. WEATHERBY, *Gray Herbarium*.

FIREWORKS FROM A "FERN."—It has long been a matter of general knowledge to the writer that Lycopodium spores can be used as fireworks material, but it is only

recently that an actual test of this fact has been made in the field. Very possibly it is familiar to many readers of the FERN JOURNAL, but on the chance that there may be others who have not tried it, this note is published.

On a recent trip near Greenwood Lake, N. Y., colonies of fruiting Lycopodiums (*L. obscurum*, *L. complanatum*, *L. clavatum*), were found near Cedar Pond, one of the northern localities for the southern white cedar. The fruiting spikes were in a condition to discharge their spores at a slight touch. When a burning match was held in readiness the spores ignited with a little puff.

Later, in the city, an ounce of *Lycopodium* spores was purchased at a drug store and a material was used for an entertainment demonstration at the start of a general science class period. Apparently a definite condition of suspension in the air is necessary for the flashing effect. When a match was held to a small quantity of the spore powder on a stone window ledge, nothing happened; when a small quantity of the powder was placed on a thin copper plate and heated over a Bunsen burner the spores scorched and blackened but did not flash. When, however, a pinch was dropped into the flame of a burning match, an instant pyrotechnic display was obtained.

The material was of special interest to the chemistry teacher of the department as being more suitable for demonstrations of the explosive quality of dust than the ordinary substances used in this connection. Any one interested to try it is cautioned against using too much at a time. It seems entirely likely that a dangerous explosion might be produced if a considerable quantity were released in the air of a room.

WHAT FERNS MAY BE WEEDS?—Some years ago, in the course of a lecture on ferns delivered in Boston, I made a statement to the effect that ferns are retiring; the denizens of the wild, and not happy under conditions of

cultivation; that one never finds ferns as weeds. The statement was challenged at the close of the talk by someone who reported the marsh fern as a real pest in cranberry culture. References have also been made in government publications to the common brake as sometimes troublesome, especially in pasture land. The following quotation regarding weeds in the State of Washington is another case in point. Readers are asked to report any other significant instances of the ferns as trouble-makers. Do they ever invade ploughed land? The quotation is another illustration of the well-known fact that most trouble in the weed line is due to immigrant plants just as most difficulty with animals is likewise concerned with foreign types.

NATIVE WEEDS.[1]—"After the removal of the forests only a few of the native species persisted as troublesome weeds in the clearings. Even some of these are species accustomed to the open places along the banks of streams or shores of lakes where trees were absent on account of the periodic fluctuation of the water level and erosion. The common brake fern, *Pteridium aquilinum* var. *pubescens* Underw., was the most troublesome pest on newly cleared uplands. Under thorough cultivation, or with persistent efforts to eradicate it, the brake fern usually survived only a few years but in some pastures and grasslands, it has survived for twenty years or more. In some neglected logged-off pasture lands it has even spread. In the lowlands, especially in sandy soil, the common field horsetail, *Equisetum arvense* L., became very abundant, especially in meadows where it is even now a bad pest in many places. *Equisetum telmateia* Ehrh. was frequently troublesome, especially in poorly

[1] Muenscher, W. C., "Some Changes in the Weed Flora of Whatcom County, Washington." Torreya **30**: 13–134. Sept.–Oct., 1930.

drained pastures. On recently burned over stump lands and newly cleared land, the fireweed, *Epilobium angustifolium* L., frequently persisted for several years on the uplands, while on the lowlands, *Epilobium adenocaulon* Haussk. was a common pest in pastures, meadows and grainfields. Neither of these weeds persisted long under cultivation."—R. C. B.

American Fern Society

The following letter, received some time ago from Dr. Kestner, but crowded out of the preceding number of the JOURNAL, should be of interest to our members, and attention is called to his desiderata.

In the April–June number, 1929, of the JOURNAL you were kind enough to insert a letter in which I appealed for spores from American rock ferns. The courteous response from members of the Society has been more than I could have expected, and thanks to their kindness I have obtained spores from almost every hardy rock fern in the United States. I have thanked the various correspondents direct and wish to renew my thanks again, also to assure those who have asked for spores and ferns from me that what I have been unable to send last year shall be sent this year with the exception of some ferns it will possibly take me longer to get hold of.

Even the rare Appalachian Aspleniums have all been sent, with the exception of no. 13 mentioned in Dr. E. T. Wherry's paper in the JOURNAL of April–June, 1925.

I am glad to say I have succeeded so far with all sowings save *Asplenium Trudelli*, which I have received from both Dr. Wherry and Mr. E. W. Graves . . . and *A. cryptolepis*. No spores of either have germinated. . . .

Dr. Wherry has sent me spores from *Woodsia scopulina* gathered in the Appalachians, which he suggested might be distinct from *W. scopulina* from the West.

Unfortunately, I have obtained only a few prothallia and they are not in a healthy condition. They have not so far produced fronds and I have but little hope that they will survive. From the western *W. scopulina* I have received no spores.

With the exceptions mentioned above most of my sowings are healthy and I have been engaged for some time, and still am engaged, in planting the sporelings on the walls I have had prepared for them.

As I am in a region of calcareous soil, I have had a brick construction made, with non-calcareous soil as a mortar and the same soil behind the walls. All is watered from a neighboring roof. This for calciphobe ferns.

There is no real difficulty in raising prothallia and sporelings of alpine rock ferns, provided you can dispose of some time every day. The difficulty arises afterwards when one has to find the appropriate way for letting them grow under conditions similar to those they find in nature.

All my sowings were made last December in the greenhouse at about 20° Centigrade. As it generally takes about 5 to 6 months for sporelings to form, this means that they can be planted direct as sporelings on the wall, starting at the end of May, when there is sufficient heat to prevent a check in growth. They can then go on developing until the first frond appears. Planting them first in pots precludes their being put afterwards in a wall, as they very rapidly develop an extensive root system which must not be disturbed.

In nature they appear to hibernate as prothallia after the spores have germinated late in the season. There is not, I believe, much chance of success to be expected by any one trying to imitate this and it is probable the method with which I am experimenting is the best.

To sum up: the following are the ferns of which I still should be pleased to obtain spores.

1. *Asplenium Trudelli.*
2. *Asplenium cryptolepis.*
3. *Woodsia scopulina* from the Appalachians.
4. *Woodsia scopulina* from the West.
5. No. 13 of Dr. Wherry's Appalachian Aspleniums.
6. If possible also more spores of *Asplenium ebenoides.* Those I have received from Dr. Wherry from Alabama and Mr. Graves from Tennessee have both germinated fairly well, but they are not as healthy as I wish them to be and are late in producing fronds, which all other Aspleniums have started 2 months ago.
7. In Mr. Tilton's *Fern Lover's Companion* the plate on page 80 shows fronds of *Asplenium ebenoides* from Maryland which much differs from those from other sources. Owing to their irregularity they look much more like hybrids than the others. Would it be possible for any members of the Society to send me fronds from Maryland? I mean fronds with ripe sori.

I may add that Dr. Wherry's research work on soil reaction is considerably facilitating my work, and he must be thanked by all who are trying to cultivate rock ferns.—PAUL KESTNER, *Aug. 14, 1930.*

Report of the Judge of Elections for 1930

As Judge of Elections of the American Fern Society I report that 110 ballots were cast, and the following officers unanimously elected:

President, William R. Maxon.
Vice-President, Mrs. Carlotta C. Hall.
Secretary, Charles S. Lewis.
Treasurer, J. G. Underwood.

NATALIE B. KIMBER

I hereby certify that the above is a correct copy of the report of the Judge of Elections.

CHARLES S. LEWIS, *Secretary*

Mr. Harold G. Rugg, Hanover, New Hampshire, wishes to obtain living plants of the following species: *Cystopteris montana*, *Asplenium Adiantum-nigrum*, *Adiantum modestum*, *A. rimicola*, *Polystichum Lemmoni*, and *P. scopulinum*.

Mr. F. G. Floyd, Sierra Madre, California, offers specimens of *Pityrogramma triangularis*, so long as the supply lasts, to members who will send him ten cents in stamps.

Miss Alice W. Wilcox, 154 South Euclid Ave., Pasadena, California, wishes to get into communication with any members who would like to increase their collections of pressed ferns by exchange.

Mr. J. William Thompson, Cleveland High School, Seattle, Washington, wishes to exchange pteridophytes of Washington for those of other parts of the world.

Through an oversight which we greatly regret, we failed to state in the preceding number of the JOURNAL that the excellent photographs employed to illustrate the report of the field meeting at Willoughby Lake were by Mr. A. T. Beals, of New York City, and were used by his kind permission. Our apologies are tendered Mr. Beals, and with them not only our thanks, none the less sincere though belated, but, we are sure, those of every reader of the JOURNAL.

Our best thanks are due also to Mr. W. Herbert Dole, who has not only contributed the three photographs accompanying his article in this number, but has generously paid for their reproduction.

New members:

Bell, Mrs. John, Box 956, Winter Park, Florida.
Cameron, Charles, Tauranga, New Zealand.
Catheart, W. H., 10700 Euclid Ave., Cleveland, Ohio.
Elwart, Max A., 317 East 90th St., New York City.

Hudson, Charles, Garfield Park Conservatory, Chicago, Ill.
James, Mrs. E. H., Box 583, Oswego, Oregon.
Miner, Mrs. John L., 1 Maher Court, Greenwich, Connecticut.
Nicholson, Miss Zaida, 43 East 27th St., New York City.
Starker, Carl, Jennings Lodge, Oregon.
Tanger, Mrs. Charles Y., 318 North President Ave., Lancaster, Pennsylvania.
Toole, W. A., Baraboo, Wisconsin.
Tracy, H. H., Fullerton Union High School and Junior College, Fullerton, California.

Changes of address:

Baker, Prof. H. R., State Board of Agriculture, Dover, Delaware.
Birger, Dr. Selim, Jarlsgratan 27, Stockholm, Sweden.
Burgin, Dr. Herman, 212 High St., Germantown, Pa.
Choate, Miss Alice D., 5002 Waterman Ave., St. Louis, Mo.
Cornman, Mrs. Leighton R., 210 Sea Vale St., Chula Vista, California.
Dowell, Dr. Philip, Port Richmond, Staten Island, New York.
Gaylord, Mrs. Ilsien Natalie, 2208 Lowena Drive, Long Beach, California.
Hall, Mrs. Carlotta C., Carnegie Laboratory, Stanford University, California.
Halsey, Miss Alice, 29 East 29th St., New York City.
Lee, Miss Eva M., Lynwood, Crofton Lane, Orpington, Kent, England.
Little, Elbert L., Southwestern Teachers' College, Weatherford, Oklahoma.
Mohr, Charles E., Bucknell University, Lewisburg, Pennsylvania.
Thompson, J. W., Cleveland High School, Seattle, Washington.
Wilcox, Miss Alice W., 154 South Euclid Ave., Pasadena, California.

Mr. E. H. Clarkson, 41 Tyng St., Newburyport, Mass., has for sale a complete set of the *Fern Bulletin*, in excellent condition. Anyone interested should communicate with him.

Fern Books to Lend

On September 13, 1930, a package containing the official reserve files of the AMERICAN FERN JOURNAL, together with the other publications belonging to the American Fern Society, was opened by Mr. Calvin Foss, Librarian of the Brooklyn Botanic Garden, the contents were checked, and formally receipted for, according to the list which had been sent by Mr. Lewis, the Society Secretary. On the same day, note was taken of a request for the loan of volumes 1–18 of the FERN JOURNAL, made by a member of the Society through the library of an Illinois town. In other words, with the establishment of the Society library at the Garden, the loan feature, which is part of the agreement, began to function.

It is the purpose of this note to make official record of the new arrangement. Accordingly, there are published below the following items: (1) the list of the Fern Society library, including the back file of the British Fern Gazette. This was purchased about a year ago as the first addition authorized by the Council, according to a plan by which the Fern Society is to allot a budget allowance of twenty-five dollars per year for this purpose; (2) the text of the agreement between the Brooklyn Botanic Garden and the American Fern Society; (3) a list of the fern titles in the library of the Brooklyn Botanic Garden.

LIST OF BOOKS AND PAMPHLETS BELONGING TO THE AMERICAN FERN SOCIETY AND NOW TRANSFERRED TO THE BOTANIC GARDEN LIBRARY AT THE BROOKLYN BOTANIC GARDEN; UNDER THE TERMS OF THE AGREEMENT BETWEEN THE GARDEN AND THE FERN SOCIETY

Abstracts of Reports of Meetings; British Pteridological Society; 1894–1905.

British Fern Gazette, vol. 1–4; 1909–1920.

American Fern Journal, Lending Set; six vols.; covering eighteen years and marked vols. 1–18.

The Fern Bulletin, five bound vols., including Vols. 7–20 inclusive.

Christensen: Review of the American Species of *Dryopteris* of the Group *D. opposita.*

Monograph of the Genus *Dryopteris.* Part 1.

de Kerville, Gadeau: Notes sur les Fougères; 2 vols., 1–5.

Considerations et Recherches expérimentales sur la Direction des Racines et des Tiges.

Dobbie: New Zealand Ferns.

Maxon, Wm. R.: Report upon a Collection of Ferns from Tahiti.

Notes Ptéridologiques, Fascicules xiv, xv, and xvi. Prince Bonaparte.

Philippine Journal of Science, unbound: Vols. 40, 41, 42 (four numbers each) and Vol. 43, No. 1.

26th and 27th Annual Reports of the Bureau of Science of the Philippine Islands.

Summarized Proceedings of the American Association for the Advancement of Science for 1921–1925.

Reprints by various authors, listed separately, as follows:

Benedict: A Peculiar Habitat for *Camptosorus.*

Some Horticultural Fern Variations.

Ferns as house plants. (Leaflet.)

Ferns as house plants. (Report of lecture.)

Game Laws for ferns and wild flowers.

Conservation of beauty.

Evolution as illustrated by ferns.

Wild plant conservation in Connecticut, a suburban state.

How shall we save rare species from extinction?

The plant wards of New York State.

Is the distribution and naturalization of the hart's tongue scientifically defensible?

The origin of new varieties of Nephrolepis by orthogenetic saltation: I. Progressive variations; II. Regressive variation or reversion from the primary and secondary sports of bostoniensis.

New bud sports in Nephrolepis.

Variation among the sporelings of a fertile sport of the Boston fern.

Tropical Ferns.

Brick: Pteridophyten, 1911, 1921.

Christensen: Filices Esquirolinanae.
Filices Purdomianae.
Dryopteris nova brasiliensis.
On *Stigmatopteris*, a new genus of ferns with a review of the species.
Two new bipinnatifid species of *Alsophila*.
Four new ferns.
New Ferns from Brazil.
Some species of Ferns collected by Dr. Carl Skottsberg in Temperate South America.
Maxonia, a new Genus of Tropical American Ferns.
New Ferns from Madagascar.
Revideret Liste over danske Pteridofyter.
On the American Species of *Leptochilus* Sect. *Bolbitis*.
Hopkins: New Varieties of Common Ferns.
Maxon: Further Notes on Hispianola Ferns.
Lip Ferns of Southwestern United States related to *Cheilanthes myriophylla*.
New Name for *Kaulfussia* Blume, a genus of *Marattiaceous* Ferns.
Waters: Analytical Key to ferns of Northeastern United States based on stipes.

The list of the Fern Society is notable for its limited scope. Chiefly, there has been frequent call for the set of Fern Journals and the partial set of Fern Bulletins. Perhaps the British Fern Gazette may also be of special interest to our members. It is to be most earnestly hoped that the Fern Society library may grow rapidly in numbers of volumes and in service to the members. The Fern Bulletin set should be completed, and the loan set of the British Fern Gazette brought up to date. In addition, may we not hope to have added to our library collections of the fern writings of the members as nearly complete as possible, together with such other miscellaneous articles on ferns as may be available? The writer of this note is taking steps to bring together as many of his articles as can be located at this time. This is an open request to other members who have written

special articles or popular fern books. Furthermore, if any members happen to have duplicate copies of common fern books, will they not donate them to our library?

With reference to the Fern Society library list, it should be noted that the Philippine Journal of Science, the Annual Reports of the Bureau of Science, of the Philippine Islands, and the Proceedings of the American Association for the Advancement of Science for 1921–1925 are general in character. The Christensen publications on Dryopteris are exhaustive, technical treatments of this genus, dealing mainly with the scores of species of the American tropics. The de Kerville "Notes" detail numerous experiments in which ferns served as the physiological material.

AGREEMENT

between

Brooklyn Botanic Garden

and

The American Fern Society

Concerning the Deposition of the Library of the Fern Society at the Botanic Garden.

WHEREAS, the American Fern Society wishes to make the contents of its library readily accessible to all students of ferns; and

WHEREAS, the Brooklyn Botanic Garden desires to cooperate in this object; and

WHEREAS, Dr. Ralph C. Benedict, Resident Investigator at the Botanic Garden, is an officer of the Fern Society, as Editor of the *American Fern Journal*, official organ of the Society, the over copies of which are now deposited at the Brooklyn Botanic Garden in accordance with the terms of an *Agreement* between the Society and the Botanic Garden, dated January 15, 1927;

It is hereby mutually agreed as follows:

1. The American Fern Society will deposit its library, comprising books, pamphlets, and periodicals received by it in exchange for the *American Fern Journal* or otherwise, at the Brooklyn

Botanic Garden, and the Botanic Garden will receive the same, and subsequent additions to the collection initially transferred, for deposit on the shelves of the Botanic Garden Library.

2. At the time of sending its library to the Botanic Garden, the Society will give the Garden, in duplicate, a full and complete list of every publication which it sends, and the Garden will sign and return one copy of this list as acknowledgment for what it receives.

3. The Society's library is to be administered as a reference library under the same regulations that govern the Botanic Garden Library as a whole, and shall be freely accessible to the Society's members, to the staff of the Botanic Garden, and to the general public, in harmony with such regulations as may be in force or adopted from time to time by the Botanic Garden authorities, concerning hours and days of opening and closing the Laboratory Building of the Garden, and access thereto and to its various rooms.

4. *a*. The publications belonging to the Society's Library will not be available for use outside the Laboratory Building except by loan to some other library, scientific institution, or school, or to the Fern Society through its officially designated representatives.

b. In general, all loans are to be for a period not to exceed two weeks, unless special arrangement for renewal is mutually agreed upon by the Botanic Garden and the borrower.

c. The borrower shall pay all costs of transportation both ways, including sufficient insurance to represent replacement value of the publication.

5. The Botanic Garden agrees to give to the books and other publications of the Society, deposited with it, similar supervision to that given to its own Library, and the Society hereby absolves the Botanic Garden from all responsibility for loss or damage to said deposited books and other publications from any cause whatsoever.

6. The books and other publications deposited are to remain the property of the American Fern Society.

7. Either party will give the other not less than one year's notice of its desire and intention to terminate and cancel this agreement.

8. The American Fern Society will remove all of the publications constituting its library and all records and papers related thereto from the Laboratory Building and property of the Brook-

lyn Botanic Garden within not less than one year after notice from the Botanic Garden of its desire to terminate and cancel this agreement, and the Botanic Garden will permit the removal of said publications and records within one year of notice from the American Fern Society of its desire to remove them and cancel this agreement.

For the Brooklyn Botanic Garden
(Signed) C. STUART GAGER,
Director

For the American Fern Society
(Signed) WILLIAM R. MAXON,
President

Brooklyn, New York,
April 21, 1930.

With reference to the terms of the agreement, attention is directed particularly to Section "4a," in which it is stated that loans will be made only to "some other library, scientific institution, or school, or to the Fern Society through its officially designated representative." This section may at first seem to make more difficult the borrowing by Fern Society members of the books of the Society library. The stipulation regarding the institutional character of borrowers to be recognized by the Brooklyn Botanic Garden was necessary to bring the Society library under the established regulations of the Garden and unify the treatment of all volumes. However, it may be noted that there is included as among the organizations to whom books may be loaned, the "American Fern Society, through its officially designated representative." When it is difficult for a member to arrange to borrow through any local public library or institution, application may be made directly to the writer of this account or to some other member who may be designated for this duty who will then arrange the loan as through the Fern Society.

Attention is also directed to section "4c" which states that "The borrower shall pay all costs of transportation

both ways, including sufficient insurance to represent replacement value of the publication." As an illustration of the application of this rule, it may be noted that the cost of carrying charges and insurance for the eighteen volumes, recently sent to Illinois, amounted to approximately $1.90 (ninety-five cents each way). The present valuation was set at $25.00; the weight was fourteen pounds.

In any case, when members apply for loans of books, whether through public library or through the Fern Society, it is requested that the name of the member for whom the volume is requested be included in the request.

FERN TITLES IN THE LIBRARY OF THE BROOKLYN BOTANIC GARDEN[1]

*AIKEN, WALTER H.

Catalogue of the ferns and flowering plants of Cincinnati, Ohio, and vicinity. 1911. (Lloyd library. Bulletin no. 15.)

†ATKINSON, GEORGE FRANCIS.

Study of the biology of ferns by the collodion method for advanced and collegiate students. N. Y., Macmillan, 1894. 134 p. il. (Includes bibliography.)

†BAUER, FRANCIS.

Genera filicum; or illustrations of the ferns, and other allied genera; from the original colored drawings of the late Francis Bauer; with additions and descriptive letter press by Sir William Jackson Hooker. Lond., Bohn, 1842. 120 pl.

†BEDDOME, R. H.

Handbook to the ferns of British India, Ceylon and the Malay peninsula, with supplement. Calcutta, Thacker, 1892. 500 + 110 p. il.

*BENEDICT, RALPH CURTISS.

Evolution as illustrated by ferns. 1922. (Brooklyn Botanic Garden. Leaflets, ser. 10, no. 3.)

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[1] An asterisk indicates popular works; a dagger, more technical treatments.

*———————. [Same.] (Brooklyn Botanic Garden. Leaflets, ser. 17, no. 6–7.) 1929.

*———————. Ferns as house plants. 1922. (Brooklyn Botanic Garden. Leaflets, ser. 10, nos. 9–10.)

*———————. Tropical ferns. 1921. (In Horticulture. v. 34, no. 6, p. 135.)

*BIRKENHEAD, J.

Ferns and fern culture . . . selection of ferns . . . insect pests and their eradication. 2d ed. Manchester, pref. 1897. 128 p. il.

†BONAPARTE, ROLAND.

Filicales et Lycopodiales de la Nouvelle Calédonie et des îles Loyalty. Wiesbaden, Kreidels, 1914. p. 35–36. il.

†———————. Notes ptéridologiques. Paris-Copenhagen, 1915–1925.

pts. 1–5, 1915–1917

pts. 12–13, 1920–1921

pt. 16, 1925

†BOWER, FREDERICK ORPEN.

The Ferns (Filicales) treated comparatively with a view to their natural classification. Cambridge, Univ. pr., 1923–28. (Cambridge botanical handbooks.) v. 1–3.

*BRADBURY, HENRY.

Nature printed ferns [illustrated plates].

*BRITTEN, JAMES.

European ferns; with colored illustrations from nature by D. Blair. N. Y., Cassell, Petter, Galpin & Co., n. d. 196 p.

†BRITTON, E. G. and TAYLOR, ALEXANDRINA.

Life history of Vittaria lineata. (In Torrey Botanical Club. Memoirs. v. 8, p. 185–211.)

†CAMPBELL, DOUGLAS HOUGHTON.

The development of the ostrich fern. 1887. (Boston Society of Natural History. Memoirs. v. 4, no. 2.)

†———————. The Eusporangiatae; the comparative morphology of the Ophioglossaceae and Marattiaceae. 1911. (Carnegie Institution of Washington. Publ. no. 140.)

†———————. The structure and development of mosses and ferns: Archegoniatae. London, 1895. il.

———————. [Same.] 2d ed. New York, 1913.

†CHRIST, H.

Die Farnkräuter der Schweiz. Bern, 1900. (Beiträge zur Kryptogamenflora der Schweiz. v. 1, pt. 2.)

†CHRISTENSEN, CARL.

Index filicum; sive, Enumeratio omnium generum specierumque filicum . . . ad finem anni 1905 descriptorum. . . . Hafniae, 1906.

*CLUTE, WILLARD NELSON.

The fern allies of North America north of Mexico. N. Y., Stokes [1905]. 278 p. il. pl.

*———. Our ferns in their haunts; a guide to all the native species. N. Y., Stokes [c. 1901]. 332 p. il.

†CONARD, HENRY SHOEMAKER.

The structure and life-history of the hay-scented fern. 1908. (Carnegie Institution of Washington. Publ. no. 94.)

*COOKE, M. C.

Fern book for everybody, containing all the British ferns, with the foreign species suitable for a fernery. N. Y., Warne, n. d. 124 p. pl.

†DE BARY, H. A.

Comparative anatomy of the vegetative organs of the phanerogams and ferns; tr. and annotated by F. O. Bower and D. H. Scott. Oxford, Clarendon pr. 1884. Illus.

*DODGE, RAYNAL.

Ferns and fern allies of New England. Binghamton, Clute, 1896. 51 p.

†DOMIN, KAREL.

Hybrids and garden forms of the genus Pityrogramma (Link). Praha, 1929. 80 p. pl.

*DRUERY, CHARLES T.

British ferns and their varieties. N. Y., Dutton, n. d. 458 p. il. pl.

*DURAND, HERBERT.

Field book of common ferns. N. Y., Putnam's, 1928. 219 p. il.

*———. Wild flowers and ferns in their homes and in our gardens. New ed. rev. & enl. N. Y., Putnam's, 1925. 394 p. il.

*EATON, DANIEL CADY.

Beautiful ferns from original water-color drawings after nature, by C. E. Faxon and J. H. Emerton; descriptive text by D. C. Eaton. Boston, Estes & Lauriat, 1882. 158 p. pl.

*————————. The ferns of North America: colored figures and descriptions, with synonymy and geographical distribution of the ferns. . . . Salem [v. 1] Boston [v. 2], 1879–80. 2 v. pl.

*————————. Systematic fern-list; a classified list of the known ferns of the U. S. of America, with the geographical range of the species. 1st ed. New Haven, Tuttle, 1880. 12 p.

†FARWELL, OLIVER ATKINS.

Fern notes. 1916.

*FLYNN, NELLIE F.

Flora of Burlington and vicinity: a list of the fern and seed plants growing without cultivation. Burlington, 1911. (Contributions to the flora of Vermont, no. 9.)

*GILBERT, BENJAMIN D.

Working list of North American pteridophytes (north of Mexico), together with descriptions of a number of varieties not heretofore published. Utica, N. Y., 1901. 40 p.

†GREVILLE, R. K. and HOOKER, W. J.

Enumeratio filicum. n. d. 44 p.

†HANDEL-MAZZETTI, HEINRICH.

Pteridophyta. 1929. (Handel-Mazzetti, H. Symbolae Sinicae . . . teil 6.)

*HOOKER, W. JACKSON.

Garden ferns; or, Colored figures and descriptions, with the needful analyses of the fructification and venation of a selection of exotic ferns. . . . Lond., Lovell, Reeve, 1862. pl.

†————. Species filicum; being descriptions of the known ferns. . . . Lond., Pamplin, 1846–64. 5 vols. pl.

†———— and BAKER, J. G.

Synopsis filicum; or, A synopsis of all known ferns. . . . Lond., Hardwicke, 1868. 482 p. col. pl. (1st ed.)

†————. [Same. 2d ed.] Lond., Hardwicke, 1874. 559 p. pl.

†———— and GREVILLE, R. K.

Icones filicum; figures and descriptions of ferns. Lond., Treuttel, and Würtz, 1831. 2 vols. pl.

*HOPKINS, LEWIS S.

The Ferns of Allegheny county, Penn., their haunts and habits and something of their folklore. Pittsburgh, 1914. 130 p. pl.

†KERVILLE, HENRI GADEAU DE.

Considerations et recherches expérimentales sur la direction des racines et des tiges. Paris, Bailliere, 1917. 157 p. pl.

†———. Notes sur les fougères. Rouen, Leclerf fils, 1915–17. 2 pts.

*KEW, ENGLAND. Royal botanic gardens.

Hand-list of ferns and fern allies cultivated in the royal botanic gardens. 2d ed. Lond., Darling, 1906. 183 p.

*KNOBEL, EDWARD.

Ferns and evergreens of New England. Bost., Whidden, 1895. 11 pl.

*LINNAEAN FERN CHAPTER.

Fernwort papers, presented at a meeting of fern students, held in New York City, June 27, 1900, under the auspices of the Linnaean fern chapter. Binghamton, N. Y., Clute, 1900.

*———. Papers presented at the Boston meeting . . . August 24, 1898. Binghamton, N. Y., Clute, 1899.

*LOWE, E. J.

Fern growing; fifty years' experience in crossing and cultivation. N. Y., Truslove & Comba, 1898. 196 p. il.

*———. Ferns; British and exotic. Lond., Bell & Daldy, 1872. 8 vols.

*———. A natural history of new and rare ferns. Lond., Bell, 1871. 192 p.

*———. Our native ferns; or, A history of the British species and their varieties. Lond., Groombridge, 1865–67. 2 vols. il. pl.

†MARTENS, MARTIN and GALEOTTI, H. G.

Mémoire sur les fougères du Mexique . . . (Reprint from Mém. Acad. Roy. Bruxelles vol. xv. 99 p. il.)

*MAXON, WILLIAM RALPH.

Ferns as a hobby. [Washington, D. C., 1925] il. (National Geographic Magazine 47: 541–86. May, 1925.)

†———. Studies of tropical American ferns. No. 6. (Contributions from the U. S. National Herbarium, v. 17, pt. 7.) Wash., Govt. pr. office, 1916.

†METTENIUS, G.

Über einige Farngattungen. I. Polypodium. Frankfurt, Brönner, 1857. 138 p.

†MEYEN, F. J. F.

Beiträge zur kenntniss der Azollen. 1836. pp. 507–524.

*MOORE, THOMAS.

British ferns and their allies; an abridgment of the popular history of British ferns, club-mosses, pepperworts, and horsetails. N. Y., Routledge, n. d. 187 p. il.

*————. Nature-printed British ferns. Lond., Bradbury & Evans, 1863. 2 vols. pl.

*PARSONS, FRANCES THEODORA.

How to know the ferns; a guide to the names, haunts and habits of our common ferns. N. Y., Scribner's, 1899. 215 p. il.

*PLUES, MARGARET.

Rambles in search of flowerless plants. Lond., Houlston, 1864. 316 p. il.

*PORTER, THOMAS CONRAD.

Catalogue of the Bryophyta (hepatics, anthocerotes and mosses) and pteridophyta (ferns and fern-allies) found in Pennsylvania. Boston, 1904. 66 p.

†POSTHUMUS, OENE.

Ferns of Surinam and of French and British Guiana. Malang, Java, N. V. Jahn, 1928. 196 p.

*PRATT, ANNE.

Ferns of Great Britain, and their allies; the club-mosses, pepperworts, and horsetails. London, Warne, n. d. 174 p. il. pl.

*ROBINSON, JOHN.

Ferns in their homes and ours. 5th ed. Bost., Whidden, 1894. 178 p. il.

†ROBINSON, WINIFRED J.

Taxonomic study of the pteridophyta of the Hawaiian islands. 1912.

†ROVIROSA, INGENIERO J. N.

Pteridografia del sur de Mexico, ó sea clasificación y descripción de los helechos de esta región. . . . Mexico, Escalante 1909. 298 p. 70 pl.

*SCHNEIDER, GEORGE.

Book of choice ferns for the garden, conservatory, and stove. Lond., Gill, 1892–94. 3 vols. il. pl.

*SIM, THOMAS R.
The ferns of South Africa, containing descriptions and figures of the ferns and fern allies of South Africa. 2d ed. Cambridge, Univ. pr., 1915. pl.

*SLOSSON, MARGARET.
How ferns grow. N. Y., Holt, 1906. 152 p. il.

*SMALL, JOHN K.
Ferns of Royal Palm Hammock; descriptions and illustrations of the ferns and fern-allies growing naturally in Royal Palm Hammock and the adjacent Everglades. N. Y., publ. by author, 1918. 38 p. il.

*———. Ferns of tropical Florida, being descriptions of and notes on the ferns and fern-allies growing naturally on the Everglade Keys and Florida Keys. N. Y., 1918. 80 p. il.

*SMITH, J.
Ferns, British and foreign; the history, organography, classification, and enumeration of the species of garden ferns. . . . New & enl. ed. Lond., Hardwicke & Bogue, 1877. 450 p. il.

*TIDESTROM, IVAR.
Elysium Marianum; ferns and fern allies. 2d ed. Wash., 1907. 95 p. pl.

*TILTON, GEORGE HENRY.
The Fern lover's companion; a guide for the northeastern states and Canada. Melrose, Mass., 1922. 240 p. il.

†UNDERWOOD, L. M.
Our native ferns and their allies, with synoptical descriptions of the American pteridophyta north of Mexico. 4th ed. rev. N. Y., Holt, 1893. 156 p.

†———. [Same.] 6th ed. 1900.

†———. Review of the genera of ferns proposed prior to 1832. (In Torrey bot. club. Memoirs. v. 6, no. 4.)

*WATERS, CAMPBELL E.
Ferns; a manual for the northeastern states, with analytical keys based on the stalks and on the fructification. N. Y., Holt, 1903. 362 p. il. pl.

*WILLIAMS, BENJAMIN SAMUEL.
Select ferns and lycopods: British and exotic. Lond., 1873. 353 p. il.

†WILLIS, JOHN CHRISTOPHER.
A manual and dictionary of the flowering plants and ferns. Cambridge, 1897. 2 v.

*WOOLSON, G. A.
Ferns, and how to grow them. N. Y., Doubleday, Page, 1914. 156 p. il.
*WRIGHT, MABEL OSGOOD.
Flowers and ferns in their haunts. N. Y., Macmillan, 1901. 338 p. il. pl.
*YATES, LORENZO G.
Ferns of Ceylon. Santa Barbara, Yates, 1887. 33 p.
†———. Notes on Hawaiian ferns, compiled from the works of Hooker, Baker, Bailey and others. Santa Barbara, Yates, 1887. 15 p.

The Botanic Garden library includes nearly ninety titles, with a wide range of popular and technical works on ferns. It is to be emphasized that in addition to the limited list of the American Fern Society library, it is possible to borrow directly from the library of the Botanic Garden, according to the terms of the agreement, that is by loan through some public library, or other public institution. Practically all the Garden list is available for loan, with a few exceptions in the case of larger and rarer volumes, like Eaton's "The ferns of North America," and some others that may be rather frequently referred to at the Garden.

In the list above, an attempt has been made to designate books as popular or technical by using an asterisk for the first and a dagger for the second. In addition to serving as a possible borrowing list, it may also be of suggestive value to members interested in building up their own libraries. Dealers in second hand books can probably obtain almost any title listed, if commissioned to do so. It may be noted that the popular books of English authorship are primarily interested in ferns as possible garden plants. For those planning a European trip, and anxious to study the ferns of the regions visited, the Britten volume is the most recent and general.

Many of the volumes listed are of very considerable interest, either because of their historical value, their special distinction in illustration and text, or because of their authoritative character. Space does not permit here of further comment, but some may be singled out in the future for special consideration and description. As additional titles of interest are added, notice will be taken in the JOURNAL.

RALPH C. BENEDICT

Vol. 21 April-June, 1931 No. 2

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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.

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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 R. C. Benedict at 1819 Dorchester Road, or Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn, N. Y.

Orders for back numbers should be sent to the Secretary of the Brooklyn Botanic Garden, Brooklyn, N. Y. Other business communications should be addressed to E. J. WINSLOW, Auburndale, Mass.

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. 21 APRIL–JUNE, 1931 No. 2

Notes on Xerophytic Ferns*

F. L. PICKETT

The material given in the following paper has been collected through some seventeen years of work with various xerophytic ferns. There is in this presentation very little that is actually new. It is rather an attempt to bring together related information collected through this period of years and to add to that some final findings and general considerations.

By most students of ferns, the prothallia have been thought of as very delicate structures readily succumbing to drought, extremes of temperatures and other unsatisfactory conditions. Before 1912 very little work indeed had been done on the ability of fern prothallia to survive periods of water shortage or actual desiccation. Before that time some German students had published papers dealing with the ability of certain mosses to live through long periods with a reduced water supply. Papers had also been published describing the ability of certain moss and fern spores to live through periods of several years in normally dry atmosphere. It was also well known that seeds and some other structures of higher plants could revive and continue growth and other activities after several years of dry storage. It is true that Goebel had described before the above date

* Contribution No. 31 from the Botany Department of the State College of Washington.

[Volume 21, No. 1 of the JOURNAL, pages 1–48, plates 1–3, was issued April 6, 1931.]

special tuberous outgrowths produced by the prothallium of *Anogramme chaerophylla* which when covered with soil might survive dry seasons and continue growth when conditions became favorable. Campbell had also called attention to the survival through extended periods of drought of the prothallia of *Gymnogramme triangularis* in the neighborhood of Stanford, California. He also had recorded the fact that a culture of these fern plants had survived exposure to dry air in the laboratory all summer. No study had been undertaken, however, to determine how long prothallia might live under such conditions or to find what changes would result from such treatment.

In 1912 while the writer was making a careful study of the life history of the little Walking Fern, *Camptosorus rhizophyllus*, he found that the prothallia of this plant were to an unexpected degree able to withstand exposure to desiccating conditions. A further study of this particular plant and of the Ebony Spleenwort, *Asplenium platyneuron*, brought out this peculiar characteristic even more definitely. It was found that these prothallia were able to survive exposure to repeated periods of three or four weeks of such drought as may occur under natural conditions.

In 1920–1923 similar though more extensive studies were made of the prothallia of *Cheilanthes gracillima*, a small fern found growing over a wide area of Washington, but limited rather closely to exposed rocky regions. Spore cultures of this fern were grown and after some of the prothallia had reached maturity were exposed to conditions of desiccation. Some were exposed to the dry air of the laboratory. Portions of other cultures were placed in desiccators over anhydrous calcium chloride and over anhydrous phosphoric acid. Plants exposed to the normal dry atmosphere of the laboratory

from April 1, 1922, to September 21, 1922 (nearly sixteen weeks), showed almost 100 per cent recovery. Plants which had been exposed to the dry air of the laboratory for six months and then placed in desiccators, as indicated above, for thirteen weeks showed almost complete recovery after the application of water. In these cases final survival was proven by placing the cultures or portions of cultures under proper growth conditions and determining the percentage of survival after the plants had ample time to continue normal growth.

In 1924 and 1925 similar studies were made on two forms of Purple Cliff Brake, *Pellaea atropurpurea* and *Pellaea glabella*. Cultures of these plants remained air dry in the laboratory from June 5, 1924, to March 24, 1925, a period of nine months and twenty days. The prothallia were mature, some of them showing young sporophytes. After the application of water to these cultures fully seventy-five per cent of the plants showed recovery and normal growth. After eighteen and a half months of desiccation a considerable number of whole plants recovered and small active areas were found in many others. A further experiment was in progress at the time the report of this work was published. At this time the final results of that experiment will be given. One culture in a six-inch clay saucer had been allowed to become air dry in the greenhouse and then placed in a dark but dry and well ventilated cupboard. On June 18, 1929, exactly five years later, this culture was removed and was put under satisfactory conditions for growth. It at once became evident that most of the plants were dead. However, a considerable number, perhaps five per cent of the total, showed either complete recovery as individuals or showed masses of living cells.

A series of experiments was carried on to determine the exact amount of water, if any, remaining in these

plants after long periods of desiccation. Small portions of soil covered with the dry prothallia were removed from cultures that had remained air dry in the laboratory for eleven months. These were very carefully weighed and then were placed in a drying oven with a temperature of from 90° to 110° C. for five hours. The masses of material used were small, so small indeed that there could be little doubt but that any residual water would be removed by this treatment. The actual loss as determined by careful weighing before and after this drying varied between four- and five-hundredths of one per cent of the total weight. Similar portions taken from the same cultures and put under suitable conditions showed a high percentage of survival and later growth of the prothallia.

In 1924 and 1925 similar experiments were carried out with prothallia of the western Polypody, *Polpodium vulgare* var. *occidentale*. It should be remembered that while this fern does not grow in arid regions, it does grow in mats of moss on logs, stumps and sometimes high above the ground on branches of trees. This habitat exposes the plants to periods of drought each year, periods that may extend over three months or more. Specimens have been noted growing on the branches of *Quercus Garryana* at the home of W. N. Suksdorf, at Bingen, Washington, where there is but a trace of rainfall from May to September.

Spores of this plant were grown in cultures that produced normal mature plants in twelve weeks. These were allowed to remain air dry in the laboratory from July 15 to October 1. After the application of water, there was almost 100 per cent revival and continued growth. Both prothallia and young sporophytes survived the season of drought.

Surely fern prothallia have no means of preventing the loss of water. They are for the most part but one cell in thickness, and the cell walls show but little evidence of cutinization. Careful examination of desiccated specimens shows that they have lost all water. The protoplasm is hard and horny, and vacuolar cavities have disappeared through the total collapse of the walls.

A very striking feature in the development of these xerophytic fern prothallia is their tendency toward vegetative propagation. While this tendency is shown by all the xerophytic forms studied, it is brought about by different methods in the different species. Old prothallia of *Camptosorus* and *Cheilanthes* which have undergone long or repeated short periods of desiccation and have then been placed under favorable conditions for growth often show a great part of the body tissue dead, although the margins show green and active cell groups. These marginal cells develop into growths in every way similar to primary prothallia. In time they may be entirely separated through the death and decay of the older tissue and then continue their life and growth as independent plants. That this becomes an important factor in increasing the number of plants as well as in continuing their growth is shown by the fact that more than a dozen such proliferations have been found on a single prothallium. In the *Pellaeas* the development of proliferations is chiefly brought about through the activity of more or less completely isolated groups of cells scattered at random through the bodies of prothallia that have shown injury at the end of periods of desiccation. Only occasionally are these masses marginal except such as are located in the apical sinus. The group of eight or ten cells may appear green and active in the central part of a prothallium that is

otherwise dead. These cells may produce a projection extending directly from the surface of the old prothallium. This projection will develop as a normal prothallium or it may branch repeatedly, each branch developing as a normal prothallium.

Somewhat closely related to the vegetative propagation just described is the development of apogamous embryos by some of these ferns. As far as the writer's studies have shown the two species of *Pellaea* mentioned produced sporophytes apogamously only. Normal archegonia have not been found although antheridia were formed quite regularly. Apogamous embryos were formed freely from living tissue near the apical sinus or from other marginal masses of cells. It is not unusual to find two or more such embryos on one prothallium.

In *Asplenium platyneuron* there has been found an extreme sensitiveness to variations in light intensity which also leads to the production of various proliferation and subsequent vegetative propagation. With a slight reduction in light intensity these prothallia will produce greatly elongated cells, several such cells appearing on the margin of an individual prothallium. With a slight increase in light intensity through a period of two or three days, each of these elongated cells will produce at its tip a group of cells resembling in every way a normal young prothallium. In due time, as a matter of fact, these groups do develop into normal prothallia. Alternating periods of bright days and dull days may thus produce from a single spore several independent plants.

There is always a question as to the relation between such laboratory experiments and the conditions found in nature. The following data may show that the results of the experimental work in this case are closely paralleled by actual findings in the field.

Prothallia of *Asplenium platyneuron* and of *Camptosorus rhizophyllus* have been found growing in the field in spring and summer, the former on soil in exposed locations, the latter protected by the mats of moss where this fern is commonly found growing. The size and condition of these prothallia indicated clearly that they had grown through one full summer season at least, and that they had lived through the following winter. Mature prothallia of *Cheilanthes* were found in abundance on exposed soil in such condition as to indicate without doubt that they had lived through at least one full summer and the succeeding winter. These old prothallia found in the field showed in many cases the proliferations and other peculiar vegetative growth which had previously been found in controlled cultures. There can be but little doubt as to the importance of the combination of the ability to survive desiccation and extreme temperature changes together with the unusual capacity for vegetative propagation in the preservation of these species of ferns.

One very striking feature of *Cheilanthes gracillima* should be mentioned in this connection. The pinnules of this fern are covered with a dense tomentum below, and when dry their margins are rolled inward, forming a compact, nearly cylindrical body. This is the normal summer condition and appearance of fronds that have matured in the spring. If such fronds are placed in a moist chamber, the pinnule margins unroll, and spores are scattered in abundance. The fronds may be allowed to become alternately dry and moist several times in succession with the scattering of spores with each new moistening. That this fits into the conditions under which the plants grow is shown clearly by close field observation. The spores are matured in April or May.

The fronds became dry and remain so through the summer. With the coming of fall rains they relax and the spores are scattered. The alternating damp and dry days of October furnish ideal conditions for the scattering of spores and for the growth of prothallia.

It seems very probable that careful study of the development of other ferns growing in areas where extreme drought prevails through at least a part of the year will show many other species with adaptive features similar to those noted above.

This material, in practically its present form, was presented at the summer meeting of the Ecological Society of America at Eugene, Oregon, June 20, 1930. A list of titles of previous publications is given for the benefit of such as may care to know more details of the work.

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THE STATE COLLEGE OF WASHINGTON,
PULLMAN, WASH.

Notes on a New Jersey Fern Garden—II.

W. HERBERT DOLE

PELLAEA ATROPURPUREA

Purple Cliff Brake suggests to me the limestone ridges of northwestern New Jersey. On a fern hunting expedition in 1928 to the vicinity of Newton this cliff brake was found in considerable abundance. Walking fern was plentiful in places and rue-spleenwort not uncommon, but I was chiefly interested in the cliff brake as the others were already in my garden and there was a little limestone cliff, or rather part limestone, waiting for new tenants.

Rue Spleenwort (*Asplenium Ruta-muraria*) was found the year before on rock ledges near Cranberry Lake. The ledges were not limestone and the plants were all small, hardly over an inch in length. A few were brought home and planted on the miniature cliff; they are still growing but are no larger than when found. Near Newton *Ruta-muraria* was found on limestone rocks, often in company with Purple Cliff Brake and Maidenhair Spleenwort and perhaps all three would be crowding each other for the same foothold. In one tiny crevice was found three little fronds, one of each kind, crowded together. The group was carefully lifted and

replanted on my miniature cliff in the garden, where they were permitted to continue their struggle. Now, two years later, *Pellaea atropurpurea* seems to have won the contest; this year it sent up a tall, slim fertile frond as sign of victory. *Ruta-muraria* has disappeared and *Asplenium Trichomanes*, exhausted, was able to hold up only two dwarfed fronds.

Several small plants of purple cliff brake were transferred to the home garden; these have increased in size and number of fronds including tall fertile fronds.

Numerous sporelings have appeared on or below my limestone cliff; some of them may be seen in the illustration. These are being watched to see how they develop. One, at least, is Maidenhair Spleenwort, others may be Lady or Marginal Shield fern.

In the construction of my limestone "cliff" I made use of a few pieces of limestone that I had obtained, but not having enough, I made a substitute—hard coal cinders crushed and mixed with sand and lime and a little cement to give strength; this aggregate was thoroughly mixed, with water added, and was cast into irregular slabs three or four inches thick.

For soil to pack between the layers of stone ordinary leafmold was used, but to overcome its probable acidity it was first put into a pail and lime water was poured over it from another pail of hydrated lime and water, after the lime had settled. This leafmold, when partially dry, was mixed with sand and limestone chips and was packed into the crevices as the pieces of stone were set in place.

Moss, brought from the woods, is very useful in a rock garden to pack into all cracks and surface voids. Sometimes the moss will grow and add to the attractiveness of the stones, giving an appearance of age to the rock ledges.

PELLAEA ATROPURPUREA, IN PLACE TWO YEARS; ASPLENIUM RUTA-MURARIA (AGAINST WHITE STONE AT CENTER), TWO YEARS.

WOODWARDIA AREOLATA

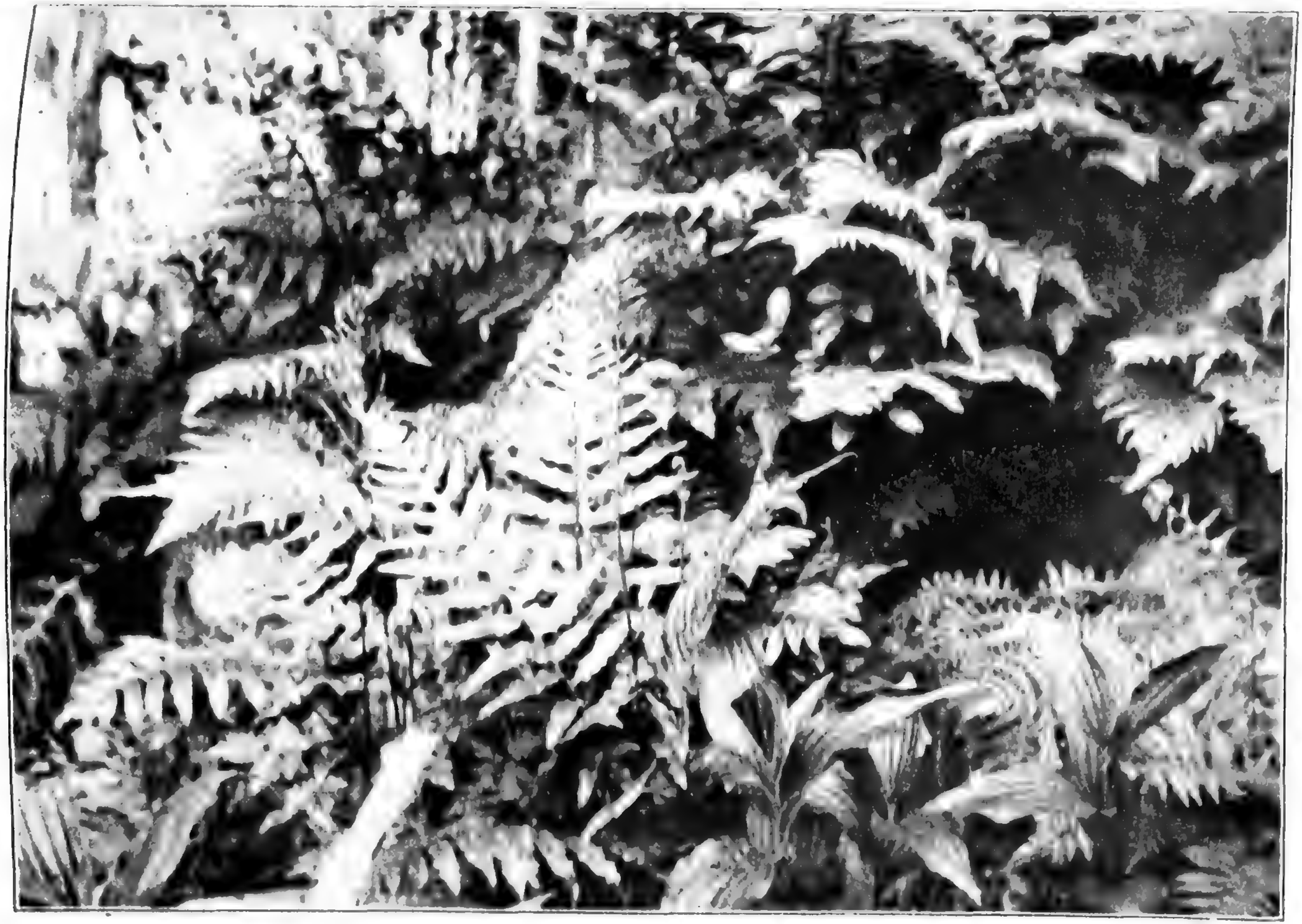
Woodwardia areolata recalls a fern-hunting expedition to the marshy woods south of Matawan, New Jersey, in 1928. The trip was made primarily in search of climbing fern, *Lygodium palmatum*. We were not successful in finding the *Lygodium* that day, but later it was found in great abundance farther north, only a short distance from New Brunswick, and on another trip we found it fairly plentiful in an area of several acres about three miles north of Indian Springs, New Jersey. It is to be hoped that the forest fires in that region during the summer of 1930 did not wipe out this fern station.

Woodwardia areolata was found growing in marshy woods along a sluggish stream and nearby on the sandy banks we found scattered specimens of *Dryopteris simulata* (at right in illustration).

Plants of both these ferns were brought home and transplanted in my miniature bog garden. Both have become well established and the clumps have increased in size. In fact, *areolata* is inclined to travel[1] and must be kept within bounds. It is a handsome fern and makes an attractive addition to the fern garden. Like *Lygodium*, it is at its best in late summer and early fall; at the end of October this year (1930), after several light frosts, it was still in perfect condition, the dark-stemmed fertile fronds standing well above the sterile fronds. Early in November a heavier frost caused the sterile fronds to wither, but the fertile fronds remained standing apparently untouched.

The "bog" garden is at the lowest end of the fern garden. An irregularly shaped hole, about eight feet long and five feet wide, was dug out about two feet deep

[1] See Mr. Pugsley's article in this JOURNAL **19**: 88–91.—Ed.



WOODWARDIA AREOLATA, IN PLACE TWO YEARS.

and was filled, first with a layer of small stones, then about six inches of decayed leaves and compost, and above that a mixture of sand, loam, humus and some peat moss. The upper two or three inches was mostly acid wood-mold, a little sand and peat moss, and some sphagnum moss. From time to time, when I have had an opportunity to gather fibrous acid soil from oak woods or cinnamon fern swamps, some of it has been scattered over the surface.

During wet weather the "bog" gets enough water from surface drainage, but during dry spells water is supplied through a hose. A tile drain a few inches below the surface prevents the water from rising so high as to flood the bog.

Besides the ferns mentioned above—*Lygodium palmatum*, *Dryopteris simulata* and *Woodwardia areolata* —there is a royal fern and *Woodwardia virginica*. The latter is even more of a wanderer than *areolata* and is inclined to crowd in among other plants and ferns where it is not wanted. This specimen has been reset several times; just at present it is trying to force its way among the cardinal flower.

Other plants are being tried in the bog garden; the above-mentioned clump of *Lobelia cardinalis* is especially vigorous. *Parnassia caroliniana* and *Arethusa bulbosa* have bloomed several times. *Cypripedium spectabile*, Pyxie ("flowering moss"), a sundew and *Iris verna* have all bloomed, but may not yet be fully established.

WEST ORANGE, N. J.

WOODWARDIA AREOLATA.—PHOTOGRAPH TAKEN NOV. 2, 1930, AFTER A FROST SEVERE ENOUGH TO KILL FRONDS OF MOST FERNS.

A List of Tennessee Ferns

W. A. ANDERSON, JR.

(*Continued from p. 20*)

ADIANTUM PEDATUM L.

Tipton's Sugar Cove, Cades Cove, Blount County, June 14, 1928, Anderson, 984.
Near Greystone, Greene County, June 24, 1928, Anderson and Jennison, 1143.
Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 950.
Near Knoxville, May, 1898, Ruth.
Tullahooma, Coffee County, ————, 1867, Gattinger.
Nashville, ————, Gattinger.
Triune, Williamson County, June, 1892, Bain.
Erin, Houston County, May 24, 1920, Palmer, 17,607.

ADIANTUM CAPILLUS–VENERIS L.

The southern maidenhair has been found at several places in the Cumberland Mountains and on Lookout Mountain, but in no other parts of the state. It is a fern I have never collected, though I have seen fresh specimens brought in by other people.

Lookout Mountain, Hamilton County, Sept., 1875, Curtiss, 3709.
Jonas Bluff, Lookout Mountain, May 3, 1906, Fuller.
Near Jasper, Sequatchee Valley, July, 1892, Middleton.

PTERIDIUM LATIUSCULUM (Desv.) Hieron., var. PSEUDOCAUDATUM (Clute) Maxon

Pteris aquilina L. var. *pseudocaudata* Clute

In the "Ferns of Tennessee" I listed *Pteridium latiusculum* and illustrated it with a drawing of *P. latiusculum* var. *pseudocaudatum*. This variety is the common form in Kentucky and Tennessee, and I confused it with the species, which I did not know at that time. Upon comparing with Gray Herbarium material I find all my

collection belongs to the variety, so assume that the material in the Tennessee herbarium is all the same.

Cold Springs Knob, Greene County, June 23, 1928, Anderson and Jennison, 1139.

Pinnacle Mountain near Greenbrier, Sevier County, Oct. 9, 1927, Anderson, 690.

Near Abram's Falls, Cades Cove, Blount County, June 15, 1928, Anderson, 1011.

Sunshine, (Kinzel Springs), Blount County, May 2, 1926, Jennison and Galyon.

Craggie Hope, Cheatham County, Aug. 20, 1922, Svenson, 342.

Along Duck River, Humphreys County, Sept. 1, 1928, Anderson, 1051.

Henderson, Chester County, and Jackson, Madison County, 1893, Bain.

Polypodium virginianum L.

Syn. *P. vulgare* of authors, not L.

Plentiful in the Great Smoky Mountains.

Tipton's Sugar Cove, Cades Cove, Blount County, June 14, 1928, Anderson, 988.

Roaring Fork, Gatlinburg, Sevier County, June 10, 1928, Anderson, 959.

Mt. Le Conte, Gatlinburg, Sevier County, May 20, 1926, W. L. Galyon.

Lookout Mountain, Hamilton County, H. W. Ravenel.

Lemon's Gap, Cocke County, Aug. 7, 1892, Ruth, 518.

White Cliff Springs, Monroe County, June 29, 1890, Scribner.

Wolf Creek, Cocke County, May 13, 1893, Kearney.

Cave Spring, Hamilton County, 1850, Gattinger.

Whiteside, Marion County, Mrs. Bennett (Gattinger's collection).

Bird Preserve, Knoxville, May 25, 1926, W. L. Galyon.

Polypodium polypodioides (L.) Watt

Syn. *P. incanum* Sw.

In Tennessee the gray polypody grows either on rocks or trees. I have seen it near Knoxville on the same rock with *Pellaea atropurpurea* and *Asplenium cryptolepis* and also growing high on a tree in the same locality.

On juniper tree, banks of Little River, near Walland, Blount County, Apr. 22, 1928, Anderson, 762.
Knoxville, Mar. 7, 1893, Kearney.
Carter County, Aug. 7, 1891, E. E. Gayle.
On tree trunk, base of bluffs, Kingston Springs, Cheatham County, Aug. 20, 1922, Svenson, 267.
On *Juniperus virginiana*, cedar glades, Lavergne, Rutherford County, Aug. 5, 1922, Svenson, 189.
Jackson, Madison County, April, ——, Bain.
Hollow Rock, Carroll County, Gattinger.
On *Quercus Phellos* in swamp, Hollow Rock Junction, (now Bruceton), Carroll County, Aug. 27, 1922, Svenson, 437.

LYGODIUM PALMATUM (Bernh.) Sw.

On the Cumberland plateau, the climbing fern is locally abundant. There is one station in the Smokies, at Mr. Whittle's summer cottage, part of the way up Mt. Le Conte. The stations in Monroe County are in the Alleghany range also.

White Cliff Springs, Monroe County, July 5, 1890, Scribner.
Buckeye Station, Monroe County, Aug., 1891, P. L. Cobb.
Burnt-over ground along creek, 7 miles from Rockwood, Roane County, Cumberland Plateau, May 22, 1929, Jennison and Anderson, 1271.
Sandy soil along creek west of Daysville, Cumberland County, July 14, 1929, Anderson, Jennison and Hesler, 1388.
Piney Falls, Rhea County, Mrs. Bennett (Gattinger's collection).

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray

Syn. *Osmunda regalis* of Am. authors in part.

White Cliff Springs, Monroe County, June 29, 1890, Scribner.
Fountain City, Knox County, Aug. 29, 1891, Kearney.
Swampy place on Cumberland Plateau, 5 miles from Rockwood, Roane County, May 22, 1929, Anderson and Jennison, 1268.
Tullahooma, Coffee County, Aug., 1867, Gattinger.
Jackson, Madison County, May 10, 189–, Bain.

OSMUNDA CLAYTONIANA L.

Near top of Cades Cove Mountain, (2300 ft.), Cades Cove, Blount County, May 1, 1929, Anderson and Hesler, 1196.

Roaring Fork, Gatlinburg, Sevier County (sterile), June 10, 1928, Anderson, 938.
Near top of mountain, Greystone, Greene County, June 24, 1928, Anderson and Jennison, 1065.
Lemon's Gap, Cocke County, May 19, 1893, Kearney.

Osmunda cinnamomea L.

State line ridge, Gregory's Bald, Cades Cove, Blount County, July 6, 1929, Anderson, 1381.
Foot of Gregory's Bald, Cades Cove, Blount County, June 14, 1928, Anderson, 975.
Top of Cades Cove Mountain, Cades Cove, Blount County, May 20, 1928, Anderson, 909.
Pinnacle Mountain, near Greenbrier, Sevier County, Oct. 9, 1927, Anderson, 691.
State line ridge above Greystone, Greene County, June 23, 1928, Anderson and Jennison, 1148.
Whiteside, Marion County, July 7, 1867, Gattinger.
Walden's Ridge, Mrs. Bennett (Gattinger's collection).
Lee's Spring, Grainger County, May 17, 1927, R. G. Henderson.
Bethel, McNairy County, May ——, Bain.

Azolla caroliniana Willd.

Bradley County, 1856, Gattinger.

Ophioglossum vulgatum L.

In the University of Tennessee Herbarium are three sheets of *Ophioglossum* labeled "*O. vulgatum.*" As I was not very familiar with this genus, I accepted these at their face value without critical examination as to the species. Two of the sheets have since been found to be *O. Engelmanni* at least in part. I have never collected any adder's tongue ferns in Tennessee.

Forked Deer Bottoms, Haywood County, June 12, 1893, Bain.

Ophioglossum Engelmanni Prantl

In the Fern Bulletin (1898) Mrs. Britton mentions *O. Engelmanni* as occurring in Tennessee. Two sheets

of Tennessee specimens were found in the Gray Herbarium, and inquiries made at the New York Botanical Garden and at the University of Tennessee concerning specimens in those herbaria. Dr. Jennison, of the University of Tennessee, after critically examining the specimens there labeled *O. vulgatum*, reports that one of Gattinger's without locality but from Cedar Glades, and one from Lavergne, May 16, 1882, are *O. Engelmanni* at least in part. Dr. Rydberg writes that there are three specimens in the herbarium of the New York Botanical Garden of which two are Gattinger's, one without locality and one, collected May, 1882, of which he could not make out the locality. In the Gray Herbarium is a sheet labeled *O. vulgatum* Cedar Glades, Lavergne, May 16, 1882, by Gattinger and annotated in Mrs. Britton's handwriting, "This is also *O. Engelmanni* Prantl and adds a new state to its range." All these specimens undoubtedly represent two collections by Gattinger, one without date and one May 16, 1882. They both were from Lavergne, as "cedar glades" in Gattinger's collection always refers to that locality.

Cedar Glades, ————, Gattinger.
Lavergne, Rutherford County, May 16, 1882, Gattinger.
Cedar Glades near Lavergne, May 17, 1923, Harper.
Open woods near Knoxville, Aug. 7, 1900, Ruth, 570.

BOTRYCHIUM DISSECTUM Spreng.

Syn. *B. obliquum* Muhl. var. *dissectum* (Spreng.) Clute.

B. dissectum grows in great profusion around Mr. Whittle's summer cottage part of the way up Le Conte. It is there associated with *B. dissectum* Spreng. var. *obliquum* (Muhl.) Clute.

Whittle's place, Gatlinburg, Sevier County, Oct. 20, 1928, Anderson, Hesler and Jennison, 1032.
Smoky Mountains, 1898, J. H. Ferriss.

Botrychium dissectum Spreng. var. obliquum (Muhl.) Clute

Syn. *B. obliquum* Muhl.

About two miles above Mr. Whittle's place on Le Conte, there is another station where *B. dissectum* var. *obliquum* occurs. This one is in the Le Conte Creek ravine. The plants grow to huge size, several times as large as those farther down the montain.

Whittle's place, Gatlinburg, Sevier County, Oct. 20, 1928, Anderson, Hesler and Jennison, 1033.
Le Conte, below falls, Gatlinburg, Sevier County, (a huge specimen, resembles *B. silaifolium*), Oct. 12, 1928, Anderson, 1122.
Trail to Abram's Falls, Cades Cove, Blount County, Sept. 30, 1928, Anderson, 1133.
Near Knoxville, E. S. Reynolds, Rhodora XIII: 14.
Hollow Rock Junction, (now Bruceton), Carroll County, Aug. 27, 1922, Svenson, 385.
Near McMinnville, Warren County, Rev. Robt. Gray.
Madison and Chester Counties, Aug. and Sept., 1892, Bain.
Glendale, Maury County, Sept. 7, 1867, Gattinger.

Botrychium virginianum (L.) Sw.

Near top of ridge, Gregory's Bald, Cades Cove, Blount County, June 14, 1928, Anderson, 978.
Trail to Abram's Falls, Cades Cove, June 15, 1928, Anderson, 994.
Knoxville, July 27, 1899, Ruth, 563.
Love's Creek, Knoxville, Apr., 1927, W. L. Galyon.
Cave Spring, Hamilton County, ————, 1859, Gattinger.
Nashville, July, 1867, Gattinger.
Joelton, Davidson County, July 16, 1922, Svenson, 86.
Hollow Rock Junction, (now Bruceton), Carroll County, Aug. 27, 1922, Svenson, 386.
Jackson, Madison County, ————, 1892, Bain.

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Since this paper was in type and after two parts of it had been published, *Trichomanes Petersii* Gray has been found in Tennessee by members of the Department of Botany, University of Tennessee. A note by Mr. Aaron J. Sharp on the discovery of this rare fern appears on page 75 of this issue of the Fern Journal.

Trichomanes Petersii Gray

Tremont, Blount County, at about 1,500 feet altitude, April 11, 1931, A. J. Sharp, H. M. Jennison, Harlow Bishop.

Cambridge, Mass.

A Glimpse of Iceland

Harold Goddard Rugg

Two days only for the interesting island of Iceland gave little opportunity for botanizing there. Yet in that brief time I saw a good deal of the country outside Reykjavik, the capital. First, let me tell you that Iceland is larger than Ireland, or than our own state of Kentucky. Although the Gulf tempers the climate near Reykjavik, so that last winter there were only three or four days of skating, nevertheless about one tenth of the Island is covered perpetually by snow or ice. Considering the size of Iceland, the flora is rather limited. Only sixteen varieties and forms of ferns are found. As the list is small I will give it.

Ophioglossum vulgatum L. var. *polyphyllum* A. Br.
Botrychium lunaria (L.) Sw.
Botrychium lanceolatum (Gmel.) Angstr.
Cystopteris fragilis (L.) Bernh.
Woodsia ilvensis (L.) R. Br.
Dryopteris filix-mas (L.) Schott
Dryopteris filix-mas f. *subintegrum* Döll.
Dryopteris dilatata (Hoffm.) Gray

Dryopteris lonchitis (L.) Ktze.
Dryopteris pulchella (Salisb.) Hayek.
Dryopteris phegopteris (L.) Baumg.
Athyrium filix-femina (L.) Rth.
Athyrium alpestre (Hoppe) Ryl.
Polypodium vulgare L.
Blechnum spicant (L.) With.
Blechnum spicant var. *fallax* Lge.

This is the nomenclature which appears in Steffansson's "Flora Islands" published in Copenhagen in 1924.

At Thingvellir, about thirty miles from Reykjavik (the scene of the first Icelandic Parliament in 900), I hunted for ferns late in the evening. During the latter half of June, and all of July and August there is continuous daylight for the twenty-four hours of the day. Although I was rewarded with many flowering plants, the real heather (*Calluna*), forget-me-nots, wild thyme, thrift (*Armeria vulgaris*) and others, I found only one fern, *Cystopteris fragilis* (L.) Bernh, and only one plant of that.

My second day, with a party of Appalachians, I climbed Mt. Esja—2,500 feet in height—a mountain several miles distant from Reykjavik. Along the automobile highway I looked for ferns, but not a single one did I see. In many places the ground was covered with lava. In fact, one twelfth of the entire island is so covered. I might say here that in the two days I saw no trees of any sort. There are a few groves, so called, of stunted birches in two or three sections of the island, but that is all. On the grassy slopes near the foot of Esja I was rewarded with several plants of *Botrychium lunaria* (L.) Sw. and on the ledges near the top of the mountain a single plant of *Cystopteris fragilis* (L.) Bernh. Apparently Iceland is not a fern lover's paradise.

Then on to the North Cape—a huge rocky promontory rising 1,000 feet sheer above the sea. In only one place is ascent possible. Here a tiny rivulet falls down over the rocks. On either side of this is a narrow stretch of vegetation. In other places the rocks are bleak and barren of vegetation for the most part, except lichens. Along the stream or by the path near by I discovered:

Cystopteris fragilis (L.) Bernh.
Athyrium alpestre (Hoppe) Ryl.
Dryopteris lonchitis (L.) Ktze.
Phegopteris dryopteris (L.) Fée
Phegopteris polypodioides Fée

With the ferns were dwarf willows, wild geranium, grass of Parnassus, a beautiful light pink dianthus, trollius, bunchberry, *Silene acaulis*, and buttercups.

In other sections of Norway I found an abundance of *Athyrium filix-femina* (L.) Rth., also *Dryopteris filix-mas* (L.) Schott, and in the mountains above Bergen, *Blechnum spicant* (L.) With. growing under evergreen trees.

At Innsbruck in the Austrian Tyrol, there was continuous rain so that I could not get up in the mountains for botanizing. At Freiburg in Germany I had the same experience except that one day I did go out in the pouring rain on the Feldburg and found magnificent specimens of *Athyrium alpestre* (Hoppe) Ryl., one of the handsomest ferns I have ever seen. Motoring from Oberammergau to Munich I stopped a moment at the Castle of Neuschwanstein. Going up through the woods to the Castle I found *Thelypteris Robertiana* (Hoffm.) Slosson in abundance, many of the fronds of which were twice as large as our common oak fern. On damp stone walls *Asplenium viride* Huds. was common.

HANOVER, N. H.

Recent Fern Literature

China is to be congratulated on the excellence of some of the botanical work that is now being vigorously prosecuted in several local institutions, for modern botanical work in China, as to Chinese institutions, dates back only about ten years. This recently issued volume on Chinese ferns[1] is an excellent example of modern Chinese printing as to format, typography, presentation of data, and illustrations. It was issued under the joint auspices of the Metropolitan Museum of Natural History, Nanking, and the Fan Memorial Institute of Biology, Peiping. It is large quarto in size, and contains the descriptions in both English and Chinese, with very excellent plates, of 51 species of Chinese ferns. Most of these have not previously been illustrated, and some of them were actually described for the first time in 1929. The figures cover macroscopic and some microscopic characters, and are unusually good. This volume, dedicated to Dr. Carl Christensen, should be in every fern lover's library, and is almost indispensible to those interested in the identification of Chinese ferns.—E. D. MERRILL, *New York Botanical Garden.*

"History of the Ferns of Chile" (Historia de los Helechos chilenos). *Revista Universitaria,* Vol. 15, October, 1930. By Gualterio Looser.

In 1906, the writer of this review began technical fern study with a reference to the work of a Spanish botanist, Cavanilles, and specifically to his description of the tropical fern genus *Antrophyum.* The present paper contains a review of the literature dealing with the ferns of Chile including both local writers, such as R. A. and

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[1] Hu, H. H., and Ching, R. C. Icones filicum sinicarum. Fasc. 1: 1–102. Pl. 1–50. 1930.

Frederico Philippi, Reiche, etc.,—and various Europeans, including Skottsberg, Presl, Bertero, and others.

The brief lists of ferns included in this review are familiar for most of their genera, but naturally not for the species, only the omnipresent *Cystopteris fragilis* being represented. In a footnote, reference is made to a FERN JOURNAL article, "The Ferns of Central Chile," published in the second number of 1930.

INJURIOUS FUNGUS PARASITE OF EQUISETUM.—During the past year a fungus disease of *Equisetum praealtum* Raf. has become very severe around Columbus, Ohio. The fungus is one of the Discomycetae, *Stamnaria americana* Massee & Morgan. This species was originally described from Preston, Ohio. It differs from the European *Stamnaria equiseti* in having much larger asci and spores. It forms large patches more especially on the lower internodes and these spread until the stem is so much injured that the shoot dies. The little cups break out in more or less longitudinal rows and when fresh have a yellowish orange color, giving very much the appearance of an ordinary rust. The cups are too small to be distinguished by the naked eye. Some parts of a large patch of Equisetum near Columbus have nearly every stalk infected, with a large percentage of them dead.—JOHN H. SCHAFFNER, *Columbus, Ohio.*

TRICHOMANES PETERSII A. GRAY IN TENNESSEE.—On Saturday and Sunday, April 11 and 12, 1931, the Smoky Mountains Hiking Club of Knoxville made a trip to Thunderhead Mountain in the Great Smokies via Townsend and Tremont, Tennessee. Making what proved to be a fortunate decision, Dr. H. M. Jennison, Mr. Harlow Bishop and the writer started some hours

in advance of the Club group in order to make some botanical collections. While searching for mosses in the moist ravines along the middle prong of the Little River above Townsend, the writer found on the faces of sandstone boulders and ledges overhanging a small brook, a growth which at first appeared to be a thin thalloid liverwort. Closer examination of the plants with a hand-lens revealed fronds with veins and terminal sori. A short pause for searching the memory was followed by whoops of joy, when the plants were recognized as the rare *Trichomanes Petersii* A. Gray. Comparison of the collection with material from Alabama on file in the herbarium of the University of Tennessee confirmed the determination. This fern may now be recorded from near Tremont, Blount County, Tennessee, which is the seventh known station[1] for the United States. We are happy to report that the new station is within the bounds of the Great Smoky Mountains National Park and under the supervision and control of the National Parks Service.—AARON J. SHARP, *University of Tennessee, Knoxville, Tennessee.*

Fern lovers may be interested to know that two fine specimens of Holly Fern (*Cyrtomium falcatum*) are growing in an old well at Cromwell, Connecticut. The spores must have blown in there from a plant a short distance away. They have survived two winters and at present writing (April, 1931) are in fine condition.—FLORENCE C. HUBBARD, *Cromwell, Conn.*

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[1] Graves, E. W. The Fern Flora of Alabama. American Fern Journal 10: 65–82. 1920.

American Fern Society

Report of the President for 1930

Aside from the general excellence of the JOURNAL for 1930, to which as usual we are indebted mainly to the enterprise of our Editors, the Society is to be congratulated on its decided progress in library matters. Members are referred particularly to Dr. Benedict's 15-page article entitled, "Fern Books to Lend," in the first number of the JOURNAL for 1931, which presents a list of titles of fern books and pamphlets belonging to the Fern Society, a list of similar publications belonging to the Brooklyn Botanic Garden, the text of the agreement between the Society and the Garden relating to "deposits and loans," and an explanation of the method and terms under which these publications may be lent for the benefit of the Society's members. This plan, which had been considered informally for some time previously, was mentioned briefly in my report for 1928 as having been authorized by the Council. The agreement was signed April 21, 1930, and actually became effective last September, on the receipt of the Society's publications by the Librarian of the Brooklyn Botanic Garden. The arrangement thus made bids fair to be a great success. Certainly it is capable of much benefit to the members. Its usefulness will, of course, be greatly increased with the growth of the Library, and to this end the Council is allotting extra funds for the purchase of Eaton's "Ferns of North America" and other standard works. Members can assist very materially also by donating copies of their own writings, as well as the commoner fern books and such miscellaneous papers as they may happen to have in duplicate. With a little consistent effort a fair reference library can thus be built up, as pointed out very effectively by Dr. Benedict, through whose personal effort the whole plan has taken form.

As to the JOURNAL, present plans look to the publication of nearly as many pages in 1931 as in 1930, the high-water mark thus far. The Council is squarely behind the Editors in their effort to extend and otherwise to improve the Journal, and urges all members to take advantage of the opportunity of publication there presented. Numerous short articles—the more the better—are just as welcome as ever.

WILLIAM R. MAXON, *President*

Report of the Editors for 1930

The Editors take pride in reporting for 1930. It was the JOURNAL's twentieth year—a definite milestone; in honor of the anniversary, an effort was made to produce the best volume yet. Letters inviting contributions were sent to promising members, especially foreign ones; a good proportion of them responded generously. As a result, we were able to publish 164 pages, by about 25 different authors, from eleven states and five foreign countries, and eleven illustrations. The articles, exclusive of those about different parts of North America, related to New Zealand, eastern Asia, Chile, Great Britain and various tropical regions, and included revisions of two small genera, *Onychium* and *Cyrtomium*. Altogether, the volume was, we believe, not only the largest, but the most comprehensive we have yet had. This happy result was due to the cordial cooperation of our contributors; they have our sincerest thanks.

A complete survey of the twenty volumes will show a total of more than 2800 pages. If we may judge by the response to sample copies, the FERN JOURNAL is its own best advertisement. A considerable proportion of those to whom sample copies are sent join the Fern Society. Recently some effort has been made to extend knowledge of the fact that there are a Fern Society and

a JOURNAL by means of exchange advertisements in additional publications. One such, in the educational journal, "School Science and Mathematics," has already incited a considerable number of requests for samples.

If the additional emphasis on the Fern Society Library and the opportunities for borrowing from the larger collection of the Brooklyn Botanic Garden Library may be considered as a phase of editorial work, attention may be drawn to the list of publications available in Vol. 21, no. 1, and to several additional titles which have been added to the Fern Society Library since that list was published and are recorded elsewhere in this number. The value of this loan arrangement for Fern Society members is obvious. The Editors hope that full use will be made of it and that this use will result in more articles for the JOURNAL.

R. C. BENEDICT,
E. J. WINSLOW,
C. A. WEATHERBY,
Editors

Dr. Georges Poirault, well-known for his intensive study on the propagation of ferns, has written that his collection has suffered much damage by unfavorable climatic conditions. In order to reconstruct this important collection he desires to have spores of any American species. Members of the society who have or can collect such spores during the coming season will be doing a great service to science by sending them to Dr. Georges Poirault, Villa Thuret, Cap d'Antibes, France.—CARLOTTA C. HALL.

Dr. Paul Kestner, Chailly Village, Lausanne, Switzerland, would like to obtain spores of the following species, in addition to those listed in the preceding number of the Journal.

Woodsia Cathcartiana
" oregana
Cryptogramma acrostichoides
" densa
Dryopteris fragrans

The following items have been added to the Society library by purchase:

Britten, James. European ferns.
Clute, W. N. The fern allies.
Clute, W. N. Our ferns in their haunts.
North American Flora, vol. 16, pt. 1.
Shreve, Forrest. Jamaican Hymenophyllaceae.
Underwood, L. M. Our native ferns.
Waters, C. E. Ferns.

Mr. C. M. Litch has generously presented to the library an additional copy of Britten's "European Ferns." The cordial thanks of the Society are extended to him.

The Editors wish to thank Dr. Maxon for his gift of 35 copies of early numbers of the Journal; and Messrs. R. A. Ware and E. H. Clarkson for similar gifts.

We are again indebted to Mr. W. H. Dole for defraying the cost of the attractive illustrations which accompany his article; and again he has our best thanks.

New members:

Ross, Miss Marjorie Ruth, 422 Eddy St., Ithaca, N. Y.
Webster, Mrs. Hollis, 1960 Massachusetts Ave., Lexington, Mass.

Changes of address:

Demaree, Delzie, Room 416B Botany, Stanford University, Cal.
Steil, Dr. W. N., 748 North 23rd St., Milwaukee, Wis.
Whitman, Mrs. William, Jr., 12 Marlboro St., Boston, Mass.
Wilcox, Miss Alice W., 750 North Chester Ave., Pasadena, Cal.

Vol. 21 July-September, 1931 No. 3

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.50

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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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. 21 JULY–SEPTEMBER No. 3

Some of the Pteridophytes of North Carolina and Their Distribution

H. L. BLOMQUIST

The state of North Carolina embraces a region of peculiar fascination to the botanist, especially if he is floristically inclined and interested in observing and studying plants in their native homes. The flora of the state is rich in variety, due largely to its latitude and varied topographical features which include a seacoast at one end, a mountainous region at the other, and a broad area of foothills of varying altitudes between. A correspondence in the distribution of some of the species which make up the flora and fauna of North Carolina with these three main physiographical regions has led to a division of the state into three biological or life zones. These are, the eastern or Atlantic coastal plain, the middle or piedmont, and the western or the mountain. From the standpoint of vegetation, although it may be easy to say that this or that species is found only in this or that zone, it is difficult to draw sharp lines of separation between them. This is due to a considerable overlapping of species and to the fact that some species are common to all of them. However, while there may be overlapping, the proportion of the species which make up the composition of the flora varies enough so that the physiognomy of the vegetation is different in the differ-

[Volume 21, No. 2 of the JOURNAL, pages 49–80, plates 4–6, was issued June 20, 1931.]

ent zones. The flora of the coastal plain is more distinctive than the other two and is more sharply delimited from the piedmont than the latter is from the mountain zone.

While my interest in the plants of North Carolina since coming here eleven years ago has not been confined to ferns and fern allies, I have in all my excursions taken notice of them and included them in my collections. Since, so far as I know, no recent report has been made of these plants from this state, I thought it might be of interest to write down some of the observations which I have made.

From the standpoint of distribution the club mosses seem to be the most definite. *Lycopodium alopecuroides* and *L. carolinianum* are confined to the Atlantic coastal plain. Besides these, is found on sand ridges *Selaginella acanthonota,* a xerophytic form which I have not collected but which has been reported by Wells[1] and others. In the middle, or piedmont section, the only common club moss is *Lycopodium complanatum* or "running cedar" as it is locally called. *Selaginella apus* is found along ditches and in swampy places but it does not seem to be as abundant here as in the western section. In the mountain section I have never seen *L. complanatum* where it seems to be replaced by the closely related species *L. tristachyum.* This is found in rich soil, especially near upland bogs where it is associated with *L. obscurum.* At higher altitudes, under spruce and fir, *L. lucidulum* is quite common and may extend lower down along the streams. In the southwestern section of the mountains of North Carolina especially where more rocky slopes are exposed, the rock Selaginellas are

[1] Wells, B. W. Plant communities of the coastal plain of North Carolina and their successional relations. Ecology, Vol. IX, No. 2, April, 1928.

very common and give a greenish tint to the pale lichen associations composed mostly of reindeer moss (*Cladonia*). The most common of these is apparently *S. tortipila*. Others reported from this section are *S. sherwoodii* and *S. rupestris*,[2] neither of which I have to my knowledge collected.

The first time I ever saw Isoetes (Plate 7) in nature was in a ditch near Rosman, in the summer of 1922. This was identified by Dr. Pfeiffer, of the Boyce Thompson Institute of Plant Research, as *I. Engelmannii*. Since then I have found it in great abundance in many of the artificial lakes of western North Carolina.

The only Equisetum I have found in the state is *E. praealtum* Raf. (*E. robustum*). This species grows in large patches between Durham and Chapel Hill. The only other place where I have found it is along a road near the Tuckaseigee Station between Sylva and Glenville. Other Equisetums have been reported from the state but apparently these are rather rare and local.

The Bulb Fern (*Cystopteris bulbifera*) seems to be rare in North Carolina as is also the Purple Cliff Brake (*Pellea atropurpurea*). The former I have not found except in a spring which gushes out of a granite wall in the Nanthahala Gorge between Bryson City and Andrews, and the latter was found by one of my students, Miss Susan B. Leonard, of Atlanta, Georgia, at Chimney Rock.

The Climbing Fern (*Lygodium palmatum*) I have not collected myself but I have obtained specimens from Professor E. H. Hall, of the North Carolina College for Women, which he collected at Piedmont Springs, Danberry. Dr. Holmes, of the State Department of Forestry, has told me that he has found it near Tuckaseigee

[2] Eseltine, G. P. Van. The allies of *Selaginella rupestris* in the southeastern United States. Contrib. Nat. Herb., Vol. XX, 1917.

Falls. Two other ferns collected by Professor Hall,[3] which I have not collected, are *Asplenium Ruta-muraria* and *Ophioglossum vulgatum*, both of which were found near Greensboro.

Of the ferns proper, the coastal plain has very few. The most common ones seem to be, the Cinnamon Fern (*Osmunda cinnamomea*), the Ebony Spleenwort (*Asplenium platyneuron*), the Gray Polypody (*Polypodium polypodioides*), and the Chain Fern (*Woodwardia areolata*). The first three, however, occur all over the state. The Cinnamon Fern is found even on mountain tops and in some places between the ridges grows in great profusion. The Gray Polypody likewise is distributed from the coast to the mountains but its habitat varies. In the eastern part of the state it grows exclusively on trees while in the western section it is found only on rocks. In the piedmont section, especially around Durham, it grows both on trees and rocks. The most common fern in the piedmont section is the Christmas Fern (*Polystichum acrostichoides*). There is considerable variety of ferns in this section but the plants are rather scattered and do not develop in such profusion as some of the same ferns do in the mountainous part of the state. Besides some of the rarer ferns mentioned above, the Mountain Spleenwort (*Asplenium montanum*) seems also to be confined to the western section. It is quite abundant in cracks in granite cliffs, especially near waterfalls. In the mountain section the ferns grow in many places in great profusion. It is not uncommon to see the New York Fern (*Dryopteris noveboracensis*), the Interrupted Fern (*Osmunda Claytoniana*), the Lowland Lady Fern (*Athyrium asplenioides*), and the Hay-

[3] Hall, Earl H. A partial check list of the ferns found in the Mountain Park and Roaring Gap region. Jour. Elisha Mitchell Scientific Society, Vol. 46, No. 1, Nov., 1930.

ISOETES ENGELMANNI VAR. CAROLINIANA A. A. EATON FROM MEDFORD POND NEAR LAKE JUNALUSKA, NORTH CAROLINA

scented Fern (*Dennstaedtia punctilobula*) in almost pure stands. The Hay-scented Fern seems to be especially hardy and is favored by grazing so that in some upland pastures it is gradually replacing all other vegetation (Plate 8).

Below is a list of the ferns and fern allies from North Carolina which I have collected and a few which have been collected and reported by others recently. After each name is given the name of the section in which each is most likely to be found. Where two sections are given, the first one is where the fern is found in greater abundance. The ones marked * I have not collected myself.

OPHIOGLOSSACEAE

**Ophioglossum vulgatum* L.	Piedmont
Botrychium virginianum (L.) Sw.	Piedmont and western
Botrychium dissectum (Spreng.) Torr.	Piedmont and western
Botrychium obliquum Muhl.	Piedmont and western

OSMUNDACEAE

Osmunda cinnamomea L.	General
Osmunda regalis L.	Western and piedmont
Osmunda Claytoniana L.	Western and piedmont

SCHIZAEACEAE

**Lygodium palmatum* (Bernh.) Sw.	Western

POLYPODIACEAE

Polypodium virginianum L	Piedmont and western
Polypodium polypodioides (L.) Watt	General

The Hay-scented Fern (Dennstaedtia punctilobula) in almost pure stand in upland pasture, Blowing Rock, North Carolina

Pteridium latiusculum var. *pseudocaudatum* (Clute) Maxon	Piedmont and western
Adiantum pedatum L.	Western and piedmont
Pellaea atropurpurea (L.) Link	Western
Cheilanthes lanosa (Michx.) Watt	Western and piedmont
Asplenium Trichomanes L.	Western and piedmont
Asplenium montanum Willd.	Western
Asplenium platyneuron (L.) Oakes	General
**Asplenium Ruta-muraria* L.	Piedmont
Athyrium acrostichoides (Sw.) Diels	Western
Athyrium asplenioides (Michx.) Desv.	Western
Camptosorus rhizophyllus (L.) Link	Western and piedmont
Woodwardia areolata (L.) Moore	Eastern and piedmont
Onoclea sensibilis L.	Western
Polystichum acrostichoides (Michx.) Schott	Piedmont and western
Dryopteris marginalis (L.) A Gray	Western and piedmont
Dryopteris hexagonoptera (Michx.) C. Chr.	Western and piedmont
Dryopteris noveboracensis (L.) A. Gray	Western and piedmont
Dryopteris thelypteris (L.) A. Gray	General
Dryopteris dilatata (Hoffm.) Gray	Western

Dryopteris intermedia (Muhl.) Gray	Piedmont and western
Dryopteris cristata (L.) A. Gray	Western and piedmont
Dennstaedtia punctilobula (Michx.) Moore	Western and piedmont
Cystopteris fragilis (L.) Bernh.	Western
Cystopteris bulbifera (L.) Bernh.	Western
Woodsia obtusa (Spreng.) Torr.	Western and piedmont

EQUISETACEAE

Equisetum praealtum Raf.	Piedmont and western

LYCOPODIACEAE

Lycopodium lucidulum Michx.	Western
Lycopodium obscurum L.	Western
Lycopodium tristachyum Pursh	Western
Lycopodium complanatum L.	Piedmont
Lycopodium alopecuroides L.	Eastern
Lycopodium carolinianum L.	Eastern

SELAGINELLACEAE

Selaginella apus (L.) Spring	Western and piedmont
Selaginella tortipila A. Br.	Western
**Selaginella Sherwoodii* Underw.	Western
**Selaginella rupestris* (L.) Spring	Western
**Selaginella acanthonota* Underw.	Eastern

ISOETACEAE

Isoetes Engelmannii var.
caroliniana A. A. Eaton Western

I wish to acknowledge with thanks my obligations to Professor E. H. Hall, of the North Carolina College for Women, for the specimens he has donated to me; to Dr. Maxon and his associates for confirming some of the identifications and making others, and to Dr. Pfeiffer for identifying the Isoetes.

DUKE UNIVERSITY, DURHAM, N. C.

Studies of Equiseta in European Herbaria*

JOHN H. SCHAFFNER

Various problems in relation to certain species of Equisetum had presented themselves to the writer which he was not able to solve with the inadequate material in American herbaria. The summer of 1930 was, therefore, spent in Europe in studying herbarium material and the opportunity was also afforded of attending the Fifth International Botanical Congress at Cambridge, England, August 16–23. The investigations were made at the following herbaria where a large number of records on the geographic distribution of all the species was also obtained: The Amsterdam Botanic Garden, the Berlin Botanic Garden, the Basel Botanic Garden, the Zürich Botanic Garden, the Herbier Boissier of the University of Geneva, the Herbier Delessert of the Geneva Botanic Garden, the Herbarium of Cambridge University, the herbarium of the British Museum of Natural History, London, the Linnean Herbarium owned by the

* Papers from the Department of Botany, the Ohio State University, No. 000.

Linnean Society of London, and the Kew Herbarium at the Kew Royal Botanic Garden. The writer is under great obligations to the Directors, Curators, and Keepers at all of these institutions and desires hereby to express his sincere thanks for the many courtesies shown and for much kindly assistance given to further his studies, which had to be made rather hurriedly because of limited time.

The deductions given below are based on the writer's own determination on good material. In all herbaria there has been much confusion in determinations and names. *Equisetum moorei* is sometimes confused with *E. trachyodon, E. diffusum* with *E. arvense, E. arvense* with *E. telmateia. E. trachyodon* is sometimes labeled *E. hiemale schleicheri,* sometimes *E. hiemale doellii,* etc. Under the name *E. laevigatum* were found not only the true *E. laevigatum* but also perfect specimens of *E. praealtum, E. fluviatile,* and *E. kansanum.* A specimen of *E. trachyodon* from Vancouver Island with long cylindrical, black, crusty sheaths, short persistent teeth, and other characters peculiar to this species, was labeled *E. ramosissimum* and has frequently been quoted as such in distribution records. The whole Equisetum problem has also been greatly confused by a ridiculous multiplication of varietal names which in most cases at least represent nothing but ordinary fluctuations. Sometimes these "varieties" do not even belong to the species to which they are attached. A beginner then must necessarily be greatly confused if he attempts to draw conclusions from the usual herbarium material both in America and Europe.

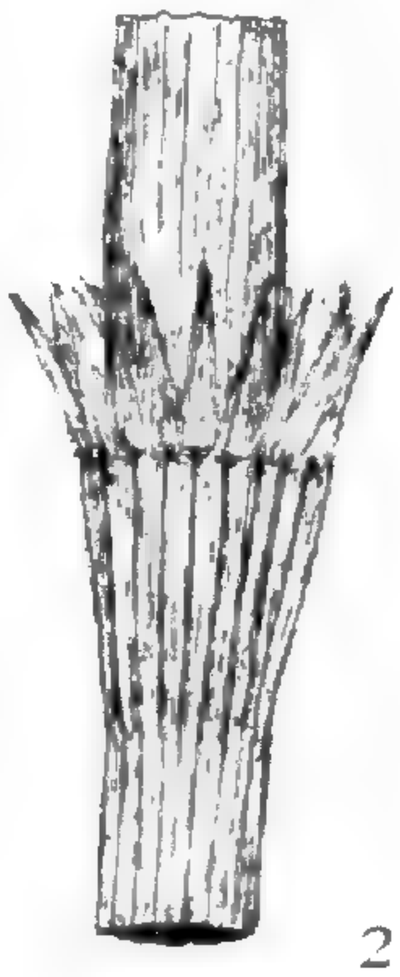
EQUISETUM RAMOSISSIMUM DESF. AND EQUISETUM DEBILE ROXB.

In general, *E. ramosissimum* extends from the Azores and the British Isles to Japan and through eastern

Africa to Cape Colony, while *E. debile* extends from northern India and Ceylon through the East Indies to the Fiji Islands. Baker considered the species as doubtfully distinct and an attempt was, therefore, made to discover distinguishing characters if such were present. Although a supposed distinction is sometimes based on the sheath segments as rounded in *E. ramosissimum* and flattened with angular sides in *E. debile* this seems of no importance. An important difference was found in the comparative lengths of the sheaths of large shoots. The sheaths of *E. ramosissimum* are usually twice as long or more as those of *E. debile.* In the latter species the sheaths are usually about as long as broad in the large shoots. It is easy to separate the two species by this character if ideal specimens are in hand (Figs. 1, 2). but smaller specimens of *E. ramosissimum* show no such distinction (Fig. 3). Apparently there are two distinct hereditary types but their fluctuations are so extreme that they overlap completely. *E. debile* seems to be the only form in southeastern Asia and the East Indies while *E. ramosissimum* is represented in the rest of Asia, Europe. and Africa. On the geographic transition it seems impossible to tell imperfect specimens apart, so there is nothing left to do but to draw the geographic line and name the specimens accordingly.

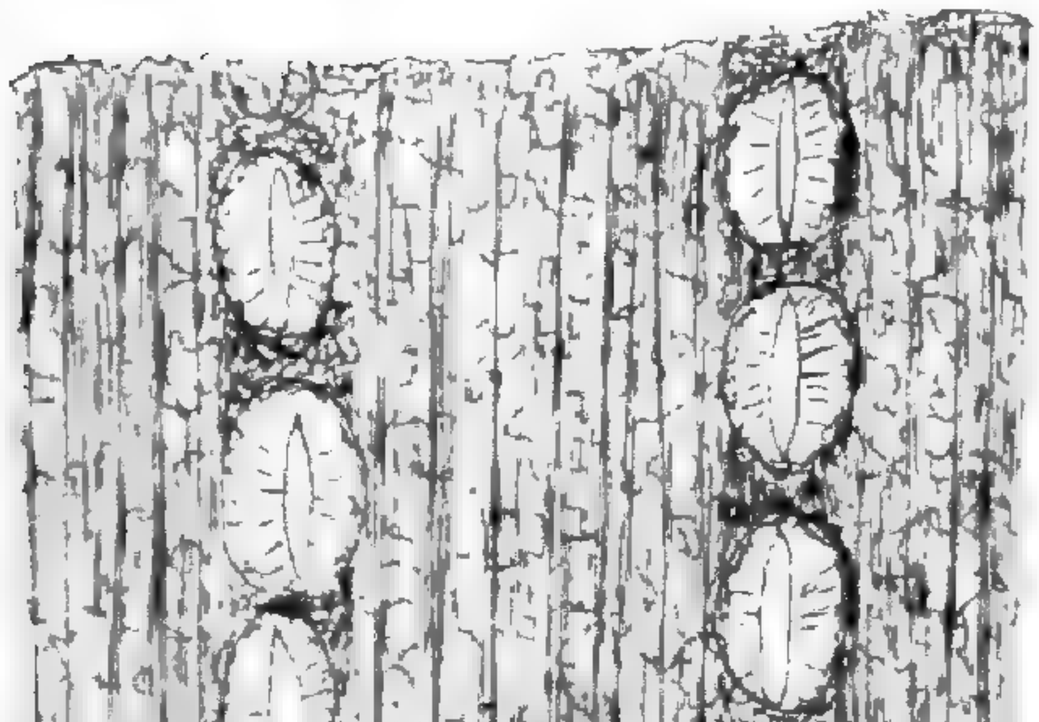
Without the teeth, which are frequently not shed, the sheaths of large specimens of *E. debile* are usually less than ½ in. (10 mm.) long while those of *E. ramosissimum* are fully 1 in. (25 mm.) in plants of corresponding size. The sheaths of large specimens of *E. ramosissimum* frequently turn brown with a papery texture. In this respect there is some similarity to *E. giganteum* and *E. myriochaetum.* All of the supposed *E. ramosissimum* of South America turned out to be small specimens of *E. giganteum* easily distinguished by its bands

1

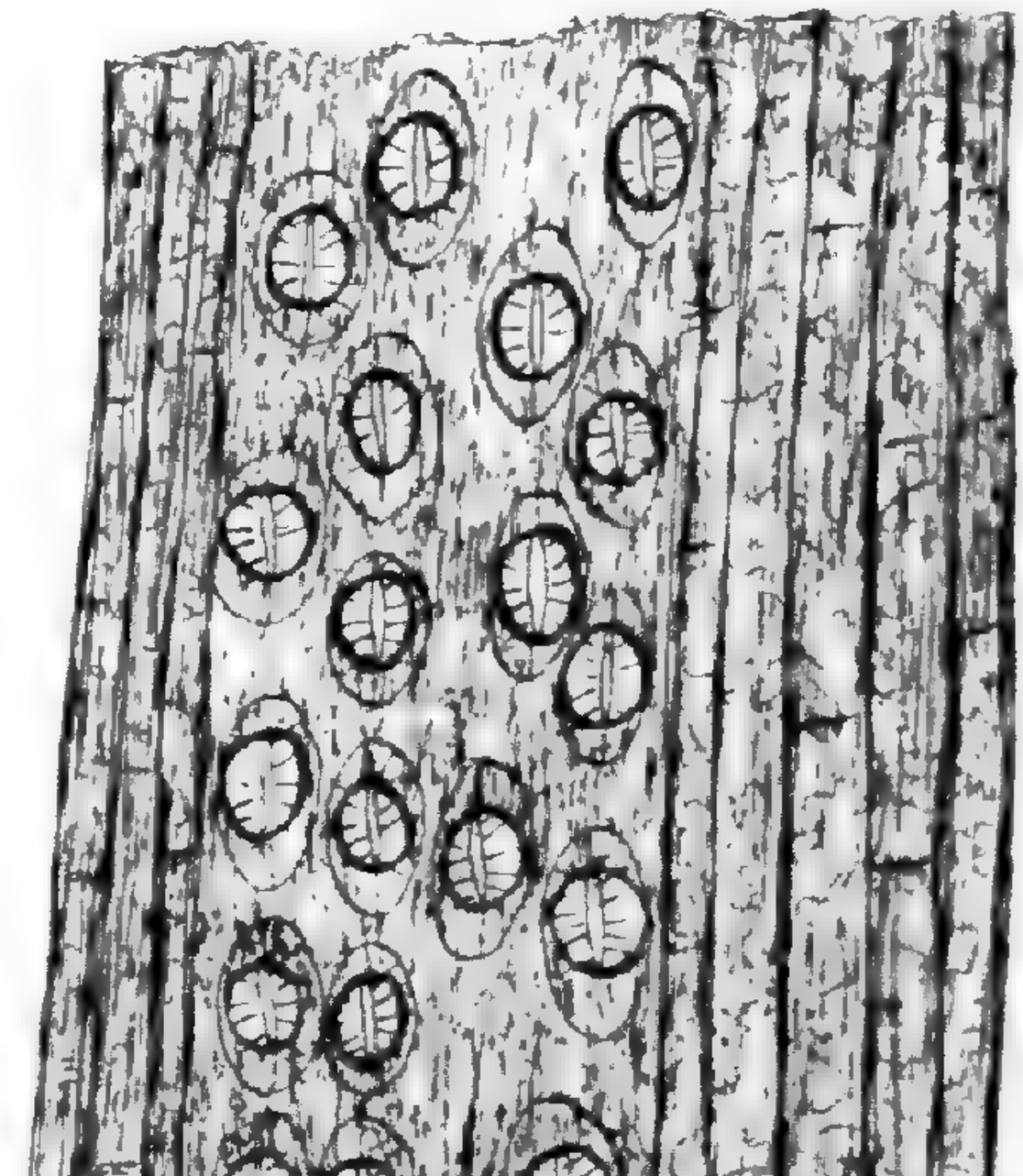


2

3



4



5

of stomata. In eastern and southern Mexico, improperly developed *E. laevigatum* or *E. myriochaetum* are sometimes referred to *E. ramosissimum*. Supposed specimens of *E. ramosissimum* from British Columbia turned out to be *E. trachyodon*. It is possible that *E. ramosissimum* is on the Pacific Coast of the United States, either native or introduced from Japan or China. It would be difficult to distinguish it from branched forms of *E. laevigatum*. Some specimens obtained from Mr. F. M. Cota from San Diego, California, appeared so similar to the smaller *E. ramosissimum* specimens of Europe and Asia that, had their origin not been known, they would have been determined as the latter species without any hesitation. This is a problem to be settled on the pacific coast. It appears to the writer that *E. debile* Roxb. is properly entitled to specific rank. Just because one cannot separate certain imperfect specimens is not to be taken as a criterion for the union of the two. One cannot easily separate young calves of horned and hornless cattle and those hybrids which have scurs in the mature condition, yet they represent three distinct hereditary types. *E. laevigatum* can be separated from *E. ramosissimum* as follows: It is much less branched and has more truncate, more ampliated, and more persistently green sheaths. The sheath segments of *E. laevigatum* have a central ridge and the same is usually true for *E. ramosissimum* but the latter may also have a central groove in the sheath segments of large sheaths or if a large shoot has developed from a broken stem.

EQUISETUM MYRIOCHAETUM SCHL. & CHAM.

Baker included *E. myriochaetum* with *E. giganteum* and also stated that *E. xylochaetum* was closely allied to *E. giganteum*. But *E. myriochaetum* has a very characteristic feature in that the stomata on the main stem

are in lines (Fig. 4), as in the typical EQUISETA HIBERNA while *E. giganteum* and *E. xylochaetum* have the stomata in bands commonly composed of three to five lines each (Fig. 5). *E. myriochaetum* sometimes has double lines of stomata for some distance and the same is true for large specimens of *E. ramosissimum* which must be regarded as the next higher species in the general series.

E. myriochaetum occurs in southern Mexico and occasionally in Central America and northern South America. Among other characteristic differences, *E. xylochaetum* has flat sheath segments and rigid, black, linear teeth which give out a twanging sound when picked while *E. giganteum* has much more membranous teeth and its sheath segments have a definite central ridge. Baker was right in disregarding *E. schaffneri*, *E. pyramidale*, and *E. martii*. They appear to be mere fluctuations of *E. giganteum* and *E. xylochaetum*. One could describe a large number of "species" in Equisetum based on such superficial characters as are supposed to be characteristic of these three "species."

The sheath of *E. myriochaetum* is very truncate, green in its earlier stages, nearly cylindrical, shorter than wide, with readily deciduous teeth and with sheath segments that are 3-keeled in the lower part or sometimes nearly to the top. The lines of stomata are very prominent and the large stem is usually nearly smooth, barely showing ridges. This species is then the proper connecting link between *E. giganteum* on the one hand and *E. ramosissimum* and *E. laevigatum* on the other. The ranges of *E. myriochaetum* and *E. laevigatum* come together in southern Mexico.

EQUISETUM MOOREI NEWM.

At various times a form of Equisetum intermediate in character between *E. ramosissimum* and *E. hiemale*

has been described from western Europe. *E. ramosissimum* is rather sensitive to frost but does frequently survive to the second year. It is not to be considered as an annual, however. The writer has seen large *E. ramosissimum* specimens which had endured the winter successfully, only the upper end being dead. The intermediate plant leading over to *E. hiemale* is about equally resistant to cold or more so. This plant is to be recognized as a proper species with the name *E. moorei* Newm. Edward Newman described *E. moorei* as a species in 1854.[1] The description given is as follows:

"*Rhizome* not noticed.

Stems annual, completely *deciduous*, 20–30 inches in length, 3 or 4 united at base, perfectly erect, always unbranched, acuminate, gradually tapering throughout their length, with 12 (more or less) deep, well-marked striae; the surface rough and hard to the touch; divided by transverse septa into 12 (more or less) internodes, the middle ones of which are longer than those of either extremity.

Sheaths loose, striated like the stem, the interspaces between the striae having a deep central sulcus, of a beautiful pearly white, with a black ring at the base, and black tips to the teeth; the sheaths of the spike black, spreading, campanulate, its teeth long, acuminate, aristate.

Teeth rigid, harsh, rounded or truncate at the apex, each having a median furrow on the back, the continuation of the intermediate furrows of the sheath; surmounted by loose, flaccid, membranous, silky, elongated, pointed awns, which are usually whitish, but occasionally black towards the apex of the stem; on the lower sheaths these awns appear evanescent, from their extreme fragility.

Spike sessile, black, composed of 35 (more or less) black, roundish scales, on which the striation of the stem

[1] The Phytologist for 1854 (Vol. V), p. 19.

is distinctly continued; surmounted by a solid, conical, acuminate apex.

Hab. Clay-banks facing the sea at Rockfield, County Wicklow, Ireland; found by Mr. Moore in company with Professor Melville, of Queens College, Galway.

Herb. Moore, Newman, etc."

While this description is taken up mostly with minute fluctuating details, as most of the earlier descriptions of species and varieties of Equisetum, there can be no question of the identity of the plant described. However, the plant does survive the winter, as intimated above, and it does branch, sometimes having cones on branches of the first year. New branches may also develop the second year. The sheaths described by Newman represent the extreme of discoloration due no doubt to the exposed habitat where the plants were collected. The sheaths in favorable habitats are long and ampliated and remain green for a long time.

The main characteristics of the species can thus be summarized as follows: Unbranched or sometimes branched either the first or second year; delicate perennial aerial shoots; long, green, ampliated sheaths usually with a black limb, becoming discolored in age; usually with promptly deciduous teeth; internodal ridges with an irregular double row of tubercles or cross bands of silex; sheath segments with a central groove; cones apiculate; often appearing superficially like *E. laevigatum*. Milde described this same type as a variety of *E. hiemale* in 1858, *E. hiemale schleicheri*. Hy described a similar plant from France in 1890 as *E. occidentale*, giving the name combination both as a variety and a species. In 1922 Samuelsson concluded that *E. hiemale schleicheri* is a hybrid between *E. hiemale* and *E. ramosissimum*. There is, however, no definite evidence for hybridity according to modern Mendelian principles of

heredity. The synonymy of the species is, therefore, as follows:

EQUISETUM MOOREI Newm. 1854.
E. hiemale schleicheri Milde. 1858.
E. occidentale Hy. 1890.
E. hiemale x *ramosissimum* Samuelsson. 1922.

These all refer to a common species representing the transition step between *E. ramosissimum* and *E. hiemale* and corresponding to the American *E. laevigatum* which stands between *E. ramosissimum* and *E. praealtum.* The plant has had other earlier designations in herbaria and perhaps other earlier published names. But as the older descriptions are too vague and incomplete it is not proper to resurrect any of them since they could never be properly established.

There is no evidence for the presence of *E. moorei* in America. Specimens so reported are to be referred to *E. laevigatum* which is easily distinguished from *E. moorei.* Unfortunately I was not able to find Newman's type specimen from Rockfield. But there is a fairly good specimen. in the herbarium of the Natural History Museum in South Kensington, collected by R. W. Scully in 1889. Another specimen from Rockfield, County Wicklow, collected in May, 1909, had only last years' shoots with about a foot of green stem and dead at the top. *E. moorei* can be separated readily from *E. hiemale* by its elongated ampliated sheaths and delicate winter habit. Its irregular double row of tubercles on the internodal ridges and its grooved sheath segments will distinguish it from both *E. ramosissimum* and *E. laevigatum* which have single rows of tubercles on the ridges and sheath segments usually with a central ridge.

EQUISETUM TRACHYODON A. BR.

Equisetum trachyodon was described by Alexander Braun in 1839. In recent years it has usually been

regarded as a hybrid between *E. hiemale* and *E. variegatum* because the cones are frequently semi-sterile. *E. hiemale doellii* Milde belongs to the same alliance, so if a well-developed plant was found it was usually regarded as *E. hiemale doellii.* This form is then simply the larger more perfectly developed *E. trachyodon.* In southwestern Greenland *E. trachyodon* occurs near one of the old Norsemen farms. Dr. C. H. Ostenfeld of Copenhagen kindly sent me enough of the Greenland material to make a definite determination. It may have been brought in by the Norsemen with hay from Iceland or Norway and then perpetuated itself in the locality ever since. It was reported as *E. hiemale doellii*, probably because one of the supposed parents of *E. trachyodon*, namely *E. hiemale,* has never been discovered in Greenland. The Greenland specimens, as judged by the sheaths and internodes, are typical *E. trachyodon.* The presence of sterile or semi-sterile cones in Equisetum is no criterion for determining hybridity. These semi-sterile and sterile cones occur in all species of Equisetum and in some species they are very abundant where no possibility of recent hybridization exists in the region. They occur with normal fertile shoots coming from the same rhizome. In the herbaria some species going under the name of *E. paleaceum* Doell. are extreme forms of *E. trachyodon* in the broad sense. *E. mackaii* Newm. is also a form of *E. trachyodon.*

The American plant described as *E. variegatum jesupi* by A. A. Eaton in 1904 is again only a form of *E. trachyodon.* Its general resemblance to *E hiemale* induced Farwell, in 1916, to rename it *Hippochaete hiemalis jesupi* and Marie-Victorin, in 1924, gave it the same position under the name *Equisetum hyemale jesupi. E. variegatum alaskanum* A. A. Eat., however, belongs to the *E. variegatum* alliance and not to *E.*

trachyodon, having a campanulate sheath, and long rigid black teeth with narrow margins. The typical *E. variegatum* is usually much more slender than its var. *alaskanum* and the teeth have a much broader white membranous margin. *E. variegatum* is thus for the most part easily separated from *E. trachyodon*.

The EQUISETA PUSILLA are not to be derived directly from either *E. moorei* or *E. hiemale* but must also be derived independently from the *E. ramosissimum—E. laevigatum* complex from ancestors with simple rows of tubercles and cross bands on the internodal ridges. This more primitive condition is retained in *E. nelsoni* (A. A. Eat.) Schaffn. but it has advanced otherwise to a nearly annual condition of the aerial shoots. The other three species of the EQUISETA PUSILLA have advanced decidedly in doubling the internodal ridges, culminating in the extreme type in *E. scirpoides*. *E. trachyodon* is thus represented centrally by what has been called *E. hiemale doellii* Milde and grades off on the one hand into the plant that has passed for a long time as the true *E. trachyodon* and on the other into Eaton's *E. variegatum jesupi*. Not all the specimens, however, labeled *E. hiemale doellii* in the herbaria are *E. trachyodon*. Some are simply small specimens of the true *E. hiemale*. As stated above *E. trachyodon* as now delimited is not to be derived from *E. hiemale* which shows a number of decided specializations of its own, among which are distinct abscission of the teeth and details of the sheath segments. *E. trachyodon* is intermediate in size between *E. hiemale* and *E. variegatum*. The sheaths are cylindrical, mostly all black or with a wide black band at the top. They are usually very crustaceous and the thickening does not extend very far into the short, narrow, mostly persistent teeth. They have a truncate appearance even when the teeth are not

broken off. This character increases its resemblance to *E. hiemale*.

With the recognition of *E. moorei*, *E. trachyodon*, *E. debile*, and *E. myriochaetum* as good species the total number of Equisetum species now considered valid by the writer amounts to 23.

THE SPECIMENS OF EQUISETUM IN LINNAEUS' HERBARIUM.

While in London, the opportunity was taken to examine the specimens of Equisetum in the Linnean Herbarium, possessed by the Linnean Society of London, at Burlington House, Piccadilly. The sheets are as follows and are without any data in general except the name: Genus 1241, Equisetum.

1. *E. silvaticum* (Sheets 1 and 2). The fertile shoot has no spicules on the internodal ridges of the main stem; the sterile shoot has double rows of spicules on the internodal ridges of the main stem.
2. *E. arvense* (Sheets 3 and 4). Fertile and sterile shoots.
3. *E. palustre* (Sheet 5).
4. *E. limosum* (Sheet 6). Contains unbranched shoots and a young branched shoot.
5. *E. hyemale* (Sheet 7).

Sheet 8 is a specimen of *E. variegatum* and has a label reading: Equisetum var: *latourrelle*—Tourelle. In lead pencil on the species sheet is written by someone

E. asperrimum Dick.
E. variegatum Jacq.

The word Tourelle in Linnaeus' handwriting probably refers to the locality from which the specimen came. Linnaeus' specimens are thus seen to be in a very unsatisfactory condition for critical study. Linnaeus was acquainted with six species of Equisetum, Five European species and one American species, *E. giganteum*,

although this is not in his herbarium. He evidently regarded *E. variegatum* as a form or variety of *E. hiemale*. The un-branched forms of *E. fluviatile* he called *E. limosum*, but since *E. fluviatile* is first on the list and both names have a continuous historical development the water horsetail should always bear the latter name. Linnaeus named the branched form *E. fluviatile* and the branched form is usually predominantly the common form while the naked form is a much rarer fluctuation. Pollich as early as 1777 selected *fluviatile* in preference to *limosum*.

EXPLANATION OF PLATE

FIG. 1. *Equisetum ramosissium* Desf. Typical sheath with teeth still persistent. Natural size.

FIG. 2. *Equisetum debile* Roxb. Typical sheath with teeth still persistent. Natural size.

FIG. 3. *Equisetum ramosissium* Desf. Sheath from small plant, the teeth fallen off. Natural size.

FIG. 4. *Equisetum myriochaetum* Cham. & Schlecht. Surface view of small area of main stem showing the single lines of stomata. Magnified about ×115.

FIG. 5. *Equisetum giganteum* L. Surface view of small area of main stem showing one of the bands of stomata composed of several lines. Magnified about ×115.

Notes on a New Jersey Fern Garden--III

W. HERBERT DOLE

ADIANTUM PEDATUM, ASPLENIUM TRICHOMANES, etc.

Adiantum pedatum is at its best where there is protection from wind, plentiful moisture and shade. The clump which may be seen at the top of the cut was planted four or five years ago and has become thoroughly established. The location, however, is not as sheltered as it might be and at times driving wind and rain have reduced beautiful fronds to a dilapidated condition, though other ferns may not be at all injured. I am trying other plants of *Adiantum* in different places in the garden in an attempt to find a position that will produce specimen plants.

At its best it is a beautiful fern, but unhappily placed it is apt to look ragged.

Other ferns appearing in the accompanying illustration are *Woodsia obtusa*, *Cystopteris fragilis*, *Asplenium platyneuron*, *A. Trichomanes* and *Pellaea atropurpurea*. The *Woodsia* is being crowded by the *Adiantum*, but is holding its own and young plants have appeared lower down, where spores have lodged and germinated.

The original plants were found near Peekskill, N. Y., in 1926. They were growing on a loose, gravelly bank near the Hudson River. The slope was barely held in place by the roots of grasses, harebells (*Campanula rotundifolia*) and other plants. Evidently the ferns were unable to maintain their hold for more than two or three years, as all noted were small and slender. Much larger and finer specimens have been seen since then in the district between Cranberry Lake and Newton, N. J.

The plants of *Asplenium Trichomanes* were obtained at the same time as were the *Woodsia obtusa*, from the

station near Peekskill. Small plants were found growing on limestone ledges, almost bone dry at the time, though there were indications of abundant moisture earlier in the season. The finest specimens of *Asplenium Trichomanes* I have seen were growing in wet moss on trap-rock ledges at the New York end of Greenwood Lake, where there was apparently a continuous flow of water down the face of the rocks.

The photograph was taken before my plants of maidenhair spleenwort had reached their prime; later in the summer the fronds are longer and more numerous.

Asplenium platyneuron seems to thrive in dry, sunny places either among rocks or on grassy slopes. It is easily grown even in shady locations, but does better in the sun. My finest specimen is in the rock garden where it receives full sunshine most of the day during summer.

The *Cystopteris fragilis* just below the *Woodsia obtusa* in the illustration is a sporeling, one of many that have appeared in the fern garden. At the lower left corner there may be seen plants of *Pellaea atropurpurea* which have already been noted.

I try to add new varieties to my fern garden every year, but as the possibilities nearby are exhausted it becomes necessary to go farther and farther afield. During the late summer of 1930, while on a week-end visit at Cragsmore above Ellenville, N. Y., I found a colony of *Cryptogramma Stelleri* on shale cliffs along a stream part way up the mountain. Due to the dry weather and lateness of the season (about August 7), the fronds had begun to shrivel, but roots were obtained and several pounds of the pulverized shale in which they were growing. Crevices in my miniature cliff were filled with this material and the roots were carefully in-

Fern Group, including Adiantum pedatum, Woodsia obtusa, Asplenium Trichomanes, etc.

serted. I am now watching to see if they will take hold and grow this spring (1931).

Near the above station of cliff brake were fine specimens of *Phegopteris Dryopteris* (oak fern), *Cystopteris bulbifera, Adiantum* and other ferns growing on wet rocks near a waterfall.

A great part of the enjoyment to be derived from a fern garden is to be found in discovering for one's self the fern stations and observing the locality and conditions under which the ferns grow. A fern brought home after an all day tramp through woods or a climb over rocks and ledges is more highly prized than one obtained by other means and is more likely to grow than one sent from an unfamiliar habitat.

WEST ORANGE, NEW JERSEY.

Recent Fern Notes from Southern California

JOSEPH EWAN

During the past three years college friends and myself have collected ferns rather extensively in the southern half of the state, and the following notes are the result of these recent trips afield.

To these personal notes are added those of Dr. P. A. Munz, of Pomona College, Claremont, California, hitherto unpublished. I express my sincere appreciation to Dr. Munz for many kindnesses and suggestions extended.

Our most complete report on the fern flora of this region is "Southern California Pteridophytes" by P. A. Munz and Ivan M. Johnston (AM. FERN JOUR. **12**: 69–77, 101–122 and **13**: 1–7, 1923). This report, and more recent scattered articles are used as the reference basis for this short paper.

All specimens cited are in the private herbarium of the author except as indicated, "Pomona College Herbarium."

ADIANTUM CAPILLUS-VENERIS L. Forms designated by Moxley as forma *cristatum*, "the tips of the fronds more or less dichotomously forking and crested," have been collected at a small canyon off Fish Canyon, of the San Gabriel Range (*Ewan, 1275*), and at Palm Canyon, Western Colorado Desert (*E. L. Peterson,* Feb. 22, 1930).

ADIANTUM PEDATUM L. var. ALEUTICUM Rupr. Collected at a hitherto unpublished station in the San Bernardino Mountains—Falls Creek, off Mill Creek, at 7200 ft. (*E. L. Peterson,* June 29, 1929, and Aug. 31, 1929). The Little Santa Anita Canyon station, San Gabriel Mts., pointed out to me by its discoverer, G. L. Moxley, was flourishing in 1928 (*Ewan, 129*), but one year later the colony had been nearly wiped out and produced freak forms (*Ewan, 1282*). This station near Orchard Camp is intermediate between the Upper Sonoran and Transition Life Zones with *Woodwardia chamissoi, Pseudotsuga macrocarpa, Quercus chrysolepis, Umbellularia californica, Boykinia rotundifolia, Acer macrophyllum* (starred by Hall in "Life-Zone Indicators in California." Proc. Calif. Acad. Sci., Vol. 9, no. 2, p. 58. as being "particularly characteristic" of the Transition Zone), and *Aralia californica* as representative plants.

ATHYRIUM FILIX-FEMINA (L.) Roth var. CALIFORNICUM Butters. Known from the Transition Zone in our mountains, but recently collected in the Canadian Zone of the San Jacinto Mts. on North Fork, Tahquitz Creek, at 8200 ft. (*Ewan, 2126*).

CHEILANTHES GRACILLIMA Eaton. Authors generally seem to have overlooked the range extension for this

species given by F. J. Smiley in "Report upon the Boreal Flora of the Sierra Nevada of California" (Univ. Calif. Publ. Bot., Vol. 9, p. 73). The Tulare County record of Dudley there cited may be strengthened by its discovery in "exposed dry rock crevices" of Moro Rock, Sequoia National Park, Tulare Co., at 6719 ft. (*Harvey Anderson*, July 21, 1929).

CRYPTOGRAMMA ACROSTICHOIDES R. Br. The southernmost station in North America for this fern, summit of San Jacinto Peak, 10,805 ft., Riverside Co., was discovered and reported by Munz (AM. FERN JOUR. **12**: 115). I re-collected the fern at this station Sept. 1, 1930 (*Ewan, 2165*).

CYSTOPTERIS FRAGILIS (L.) Bernh. Collected in Little Santa Anita Canyon, San Gabriel Mts., at 3000 ft. (Davidson & Moxley, Fl. So. Calif., p. 16, 1923) in 1928 (*Ewan, 18*), in the immediate vicinity of the *Adiantum pedatum aleuticum* station above described, but now extinct. This fern has an altitudinal range in Southern California of 8000 ft.; for contrasted with the last station is "rare about rocks, north side of San Gorgonio Peak at 11,100 ft." (*Munz, 6207*) in Pomona College Herb. Also collected on summit of San Jacinto Peak, 10,805 ft., by Dr. Munz in the past and by myself in 1930 (*Ewan, 2157*). An interesting collection was made of this fern near Keyes Ranch, 4500 ft., Little San Bernardino Mts., by F. R. Fosberg, May 1, 1930 (in Pomona College Herb.). This station emphasizes the great altitudinal range of this fern. Notes kindly furnished by Mr. Fosberg.

NOTHOLAENA CALIFORNICA Eaton. To the published lists of known stations for the coastal slope of Southern California may be added: "rock crevices between Fish and San Gabriel Canyons," Los Angeles Co. (*Moxley,*

1126), May 30, 1923. Mr. Moxley kindly granted me permission to publish this record.

POLYPODIUM HESPERIUM Maxon. An unreported station for this fern is Bluff Lake, 7500 ft., San Bernardino Mts., where it grows in "north facing crevices" and was first collected by *Munz* (*8162*), June 1, 1924, and subsequently by *Johnston* at a slightly higher elevation, 7650 ft., July 5, 1924. Another station of this region is "two miles east of Bluff Lake at 7400 ft." (*Munz, 10668*). Unreported stations for the San Jacinto Mts. are "Long Valley, 8500 ft." *Jaeger*, June 28, 1923, and Dark Canyon, 7200 ft. (*Munz & Johnston, 8778*) where it favored the "north side of rocks." All specimens of *P. hesperium* cited are in the Pomona College Herb.

THELYPTERIS AUGESCENS (Link) M. & J. An unreported station of the San Gabriel Range is Van Tassel Canyon, west of Fish Canyon (*Ewan, 1278*), where a freak fertile frond was also collected (*Ewan, 1277*).

LOS ANGELES, CALIFORNIA.

Recent Fern Literature

Graustein, Miss Jeanette E., "Evidences of Hybridism in Selaginella," Bot'l Gazette, Vol. 90, September, 1930.

Miss Graustein has examined eight species of Selaginella including the two common hardy forms, *S. apoda* and *S. rupestris*. She has subjected fruiting material of these forms to cytological study and has found numerous aberrations from normal behavior. In general, such divergences in the process of spore formation and so forth are found to be characteristic of hybrids. In this connection, she reaches the conclusion that hybridism has played a considerable part in the evolution

of this group. It is a matter of interest that the common ledge species, *S. rupestris*, is "apogamous" and almost completely megasporangiate, that there is a large percentage of sterility in the spores of the species examined: that in the cultivated form, *S. Mandiana*, amitotic divisions are common.

Of less technical interest, it may be noted that "Selaginella represents a survivor of an ancient group, . . . fossil Lycopodia of the Paleozoic;" that over 600 species are now recognized.

Kümmerle, J. V. (Budapest, Hungary).

Dr. Kümmerle has sent in three short papers dealing with exotic fern types. In one the occurrence of *Azolla filiculoides* in Japan and Italy is discussed. In another, a noteworthy form of *Woodwardia radicans* is commented upon. In the third, reference is made to Dr. Kümmerle's forthcoming Catalog of *Lycopodiacae*, *Psilotacaeae*, and *Selaginellacuea*.

During the years 1920–1924 Dr. Joseph F. Rock made a large collection of ferns in China, chiefly in the southwestern portions. Dr. Christensen has been working since 1926 at their determination. He has encountered considerable difficulty in making out identities; his list, now published, is not only a model of its kind in other ways, but of especial value in that it straightens out many of the tangles caused by the work of Baker and Christ. These men, noted fern specialists in their day, received many Chinese ferns for study. In at least one case, the classical collection of Dr. August Henry, sets were sent to both and each worked at them quite independently of the other. The result was that the same species was often described under different names by both, that each misunderstood the other's descriptions

(sometimes quite excusably) and, much less inevitably, each described over again species of his own about which he had forgotten. By a systematic study of type specimens Dr. Christensen has been able to put in their proper places these confused and confusing names, so far as they relate to the Rock collections, and his accompanying comment is of high value.

To any young taxonomist beginning the study of ferns, Dr. Christensen's statement of his point of view and methods on pages 266 and 267 is likewise most heartily commended.[1]

THE OLDEST LIVING FERN.—One modern fern species is reported as identical with a form existing millions of years ago in Eocene time, namely, *Onoclea sensibilis*. The fossil form was described by Newberry as *O. sensibilis fossilis*. It is referred to in a recent book by Dr. F. H. Knowlton of the U. S. Geological Survey ("Plants of the Past"), Fig. 85 in that text shows a fragment of a leaf with the lobing and venation clearly evident. It would be strange if the form of several million years earlier was identically the same as our modern species, but paleontologists who have studied it have not found evidence as yet justifying separation as a distinct species. It is further noteworthy as the only modern fern species known also as fossil.

ASPLENIUM BRADLEYI ERRONEOUSLY REPORTED ON LIMESTONE AGAIN.—In carrying out studies on the soil reaction preferences of ferns, I have repeatedly tested the soils supporting Bradley's Spleenwort, and have in-

[1] Christensen, C. Asiatic Pteridophyta collected by Joseph F. Rock, 1920–1924. Cont. U. S. Nat. Herb. 26: 265–337, pl. 13–29. 1931.

variably found them to be decidedly acid.[1] This has led me to inspect critically reports of the findings of the species on limestone, where the soils are normally alkaline, and in all cases the data have proved open to doubt. As the idea still seems to prevail in many places that this fern is "lime-loving," however, further discussion of the matter seems called for.

Asplenium bradleyi was collected near Newburgh, New York, "on limerock," by Bumstead and Eaton[2] in 1864; as the rocks exposed near that place are dominantly siliceous, however, there would appear to be strong probability that the rock supporting the fern was wrongly identified. It was later found in the Shawangunk Mountains by Clarence Lown.[3] The compiler of the Flora of the Vicinity of New York[4] stated it to be "known in our area only from the predominantly limestone region in the Shawangunk Mountains," although reference to any geological map would have shown him that these mountains are made up almost entirely of sandstone rocks instead.

When statements of this sort get into the literature, however, their copying from one compilation to another seems to be inevitable. So, in the Annotated List of the Ferns and Flowering Plants of New York State[5] we find the above cited statements paraphrased as "On rocks, preferring limestone," and these words were faithfully repeated in the Fern Lover's Companion.[6]

---

[1] Wherry, AM. FERN J. 10: 17, 47. 1920. 15: 47. 1925. 18: 62. 1928.

[2] Eaton, Ferns N. A. 2: 40. 1893.

[3] Davenport, Bull. Torr. Bot. Club 10: 6. 1893.

[4] Taylor, Fl. Vic. N. Y. 60. 1915.

[5] House, Bull. N. Y. St. Mus. No. 254: 27. 1924.

[6] Tilton, Fern Lover's Comp. 87. 1922.

Recently there has been published an elaborate book on the Wild Flowers of the Alleghanies,[7] including a check list of the ferns of that region. The latter contains data as to the habitats of the several species,[8] and *Asplenium bradleyi* is alleged to grow "usually on limestone rocks." Unfortunately, in acknowledging my aid in correcting the proof of that work, its writer inadvertently failed to mention that considerable material, including that on ferns, was added after I had seen the proof. This omission places me in the awkward position of seeming to sponsor the very statement as to the soil preferences of this fern which I have been trying so hard to correct for the past ten years!

For the benefit of future compilers of data on plant habitats, then, I am once more stating the situation with reference to *Asplenium bradleyi:* As far as authenticated records go, this fern never occurs on limestone at all, but is strictly limited to sandstone, quartzite, mica-gneiss, and other siliceous rocks, in the crevices of which decidedly acid soils have accumulated.—EDGAR T. WHERRY, *Department of Botany, University of Pennsylvania.*

---

[7] Harned, Wild Fl. Alleghanies 624. 1931.

[8] These seem to have been compiled from more or less untrustworthy sources, as many of them are inaccurate or misleading.

American Fern Society

Report of Treasurer for Year 1930

GENERAL FUND

RECEIVED

Cash on hand Jan. 1		$1,191.39
Membership dues—		
1927	$ 1.50	
1928	1.50	
1929	22.50	
1930	423.28	
1931	28.35	
1932	1.50	
		$478.63
Subscriptions to Journal	93.92	
Emergency Fund—sale of back numbers of the Journal	80.15	
Illustrating Fund, Gifts	3.50	
Advertising	5.00	
Interest	35.00	
Miscellaneous	.40	
Reprints repaid	14.76	
Protested check repaid	1.50	
		712.86
		$1,904.25

PAID OUT

Editor's Account American Fern Journal

Printing 700 copies	$281.00
Title page, contents, index, 6 and 8 pt.	36.71
Extra pages	104.32
Inserts and extra copies No. 2	20.76
Illustrations	55.26
Postage, mailing, envelopes, stencils	22.40
Editor's postage	1.50
Total cost of Journal	$521.95
Less credit on 1921 No. 4	6.92
Net amount paid on Journal account	$515.03

Treasurer's Expense	19.60	
Secretary's Expense, postage and election	11.10	
Reprints from Journal, repaid	14.76	
Protested check, repaid	1.50	
		561.99
BALANCE ON HAND		$1,342.26

This balance is made up as follows:

EMERGENCY FUND

On hand Jan. 1	$373.70	
Back numbers sold	80.15	
On hand Dec. 31		$ 453.85

ILLUSTRATING FUND

On hand	0.00	
Received	3.50	
Special order for Herbarium expenses		25.00
General Fund unappropriated		859.91
		$1,342.26

SPECIAL RESERVE FUND

On hand Jan. 1	$ 925.46
Interest received	47.88
Balance on hand Dec. 31	$ 973.34

Respectfully submitted,

JAY G. UNDERWOOD,

Treasurer

The Society will hold a fall outing in the Pine Barrens of New Jersey, in cooperation with the Torrey Botanical Club, from Friday evening, September 25th through Sunday, September 27th, 1931.

The flora of the Pine Barrens is strikingly different from that of the upland area of the North Atlantic states. Among the ferns are climbing fern (*Lygodium*

palmatum) in abundance and the rare curly grass (*Schizaea pusilla*); also *Woodwardia virginica, W. areolata, Dryopteris simulata* and others more generally common. Many unusual flowering plants, characteristic of the region, may likewise be seen.

Field excursions will be held Saturday morning and afternoon and Sunday till mid-afternoon. At evening sessions, Dr. M. A. Chrysler, of Rutgers College, will speak on the characteristic flora of the region, with lantern slides from natural color plates; Mrs. George E. Anderson on its lichens and algae; Mr. A. T. Beals on its mosses; Mr. Raymond H. Torrey on its geology as affecting local ecology; and Dr. William S. Thomas on its mushrooms.

Brown's Mills-in-the-Pines, New Jersey, will be headquarters. It may be reached by bus from New York, Philadelphia, Trenton (the nearest convenient railroad station) and Lakewood. There are perfect automobile roads from all directions. Inn charges range from $3.50 to $4.50 per person per day American plan. Rooms with private baths one dollar additional. Rooms for single occupancy fifty cents additional.

Detailed itinary, with program of events, maps, and transportation schedules will be furnished to enquirers and registrants. Registration must be made, as early as possible, with the leaders, Mr. and Mrs. Wm. Gavin Taylor, 6 Beech St., Arlington, N. J. (tel. Kearny 2: 1139) and 60 Park Place, Newark, N. J. (tel. Mitchell 2: 1919).

Again we are indebted to Mr. W. Herbert Dole for the attractive illustration which accompanies his article.

New member: Dr. H. K. Svenson, Brooklyn Botanic Garden, Brooklyn, N. Y.

Vol. 21 October-December, 1931 No. 4

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

The American Fern Society

Council for 1931

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American Fern Journal

EDITORS

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CURATOR OF THE HERBARIUM

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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. 21 OCTOBER–DECEMBER No. 4

1930 Washington Fern Notes

J. William Thompson

Several days before school closes, I begin to feel the lure of the wild—a strong desire to shoulder my pack and hie me away to the mountains and forests to search for new and rare plants—to stay until I "starve out," my only weapon my botany pick and the only roof the open sky fringed with the spreading boughs of the alpine firs. When my food gives out, or the amount of my collections become burdensome, I come back to civilization long enough to care for the plants, feed up, and set out again. This past year I was late in getting started, but on July 22 I alighted at the Mt. Baker Lodge, altitude 4200 feet, and began one of the shortest but most successful seasons I have ever had. I gathered both flowering plants and ferns, but here I shall mention only the ferns I found, except to say that I have found about seven new species and varieties of the former. I should like to tell of the many thrills I experienced with bears, eagles, weather, etc., but that belongs elsewhere. Between the date above and August 20, I made two visits to Mt. Baker, one to Mt. Rainier, one to Mt. Angeles in the Olympics, and one to Mt. Stuart in the heart of the Wenatchee Mountains. All regions were interesting in some particular as you can judge by following the cited collections later on. My

[Volume 21, No. 3, of the Journal, pages 81–116, plates 7–9, was issued August 24, 1931.]

trips to Mt. Rainier and Mt. Angeles were too brief to do justice to either in the way of ferns, but both mountains yielded me several interesting endemics. Next year I hope to have a lot more to say about the ferns I hope to find in the Olympics. The following species were found, and localities are given for each.

WOODSIA SCOPULINA D. C. Eaton. Much more common than *W. oregana*. Widely distributed in this State, growing in clefts of cliffs, etc. Rocky clefts on Mt. Hermann, 4800 feet, *Thompson 5364;* rocky crags near summit of Mt. Angeles, scarce, 5400 feet, *Thompson 5582;* crevices of cliffs at 7500 feet, common, Mt. Stuart, *Thompson 5780.*

CYSTOPTERIS FRAGILIS (L.) Bernh. Rocky crevices east of Lodge, 4200 feet, Mt. Baker region, *Thompson 5287;* rocky crevices of Mt. Angeles, *Thompson 5479;* rocky clefts at summit of Skyline Ridge, Mt. Baker, 6000 feet, *Thompson 5651.* This fern is so common that I seldom collect it, occurring literally everywhere in all sorts of situations, even under sagebrush in the dry plains area.

POLYPODIUM VULGARE L. var. COLUMBIANUM Gilbert. (*P. hesperium* Maxon.) Widely distributed along the Pacific coast. Rocky crevices on Mt. Hermann, Mt. Baker region, 4400 feet, *Thompson 5357;* crags and crevices near summit of Mt. Angeles, 5400 feet, *Thompson 5581;* fairly common in the crevices of rocks and cliffs on Mt. Stuart, 7500 feet, *Thompson 5872.* It grows in the cracks of cliffs and its roots are very difficult to obtain even with a pick.

POLYPODIUM VULGARE L. var. OCCIDENTALE Hook. So common on the lower levels that I made only one collection out of a possible dozen. Lower wooded slopes of Mt. Angeles, 3000 feet, *Thompson 5507.*

POLYSTICHUM LONCHITIS (L.) Roth. Crevices of cliffs on south slope of Mt. Hermann, 4500 feet, *Thompson 5253;* rocky crevices at summit of Mt. Angeles, 5500 feet, *Thompson 5526;* crevices of cliffs on Mt. Stuart, 8000 feet, *Thompson 5782.* A beautiful fern to see growing on some wild ledge, often impossible to reach.

POLYSTICHUM LEMMONI Underw. This was the main object of the trip to Mt. Stuart where this fern occurs in great profusion from 5000 to 8000 feet, so abundant, in fact, that one might think this was its original home. See cut. By side of granite boulders, Mt. Stuart region, 5000 feet, *Thompson 5870.*

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon. Seems to be the rarest fern yet in my experience, having looked for it in many likely places but so far have found only one clump—crevices of high cliffs, Mt. Stuart, 8000 feet, *Thompson 5837.*

POLYSTICHUM CALIFORNICUM (D. C. Eaton) Underw. This was the biggest surprise of the season, the finding that it occurred in great numbers along the lower levels in the Wenatchee Mountains, and indeed a surprise that no one else seems to have found it there. Second record, I believe, for this State. Common along trail to Mt. Stuart, 4000 feet, *Thompson 5871.*

POLYSTICHUM ANDERSONI Hopkins. This fern has been recently found on Mt. Baker, but I have yet failed to find it. While on the brief trip to Mt. Rainier, a forest ranger, Mr. T. A. Warren, had a clump on display which he had found in the Ipsut Pass, 5000 feet, and gave me a frond for my collection. I hope to have more to say of this fern next year.

THELYPTERIS DRYOPTERIS (L.) Slosson. Shady woods; widely distributed. I found it many times, but made

Clumps of Polystichum Lemmoni Among the Rocks of Mt. Shasta

only one collection from each locality I visited. Woods, Mt. Baker region, 4500 feet, *Thompson 5270;* by trail to Mt. Angeles, 3000 feet, *Thompson 5484.*

THELYPTERIS PHEGOPTERIS (L.) Slosson. Base of ledge below Austin Pass, Mt. Baker region, 4000 feet, *Thompson 5258;* rocky crevices, base of Panorama Dome, 4200 feet, Mt. Baker region, *Thompson 5721.*

THELYPTERIS OREOPTERIS (Sw.) Slosson. Talus slope below Austin Pass, with the last, *Thompson 5692.*

THELYPTERIS SPINULOSA (Muell.) Nieuwl. var. DILATATA (Hoffm.) St. John. Deep woods by trail of Spray Park, 4000 feet, Mt. Rainier, *Thompson 5463;* lower wooded slope of Mt. Angeles, 3000 feet, *Thompson 5506;* talus slope below Austin Pass, 4000 feet, Mt. Baker region, *Thompson 5720;* base of Panorama Dome, Mt. Baker region, 4200 feet, *Thompson 5720½.*

ASPLENIUM TRICHOMANES L. Crevices of cliffs above Bagley Lake, Mt. Baker region, 4400 feet, *Thompson 5255.* I observed this species elsewhere, but each time it proved inaccessible.

ASPLENIUM VIRIDE Huds. Deep fissure at base of Panorama Dome, Mt. Baker region, 4200 feet, *Thompson 5259;* rocky crevices near summit of second peak, Mt. Angeles, 5500 feet, *Thompson 5480;* crevices of high cliffs, Mt. Hermann, 6000 feet, Mt. Baker region, *Thompson 5711;* cracks of cliffs on Mt. Stuart at 6000 feet, *Thompson 5774.* This supposedly rare fern is evidently not so rare with us, just hard to find, I judge. Each of the above collections is a first record, as far as I know, for each of the regions.

ATHYRIUM FILIX-FEMINA (L.) Roth. Widely distributed and very variable. The variety *sitchense* Rupr.

occurs in the mountains but intergrades of every sort occur making it impossible for an amateur to know where to draw the line between the species and the variety. Moist exposed talus slopes, Mt. Baker region, 4200 feet, *Thompson 5290;* common in wet swales up to 4800 feet, Mt. Baker region, *Thompson 5346;* by stream banks at 5500 feet, Mt. Stuart region, *Thompson 5773.*

ATHYRIUM ALPESTRE (Hoppe) Ryl. var. AMERICANUM Butters. So abundant in the Mt. Baker region as to become monotonous,—not so much so in the other places visited. Large tufts among old rock slides near Lodge, Mt. Baker region, 4200 feet, *Thompson 5276;* talus slopes on Mt. Hermann, Mt. Baker region, 5000 feet, *Thompson 5328;* talus slopes at base of Panorama Dome, Mt. Baker region, 4200 feet, *Thompson 5708;* base of boulders and cliffs, Mt. Stuart at 8000 feet, *Thompson 5783.* This fern was observed on both Mt. Rainier and Mt. Angeles, but failing to find good material, I neglected to get specimens from those places.

STRUTHIOPTERIS SPICANT (L.) Weis. The only fern I collected near home. Widely distributed and very abundant west of the Cascades, usually at slight elevations. Shady woods, south Seattle, *Thompson 5194;* moist shady woods, Mt. Rainier, 4000 feet, *Thompson 5471.*

CRYPTOGRAMMA ACROSTICHOIDES R. Br. Rocky slopes of Mt. Hermann, Mt. Baker region, *Thompson 5330;* rocky crevices near summit of Mt. Angeles, 5300 feet, *Thompson 5583;* talus slope below Austin Pass, Mt. Baker region, *Thompson 5694.* Observed in several localities; fairly common in the mountains, and occasionally near sea-level along the coast in old lava formations.

PTERIDIUM AQUILINUM (L.) Kuhn var. PUBESCENS Underw. Since this fern is literally a pest west of the Cascade Mountains, I took the trouble to make only one collection, a dwarfed specimen as follows: dry slope at 4000 feet by trail to Mt. Stuart, *Thompson 5855*.

ADIANTUM PEDATUM L. and variety ALEUTICUM Rupr. Moist draw above Bagley Lake, Mt. Baker region, 4300 feet, *Thompson 5263;* talus slope below Austin Pass, Mt. Baker region, 4000 feet, *Thompson 5705;* clefts of rocks along mountain streams, Mt. Stuart region, 4000 feet, *Thompson 5856*.

CHEILANTHES SILIQUOSA Maxon. Base of large granite boulders, Mt. Stuart region, 4000 to 6000 feet, *Thompson 5852*. Very abundant in the region above; but I failed to find it in any of the other places visited this past year. In the Mt. Stuart region it seems to spring up around nearly every large boulder, forming clumps often two feet across.

CHEILANTHES GRACILLIMA D. C. Eaton. Cracks of cliffs and slate ledges, Mt. Hermann, Mt. Baker region, 4300 feet, *Thompson 5696;* crevices of cliffs and ledges at 5500 feet, Mt. Stuart region, *Thompson 5772*. Rare in the Mt. Baker region, but very common in the Mt. Stuart region.

EQUISETUM ARVENSE L. Marshy bank of Chain Lakes, Mt. Baker region, 5000 feet, *Thompson 5367*. One of the season's disappointments was that I failed to find *E. scirpoides* Michx. I hope to find it in the Mt. Baker region in 1931. Several other species occur in the State, but I neglected them for time in the mountains.

LYCOPODIUM SELAGO L. Rocky ledge at base of Panorama Dome, Mt. Baker region, 4200 feet, *Thompson 5278;*

wet bank by Chain Lakes, 5000 feet, Mt. Baker region, *Thompson 5747.*

LYCOPODIUM SABINAEFOLIUM Willd. var. SITCHENSE (Rupr.) Fern. Common in the alpine meadows, by Bagley Lake, 4300 feet, Mt. Baker region, *Thompson 5297, 5674;* in a long stringy mass in deep shade of alpine firs, south slope of Mt. Hermann, Mt. Baker region, 5500 feet, *Thompson 5745;* alpine meadows, Mt. Rainier, 6000 feet, *Thompson 5445.*

LYCOPODIUM ANNOTINUM L. The typical form was found in a deep forest on middle slopes of Skyline Ridge, Mt. Baker, 3000 feet, *Thompson 5620;* while a startling extension of range for var. ACRIFOLIUM Fern. was found on the lower wooded slopes of Mt. Angeles, 3000 feet, *Thompson 5511.* The writer is indebted to Frére Marie-Victorin for the determination of this interesting find.

LYCOPODIUM CLAVATUM L. var. INTEGERRIMUM Spring. Rocky slope above timberline by trail to Lake Ann, 4500 feet, Mt. Baker region, *Thompson 5339.*

SELAGINELLA WALLACEI Hieron. Very variable, but typical forms were found as follows: rocky ledge below Austin Pass, Mt. Baker region, 4000 feet, *Thompson 5263;* dry slopes of Mt. Angeles, 5500 feet, *Thompson 5478;* an extreme variant was found in the cracks of a cliff on Mt. Hermann, Mt. Baker region, 4300 feet, *Thompson 5695,* and for the time being referred to this species.

SELAGINELLA SCOPULORUM Maxon. Another collection very doubtfully referred here. Mt. Stuart, 7500 feet, *Thompson 5779.*

CLEVELAND HIGH SCHOOL, SEATTLE, WASH.

Botrychiums of the Central States

E. W. GRAVES

In examining the herbaria of several noted institutions of the Middle West, I have been forcibly impressed by the different zonal arrangements of the various species of the Botrychium group growing in the region drained by the Mississippi River and some of its tributaries.

In corresponding with Prof. F. K. Butters, of the University of Minnesota, he informed me that there were a number of sheets in their herbarium containing specimens labeled *Botrychium obliquum*, but to his mind they were incorrectly labeled, that they were for the most part really *Botrychium ternatum* var. *intermedium*. He stated that one sheet contained specimens that may be *B. ternatum* var. *oneidense*. At that time *Botrychium dissectum* had not been found in the state. I obtained a loan of herbarium material from Prof. Butters, and, after a careful study, I concluded he was correct in stating that *B. obliquum* was not represented in the state flora of Minnesota. Also that *B. ternatum* var. *oneidense* was found there.

About this time I borrowed material from the Public Museum of Milwaukee, Wisconsin, in order that I might study the Botrychiums of that state. I was not able to see the material from the University herbarium. The numerous records of *Botrychium obliquum* presented in No. 4, Vol. 18, of the FERN JOURNAL, by Steil and Fuller, were perhaps made from the labels without studying the specimens concerned. I found, as in the case of the Minnesota ferns, that nearly all the plants labeled *B. obliquum* were really *B. ternatum* var. *intermedium*. There was one exception. One plant labeled *B. obliquum* from the locality of Milwaukee was *B. obliquum* var.

tenuifolium. I wondered how that could be possible, but noticing on one lower corner the word (over) I turned the label and saw written "Arkansas, Dr. H. E. Hasse." It seems that in some way this specimen had been collected by Hasse in Arkansas and as it had been deposited in the Milwaukee Public Museum someone had incorrectly labeled it from the district of Milwaukee. There were three sheets labeled *B. ternatum* var. *rutaefolium*, but I am eliminating the name *rutaefolium* and classing them all *B. ternatum* var. *intermedium*, as I can see no reason for determining the small specimens *rutaefolium*, and the large ones *intermedium.* In corresponding with Mr. C. A. Weatherby he expressed his opinion that *rutaefolium*, at least so far as most of the specimens so labeled are concerned, was nothing more than a juvenile form of *intermedium.*

In the collection from the Milwaukee Herbarium there were four sheets that contained specimens of *B. ternatum* var. *oneidense.* Three of them were classed as *B. obliquum*, but the label on one sheet stated that the specimen appeared more like *oneidense.* I consider it a good typical specimen. The specimen had been collected near Milwaukee. There were three other sheets of the same species. One had been collected in Rush County, one from Wood County, and one from Shawano County. These four specimens without doubt are *B. ternatum* var. *oneidense.*

In Minnesota, besides the station in Houston County, there was one plant from Rush City which I consider is a specimen of *B. ternatum* var. *oneidense*, and Prof. Butters expressed himself in favor of my decision. There were several sheets from Minnesota that were classed as *Botrychium ternatum* var. *rutaefolium*, but I am placing them all as *B. ternatum* var. *intermedium.*

In examining the Botrychiums from the herbarium of the University of Illinois, I found one specimen of *B. ternatum* var. *oneidense* collected in Michillinda, Michigan. This station is just across the lake from Milwaukee. In this collection was a sheet of *B. ternatum* var. *intermedium* taken at Millers, Indiana. That town is at the extreme south end of Lake Michigan. This is the farthest south for that fern of any record that I have seen. In the Illinois collection there are three sheets of *B. obliquum* and one of *B. dissectum* from stations in Illinois and one of *B. obliquum* from a station in Indiana. All three stations of *B. obliquum* in Illinois are from the south half of the state. The station for *B. dissectum* is from the north part. In corresponding with Mr. E. J. Palmer he informed me that he had found *B. obliquum* and *B. dissectum* growing together in Franklin County, which is in the extreme southeastern part of the state.

In a visit to the herbarium of the Missouri Botanical Garden I saw specimens of *B. obliquum* from Annapolis, Allentown, Carthage, Poplar Bluff, Campbell, Swope Park, Franklin County, and St. Genevieve County, Missouri. I learned from Mr. Palmer, that he had found it at both Reeds and Carthage, Missouri, and that Mr. B. F. Bush had found it in Jackson County, near Kansas City, Missouri. That gives ten stations from Mississippi River Valley. *B. dissectum* was represented from Valley Park, Annapolis, Allentown, and one other station from St. Louis County. That gives three stations for St. Louis County and one for Iron County, a larger number than from any other state of the Mississippi River region. Very singular, but this herbarium at the Botanical Garden did not contain a single speci-

men of *B. obliquum* or *B. dissectum* from Illinois, although it had specimens of either or both ferns from Ohio, Kentucky, Tennessee, and other states to the east and south.

In the herbarium of the State Agricultural College at Ames, Iowa, is a specimen of *B. ternatum* var. *intermedium* from Fayette, Iowa. Prof. B. Shimek, of the State University at Iowa City, informs me that he collected *B. obliquum* near Cedar Rapids. I have located three stations for *B. obliquum* in Van Buren County, two of them near Bentonsport, and one near Keosauqua, besides the station for *B. dissectum*. In the three stations for *B. obliquum* I have not found a single plant of *B. dissectum*. Neither does *B. obliquum* grow at the station of *B. dissectum*.

While at the Missouri Botanical Garden I examined specimens which were collected by Mr. E. J. Palmer in Arkansas and Texas. There were also specimens from Arkansas, collected by Dr. Greenman, deposited there. All those collected from Arkansas and east Texas apparently were *B. obliquum* var. *tenuifolium*.

The stations representing *B. ternatum* var. *intermedium* in Minnesota from the university herbarium were: Lake Itasca, Leaf Mountain, Onania, Chisago, Clear Lake, Grand Marais, Ft. Snelling and Sandy Lake. The last place I could not find on the map. The other places are all in the north half of the state. The stations in Wisconsin were from Antigo, Merrill, Rinelander, Prentice, Marinette (two stations), Mountain, Rib Lake, and Ellison Bay. I obtained specimens from Mrs. Summerville at Superior, and from another party at Barksdale. As I did not see the specimens from Marquette University I do not know where to place them. Some of them no doubt were *B. ternatum* var.

oneidense and some *B. ternatum* var. *intermedium* so I am not considering them in this arrangement. Now look at the map of these two states and you will see that *B. ternatum* var. *intermedium* is from the north half of both states. There may be a few scattering stations farther south in Wisconsin, one station at Fayette, Iowa, and one at Millers, Indiana, showing that the southern limit for the zone for *B. ternatum* var. *intermedium* is north Iowa, and north Indiana, but it becomes more plentiful as you advance northward.

Botrychium ternatum var. *oneidense* is represented from Spring Grove and Rush City, Minnesota, and from Ladysmith, Marshfield, Keshna, and Milwaukee in Wisconsin, and across the lake in Michigan at Michillinda. These stations are in the south part of the *B. ternatum* var. *intermedium* zone.

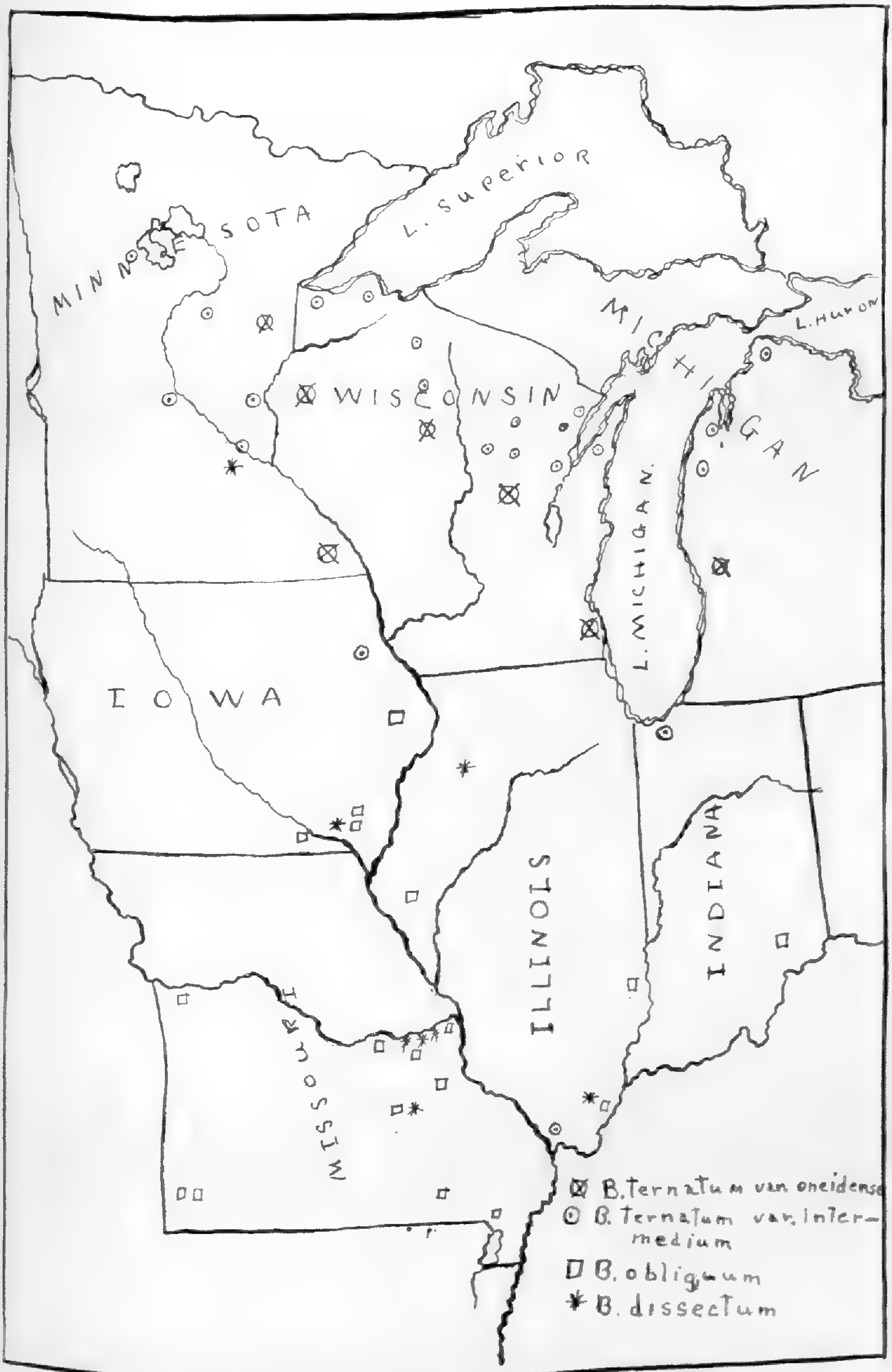
Botrychium obliquum occurs from the south limit of *B. ternatum* var. *intermedium* zone, and ranges southward. It is represented at the Illinois University herbarium from Carlinsville, Olmstead and Mt. Carmel; and Mr. E. J. Palmer found it in Franklin County. In Missouri it is quite plentiful in the south half of the state, but has not been found in the north part to my knowledge. In Iowa there are three stations in Van Buren County, and one near Cedar Rapids. The Cedar Rapids station marks the extreme north limit of *B. obliquum* in the Mississippi Valley region, but as we travel eastward the zone seems to extend farther north.

Botrychium dissectum occupies almost the same zone as *B. obliquum*, but extends farther north and overlaps the southern part of the *B. ternatum* var. *intermedium* zone. With only one exception does it extend south into the zone of *B. obliquum* var. *tenuifolium*, which occupies the southern part of the eastern United States. That exception is two plants collected at Chipley,

Florida, by Miss Sadie Price. Chipley is in the northwest part of the state. Eaton collected four specimens at Cades Cove, Tennessee, which he placed in the herbarium of the Missouri Botanical Garden. Cades Cove is not in the *B. obliquum* var. *tenuifolium* zone. I have no record of it extending that far north. I have collected it on Sand Mountain near Long Island, Alabama. I have also collected *B. obliquum* within one mile of the station of *B. obliquum* var. *tenuifolium*, but the latter grows at a lower altitude along a creek bottom land, while *B. obliquum* was found higher up on the plateau.

There is one more feature I wish to speak of in this article. It is the time of fruiting of the different members of this group. Of the specimens both *B. t.* var. *intermedium* and *B. t.* var. *oneidense* from Minnesota, the larger number having ripe spores had been collected in August or earlier; only one plant had been collected in September; but it might have been collected earlier as its spores were perfectly ripe. Some of them had been collected in June, but the spores, though formed, were not ripe. Of the specimens from Wisconsin both *B. t.* var. *intermedium* and *B. t.* var. *oneidense* with mature spores were collected either in August or the first of September, but perhaps those taken in September could have been collected in August with ripe spores. Of four sheets of *B. t.* var. *intermedium* in the Illinois collection which had been taken in Michigan all but one had been collected with ripe spores in August. One from Michigan reported no date. The specimen from Indiana was also collected in August with ripe spores. The one specimen of *B. t.* var. *oneidense* from Michigan was collected in August with ripe spores.

Of the plants of *B. obliquum* from the Illinois collection one plant only had a fertile frond, and it was collected at Mt. Carmel, Illinois, September 30. Of all the



Distribution of Botrychiums in the North Central States

plants of *B. obliquum* that I have found here in Iowa not one had produced ripe spores before October; and some were as late as November.

Botrychium dissectum also ripens its spores not earlier than the last of September and often as late as November. This seems to show that *B. obliquum* and *B. dissectum* mature at least a month later than *B. t.* var. *intermedium* and *B. t.* var. *oneidense.*

These notes will give some idea as to the difference in life history of this group of Botrychiums growing in the country drained by a large part of the Mississippi River.

BENTONSPORT, IOWA

Tropical American Isoetes

T. CHALKLEY PALMER

In a former number of this JOURNAL (Vol. 19, No. 1), I commented on the scarcity of material representative of *Isoetes* from South America. This condition bids fair to mend with lapse of time. At present, I am able to record additional collections from Tropical America as follows:

ISOETES MARTII A. Br. A single specimen was collected by Dr. Francis Pennell (*Pennell and Hazen*, No. 9958) in August, 1922, in Colombia, Department of Caldas. This is in the Herbarium of the Academy of Natural Sciences of Philadelphia. It is typical in every respect except as to length of leaves. These are quite short compared with the 24–52 cm. seen in previous specimens—a difference of ecological significance only.

ISOETES CUBANA Engelm. Collected by W. C. Meyers, No. 122, in British Honduras, August, 1930 (U. S. National Herbarium No. 1491113). This is of very special interest in that it is only the second gathering of the

species on record, and the first from the mainland. Habitat: "Near Honey Camp, in wet sand of water-hole on pine ridge. Part of the year covered with water." This species is notable for its very heavy bast bundles and for its handsome megaspores—perhaps the most beautiful in the genus. The specimens, considering their origin, are in unexpected conformity with Engelmann's description of the plant as it occurred in Cuba (Trans. St. Louis Acad. Sci., **4**: 389. 1882). Speculation as to distributional history present themselves, but these cannot be followed here. I desire, however, to note the apparent similarity of the environment in the two occurrences, one on each side of the Yucatan Channel. Wright's (No. 3912) plants, collected in 1866, were noted as growing "in rivulets (on the bottom) of the pinewood, Western Cuba, Pinar del Rio." Those of Meyers, as aforesaid, were in wet sand on a "pine ridge."

ISOETES TRIQUETRA A. Br. A sheet holding three fine specimens of this species comes under U. S. National Herbarium No. 1495549, and Rimbach No. 103. There is no date, the only notation is: "Ecuador. Eastern Cordillera of Prisbamba. 4000 m. On swampy meadows. Only the top of the leaves within the air."

Braun's description (Verh. Bot. Verein Brand. **4**. 1862) of Lechler's specimens from Peru is, of course, masterly so far as it goes, but that material was immature, and spores were entirely lacking. Motelay and Vendryès (Actes Soc. Linn. Bord. 36. 1882) have included under the same head the gathering of Spruce, Andes de Quinto. Already in 1862, Braun held the same opinion, and the manuscript name *I. Andina* need not detain us. The description by Motelay and Vendryès of the Spruce material in the herbarium of Motelay would indicate the presence of spores, but the

diagnosis is somewhat vague, and no dimensions are given. Altogether, it seems probable that these specimens of Rimbach are the first fully matured plants of this species that have come to hand. It would appear, therefore, that an emended description is in order, and this may be formulated as follows:

ISOETES TRIQUETRA A. Br. (emend.). Corm 2.5 cm. high, 2 cm. broad, bilobed. Leaves numerous, firm, stout, 10 cm. long, spreading, recurved, triquetrous, with wide membranous margins brown below, diminishing and colorless above, often approaching the abrupt, rounded, brown and shining tip. Stomata and bast bundles none. Ligule ovate-acuminate, colorless, 4 mm. long. Velum none. Sporangium oblong, rounded below, truncate above, 4 mm. long, 3 mm. broad, yellowish, with many thickened cells but scarcely brown-spotted. Megaspores 660–800 μ (average 730) diameter, white, with low papillae more or less confluent into wrinkles. Microspores reddish brown, densely echinulate, 40–48 μ long.

The firm texture of the stout leaves, reminiscent of *I. lacustris* and of *I. hieroglyphica,* is due, as noted by Braun, to the heavy walls of the long, narrow epidermal cells. The tip of the leaf is a crescentic mass of very small cells with brownish walls and glistening surfaces. Both sorts of spores are among the largest of the genus. An occasional megaspore attains a diameter of 850 μ.

The loan of specimens of the following and of the two preceding, I owe to the kindness of Dr. Maxon.

ISOETES **montana,** sp. nov. **Cristatae** Pfeiffer.

Corm 2 cm. in diameter, apparently 3-lobed. Leaves numerous, stout, very brittle when dry, reaching 7 cm. in length, obscurely quadrangular, with pointed tip, the basal membranous wings brown-edged, attenuate to thrice the height of the sporangium. Stomata present, bast bundles none. Ligule fleshy, irregular, brown or black. Velum thick, opaque, yellow-tinted, approxi-

mately complete. Sporangium oblong, 5–6 mm. long, brown, the trabeculae often dark brown and shining. Megaspores white when dry, plumbeous when wet, 500–700 μ (average 611) diameter, all faces densely set with high, very thin, crested columns and ridges. Microspores brown, red-brown when wet, nearly smooth, 31–39 μ long. TYPE: *H. E. Stork*, No. 2361. Costa Rica, Poas Lake, June 5th, 1928. "A submersed plant, in sandy shallows about a foot deep on the average. Elevation 8500." U. S. National Herbarium No. 1490673.[1]

Later, at Dr. Maxon's request, Professor Stork forwarded another sheet (U. S. Herbarium No. 1409949) supporting a second specimen of the same gathering, together with photograph and a letter descriptive of the habitat; from all of which it appears that this lake is in the crater of an extinct volcano. "Sphagnum growing in mats on the bank indicates the acid nature of the water."

The nearest relative of this species is undoubtedly *I. Salvatieri* of the remote, desolate region about the Straits of Magellan. From this it differs in the nearly or quite complete velum, and apparently in the size and shape of the sporangium. In Professor Stork's plant the velum is very thick and opaque, and quite different in appearance from a velum as usually seen. It shows at most a minute, round, dark-rimmed opening at the

[1] ISOETES **montana**, sp. nov., cormo diametro 2 cm. ut videtur trilobato; foliis multis crassis siccatis fragillimis ad 7 cm. longis obscure quadrangularibus apice brunneis acutis, stomatibus instructis, fasciculis fibrosis carentibus, alis basalibus membranaceis brunneo-marginatis superne attenuatis sporangium triplo superantibus; ligula irregulari suculenta brunnea vel atra; velo crasso opaco flavo-tincto fere perfecto; sporangio oblongo 5–6 mm. longo brunneo, trabeculis saepe atro-brunneis lucidisque; megasporis siccatis albis humentibus plumbeis diametro 500–700 μ (circiter 611), faciebus omnibus columellis rugulisque altis tenuissimis cristatis dense onustis; microsporis brunneis humentibus rubro-brunneis fere laevibus 31–39 μ longis.

base. There is a considerable amount of brown pigment about the base of the leaf; and within the sporangium is a layer of brown amorphous matter, gelatinous when wet, which shows through the wall. The sculpture of the megaspore recalls that of *I. saccharata*, but the columns and ridges are much more numerous, and more slender and delicate.

DELAWARE COUNTY INSTITUTE OF SCIENCE,
MEDIA, PENNA.

New Tropical American Ferns—VIII[1]

WILLIAM R. MAXON

The two new species here described are based on specimens collected rather recently in Panama. Both are exceedingly well marked.

Adiantum cordatum Maxon, sp. nov.

§ *Hewardia.* Habitu et nervis areolis plus minus elongatis omnino anastomosantibus *Adianto diphyllo* proximum, quod pinnis manifeste petiolulatis late cuneatis nec incumbentibus cordatisque, sporangiorum annulo incrassato 18–20-articulato, sporis atris valde trigonis opacis satis recedit.

§ *Hewardia.* Rhizome short-creeping, 5–10 cm. long, about 5 mm. thick, roughly nodose from old pseudopodia, finely paleaceous; scales bright brown, about 2 mm. long, linear to lance-subulate, laxly ciliate at base, remotely so toward the filiform tip. Fronds 6 or 7, closely tristichous, rigidly ascending, 25–55 cm. long, the stipes mostly very much longer than the blades, 1–2 mm. thick, subterete, narrowly sulcate ventrally, atropurpureous, lustrous, finely paleaceous at extreme base, glabrescent; mature blades simple or simply pinnate, if simple elongate-cordate, 10–18 cm. long, 6–10 cm. broad, very

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

deeply cordate at base, evenly long-acuminate at apex, the tip attenuate or caudate; if bipinnate developing only 1 or 2 lateral pinnae, these smaller than the terminal one, 8–11 cm. long, normally ovate, long-acuminate at apex, subsessile, inequilateral, unequally cordate at base, the large rounded proximal portion incumbent upon the short slender atropurpureous rachis; costa nearly or quite percurrent, evident upon both surfaces, brown-sclerotic in the basal portion beneath, glabrous; veins elevated above, prominulous beneath, coarsely reticulate throughout, the areoles elongate, 5- to 7-seriate between costa and margin, successively smaller toward apex and sides, free excurrent veins minute or wanting, the marginal areoles very small; sterile margins entire or subentire; leaf tissue chartaceo-coriaceous, translucent, above dull gray-green, striolate between the veins, light or yellowish green beneath, glabrous; sori 2, each a continuous line extending from near the basal sinus nearly or quite to base of acumen, the closely revolute marginal portion of the leaf blade very narrow (about 0.5 mm.), the true indusium brownish, membranous, about 1 mm. broad, subentire or minutely erose; thickened annulus of sporangia 12- or 13-celled; spores triplanate, rounded-trilobate, about 40 μ in diameter, yellowish, granular, subhyaline.

Type in the U. S. National Herbarium, nos. 679412 and 679413, collected in forest around Puerto Obaldía, San Blas coast, Panamá, altitude 50 meters or less, August, 1911, by H. Pittier (no. 4297). There is at hand also a small frond collected in the Canal Zone region in 1911 or 1912 by E. D. Christopherson (no. 404).

To be compared with **Adiantum diphyllum** (Fée) Maxon,[2] founded upon a specimen collected by Blanchet in the region of Bahia. That species, which as described and illustrated by Fée seems most distinct, has strangely been reduced to synonymy under *A. adiantoides* (J. Sm.) C. Chr., a large decompound plant of utterly different

[2] *Hewardia diphylla* Fée, Crypt. Vasc. Brés. 1: 39. *pl. 9, f. 3.* 1869.

appearance. *A. diphyllum* resembles *A. cordatum* rather closely in its wholly areolate venation, but differs definitely in its distinctly petiolulate non-cordate pinnae, its 18- to 20-celled thickened annulus, and its dark, opaque, deeply 3-lobed spores. Both species depart widely from *A. Wilsoni* in their completely areolate venation.

Leptochilus Killipii Maxon, sp. nov.

Species diversa *L. oligarchico* mirabiliter olim confusa, a quo maxime recedit: statura minuscula, stipitibus gracillimis, laminis parvis debilioribus simplicibus, nervis (lateralibus exceptis) subimmersis tenuibus nec omnibus valde reticulatis crassisque.

Rhizome wide-creeping (10–25 cm.), 2–3 mm. thick, smooth, subangulate, flexuous, light brown, laxly and deciduously paleaceous; scales few, distant, brown, 3–5 mm. long, linear to lance-attenuate, distantly dentate, the teeth sometimes linear and gland-tipped. Fronds few (2 to 4), distant 1.5–10 cm., laxly ascending, the fertile usually surpassing the sterile. Sterile fronds 2 or 3, 25–30 cm. long, the stipes short (4–9 cm.), about 1 mm. thick, olivaceous, bearing a few lax deciduous scales; blades simple, lance-ovate to elliptic-lanceolate, acutely cuneate at base, acuminate or long-acuminate at apex, 20–26 cm. long, 4.5–7.5 cm. broad, entire, the slender costa strongly elevated on both sides; lateral veins 18–20 pairs, nearly straight, diverging from the costa at an angle of about 70°, prominulous; transverse connecting-veins arcuate, forming about 5 series of major areoles, these consisting of 3–5 diverse minor areoles, each with a few, simple or broadly forked, included veinlets; leaf tissue dark green above, slightly paler beneath, papyraceous, glabrous, translucent, the ultimate venation evident but scarcely prominulous. Fertile fronds solitary, 35–40 cm. long, delicate, the stipe 21–27 cm. long, slender, pale olivaceous, bearing a few distant scales; blade 13–14 cm. long, 1.5–2 cm. broad, lance-linear, narrowly attenuate both ways from the middle half, the extreme base decurrent; sporangia diffused, the free marginal zone 0.5–1 mm. broad, plane; spores subglobose, yellow-

ish, very broadly alate, about 70 μ in diameter (wings included).

Type in the U. S. National Herbarium, no. 1013101, collected near Juan Díaz, Panamá, alt. 75 meters, in wet forest ravine, January 13, 1918, by E. P. Killip (no. 2778). A second sheet of the same collection is almost identical, and there is also a sterile specimen from the vicinity of Frijoles, Canal Zone (*Killip* 2918). Otherwise the species is known only from a single Peruvian collection (*Spruce* 4636), to be mentioned further.

Baker's inadequate and misleading description of *Acrostichum oligarchicum* (*Leptochilus oligarchicus* C. Chr.) is based upon two Peruvian specimens, both collected by Spruce on Mount Guayrapurina. I have studied these at Kew. The first of them, no. 4737, collected in September, 1856, is a large, very robust, coarse plant with fully pinnate blades, the pinnae very strongly reticulate-veined; it is annotated by Baker, and must be regarded as the type specimen of his species. The second element, *Spruce* 4636, collected in July, 1855, is exactly our Panama plant, with delicate simple fronds. It is not annotated by Baker and is so utterly different that one wonders how it could possibly have been included in his concept of *A. oligarchicum*. Both specimens are represented by excellent photographs in the U. S. National Herbarium.

WASHINGTON, D. C.

Recent Fern Literature

Andersson-Kotto, Irma. "Variegation in three species of ferns." Zeitschrift fur induktive Abstammungs- und Vererbungslehre. 1930 Bd. LVI Heft 2, p. 115–201.

The author of this paper has completed and published results of another extensive and intensive study of fern genetics. The report comprises nearly 100 pages with numerous illustrations. It may be noted that owing to

the separate development of the gametophyte generation ferns offer especially interesting material for the purpose of genetic analysis. In this study the writer has followed through the behavior of variegation in successive generations of three types of cultivated ferns which she designates as *Polystichum angulare, Lastraea atrata, Scolopendrium vulgare.* The paper is too extensive for detailed review in this journal but it represents a noteworthy contribution both to fern genetics and to plant genetics, in general. It is noted that the character of variegation found expression in the prothallia as well as in the leafy fern plant. Possibly, this is the first case in which albinism has been recorded for the gametophyte generation.—R. C. B.

Prof. Conard has briefly recorded the finding of prothallia of *Botrychium virginianum* in Iowa and published photographs of some of his material. The specimens were about 12 cm. below the surface of the ground, "irregular roundish tubers, dark brown and coarsely bristly outside. . . . The dense interior tissue was of the color and consistency of white potato."[1]

A recent issue of *Trillia* (no. 9, Oct., 1930), the journal of the Botanical Society of western Pennsylvania, contains an annotated list of 26 species of ferns and fern allies observed at Little Moose Lake in the Adirondacks by Marie B. Knauz.

A SECOND STATION FOR ASPLENIUM MONTANUM IN MASSACHUSETTS.—There is a terse saying, once current among the old-time mining prospectors of the west that "gold is where you find it." In a broader sense this is often true of many of the desirable things of life. I have sometimes thought that this statement was also

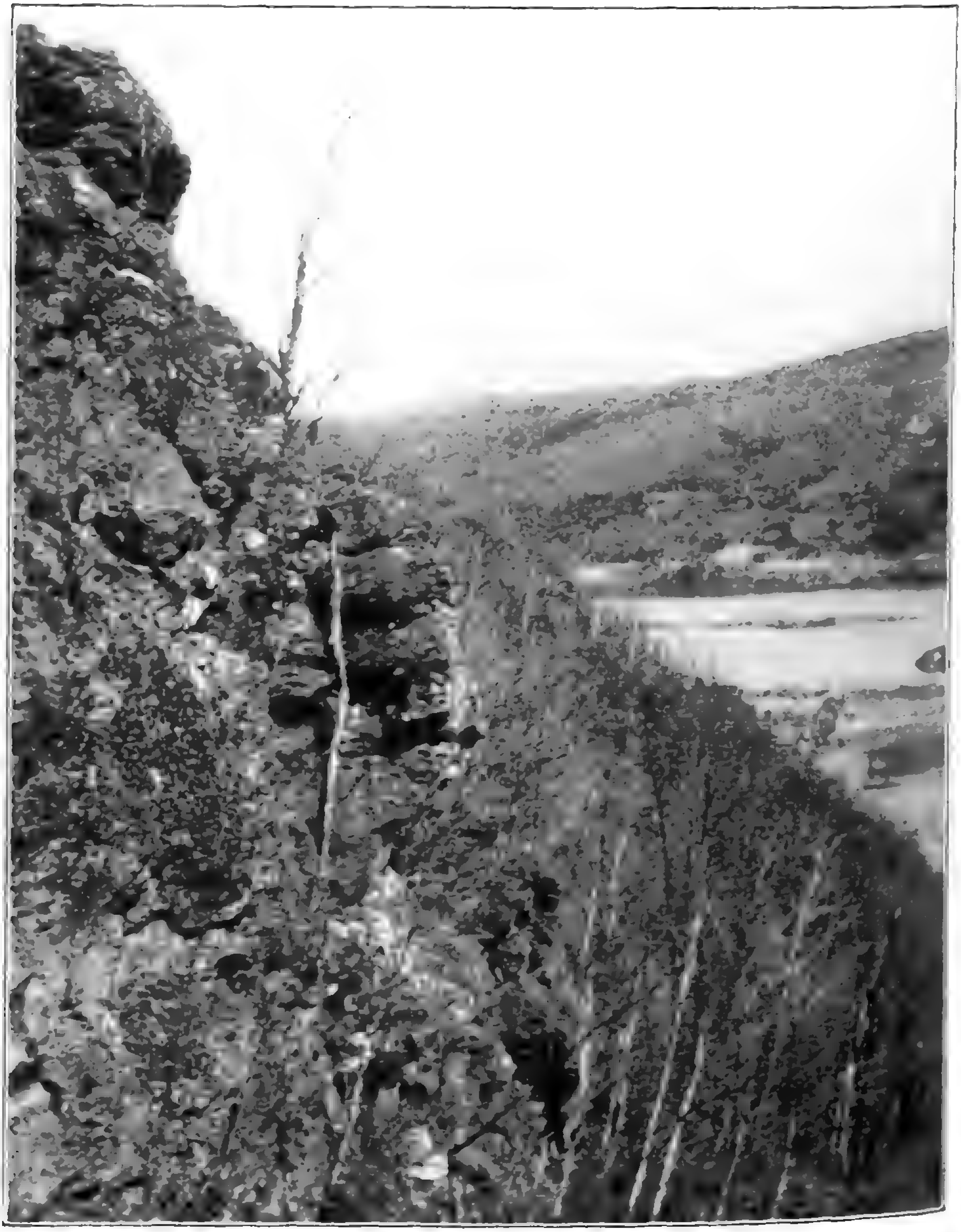
[1] Conard, H. S. Proc. Iowa Acad. Sci. 36: 141–142, plates 1 and 2. 1931.

particularly applicable to some of our rarer ferns and orchids, and might well be extended to include the unusual occurrences of birds and animals.

In May, 1924, while climbing down the cliffs at Monument Mountain, Great Barrington, I found a small colony of *Asplenium montanum* growing in a niche along the rugged face of the quartzite formation. This was the first known station in Massachusetts for this species.[1] It is some twenty miles farther north than any previously reported. In April, 1930, I made another "strike," to continue with the parlance of the prospector, of *A. montanum*, this time some twenty-five miles still farther north than Monument Mountain, at Blue Hawk Mountain (1800 ft. elevation), at Cheshire, Massachusetts. Here, as on the occasion at Monument Mountain, while I was making photographic studies of the nesting falcons, I found one or two fronds of this little fern, so few indeed in the latter case, and in such poor condition that to take them as evidence of my find might have destroyed the meager colony. In fact the first few fronds found here from their very scarcity and weather-beaten condition, afforded just sufficient evidence to appraise me of their true identity. But this slight evidence gave me ample incentive for further search here. Accordingly in early October, in company with Mr. Broun, of Lenox, I revisited the Blue Hawk station prepared to carefully search the steep outcroppings of schist that form the mountain.

Starting in at the point of my discovery we worked our way northward along the easterly face of the cliffs, inspecting pretty closely the seamed and scarred surface, for anything of botanical interest. Within an hour, about sixty yards from our starting point we were delighted at finding a fine colony of *A. montanum*, some twelve or fifteen groups in all. These were all found

[1] See AMERICAN FERN JOURNAL 14: 92. 1924.



Habitat of Mountain Spleenwort at Blue Hawk Mt., Cheshire, Massachusetts

within a fairly limited area, and fairly accessible, but were all we could find or reach, in the immediate vicinity, without the aid of a rope. There may be more of them, very probably are, in less accessible locations near-by, for there yet remains a considerable area of exceedingly difficult going, for further exploration. Several of the small groups found seemed to be especially flourishing, even luxuriant, for this dainty rock-loving species.

The finding of this species so far out of its previously known range has led to the query, have we in our botanical explorations overlooked this small species, or in other words, is it not possible that it occurs over a considerably wider range than our observations have defined for it? For my own part I have a very definite feeling that hereafter I shall be constantly on the alert for it at still more northern stations.—S. W. BAILEY, *Pittsfield, Mass.*

American Fern Society

Library Notes–I.

Newman, Edward. "A History of British Ferns and Allied Plants." John Van Voorst, London, 1844.

This book is a contribution of a fern enthusiast of the British Isles who began his fern study "while wandering among the Welsh mountains in the autumn of 1837." In his first undertaking to identify the forms which he found in Wales, some 20 or more, he found on his first attempt that he could certainly name only two—*Pteris aquilina* and *Polypodium vulgare*. During the next three summers, he undertook an intensive study of the native ferns, both in the field and by cultivation in the garden, and prepared a first edition of his book on British ferns. Some three years later, the second edition, represented by the new accession to the Fern Society Library, appeared, considerably increased in size. It is a matter of interest that Mr. Hombersley has presented a book not represented before either in the Fern Society Library or in the Brooklyn Botanic Garden Library.

As already noted, it is decidedly the book of a fern lover, written with interest and enthusiasm, illustrated with general and detailed studies of the species treated.

Fern classification reached a state of considerable maturity in England more than 50 years before it became an object of special interest in the United States. This book of Newman's seems to represent for England a stage corresponding in general with our early popular fern books, those of Parsons and Clute. With its contribution of lists of definite localities for each species, it should constitute an interesting reference for those planning a fern visit abroad. Newman seems to have had considerable correspondence and interchange of

specimens with the United States, as he comments rather regularly on the possible American range of these British species. An interesting contemporary comment of this type brings out an early name of an American species, referring to the Beech Fern, which he calls *Polypodium Phegopteris:*

"The North American *Polypodium connectile,* for specimens of which I am indebted to Mr. Booth and Mr. Lea, is so similar that I can scarcely assent to the opinion of that plant being distinct as a species."

It is interesting to compare this Newman book with the more recent types of British fern books. For example, Druery's "British Ferns and Their Varieties" issued in 1900, contains the following comment:

"The literature of our native ferns is very copious but that of the earlier days of fern study either makes no reference to varieties at all or dismisses them as monstrosities and consequently unworthy of serious attention."

Apparently, in this volume, Druery emphasizes only such species as have given rise to some type of unusual leaf form. Newman, on the other hand, is not concerned with sports. His volume lists some 43 species, with ten equisetums and about as many lycopodiums. The Newman contains such true ferns as *Pilularia* and *Marsilea* which find no place in the Druery.

A further commentary on the present point of view in British fern study may be found in an opinion expressed by Mr. Druery that the crested Shield Fern together with spinulosa and another British type should really be considered as varieties or sub-species of dilatata.

The point made at the start is thus obvious. This book of Newman's deals with British ferns from the point of view in which we still study our local species—as botanical forms of the wild, and not as garden varieties.—R. C. B.

"Icones Filicum Sinicarum," reviewed by Dr. Merrill in a recent number of the JOURNAL, has been added to the Society Library.

In a communication to the editors, Mr. Charles J. Hudson, Jr., invites members who may have the opportunity to visit the fern room in the conservatories in Garfield Park, Chicago. The collection here contains some seventy-five species of ferns, representing tropical types, together with cycads of all the known living genera, Selaginellas, liverworts and mosses. The larger plants are artistically arranged about a pool, fed by streams which make miniature waterfalls as they find their way over the rock-work among the ferns. These are of all sizes up to giant-fronded swamp ferns (*Angiopteris*) and tree-ferns twenty-five feet tall. In short, the conservatory is a place of beauty and of interest to the lover of ferns, well worth a visit.

Richard William Woodward, a member of the Society since 1915, died at New Haven, Connecticut, May 16, 1931, aged 84. He was a native of Franklin, Connecticut; he graduated from Yale in 1867, later pursuing studies in various German universities. On his return to the United States, he was appointed chemist to the expedition for the exploration of the 40th parallel under Clarence King. He was for several years with the Colorado Coal & Iron Co., at a time when Colorado was still on the frontier. His later years were spent in Connecticut, where much of his time was devoted to botany in which he had long been interested. He was a familiar figure at the field meetings of New England local botanical societies, more than commonly welcome because of his modest, but altogether attractive personality, as well as his keenness, skill and care as

collector and observer. He published a number of notes embodying both new localities for the rarer plants of his region and, more noteworthy, original studies of the floral behavior of *Arenaria lateriflora* and *Elodea*.

New members:

Benner, Jefferson S., Edison High School, Minneapolis, Minn.
Capt, Prof. Lucile, Dept. of Botany, Baylor College, Belton, Texas.
Cooper, Mrs. Bertha A., 1227 Thurman St., Portland, Oregon.
Goodman, Dr. Edward H., Dorset, Vermont.
Knight, William A., Biltmore Forest, Biltmore, N. C.
Lippincott, Miss Rebecca C., Mooretown, N. J.
Lyness, Arthur S., 45 River Road, Iowa City, Iowa.
Matthews, Mrs. Florence W., 548 Santa Clara Ave., Berkeley, Cal.
Peterson, Mrs. E., R. D. no. 2, box 759, Miami, Fla.
Reupke, A. H., 3624 North Oakley Ave., Chicago, Ill.
Smith, Albert C., New York Botanical Garden, New York City.
Smith, Mrs. Frank C., Jr., 32 Cedar St., Worcester, Mass.
Starry, David E., 403 Frear Hall, State College, Pa.
Stearns, Miss Frances, Junior College, Grand Rapids, Mich.
Tinkham, Mrs. F. L., Woods Hole, Mass.
Wiepert, D. D., 413 Eighth St., Brooklyn, N. Y.

Changes of address:

Anderson, Dr. W. A., Dept. of Botany, University of Iowa, Iowa City, Iowa.
Corne, Miss F. E., 17 Hilliard St., Cambridge, Mass.
DuBois, Mrs. Louis J., 654 South Market Ave., Sta. B, Brooklyn, N. Y.
Freedley, Miss Anna B., A. W. A. Club House, 353 West 57th St., New York City.
Gaylord, Mrs. Ilsien Natalie, Hotel Commander, Cambridge, Mass.
Haring, Mrs. H. A., Woodland, Ulster Co., New York.
Lawton, Elva, Hunter College, Park Ave. and 69th St., New York City.
Lewis, Rev. William F., Box 477, Bozeman, Montana.

Richardson, H. H., 25 Cottage St., Brookline, Mass.
Stebbins, Dr. G. Ledyard, Jr., 47 Maple Ave., Hamilton, N. Y.

Mrs. Bertha A. Cooper, 1227 Thurman St., Portland, Oregon, wishes to purchase ferns from Arizona, New Mexico and Texas.

WANTED—to exchange *Trichomanes petersii, Woodsia obtusa, W. glabella, Pellaea atropurpurea, P. glabella, Scolopendrium vulgare, Cheilanthes feei, C. californica, Pityogramma triangularis, Botrychium dissectum, B. obliquum, Asplenium platyneuron, A. pinnatifidum,* for specimens of *Botrychium lanceolatum, B. simplex, B. matricariaefolium, Ophioglossum vulgatum,* and *B. dissectum,* and *B. obliquum,* from the N. E. States.—E. W. GRAVES, Bentonsport, Ia.

Mr. Arthur S. Lyness, a new member of the Fern Society, whose address will be found on page 147, is making a study of the fernworts of Iowa and is anxious to obtain as many specimens of Iowa material as possible. Loan material may be sent to him at the Graduate College, University of Iowa, Iowa City, Iowa. He will also be glad to get definite information regarding special localities.

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ERRATA

Page 52,	line 17.	For *Polpodium*, read *Polypodium*.
Page 71,	line 31.	For *subintegrum*, read *subintegra*.
Page 83,	line 5.	For *sherwoodii*, read *Sherwoodii*.
Page 110,	line 11.	For *Kümmerle, J. V.*, read *Kümmerle, J. B.*
Page 110,	line 17.	For *Lycopodiacae*, read *Lycopodiaceae*.
Page 110,	line 18.	For *Selaginellacaea*, read *Selaginellaceae*.
Page 110,	line 18.	For *Psilotacaeae*, read *Psilotaceae*.

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW

C. A. WEATHERBY

VOLUME XXII

1 9 3 2

LANCASTER, PENNSYLVANIA

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ANNUAL SUBSCRIPTION. $1.25; FOREIGN. $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa. under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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An illustrated quarterly devoted to the general study of ferns.

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American Fern Journal

VOL. 22 JANUARY–MARCH, 1932 No. 1

Distribution of the Ferns of Wyoming

LEO A. HANNA

The author served in the Rocky Mountain Herbarium of the University of Wyoming as personal research assistant to Dr. Aven Nelson during the years 1929–1930. It was his good fortune to have an opportunity to study the specimens of ferns in the Rocky Mountain Herbarium and to review class notes from a number of lectures delivered by the late Dr. Edwin B. Payson. The key to the ferns as adapted to this paper was originally worked out by Elias Nelson. Dr. Payson made a number of changes. Many of the notes upon the several genera as well as numerous citations represent the work of Dr. E. B. Payson. (Herbarium numbers allude to specimens of the Rocky Mountain Herbarium.)

KEY TO THE FERNS (POLYPODIACEAE) OF WYOMING

a. Lower surface of the leaves covered with a dense tomentum, scales, or a conspicuous white powder.

b. Leaves tomentose or scaly beneath ..... 1. *Cheilanthes*

bb. Leaves covered with white powder beneath ... 2. *Notholaena*

aa. Lower surface of the leaves glabrous or merely pubescent.

b. No indusium present (or if present, then inconspicuous).

c. Leaves simply pinnatifid or once pinnate.

3. *Polypodium*

cc. Leaves at least twice pinnate or pinnatifid.

d. No indusium present; large ferns, leaves 2–9 dm. long ..... 4. *Athyrium*

[Volume 21, No. 4, of the JOURNAL, pages 117–152, plates 10–12, was issued Dec. 2, 1931.]

dd. Inconspicuous indusium present; medium-sized ferns, leaves rarely over 3 dm. long.

e. Leaves usually more or less pubescent and glandular; indusium split into narrow lobes and spreading on every side of the sorus.

5. *Woodsia*

ee. Leaves perfectly glabrous; indusium attached at one side and thrown back by ripening sporangia ..... 6. *Cystopteris*

bb. Indusium present, formed either of the inrolled leaf margin or from epidermal cells not attached to the margin.

c. Indusium formed from inrolled leaf margin.

d. Large ferns, leaves 50–200 cm. long; stipes stout, pale brown or straw-colored ..... 7. *Pteris*

dd. Small ferns of rock slides and cliffs, leaves rarely 20 cm. long.

e. Bases of the stipes involved in copious brown hairlike scales; pinnules ovate or lanceolate ..... 8. *Pellaea*

ee. Bases of the stipes not conspicuously hairy or scaly; at least the fertile pinnules linear or linear-lanceolate ..... 9. *Cryptogramma*

cc. Indusium formed from epidermal cells not connected with the margin of the leaf.

d. Sori round or nearly so.

e. Leaves simply pinnate, pinnae spinulose.

10. *Polystichum*

ee. Leaves at least twice pinnatifid.

f. Sori usually variable in shape on the same leaf, some elongated and hooked or curved at one end ..... 4. *Athyrium*

ff. Sori nearly uniform, round.

g. Indusium conspicuous with a notch at one side ..... 11. *Dryopteris*

gg. Indusium less clearly evident, not round with a notch at one side.

h. Leaves usually more or less pubescent and glandular; indusium split into narrow lobes and spreading on every side of the sorus ..... 5. *Woodsia*

hh. Leaves perfectly glabrous; indusium attached at one side and thrown back by the ripening sporangia ..... 6. *Cystopteris*

dd. Sori elongated or linear, not round.

e. Leaves twice pinnate or pinnatifid; sori usually more or less lunate or hooked. 4. *Athyrium*

ee. Leaves once pinnate or linear and forked. 12. *Asplenium*

(Credit for the key is ascribed to the Department of Botany, University of Wyoming)

1. CHEILANTHES Swartz. Lip Fern

1. CHEILANTHES FEEI Moore.

Cheilanthes lanuginosa Nutt.

Common in the crevices of dry rocks. Sonoran and Transition zones.

Specimens examined: Barnum, Johnson County, *A. Nelson*, 272; Guernsey, *A. Nelson*, 9202; Platte Canyon, Natrona County, *Goodding*, 127; Platte River, *A. Nelson*, 494; Hills east of Laramie, *Buffum*, 1197; Laramie Hills, *E. Nelson*, 442; Laramie Hills, *A. Nelson*, 8106.

Cheilanthes Fendleri. This fern has been collected in the foothills of Larimer County, Colorado.

Cheilanthes gracillima. This fern occurs in central Idaho and southwestern Montana.

2. NOTHOLAENA R. Br. Cloak Fern

1. NOTHOLAENA FENDLERI Kuntze.

Dry rock crevices. Upper Sonoran or Transition zones.

Specimens examined: Crow Creek Canyon, *E. Nelson*, 2020.

3. POLYPODIUM L. Polypody

1. POLYPODIUM VULGARE L.

Polypodium hesperium Maxon, Proc. Biol. Soc. Wash. **13**: 200. 1921.

The plant occurring in Wyoming is not quite typical *P. vulgare*. Maxon considers it a different species, while Fernald in Rhodora **24**: 137. 1922, treats it as the variety *columbianum* Gilbert of *P. vulgare*. At this time only one collection is known from Wyoming; Crow Creek, Laramie Hills, *A. Nelson*, 8902.

4. ATHYRIUM Roth. Lady Fern

Indusium vestigial, rarely at all evident. Sori round.
1. ***Athyrium alpestre***

Indusium more evident. Sori usually somewhat elongated and curved or hooked ..... 2. *Athyrium Filix-femina*

1. ATHYRIUM ALPESTRE (Hoppe) Rylands.

The form occurring in Wyoming is the variety *americanum* Butters (Rhodora **19**: 204. 1917). This variety was raised to specific rank by Maxon, as *Athyrium americanum* (Butters) Max., AM. FERN JOUR. **8**: 120. 1918. At present this plant is known from but one locality in Wyoming. It is to be expected in other places, however, as there are specimens in the herbarium from northern Colorado and western Montana.

Specimen examined: Glacial cliff, Teton Mountains. *Merrill and Wilcox*, 1032.

2. ATHYRIUM FILIX-FEMINA (L.) Roth.

Asplenium Filix-femina (L.) Bernh.

The relationships of the American forms of this species are treated by Butters in Rhodora **19**: 170–207, 1917. The Wyoming forms are intermediate between typical *A. Filix-femina* and the variety *californicum* Butters.

Specimens examined: Vicinity of the Big Horn Mountains, July–August, 1897, *T. A. Williams*, collected specimens from floating logs; Leigh's Lake, Jackson's Hole, *Merrill and Wilcox*, 920; Jackson's Hole, *A. Nelson*, 940.

5. WOODSIA R. Br.

Leaves conspicuously pubescent and glandular; lobes of the indusium narrow, but not beaded ..... 1. *Woodsia scopulina*
Leaves finely glandular or sometimes glabrous; lobes of the indusium linear and beaded ..... 2. *Woodsia oregana*

1. WOODSIA SCOPULINA D.C. Eat.

A common fern of rather dry situations. Transition to Canadian zones. (Sometimes found nearly at the timber line.)

Specimens examined: Teepee Creek hills, Big Horn Mts., *Willits*, 474; headwaters of Clear Creek and Crazy Woman River, *Tweedy*, 3544, 3547; along the Snake River, 20 miles south of Jackson, *Merrill and Wilcox*, 939; Laramie Peak, *A. Nelson*, 1594; Centennial Hills, *A. Nelson*, 1682; Bridger Peak, *Goodding*, 1953.

2. WOODSIA OREGANA D.C. Eat.

At present this plant is known from but a single station in Wyoming: Sundance Mt., Crook County, *A. Nelson*, 2153. It is noted that the leaves are somewhat thicker than in *scopulina*.

6. CYSTOPTERIS Bernh. Brittle Fern

1. CYSTOPTERIS FRAGILIS (L.) Bernh.

Filix fragilis (L.) Underw.

The commonest fern of Wyoming. It occurs in the Transition, Canadian, and Hudsonian zones. It is often confused with *Woodsia*.

Specimens examined: Myan Kara Mt., *Carter;* Sundance Creek, *A. Nelson*, 2113; Wolf Creek Canyon, *A. Nelson*, 2297; Trabine Creek, Big Horn Mts., *Willits*, 105; headwaters of Clear Creek and Crazy Woman River, *Tweedy*, 3545; Moose Falls, Yellowstone Park, *A. and E. Nelson*, 6577, 6578; Yellowstone Canyon, *Oleson*, 391a; Teton Mts. near Leigh's Lake, *Merrill and Wilcox*, 1057; Mexico mines, *A. Nelson*, 587; Lincoln Gulch, *A. Nelson*, 2606; Pole Creek, *A. Nelson*, 97; La Plata Mines, *E. Nelson*, 5122; Leucite Hills, *Merrill and Wilcox*, 471, 474.

7. PTERIS L. Bracken Fern

1. PTERIS AQUILINA L.

Pteridium aquilinum (L.) Kuhn.

The Wyoming plant is rather intermediate between the eastern *P. aquilina* and the western *P. aquilina*, variety *pubescens* (Underw.) Kuntze.

Wyoming specimens examined: Gibbon Canyon, Yellowstone Park, *A. and E. Nelson*, 6733; Leigh's Lake, *Merrill and Wilcox*, 923; Jackson's Hole, between Jenny and Leigh's Lake, *Payson and Payson*, 2275; Laramie Peak, *A. Nelson*, 1601, 7518; Centennial Valley, *A. Nelson*, 2662; Jordan's ranch, Alpine, *Payson and Armstrong*, 3486.

8. PELLAEA Link. Cliff Brake

At least the upper pinnae of the leaf usually entire; stipes slender, .5 to .75 mm. in diameter, sometimes marked transversely, but not usually breaking off near the ground. 1. *Pellaea glabella*

Upper pinnae usually two-parted; stipes rather stout, about 1 mm. thick, usually marked near the base with transverse depressions along which the stipes break easily ..... 2. *Pellaea Breweri*

1. PELLAEA GLABELLA Mett.

Pellaea atropurpurea occidentalis E. Nels. Fern Bull. 7: 30, 1899.

Pellaea occidentalis (E. Nels.) Rydberg; Underw. Native Ferns, p. 98, 1900.

Pellaea pumila Rydb., Mem. N. Y. Bot. Gard. 1: 4, 1900.

This plant occurs in the Transition zone. It is closely related to *Pellaea atropurpurea* of the eastern states and may be only a distinct variety.

Specimens examined: Headwaters of Clear Creek and Crazy Woman River, *Tweedy*, 3546; Loomis Creek, Natrona County, *Goodding*, 183; Laramie Hills, *A. Nelson*, 1919; Laramie Hills, *A. and E. Nelson*, 6837.

2. PELLAEA BREWERI D. C. Eat.

Rock crevices. Transition, Canadian, and Hudsonian zones.

Specimens examined: Hoback River Canyon, *Payson and Payson*, 3066; Sheep Mt. (Ferry Peak) near Alpine, *Payson and Armstrong*, 3649; Piney Mt., *Payson and Payson*, 2708; Leucite Hills, *Merrill and Wilcox*, 474, 513.

9. CRYPTOGRAMMA R. Br. Rock Brake

All the leaves usually spore-bearing, essentially alike; stipes dark brown ..... 1. *Cryptogramma densa*

Leaves distinctly of two kinds, the spore-bearing taller and the pinnae narrower; stipes green or straw-colored. 2. *Cryptogramma acrostichoides*

1. CRYPTOGRAMMA DENSA (Brack.) Diels.

Pellaea densa Hook.

Cheilanthes siliquosa Maxon, AM. FERN. JOUR. 8: 116, 1918.

Canadian zone. As far as the specimens of the Rocky Mountain Herbarium show, this species has been collected but once in Wyoming. This was from Glacier Creek, Teton Mountains, *Payson and Payson*, 2266 Elias Nelson reports it from the "Teton Range" in the Fern Bulletin 7: 30, 1899. Probably it was reported from there by Brandegee.

2. CRYPTOGRAMMA ACROSTICHOIDES R. Br.

Common in rock slides. Hudsonian and Arctic-Alpine zones.

Specimens examined: Little Goose Creek hills, *A. Nelson*, 2340; Obsidian cliff, Yellowstone Park, *Payson and Payson*, 3103; Upper Geyser Basin, *Blankinship;* Gibbon meadow, Yellowstone Park, *A. & E. Nelson*, 6191; Teton Mts., *Owen;* Jackson's Hole, *A. Nelson*, 950; Teton Mts., *Merrill and Wilcox*, 1066; Grand Teton, *Payson and Payson*, 2235; Medicine Bow Mts., *Good-*

ding, 2050; Battle Lake Mt., *A. Nelson*, 4222. Dr. E. B. Payson observed this fern in abundance at Cottonwood Lake, east of Smoot.

10. POLYSTICHUM Roth. Holly Fern

Polystichum mohrioides, variety *scopulinum*. Fernald in Contr. Gray Herb. 72 (Rhodora 26): 92 gives an account of this fern. Though reported from the Teton Canyon of Idaho, probably it actually occurred in Wyoming.

1. POLYSTICHUM LONCHITIS (L.) Roth.
   Canadian zone.

Specimens examined: Teton Mts., near Leigh's Lake, *Merrill & Wilcox*, 1081; Teton Mts., above Jenny Lake, *Payson and Payson*, 2291; Salt River Mts. east of Afton, *Payson and Armstrong*, 3278; Battle Lake Mt., *A. Nelson*, 4240; Bridger Peak, *Goodding*, 1936.

11. DRYOPTERIS Adans.

1. DRYOPTERIS FILIX-MAS (L.) Sw. Male Fern.
   Canadian zone.

Specimens examined: Dale Creek, *Roth*; Chimneys of Pedro Mountains, Natrona County, *Goodding*, 119; Laramie Peak, *A. Nelson*, 7558; Ragged Top, *A. Nelson*, 8935.

12. ASPLENIUM L. Spleenwort

Leaves linear, irregularly forking ..... 1. *Asplenium septentrionale*
Leaves broader, pinnae oval or oblong.
  Stipe brownish near base, rachis green ..... 2. *Asplenium viride*
  Stipe and rachis brownish throughout. 3. *Asplenium Trichomanes*

1. ASPLENIUM SEPTENTRIONALE (L.) Hoffm.
   Belvisia septentrionalis Mirb.
   Transition zone.

Specimens examined: Dry granite cliffs, Crow Creek, Laramie Hills, *Aven Nelson*, 8900; Granite rocks, Fish Creek, Albany County, near the Colorado line, *Payson & Payson*, 2508.

2. ASPLENIUM VIRIDE Hudson.

Canadian zone.

Specimens examined: Teton National Forest, *Brandegee;* Near Summit, Teton Pass, *Merrill & Wilcox*, 1181.

3. ASPLENIUM TRICHOMANES L. Maidenhair Spleenwort.

Transition zone.

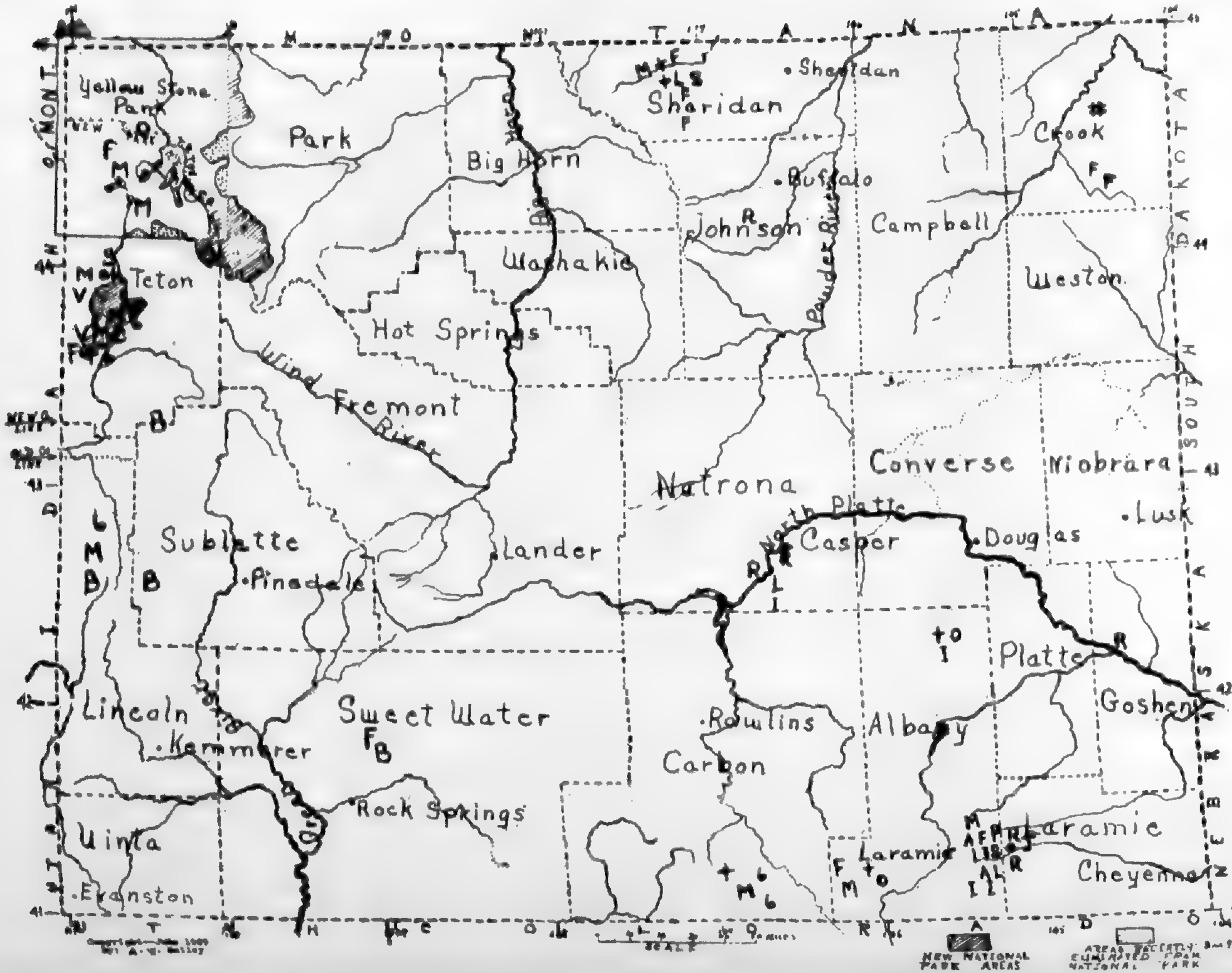
Specimens examined: Dry granite cliffs, Crow Creek, Albany County, *A. Nels.*, 8901.

The map accompanying this article is self-explanatory. It is sufficient to say that it is an attempt to show graphically the distribution of the ferns of Wyoming.

CONCLUSION

At the present time it is known that the eighteen species of ferns above listed are indigenous to the area included within the state of Wyoming and that the additional species, *Polystichum mohrioides, Cheilanthes Fendleri,* and *Cheilanthes gracillima,* will probably be found within the limits of the state. It will be noted that there are four areas characterized by a relatively great abundance of species of ferns, the Teton Mountains, the Laramie Hills, the Big Horn Mountains, and the Medicine Bow Mountains. It is significant that few or no ferns have been reported from the Salt River, Wind River, Absoroka, and Uinta Mountains.

GRANGER, WYOMING.



(This map is used here by courtesy of the Bailey School Supply House, Casper, Wyoming.)

EXPLANATION OF PLATE

R *Cheilanthes Feei*
P *Notholaena Fendleri*
. *Polypodium vulgare*
W *Athyrium alpestre*
S *Athyrium Filix-femina*
\+ *Woodsia scopulina*
# *Woodsia oregana*
O *Pteris aquilina*
A *Asplenium septentrionale*
T *Asplenium Trichomanes*
V *Asplenium viride*
F *Cystopteris fragilis*
L *Pellaea glabella*
B *Pellaea Breweri*
I *Dryopteris Filix-mas*
C *Cryptogramma densa*
M *Cryptogramma acrostichoides*
6 *Polystichium Lonchitis*

New Tropical American Ferns—IX[1]

WILLIAM R. MAXON

In the present instalment two new West Indian species are described. The first, from Jamaica, is related to *Elaphoglossum heteromorphum*, of the South American Andes, but appears to have been strangely confused with *E. Lindeni*, which for the present must be excluded from the Jamaican flora. The second species, *Adiantopsis asplenioides*, is a very rare Cuban plant, closely allied to *A. monticola*, of Brazil.

Elaphoglossum nematorhizon Maxon, sp. nov.

§ *Condyloneura.* Faciei et praesertim rhizomate filiformi tenui *E. heteromorpho* simillimum, sed frondibus

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

fertilibus quam steriles brevioribus, laminis fertilibus ovatis nec ellipticis, laminis sterilibus basi cuneatis nec rotundato-truncatis, nervis obliquis nec patentibus, sporis triplanatis subglobosis laevibus nec oblongo-reniformibus crenato-marginatisque satis diversum.

Rhizome wide-creeping, up to 35 cm. long, branched, filiform (0.5–1 mm. in diameter), light castaneous, angulate, deciduously squarrose-paleaceous; scales lax, bright brown, narrowly lance-attenuate, 3–4 mm. long, 0.5–0.8 mm. broad above the rounded base, subentire. Fronds numerous, distant, laxly ascending, long-stipitate, the sterile ones surpassing the fertile. Sterile fronds 8–21 cm. long, the stipes filiform, 0.2–0.3 mm. thick, 1–2 times as long as the blade, lightly flexuous, olivaceous from a brownish base, laxly scaly, minutely glandular-puberulous, the hairs capitate, extending sparingly throughout the frond; blades 4–8 cm. long, 1–2 cm. broad, lance-elliptic to linear-oblong, cuneate at base, acuminate or usually acute at apex (the tip obtuse), laxly and distantly paleaceous upon the margins, the lower surface, and the slender elevated subflexuous costa above and beneath, the scales similar to those of the rhizome, but smaller, subinvolute, and subserrulate at tip; veins 15–20 pairs, distant, oblique, immersed, simple or once forked, terminating in large depressed circular hydathodes 0.5 mm. from the margin; leaf tissue bright green, membrano-herbaceous. Fertile fronds very few, 4–14 cm. long, the filiform stipe 2–4 times as long as the blade, laxly paleaceous, flexuous; blade 1.5–2.5 cm. long, 10–12 mm. broad, ovate, abruptly acuminate at base, acutish at apex, narrowly revolute-marginate, persistently paleaceous above, scantily so beneath; spores triplanate, subglobose, about 70 μ in diameter, yellowish, nearly smooth.

Type in the U. S. National Herbarium, no. 1183948, collected near the extreme summit of Blue Mountain Peak, Jamaica, altitude 2100–2200 meters, on steep shady earth-slope (clay) of forest ravine, July 8, 1926, by William R. Maxon (no. 10566). A second collection, with identical data, is *Maxon* 9938.

In his synoptical treatment of the ferns of Jamaica Jenman lists *Acrostichum Lindeni* Bory as "infrequent

on the sides of large rocks and banks in the forest above 7000 ft. altitude, just below the crown of Blue Mountain Peak.'' There are, however, no specimens of *E. Lindeni* in the Jenman Herbarium at the New York Botanical Garden, the Jamaican Government Herbarium at Kingston, or the herbarium of the Royal Botanic Gardens, Kew, to which institution Jenman customarily sent new or critical material during his residence in Jamaica. His description is fairly good for *E. Lindeni*, which is well known from continental material ranging from Mexico to Ecuador and Bolivia, and does not at all apply to the present plant, *E. nematorhizon*. Nevertheless, considering the nearly or quite identical locality ascribed by Jenman, and the further fact that in detached sterile fronds of the two species there is a general resemblance in texture, size, shape, and coarse venation of the blade, it seems very probable that Jenman observed the Jamaican plant in the field (mistaking it for *E. Lindeni*) but subsequently lost or misplaced his specimens, and that eventually in preparing manuscript for the Synoptical List of Jamaican ferns he trusted to memory in this instance and based his description of *E. Lindeni* wholly upon herbarium specimens of the common continental plant. In no other way can one reconcile, for example, his disregard of the wide-creeping filiform rhizome of the Jamaican plant, which stands in the strongest contrast to the short thickish rhizome and its copious covering of strongly denticulate-ciliate, dark castaneous scales correctly ascribed to *E. Lindeni*. It is almost certain that *E. Lindeni* must be excluded from the Jamaican flora.

The true alliance of *E. nematorhizon* is with *E. heteromorphum* (Kl.) Moore, founded upon Colombia specimens (*Hartweg* 1525), of which typical examples have been studied at Kew and the British Museum. Though similar in its rhizome, that species differs definitely in

having the fertile fronds longer than the sterile, in its oval-oblong sterile blades, which are rounded-truncate at base and have the veins spreading, in its elliptic fertile blades, and in minute characters of scales and spores.

Adiantopsis asplenioides Maxon, sp. nov.

Species rarissima *A. monticolae* affinis, quod differt: statura minora, textura crassiora, pinnis plerisque oblongis et solum auriculatis nec late trapeziformibus et profunde lobatis vel partitis, nervis pinnatis nec flabellatis, et marginibus sterilibus subintegris nec profunde crenulatis.

Rhizome ascending, about 1.5 cm. long, 5 mm. thick, rigidly appressed-paleaceous; scales 3.5–4.5 mm. long, narrowly subulate-attenuate to a fragile filiform tip, light castaneous, concolorous or thicker and darker with age, subentire. Fronds several, cespitose, recurved-ascending, 10–18 cm. long; stipes 2–6 cm. long, 0.3 mm. thick, wiry, dark castaneous, naked, glabrous; blades linear, 8–12 cm. long, 1–1.5 cm. broad, slightly narrowed at the abruptly obtuse apex, barely or not reduced at base, pinnate-pinnatifid, the rachis delicate, like the stipe; pinnae 10–20 pairs, alternate or (in the basal half) sub-opposite, spreading or appearing retrorse, mostly 5–8 mm. long, 3–7 mm. broad, broadly rhombic, strongly inequilateral, deeply auriculate-lobate at distal base (the lobe cuneiform, 1.5–3.5 mm. broad, often free in the lower pinnae, deeply crenulate if sterile), broadly decurved-excavate proximally (the lower margin entire), the main portion of the segment broadly rhombic-cuneate and coarsely 2-lobate or 3-lobate; venation immersed; sori single or geminate in the sinuses (rarely confluent), few-sporangiate, the indusia ample, oblong to narrowly reniform, vaulted, subentire; spores triplanate, yellowish, translucent, about 72 μ in diameter, nearly smooth. Leaf tissue light or yellowish green, delicately herbaceous, glabrous.

Type in the U. S. National Herbarium, no. 1301520, collected near Río del Medio, at Las Pozas, Province of Pinar del Río, Cuba, "very scarce," Sept. 10, 1923, by Erik L. Ekman (no. 17456). Collected also in eastern

Cuba long ago by Charles Wright (no. 881), according to a specimen at Kew first identified by Hooker as *A. paupercula* and subsequently as *Hypolepis Gardneri* Hook., *i.e. Adiantopsis monticola* (Gardn.) Moore, a Brazilian species founded on *Gardner* 3557, of which an excellent example is at hand.

The relationship of *A. asplenioides* is in fact clearly with *A. monticola*. The latter is, however, a considerably smaller yet coarser plant, differing in its ebeneous stipe and rachis and its rather narrowly oblong pinnae, these with scarcely an exception merely auriculate at the upper base, in contrast to the deeply lobate or pinnatifid pinnae of *A. asplenioides*, in which the basal lobe is sometimes free. In *A. monticola* the leaf tissue is rigidly herbaceous and the sterile margins are subentire; the veins also are pinnately arranged, as opposed to the flabellate venation of *A. asplenioides*.

The Genus Lomagramma in America[1]

R. C. CHING

In the course of my recent study of the genus *Leptochilus* as treated by Christensen in the Index Filicum, I came across the American *L. guianensis* (Aublet) C. Chr.,[2] which does not agree well with *Leptochilus* Kaulfuss, nor *Bolbitis* Schott (*Campium* Presl), but, on the contrary, comes so near *Lomagramma*, a genus known hitherto only from tropical Asia, that its affinity seems too obvious to be mistaken.

The genus *Lomagramma*[3] was first founded by J.

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[1] The present short paper is written in response to a kind request from Dr. Carl Christensen, who thought it might prove of some interest to the readers of the AMERICAN FERN JOURNAL.

[2] C. Chr. Index Filicum, p. 385. 1905.

[3] Journal of Botany 3: 402. 1841.

Smith upon *L. pteroides* (nomen) from Luzon (leg. Cuming), which was, however, later found by Hooker,[4] and admitted by its author,[5] to be only an abnormal form of *Leptochilus lomarioides*[6] Blume, a fern common in the Indian Peninsula, throughout Malesia and the Philippines, and northward to Liu-Kiu, Tonkin and South China.

As a genus, *Lomagramma* distinguishes itself from other related genera by a wide-scandent habit, the articulate pinnae with reticulated venation, and by the absence of lateral main veins. Fronds stipitate and adherent to the rhizome; lamina oblong or oblong-lanceolate, simply pinnate or rarely bipinnate, pinnae articulate to the rachis and easily detached; venation anastomosing in 2 to several series between the margin and costa, of angular oblique areoles without free included veinlets as in some of the species of *Bolbitis,* to which the present genus is closely related, and like, that, probably of a meniscioid origin.

As hinted above, *Lomagramma* J. Sm. has hitherto been considered as an exclusively Asiatic genus, representing about half a dozen[7] good species, all natives of the tropical countries. However, our attention was called long ago to the unnatural systematic position of *Leptochilus guianensis* (Aublet) by Dr. Carl Christensen,[8] who, having noticed the peculiarly articulated pinnae and the wide-scandent rhizome, was then of the opinion that it should be segregated as a distinct genus.

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[4] Species Filicum 5: 269. 1864.

[5] Historia Filicum 141. 1875.

[6] Enumeratio plant. Javae, etc., 206. 1828.

[7] As construed here, *Lomagramma* does not include the free-veined species, always with bipinnate to tripinnatifid leaves. They are of *Arthrobotrya* J. Sm.

[8] On the American Species of *Leptochilus* sect. *Bolbitis,* in Botanisk Tidsskrift 26: 2. Hefte, p. 286. 1904.

Speaking systematically, *Leptochilus guianensis* (Aublet) appears so well associated with the Asiatic *Lomagramma lomarioides* (Bl.) J. Sm. in many respects, that, apart from the geographical distinction, it can safely be distinguished from the Asiatic species only by the coadunately binnatifid leaf-apex, the more or less cuneate base of the shortly stalked lower pinnae and by the rufous-brown scales on rhizome, and on rachis and costa beneath, the latter of which are rather sparingly scaly. On the other hand, the Asiatic species has impari-pinnate leaves, truncate or rotundo-truncate sessile pinnae and copiously shaggy fuscous larger scales on rachis and bullate ones on the costa beneath. Both species, however, agree in having the rachis more or less narrowly winged, particularly towards the apex, in stipes and rachis being broadly channeled on the upper side and in very thin herbaceous texture. The venation-patterns are essentially alike, except that the American species has more often open areoles towards the margin and prominently clavate tips of the veinlets.

Having so far briefly reviewed both generically and specifically, I feel it, now, safe enough to conclude that *Leptochilus guianensis* (Aublet) C. Chr. is a *Lomagramma* J. Sm., and it is very closely related to *L. lomarioides* (Bl.) J. Sm. from Asia, and, therefore, to propose the following nomenclatural change:

LOMAGRAMMA **guianensis** (Aublet) Ching, comb. nov.
Polypodium guianense Aublet, Hist. Pl. Guian. **2**: 962. 1775.
Leptochilus guianensis C. Chr. Bot. Tidssk. **26**: 286. 1904.

For further synonyms, C. Chr. Index Fil., p. 385, may be referred to.

Thus, *Lomagramma guianensis* (Aublet) is the first American species of the genus, known heretofore only

from Asia. The fern is said to be common in the southern Brazil, and is besides known from Guiana, Puerto Rico, Hispaniola and Cuba. Like its Asiatic sister species, the present fern is a tall climber (6–10 m.), growing in damp shaded places, running over rocks or high trees in tropical forests. Furthermore, like most other scandent ferns, it is also rather rarely to be found in the fertile state.

In closing, it may be stated that, as perhaps might reasonably be expected, the two phyletically related genera, *Bolbitis* Schott and *Lomagramma* J. Sm. are found, today, represented by species in the New World as well as the Old, with a far greater number in Asia. On the other hand, the other three closely related genera, *Leptochilus* Klf., *Selliguea* Bory (*S. Feei* Bory), and *Colysis* Presl (*C. membranacea* Presl), each represented in Asia by a dozen or so species, are not yet known in the New World. This shows that the last three genera, being polypodioid ferns in (or towards) a coenosorous state, are phyletically wide apart from the first two, and that *Leptochilus* Klf. is not at all related to *Bolbitis* Schott (*Campium* Presl), as often supposed by authors, but its affinity to the other two genera, particularly *Colysis*, is very close or rather so close that the generic delimitation of the one from the other is, in my mind, by no means a clear-cut one, as I shall show in the near future.

NANKING, CHINA.

Goebel's "Roraima Ferns"[1]

C. V. MORTON

Although it is now several years since Goebel's paper on some Roraima ferns was published, no review of it has hitherto appeared in the AMERICAN FERN JOURNAL. Any paper by Professor Goebel is, of course, deserving of serious study by all botanists, but this one is of particular interest, and the present somewhat extended account may not be inappropriate.

The introduction to the paper gives a brief summary of explorations of Mt. Roraima. The summit, the dividing point between British Guiana, Venezuela, and Brazil, is one of the most floristically interesting regions in the world. Quoting im Thurn, "The district of Roraima is . . . an oasis clothed with vegetation distinct from that of the country which immediately surrounds it . . ." The percentage of endemic species is very high. Plants are here subjected to extreme climatic conditions: strong winds, comparatively low temperatures, intense light, excessively high humidity and daily downpours of rain.

The chief interest of the paper lies in the description of a new genus of ferns, *Hymenophyllopsis*, of doubtful affinity. The genus is described from plants collected by Dr. Ph. von Luetzelburg, who gives the Indian common name as *Curacumurâ*. Goebel remarks that either the plant must be very common in order to have attracted the attention of the natives (for it is small and to the untutored eye without any very striking characteristics) or that it must be possessed of medicinal properties. The latter is perhaps the case since the fern is

[1] Archegoniatenstudien XVIII Roraimafarne, by K. Goebel, in Flora n. ser. **24**: 1–37. 1929.

found to be very rich in tannin. The species is described in German and illustrated with numerous anatomical drawings. A short Latin diagnosis follows the German description.

The following is an abbreviated account of the more striking characteristics of this remarkable new genus.

The rhizome is densely covered with numerous, small, red-yellow scales, these reaching a length of over two centimeters and a width of 0.5–1 millimeter. These scales end in a hairlike tip, one cell in width, and have the appearance of being "clathrate." They are entire or with small teethlike projections. Such scales are unknown in the Hymenophyllaceae, which possess only hairs consisting of a single row of cells. Thus the genus may be distinguished at a glance from all of the numerous species of that family.

A cross-section of the rhizome shows that sclerenchyma is absent. The parenchyma is divided into an outer part with brown-colored cell walls and an inner with colorless. In the center lies a single amphiphloeic solenostele (siphonostele). At the nodes the stele is broken by a short obvious leaf-gap from which two vascular bundles enter the stipe. This structure is in marked contrast to that of the family Hymenophyllaceae, which uniformly has the vascular system of the rhizome of a protostelic type and therefore without leaf-gaps. In the Hymenophyllaceae only a single vascular strand enters the stipe.

The leaf-tissue is composed of three layers of cells. The upper and lower are of small, chlorophyll-bearing, thin-walled cells, irregularly arched, giving the leaf surface a "papillose" appearance. The middle cells are much larger and seem not to possess chlorophyll. Intercellular spaces are absent. The nerves of the leaves consist of tracheides only. On the other hand, most of the

species of Hymenophyllaceae have leaf-tissue composed of a single layer of cells.

The sorus is of a peculiar type. The indusium-lobe is of the same texture and anatomical structure as the leaf-tissue except that it contains no nerve. It is situated on the under surface (not reaching the margin) and is usually united with the leaf-tissue at the base only; in rare cases the upper border only may be free. The sorus is at the end of a nerve which may end there or may be continued beyond into the leaf-tissue which forms the other lobe of the indusium. This extension of the nerve may branch and even the leaf-tissue beyond may be once furcate. This indusial structure is utterly opposed to that of *Hymenophyllum*, in which the two lobes of the indusium are exactly alike, always strictly marginal, and nerveless.

The sporangia also show some differences. They are very large and are few in number, only 4 or 5 to a sorus. Corresponding to this reduction in number of sporangia there is a dwarfing of the receptacle, which is extremely minute, in contrast to the usually very conspicuous receptable of the Hymenophyllaceae. There are differences between the sporangia of *Hymenophyllopsis* and the Hymenophyllaceae in their insertion, the course of the annulus and general form. In contrast to the Hymenophyllaceae, the spores of *Hymenophyllopsis* do not contain any chlorophyll.

All of these numerous and fundamental points of difference show that the genus can not be referred to the family Hymenophyllaceae at all. The form of the indusium shows the general character of the tribe Davallieae, in particular the genera *Wibelia*, *Lindsaya*, and *Odontosoria*, but these have sporangia of the typical polypodiaceous type with vertical annulus. The sporangia are very similar in type to those of the Cyathea-

ceae. The tree ferns, however, are usually very large, with a conspicuous receptacle, gradate sori, and a large number of sporangia. Moreover, the only genus of Cyatheaceae having a dorsal indusium is *Hemitelia,* in which genus, however, the indusium is extremely fragile and the sorus is never terminal on a nerve. Goebel, therefore, concludes that the genus may be representative of a new family of ferns, for which, however, he does not propose a name.

The reviewer has only one criticism to make of Goebel's admirable work and that is concerned with his choice of a specific name. As he remarks, Baker described from the summit of Mt. Roraima a "*Hymenophyllum dejectum,*" the description being strongly suggestive of *Hymenophyllopsis.* Goebel, however, finds it hard to believe that Baker with his long experience with ferns could have referred the plant to *Hymenophyllum* and have believed it related to *H. polyanthos.* One who is familiar with Baker's work, however, does not find this so hard to believe. Goebel, therefore, describes his new species as *Hymenophyllopsis dejecta,* in order, as he says, to avoid a change in specific name in case the two species should be found to be identical. This is a procedure which must have been entirely unnecessary, inasmuch as the type specimen of *Hymenophyllum dejectum* Baker could presumably have been borrowed from Kew by Professor Goebel, who would then have been in a position to make a definite statement. Three sheets of *Hymenophyllum dejectum* Baker are in the U. S. National Herbarium, one representing part of the type material (*im Thurn* 318), the other two collected by McConnell & Quelch (no. 626). There is little doubt but that they are identical with the plant described by Goebel.

The remainder of the paper need not be discussed in this place, it being of less interest and importance to the fern student in general.

WASHINGTON, D. C.

Shorter Notes

ASPLENIUM PINNATIFIDUM NUTT. IN OKLAHOMA.—A record of *Asplenium pinnatifidum* Nutt. from Oklahoma may be worthy of note, since this species apparently has not been reported from the state.[1] On April 25, 1931, during the spring meeting of the Oklahoma Academy of Science, the writer found this fern at Robbers' Cave Boy Scout Camp, about 9 miles north of Wilburton, Latimer County, southeastern Oklahoma. This species was growing on a sandstone bluff in the pine-oak forest of the Sans Bois Mountains. According to the distribution given in manuals, this station may extend the known southwestern range of *Asplenium pinnatifidum* Nutt. Dr. William R. Maxon has kindly checked the determination and a specimen has been deposited in the United States National Herbarium.—ELBERT L. LITTLE, JR., *Southwestern State Teachers College, Weatherford, Okla.*

OSMUNDA REGALIS VAR. SPECTABILIS (WILLD.) A. GRAY.—J. Smith notes on a sheet from his herbarium (now at the British Museum):

"I have from year to year noticed the very distinct habits of this plant and *O. spectabilis* from the true form of *O. regalis*—

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[1] See Greene, F. C. Notes on the Pteridophyta of Oklahoma. AMER. FERN JOURNAL **17**: 125–129. 1927; Bush, B. F. Ferns of Oklahoma. Amer. Midland Naturalist **12**: 91–112. 1930; Jeffs, R. E., and E. L. Little, Jr. A preliminary list of the ferns and seed plants of Oklahoma. Publ. Univ. Okla. Biol. Surv. **2**: 33–101. 1930.

the *spectabilis* form is readily distinguished from *regalis* by its red colour and much more delicate fronds."

The red colour presumably refers to the young fronds; it would be interesting to know if this character is constant in wild plants growing in North America.—A. H. G. ALSTON, *British Museum (Natural History), London.*

IS THE AMERICAN ROYAL FERN SPECIFICALLY DISTINCT FROM A EUROPEAN SPECIES?—According to the manuals, this question has been answered both affirmatively and negatively over a period of years. Willdenow described the American plant as a distinct species, *O. spectabilis.* Others have segregated the tropical American representatives as further distinct types; for example, *O. gracilis* Link of Brazil. Mr. Alston raises the query regarding a distinctly individual characteristic. In that connection, it will be interesting to have reports from any who have had the opportunity to observe both types carefully, either through herbarium studies, experience in Europe or America, or the cultivation of the European form in American gardens. In the latter connection, it may be noted that a plant of the European form cultivated at the New York Botanical Garden for years showed persistent differences in the appearance of its leaves, in their longer persistence in the fall and in the stipe characters. This plant behaved like the European trees commonly cultivated in the eastern states, the Norway Maple, for example, which holds its leaves much later in the fall than the American species, but which does not manifest the blaze of color our American forms usually show. Some years ago, the writer called attention to the fact that the Royal Fern growing along Adirondack lakes and streams contributed a distinct color feature,—yellows and bronzes,—to the autumnal palette. Purely from memory, the observation is here

reported that in the spring our native Royal Fern develops some tint of purple or red.—R. C. BENEDICT.

SNAILS FEED ON RIPENING CONES OF EQUISETUM.—One cloudy, misty day in May I was studying *Equisetum praealtum* Raf. in Indian Springs ravine north of Columbus, Ohio, when I noticed that a large land snail was eating the ripening cones of this species of Scouring-rush. A number of the snails caught in the act of feeding were collected and sent to Prof. Frank C. Baker, of the University of Illinois Museum of Natural History, for determination. He reported that the snail was a common woodland species, *Polygyra thyroides*. The snails were eating the tissues of the sporophylls, sporangia, and spores and some of the cones attacked were entirely eaten up. The snails have only been observed to feed on the cones in wet cloudy weather and they seem to prefer them when they are nearly mature, just before or at the time that the sporangia begin to break open. Thus there are at least four kinds of "Equisetivorous" creatures—rabbits, cows, snails, and men. Cattle have a special liking for *Equisetum kansanum* Schaffn. and Chinamen are reported to eat the tender fertile shoots of *Equisetum arvense* L.—JOHN H. SCHAFFNER, *Ohio State University.*

ANOTHER FERN LIST.—The reporter of the list which follows seems to have followed a course which many other Fern Society members have taken in their beginning fern study. We may be grateful to the writers of popular fern books, like Mrs. Parsons, Mr. Clute, Mr. Durand, and Dr. Waters, for their success in arousing the interest of readers in the study of ferns. Mr. Dix's addition of Archaeopteris, a fossil fern, suggests a new line of increasing the fern flora of any locality where fossil-bearing rocks occur.—R. C. BENEDICT.

I am very much of an amateur, becoming interested last year by reading Mrs. Parson's book. With this and Herbert Durand's book during last summer I identified thirty-five species.

My vacation is spent at Shehawken Lake, a small glacial lake about one-half mile in extent. Within less than one-half mile of this lake I found the following twenty-six species:

Polypodium virginianum, Adiantum pedatum, Pteridium latiusculum, Asplenium platyneuron, Athyrium acrostichoides, Athyrium angustum, Polystichum acrostichoides, P. Braunii, Thelypteris palustris, T. simulata, T. noveboracensis, T. phegopteris, T. dryopteris, T. marginalis, T. goldiana, T. cristata, T. clintoniana, T. spinulosa, T. americana, Cystopteris fragilis, Dennstaedtia punctilobula, Onoclea sensibilis, Osmunda regalis, O. claytoniana, O. cinnamomea, Botrychium obliquum, B. virginianum.

I am quite sure that I can add to this list about six more which will make quite a good list for so small a section of territory. Seventeen of the above can be found in a tiny wooded ravine at the outlet, not more than five rods wide and less than twenty long.

This lake is situated in the extreme northeastern corner of Pennsylvania, at an elevation of 1800 feet above sea-level. It is a sandstone country, with rocks of the later Devonian period.

About a mile from the lake I have found two or three species of Archaeopteris, a fossil fern.—W. R. DIX.

FERNS AS WEEDS.—In connection with this subject, the following quotation from the New Zealand Journal of Agriculture, vol. 20, no. 6, page 358 (1920), kindly sent us by Dr. Maxon, is of interest. Readers in the northern hemisphere should not forget that in New Zealand, March is an autumn month.

"ERADICATION OF SILVER-FERN

"It is generally admitted that the control on broken country of silver-fern (*Pteris scaberula*), which occurs so freely throughout the King-country of the North Island, and elsewhere, presents a difficult problem—far more so than in the case of the ordinary bracken-fern. From the experience of settlers and the writer's own observations it would appear that there are only two effective methods of treatment. The first method is to subdivide the area, and stock heavily with sheep or cattle according to the conformation of the land, but the more cattle the better. If possible there should be three paddocks, and the stock should be ten days in each, or ten days on and twenty days off. The number of stock should be regulated so that they will have fair feed for, say, seven days, but during the last three days will have to work for their living. As the patches of fern are crushed out they should be surface-sown with a heavy seeding of grasses suitable to the district. If the land is steep the mixture should contain a large percentage of *Danthonia pilosa*. The other method is to fire the patches of fern. This can sometimes be done in the early spring after a few frosts when the sap is right down, but the best and safest time is about the end of March. It is necessary that the fern be very dry so as to ensure a good hot fire, a poor fire doing more harm than good. For this reason considerable judgment is necessary in burning, and if the conditions are not ideal one should wait, even if it means missing a year, rather than risk a bad burn. As soon as the ashes are cool apply a heavy seeding of grass-seed as recommended under the first method. It is very important that the seed be sown before rain has fallen. A great deal of the success of the operation depends on

this. The foregoing note was prompted by an inquiry from a King-country correspondent who used the name silver-fern. *Pteris scaberula* is also variously known as carpet-fern, creeping-fern, hard-fern, and pig-fern.''—J. W. DEEM, *Fields Instructor, Wanganui.*

American Fern Society

BROWN'S MILLS, N. J., OUTING, SEPTEMBER 25 TO 27, 1931

Leaders: Mr. and Mrs. Wm. Gavin Taylor

Eighty-eight members and friends of the American Fern Society attended this meeting at Brown's Mills, New Jersey, in which the Torrey Botanical Club of New York and the Philadelphia Botanical Club participated. Friday evening was given over to social contacts and informal discussion. Saturday was spent in the field, visits being made to several widely separated stations, including West Plains, Batsto, Atsion, and Hanover Furnace. The characteristic landscape features were a new experience to many of the party. In the evening we listened to lectures by Raymond H. Torrey, on ''The Relation of the Flora of New Jersey Pine Barrens to the Geological History of the Region''; Dr. Edgar T. Wherry on ''Soil Characteristics Affecting Pine Barren Flora''; A. Tennyson Beals on ''Mosses of the Pine Barrens''; Dr. Wm. S. Thomas on ''Mushrooms of the Pine Barrens''; and Dr. M. A. Chrysler on ''Characteristic Flora of the Pine Barrens'' with lantern illustrations made by natural color photography. On Sunday we visited the gardens of Miss Elizabeth White, at Whitesbog. Miss White has a very comprehensive collection of plants of the region, growing as they are found in their natural surroundings. She also had some fine specimens of the rare tree, Franklinia, in bloom, and cranberries and blueberries of many species under cultivation. Perhaps the

THE PALES AT BROWN'S MILLS, SEPTEMBER, 1931

most interesting flower found on the trip was the Pine Barrens Gentian, *Gentiana Porphyrio*. Other interesting plants in bloom were the Orange Milkwort, *Polygala lutea;* Golden Aster, *Chrysopsis mariana;* Small White Water Lily, *Castalia odorata* variety *minor;* Goat's Rue, *Cracca virginiana;* Ladies' Tresses, *Gyrostachys;* and Pickering's Morning Glory, *Breweria pickeringii*. Conrad's Crowberry, *Corema conradii;* Turkey-beard, *Xerophyllum asphodeloides;* Beach Heather, *Hudsonia tomentosa;* Pine Barrens Heather, *Hudsonia ericoides;* and Pyxie, *Pyxidanthera barbulata*, were among the interesting flowering plants which were found but not in bloom. The ferns deserving of special mention were the two chain ferns, *Woodwardia virginica* and *Woodwardia areolata;* the Massachusetts Fern, *Aspidium simulatum;* the Climbing Fern, *Lygodium palmatum;* and the very rare and elusive Curly Grass, *Schizaea pusilla*. Excellent stands of these ferns were found.

FIELD MEETING FOR 1932

At present, tentative plans can be announced for two field meetings of the American Fern Society during 1932. The first one is scheduled to be held at Syracuse, June 20–25, in conjunction with the regular summer meeting of the American Association for the Advancement of Science, with which the American Fern Society is affiliated. Plans for this meeting include field trips to some of the notable fern habitats near Syracuse, and probably also an indoor meeting. The following places of interest are suggested for the consideration of members: Jamesville region with its several Hartstongue localities. as well as its other significant botanical and topographical features; the Hartstongue stations at Chittenango Falls and at Perryville; Labrador Pond, south of Syracuse. which is a notable locality; and Cicero Swamp, a large

A Bank of Hartstongue near Jamesville, New York

extent of sphagnum bog, north of the city. Here is a "menu" which ought to tempt a considerable number of fern enthusiasts to visit central New York next June; the accompanying illustration of a bank of Hartstongue should whet the appetite of any who are hesitant. A Committee for the meeting is being organized with representatives in different sections. Volunteers are enlisted. It is hoped that the affair may be arranged as a joint trip with the Torrey Botanical Club.

Another meeting to be held jointly with the Torrey Club in the New York region is projected for the early part of August. The exact place will be announced later.

List of Members of the American Fern Society

CORRECTED TO MARCH 15, 1932

SUPPLEMENT TO THE AMERICAN FERN JOURNAL,
VOL. 22, NO. 1

(* Charter Members; † Life Members; ‡ Honorary Members)

Aiken, Walter H., 1520 Aster Place, Cincinnati, Ohio 1911
Allen, Charles L., Care Norton Co., Worcester, Mass. 1929
Allen, Dr. Fred H., 16 Fairfield Ave., Holyoke, Mass. 1921
Allen, Henry V. D., Care Canadian Dept., General Electric Co., Schenectady, N. Y. 1904
Allen, Walter S., 224 State St., Flushing, N. Y. 1917
Ames, Prof. Oakes, Botanical Museum, Oxford St., Cambridge, Mass. 1917
Amidon, Dr. Royal Wells, Chaumont, Jefferson Co., N. Y. ... 1911
Ammons, Miss Nellie, 146 Hunt St., Morgantown, W. Va. ... 1929
Anderson, Dr. W. A., Dept. of Botany, Univ. of Iowa, Iowa City, Iowa 1927
Armstrong, Mrs. C. R., Trudeau, N. Y. 1906
Arnold, William T., 21 Park Rd., Wyomissing, Pa. 1919

Baber, E. A., Longview Hospital, Cincinnati, Ohio 1926
Bailey, Dr. Liberty Hyde, Ithaca, N. Y. 1921
Baker, Prof. H. R., State Board of Agriculture, Dover, Del. 1927
Barnes, Mrs. Albert C., Barnes Foundation, Latch's Lane, Merion, Pa. 1926
Barnes, Franklin Augustus, P. O. Box 44, Bellona, Yates Co., N. Y. 1914
Barnhart, Dr. John Hendley, New York Botanical Garden, New York, N. Y. 1911
Barrie, George N., Roughwood, Chestnut Hill, Mass. 1925
Barry, Mr. E. T., 260 E. 194th St., New York City 1932
Bartsch, Dr. Paul, Smithsonian Institution, Washington, D. C. 1911
Bates, Miss Amy L., Park Museum, Providence, R. I. 1926
Baxter, M. S., 46 Bly St., Rochester, N. Y. 1912
Beals, Mrs. A. Tennyson, 5833 85th St., Elmhurst, N. Y. 1928
Bean, Ralph C., 48 Emerson St., Wakefield, Mass. 1920
Beck, Mrs. Walter Innisfree, Millbrook, N. Y. 1928
Bell, Mrs. John J., Box 956, Winter Park, Fla. 1931
Benedict, J. E., Jr., 945 Pennsylvania Ave., Washington, D. C. 1923
Benedict, Dr. Ralph Curtiss, 1819 Dorchester Road, Brooklyn, N. Y. 1905
Benfield, Rev. W. A., Link's Grove, W. Va. 1924
Benner, Jefferson S., Edison High School, Minneapolis, Minn. 1931
Bill, Mrs. G. E., 819 Third St., Harrisburg, Pa. 1922
Birger, Dr. Selim, Jarlesgratan 27, Stockholm, Sweden 1922
Blanding, H. W., P. O. Box 54, Silver Creek, N. Y. 1929
Boehland, G., Rockford, Ill. 1928
Boughton, Fred S., Pittsford, N. Y. 1917
Bowen, Leon W., 77 Evergreen Ave., Bloomfield, N. J. 1932

‡Bower, Prof. Frederick Orpen, 2 The Crescent, Ripon, England 1926
Bowman, F. Willard, 245 Beverly Road, Douglaston, L. I. 1932
Boyce, Mrs. David C., 40 Battle Road, Princeton, N. J. 1930
Boydston, Mrs. Kathryn E., 616 Forest Ave., Glen Ellyn, Ill. 1930
Braun, Prof. E. Lucy, 2702 May St., Cincinnati, Ohio 1920
Bray, Dr. William L., 1005 Harrison St., Syracuse, N. Y. 1916
Breckenridge, Prof. Lester Paige, North Ferrisburg, Vt. ... 1915
Britton, Mrs. Elizabeth Gertrude, 2965 Decatur Ave., New York, N. Y. 1911
Britton, Dr. Nathaniel Lord, New York Botanical Garden, New York, N. Y. 1911
Brooks, Maurice G., French Creek, West Virginia 1926
Brooks, Mrs. Wm. F., 48 High St., New Britain, Conn. 1908
Brown, Miss Bertha M., 10 Greenman Ave., Westerly, R. I. 1921
Brown, Hubert H., 42 Pacific Ave., Toronto 9, Canada 1926
Burgin, Herman, M.D., 212 High St., Germantown, Philadelphia, Pa. 1915
Burnham, Stewart Henry, Dept. Botany, College of Agriculture, Ithaca, N. Y. 1897
Butters, Prof. Frederic K., University of Minnesota, Minneapolis, Minn. 1917

Cameron, Charles, Tauranga, New Zealand 1930
Campbell, Dr. Douglas Houghton, Leland Stanford University, Palo Alto, Cal. 1915
†Capp, Seth Bunker, P. O. Box 2054, Philadelphia, Pa. 1915
Carhart, Macy, 1462 Morada Place, Pasadena, Cal. 1915
Carpenter, Dana S., Middletown Springs, Vt. 1926
Cathcart, W. H., 10700 Euclid Ave., Cleveland, Ohio 1931
Cheever, Dr. Austin Walter, 203 Clinton Road, Brookline, Mass. 1911
Cheney, Prof. Ralph H., Biological Dept., Long Island University, 300 Pearl St., Brooklyn, N. Y. 1925
Child, Mrs. H. W., 186 Commonwealth Ave., Boston, Mass. 1915
Child, W. A., 389 Hess St., South Hamilton. Ontario 1917
Chisholm, Mrs. Maud L., Proctor, Vt. 1923
Choate, Miss Alice D., Lesone Hotel, 5002 Waterman Ave., St. Louis, Mo. 1898
‡Christensen, Dr. Carl, Botanical Museum, Copenhagen, Denmark 1915
Church, Mrs. George A., Amherst, Mass. 1930
Clark, Mrs. B. Preston, 171 Marlboro St., Boston, Mass. 1928
Clarkson, E. H., 41 Tyng St., Newburyport, Mass. 1917
Clayton, Ernest, 434 Laurel St., San Anselmo, Marin Co., Cal. 1928
*Clute, Prof. Willard Nelson, Butler University, Indianapolis, Indiana 1893
Cooper, Mrs. Bertha A., 1227 Thurman St., Portland, Ore. 1931
Corne, Miss F. E., 17 Hilliard St., Cambridge, Mass. 1910
Cornman, Mrs. L. R., 210 Sea Vale St., Chula Vista, Cal. 1917
Cowan, Alexander, Valleyfield, Penicuik, Midlothian, Scotland 1914
Cowles, Judge Clarence P., Burlington, Vt. 1930

Cromwell, Miss Mary L., 198 Flax Hill Rd., South Norwalk, Conn. 1926

Dacy, Miss Alice Evelyn, 98 Hemenway St., Boston, Mass. 1898
Dane, Mrs. Ernest B., Roughwood, Chestnut Hill, Mass. 1925
Darling, Cyrus, 30 Apricot St., Worcester, Mass. 1929
Darling, Miss Nancy, "The Highlands," R. D. No. 2, Woodstock, Vt. 1909
Davenport, Mrs. Elizabeth Braxton, 46 Western Ave., Brattleboro, Vt. 1901
Davis, Edward E., Norwich, N. Y. 1928
Davis, Wm. Anthony, West Barrington, R. I. 1927
Deam, Charles Clemon, R. D. No. 6, Bluffton, Ind. 1905
Delafield, Mrs. John P., 17 East 79th St., New York, N. Y. 1923
Demaree, Delzie, Stanford University, Cal. 1928
Diddell, Mrs. W. D., 276 Talleyrand Ave., Jacksonville, Fla.
Dobbie, H. B., 84 Market Rd., Epsom, Auckland, New Zealand 1926
Dobbins, R. A., Ohio Northern University, Ada, Ohio 1927
Dole, W. Herbert, 23 Overlook Ave., West Orange, N. J. 1926
Doubleday, Mrs. Arthur W. (Florence F.), Woodstock, Vt. 1928
Dowell, Dr. Philip, Port Richmond, Staten Island, N. Y. 1906
Drown, Mrs. George L., 9 Walnut St., Barre, Vt. 1930
Dubois, Mrs. Louis J., 645 St. Marks Ave., Brooklyn, N. Y. 1927
Duncan, Robert, 136 Woodland Rd., Chestnut Hill, Mass. 1927
Durand, Herbert, 8 The High Rd., Bronxville, Westchester Co., N. Y. 1924

Eames, Mrs. Edward A., 155 Bryant St., Buffalo, N. Y. 1918
Earle, Mr. R. S., 350 Commonwealth Ave., Boston, Mass. 1928
Eaton, Prof. E. H., 678 Main St., Geneva, N. Y. 1927
Eaton, Frederick W., Concord, Mass. 1921
Edson, Mrs. Josephine Z., 54 Fairview Ave., Rochester, N. Y. 1928
Edwards, James L., 27 Stanford Place, Montclair, N. J. 1932
Egerton, John B., 333 East 20th St., Baltimore, Md. 1929
Eggleston, Willard Webster, U. S. Dept. of Agriculture, Washington, D. C. 1911
Eisman, Louis, 45 Rockaway Ave., Brooklyn, N. Y. 1929
Elwert, Max A., 317 East 90th St., New York City 1931
Emmons, Edward Thayles, Geneva, N. Y. 1915
Ewan, Joseph, 1631 Shatto St., Los Angeles, Cal. 1930

Farwell, Oliver Atkins, 271 Smith Ave., Detroit, Mich. 1913
Featherly, H. I., Dept. of Botany, Oklahoma Agric. and Mechan. College, Stillwater, Okla. 1928
Fedtschenko, Prof. Boris, Jardin Botanique Principal, Leningrad, U. S. S. R. 1927
Finegan, Mrs. Thomas C. (Grace B.), 26 Strathallan Park, Rochester, N. Y. 1925
Flett, J. B., Route 1, Bremerton, Wash. 1899
Floyd, Fred Gillan, Sierra Madre, Cal. 1897
Foote, Mrs. E. M. (Caroline C.), 119 East 40th St., New York, N. Y. 1925
Forbes, Fayette Frederick, Brookline, Mass. 1911
Francke, Mrs. Louis J., Brookville, Glen Head, N. Y. 1930
Frazee, Vernon L., 67 East 4th St., Clifton, N. J. 1930

Freedley, Miss Anna B., A. W. A. Club House, 153 West 57th St., New York City 1928

Gannett, L. S., 120 East 16th St., New York City 1928
Gaylord, Mrs. Ilsien Nathalie, 2208 Lowena Drive, Long Beach, Cal. 1924
Geske, E. J., P. O. Box 3733, West Palm Beach, Fla. 1924
Goldin, Oscar, Curtis High School, New Brighton, N. Y. 1930
Golding, Mrs. Ada, Mill River, Mass. 1925
Goodale, Prof. Alfred S., Dept. of Botany, Amherst College, Amherst, Mass. 1921
Goodman, Dr. Edward H., Speedwell, Dorset, Vt. 1930
Gordon, Miss Sue S., Livermore, Maine 1926
Graves, Edward W., Bentonsport, Iowa 1917
Gray, Rev. Frederick W., Marlinton, W. Va. 1923
Greene, F. C., 1434 Cincinnati Ave., Tulsa, Okla. 1913
Greene, Henry Jewett, "Green Top," Petersham, Mass. 1929
Griffin, Miss Margaret, 324 Broadway, Apt. 506, Paterson, N. J. 1930
Grout, Dr. Abel Joel, 1 Vine St., New Brighton, Staten Island, N. Y. 1910
Grow, Mrs. Eugene J. (Anna K.), 29 School St., Lebanon, N. H. 1930
Grubb, Prof. Percy Lamar, 417 Briggs St., Harrisburg, Pa. 1905
Gruber, C. L., Kutztown, Pa. 1907

Haas, Dr. Flora Anderson, Arkansas State Teachers' College, Normal Station, Conway, Ark. 1917
Hall, Miss Anna L., 103 Macon St., Brooklyn, N. Y. 1929
Hall, Mrs. Carlotta C., Carnegie Laboratory, Stanford University, Cal. 1913
Halsey, Miss Alice, Garrison-on-Hudson, N. Y. 1923
Hanna, Leo A., The Great Divide Exp. Station, Granger, Wyo. 1932
Haring, Mrs. H. A. (Inez M.), Woodland, Ulster Co., N. Y. 1930
Harper, Prof. Robert Almer, Columbia University, New York City 1913
Hart, Bertrand K., 32 Dudley St., Fall River, Mass. 1928
Hartline, Mrs. D. S., State Teachers' College, Box 14, Bloomsburg, Pa. 1910
Hazen, Edwin Humphrey, 91 Howe St., New Haven, Conn. 1923
Hazen, Dr. Tracy Elliot, Columbia University, New York City 1910
Heerman, F. M., 272 President Ave., Providence, R. I. 1930
Heermance, Miss Laura W., 354 Edward St., New Haven, Conn. 1923
Hensley, J. D., 240 Forsythe St., Beaumont, Texas 1925
Hewitt, Mrs. Judith D., 308 West 82nd St., New York City 1926
Highton, W. L., 77 Roseville Ave., Newark, N. J. 1932
Higman, Harry W., 1320 East 63rd St., Seattle, Wash. 1932
Hobbs, Mrs. John E., 2933 Whitney Ave., Mount Carmel, Conn. 1927
Hombersley, Archdeacon A., Port-of-Spain, Trinidad 1930
Hopkins, Prof. Lewis S., Culver-Stockton College, Canton, Mo. 1905
House, Dr. Homer Dolliver, Education Bldg., Albany, N. Y. 1918

Howard, Miss Grace E., Dept. of Botany, Wellesley College, Wellesley, Mass. 1930
Howe, Dr. Marshall Avery, New York Botanical Garden, New York City 1911
Huber, F. F., Farmers' National Bank, Pennsburg, Pa. 1926
Hudson, Charles, Garfield Park Conservatory, Chicago, Ill. 1931
Humphrey, George Scranton, 32 Liberty St., New York City 1911
Hunnewell, Francis Welles, 5 University Hall, Cambridge, Mass. 1915
Hutchinson, Mrs. Susan W., 724 South Orange Drive, Los Angeles, Cal. 1923

James, Mrs. E. H., 309 North 22nd St., Portland, Oregon 1930
James, Mrs. Walter B., 7 East 70th St., New York, N. Y. 1921
Jayne, Miss Addie, Hampton Institute, Va. 1925
Jennings, Dr. Otto Emery, Carnegie Museum, Pittsburgh, Pa. 1911
Junberg, Sture A., 1069 78th St., Brooklyn, N. Y. .....
Jurica, Hilary S., St. Procopius College, Lisle, Ill. 1919

Kamm, Mrs. Oliver (Minnie W.), 571 Washington Rd., Grosse Pointe, Mich. 1922
Kaufman, Miss Pauline, 83 Argyle Ave., New Rochelle, N. Y. 1900
Keeler, Mrs. L. M., P. O. Box 273, Scarsdale, N. Y. 1913
Keffer, Dr. Edward I., 5971 Drexel Rd., Philadelphia, Pa. 1930
Kelsey, Harlan P., East Boxford, Mass. 1921
Kelton, Mrs. George H. (Ruth C.), Hubbardston, Mass. 1926
Kestner, Paul, Le Clos Etoilé, Chailly Village, Lausanne, Switzerland 1928
†Kidder, Nathaniel T., Milton, Mass. 1921
Killip, Ellsworth P., U. S. National Museum, Washington, D. C. 1916
Kimball, Miss Laura F., 1515 L Ave., National City, San Diego Co., Cal. 1897
Kimber, Miss N. B., 538 Locust Ave., Germantown, Philadelphia, Pa. 1925
Kittredge, Miss E. M., North Ferrisburg, Vt. 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
Knowlton, Clarence Hinckley, Hingham, Mass. 1911
Kobbé, Frederick W., 1155 Park Ave., New York, N. Y. 1921

Laughlin, Mrs. Charles P., 333 North Sandusky St., Delaware, Ohio 1925
Lawton, Miss Elva, Dept. of Botany, University of Michigan, Ann Arbor, Mich. 1926
Lee, Mrs. Eva M., Lynwood, Crofton Lane, Orpington, Kent, England 1924
Leeds, Arthur N., 5321 Baynton St., Germantown, Philadelphia, Pa. 1921
Leonard, Emery C., National Museum, Washington, D. C. ... 1920
Lewis, Rev. Charles Smith, Trinity Rectory, Plattsburg, N. Y. 1917
Lewis, Miss Stella M., 137 Flower Ave. West, Watertown, N. Y. (Winter Address: 821 Donnelly St., Mt. Dora, Fla.) 1925
Lewis, Rev. William Fisher, Box 477, Bozeman, Montana 1920

Lillibridge, Miss Amey A., 429 Lloyd Ave., Providence, R. I. 1921
Lippincott, Miss Rebecca C., 122 West Main St., Moorestown, N. J. 1931
Litch, C. M., 14 Burnap St., Fitchburg, Mass. 1916
Little, Elbert L., Jr., Southwestern Teachers' College, Weatherford, Okla. 1927
Logue, Dr. Everett G., 1601 Almon St., Williamsport, Pa. 1920
Lombard, Dr. Robert H., Box 293, Ashburnham, Mass. 1916
Long, Bayard, 250 Ashbourne Rd., Elkins Park, Philadelphia, Pa. 1911
Looser, Gualterio, Casilla 5542, Santiago, Chile 1928
†Lowe, Mrs. Frank E. (Rachel L.), The Stateway, Portland, Maine 1917
Lownes, Albert E., 69 Manning St., Providence, R. I. 1924
Lyness, Arthur S., 45 River Road, Iowa City, Iowa 1931
Lyon, Dr. Harold Lloyd, P. O. Box 411, Honolulu, H. I. 1911

McAvoy, Miss Blanche, 206 South Main St., Norwal, Ill. 1920
MacCaskill, Allan, Jr., Coleraine, Victoria, Australia 1925
McColl, W. R., 819 Second Ave. East, Owen Sound, Ontario 1917
MacFadden, Mrs. J. P., 9001 La Tuna, Canyon Rd., Roscoe, Cal. 1924
McFarland, Prof. Frank T., Dept. of Botany, University of Kentucky, Lexington, Ky. 1915
McLean, Dr. F. T., New York Botanical Garden, Bronx Park, New York City 1932
Mackenzie, Kenneth K., 615 Prospect St., Maplewood, N. J. 1923
Macy, Perry D., Springbrook, Ore. 1928
Mansfield, Mrs. Bessie R., Box 957, Westboro, Mass. 1921
Mansfield, William, College of Pharmacy, Albany, N. Y. 1922
†Marble, John E., 1313 Garfield Ave., South Pasadena, Cal. 1928
Mark, Miss Clara G., 270 South State St., Westerville, Ohio 1913
Marsh, Spencer S., Midwood Terrace, Madison, N. J. 1927
Marsh, Mrs. Spencer S., Midwood Terrace, Madison, N. J. 1927
Matthews, Mrs. Florence W., 548 Santa Clara Ave., Berkeley, Cal. 1931
Maxon, Dr. William Ralph, U. S. National Museum, Washington, D. C. 1895
Maxson, Miss Persis H., 93 High St., Brockton, Mass. 1930
May, Dr. James V., Rooms 1 and 2, First National Bank Bldg., Marinette, Wis. 1927
Mendelson, Dr. Walter, 639 Church Lane, Germantown, Philadelphia, Pa. 1910
Merrill, Henry Wilson, East Hiram, Maine 1906
Miner, Mrs. John L. (Bess B.), 1 Maher Ct., Greenwich, Conn. 1930
Mirick, Miss Nellie, 232 East Walnut St., Oneida, N. Y. 1896
Mohr, Charles E. I., Bucknell University, Lewisburg, Pa. 1930
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. No. 3, Waterbury, Vt. 1923
Moore, Dr. George T., Missouri Botanical Garden, St. Louis, Mo. 1915
More, Miss Eleanor, St. Johnsbury House, St. Johnsbury, Vt. 1931

Morse, Prof. A. P., Peabody Museum, Salem, Mass. 1925
Moss, Mrs. C. E., Box 1176, Johannesburg, South Africa..... 1916
Mottier, Dr. David Myers, Indiana University, Bloomington, Ind. 1911
Mousley, H., 4073 Tupper St., Westmount, Montreal, Canada 1920
Mulliken, Robert S., Ryerson Physical Lab., University of Chicago, Chicago, Ill. 1927
Munz, Prof. Philip A., 1165 Indian Head Blvd., Claremont, Cal. 1921

Newell, Chauncey Jackson, Alstead, N. H. 1902
Nicholson, Miss Zaida, 43 East 27th St., New York City..... 1931
Noyes, Miss Elmira Elsie, 912 Brandon Ave., Norfolk, Va. 1893

Oliphant, Roy L., 98 Glen Ave., Oakland, Cal. 1930
Oliver, Miss Mary H., 270 S. State St., Westerville, Ohio..... 1920
Osborne, Mrs. Lydia A., 96 Winthrop St., Winthrop, Mass 1924
Osmun, Prof. Albert Vincent, Agricultural College, Amherst, Mass. 1901
Osterlund, P., 131 West 140th St., New York City..... 1920
Otis, Ira C., 4320 First Ave., N. E., Seattle, Wash. 1921
Ottley, Prof. Alice M., 46 Dover Rd., Wellesley, Mass..... 1930
Overacker, Miss Minnie L., 127 Robineau Rd., Syracuse, N. Y. 1915

Palmer, Ernest Jesse, 321 South Allen St., Webb City, Mo. 1909
Palmer, T. Chalkley, Delaware County Institute of Science, Media, Pa. 1898
Palmer, Dr. Theo. Sherman, 1939 Biltmore St., N. W., Washington, D. C. 1911
Peckham, Mrs. Wheeler H., Davenport Neck, New Rochelle, N. Y. 1917
Perry, Mrs. Robert Dunlap, Brunswick, Maine 1929
Peterson, Mrs. E., Route 2, Box 759, Miami, Fla. 1931
Petzke, Earnest A., M.D., Hixton, Wis. 1926
Phair, Miss Gertrude G., 804 East 19th St., Brooklyn, N. Y. 1916
Pickett, Prof. Fermen Layton, Ph.D., State College of Washington, Pullman, Wash. 1914
Platt, Miss Caroline M., 142 East 49th St., New York City 1926
Plitt, Charles Christian, 3933 Lowndes Ave., Baltimore, Md. 1898
Pond, Bremer Whidden, 250 Stuart St., Boston, Mass. 1910
Pontius, Leslie L., 170 West High St., Circleville, Ohio..... 1930
Porter, Miss May N., Apt. A–7, Bldg. No. 2, 1 Greenridge Ave., White Plains, N. Y. 1929
Potter, Miss Mabelle A., Rowe, Mass. 1928
Pretz, Harold W., 123 South 17th St., Allentown, Pa. 1909
Prince, Prof. S. Fred, Reed's Spring, Stone Co., Mo. 1905
Pugsley, Frank M., Pittsford, N. Y. 1926

Quinn, James J., Winchester, Mass. 1929

Radlo, Miss Dora A., 32 Cherry St., North Adams, Mass. 1894
Ransier, Herbert Earl, Manlius, N. Y. 1902
Raska, Miss Clara, 2114 149th St., Whitestone, N. Y. 1929
Razek, Mrs. Frances, 6252 Wissahickon Ave., Germantown, Philadelphia, Pa. 1927

Redelings, Dr. T. J., Marinette, Wis. 1929
Redles, George, 207 East Winter St., Germantown, Philadelphia, Pa. 1913
Reupke, A. H., 3624 North Oakley Ave., Chicago, Ill. 1931
Rhodes, Charles Orman, Box 366, Groton, N. Y. 1896
Richards, Miss Margaret D., 670 Willey St., Morgantown, W. Va. 1929
Richardson, H. H., 25 Cottage St., Brookline, Mass. 1922
Ridlon, Harry Cooper, Bennington, Vt. 1908
Rippey, Mrs. R. C., 806 East Sherman St., Portland, Ore. 1930
Roberts, Miss Louisa Wright, 520 Roberts Ave., Syracuse, N. Y. 1915
Robertson, Carl T., 1626 Holyrood Rd., N. E., Cleveland, Ohio 1921
Rooney, Mrs. Frank (Anna K.), 810 East 40th St., Brooklyn, N. Y. 1916
Ross, Miss Marjorie Ruth, 422 Eddy St., Ithaca, N. Y. 1927
†Rossberg, William B., 44 Hawkins St., New Britain, Conn. 1911
Rugg, Harold Goddard, Dartmouth College, Hanover, N. H. 1906
Rust, Miss Sarah H., 6 Beacon St., Boston, Mass. 1922
Sadler, Miss Nellie M., 429 Westcott St., Syracuse, N. Y. 1926
Sanford, Samuel Newton Folius, P. O. Box 702, Fall River, Mass. 1918
Saunders, Miss Helen E., 454 7th St., Brooklyn, N. Y. 1929
Saunders, W. E., 250 Central Ave., London, Ontario 1928
Schaffner, Prof. John H., Ohio State University, Columbus, Ohio 1920
Scott, Mrs. Willard, 1651 Beacon St., Brookline, Mass. 1917
Sharpe, Dr. M. R., Uxbridge, Mass. 1929
Slifer, Mrs. Walter B., 56 Southern Parkway, Rochester, N. Y. 1928
Smith, Albert C., New York Botanical Garden, Bronx Park, New York City 1931
Smith, Mrs. Cora Roe, The Pines, Branchville, N. Y. 1928
Smith, Ewart G., 147 High St., Christ Church, New Zealand 1927
Smith, Mrs. Frank C., Jr., 32 Cedar St., Worcester, Mass. 1931
Snavlin, Mrs. C. T., 300 Greenwood Place, Syracuse, N. Y. 1929
Snow, E. W., 193 Aldine St., Rochester, N. Y. 1930
Sohol, Miss Eva, 225 East 63rd St., New York City 1932
Somerville, Mrs. J. H., 2011 John Ave., Superior, Wis. 1923
Standley, Paul Carpenter, Field Museum of Natural History, Chicago, Ill. 1915
Starker, Carl, Jennings Lodge, Ore. 1931
Starry, David E., 403 Frear Hall, State College, Pa. 1931
Steagall, Miss Mary M., 808 S. Illinois Ave., Carbondale, Ill. 1923
Stearns, Mrs. H. B., Saranac Lake, N. Y. 1923
Stebbins, Dr. George Ledyard, Jr., 47 Maple Ave., Hamilton, N. Y. 1926
Steil, Dr. William N., 748 North 23rd St., Milwaukee, Wis. 1916
Stephens, George E., 86 Bedford Rd., Horsham, Sussex, England 1928
Stetson, Richard N., 7278 Hollywood Ave., Hollywood, Cal. 1927

Stewart, F. E., 1708 Gardena Ave., Long Beach, Cal. 1930
Stone, Miss Edna L., 1618 Rhode Island Ave., N. W., Washington, D. C. 1928
Stratton, Mrs. G. W., 518 Franklin Ave., Wilkinsburg Branch, Pittsburgh, Pa. 1916
Suksdorf, Wilhelm Nikolaus, Bingen, Wash. 1914
Svenson, Dr. H. K., Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn, N. Y. 1931
Swinerton, John R., 2115 Chestnut Ave., Newport News, Va. 1909

Tanger, Mrs. Charles Y. (Louise F. A.), 318 North President Ave., Lancaster, Pa. 1930
Taylor, Dr. Aravilla M., Lake Erie College, Painesville, Ohio 1923
Taylor, Mrs. H. B., Lock Box 613, Marion, Mass. 1929
Taylor, William Gavin, 6 Beech St., Arlington, N. J. 1926
Thomas, Dr. William S., 1173 Park Ave., New York City..... 1929
Thompson, J. W., Cleveland High School, Seattle, Wash. 1928
Tilley, Trenor P., 1356 Northampton St., Holyoke, Mass. 1921
Tinkham, Miss Florence L., Woods Hole, Mass. 1931
Todd, Dr. J. B., 740 South Beech St., Syracuse, N. Y. 1915
Toole, W. A., Baraboo, Wis. 1931
Topping, D. LeRoy, P. O. Box 2356, Honolulu, H. I. 1896
Tracy, H. H., Fullerton District Junior College, Fullerton, Cal. 1931
Trudell, Harry W., 2030 East Madison St., Philadelphia, Pa. 1919
Turner, Mrs. H. M., 88 Barnet St., New Haven, Conn. 1930

Underwood, Jay Gove, Hartland, Vt. 1910
Upham, Alan W., East Woodstock, Conn. 1926
Upham, Miss Ethel E., East Woodstock, Conn. 1922

Van Everen, Mrs. Horace, 13 Kirkland St., Cambridge, Mass. 1923
Van Meter, Miss Mary G., 1757 K St., N. W., Washington, D. C. 1923
Victorin, Prof. Marie, Université de Montreal, Montreal, Canada 1917
Vincent, Mrs. Myron H., Chilmark, Mass. 1917

Walton, Rev. A. J., Box 913, Logan, W. Va. 1925
Ward, Mrs. Norman N. (Isadora T.), 618 Berkeley Ave., Orange, N. J. 1925
Ware, Robert Allison, 81 Pinckney St., Boston, Mass. 1903
*Waters, Dr. Campbell E., 5812 Chevy Chase Parkway, Washington, D. C. 1893
Weatherby, Charles Alfred, 27 Raymond St., Cambridge, Mass. 1912
Weatherby, Mrs. C. A., 27 Raymond St., Cambridge, Mass. 1914
Webster, Mrs. Helen Noyes, 1960 Massachusetts Ave., Lexington, Mass. 1931
Webster, L. J., 189 Hawthorne Ave., Hawthorne, N. J. 1929
Wells, Roy, Karere, Longburn, Palmerton North, New Zealand 1929
Westley, Edwin, 2865 Nina St., Lamanda Park, Pasadena, Cal. 1926

Wheeler, Dr. Edward J., 136 Lancaster St., Albany, N. Y. 1907
Wheeler, Mrs. George C. (F. H.), 4501 Livingston Ave., Fieldstone, The Bronx, New York City 1925
†Wheeler, Leston Ansel, R. F. D. No. 2, Bethel, Maine 1914
Wherry, Edgar T., University of Pennsylvania, Philadelphia, Pa. 1918
White, Kelton E., 411 North Newstead Ave., St. Louis, Mo. 1919
Whitehorn, Mrs. A. R., 81 Wilmington St., Rochester, N. Y.
Whitman, Mrs. William, Jr., 12 Marlboro St., Boston, Mass. 1922
Whitney, Mrs. Elsie Gibson, State Museum, Albany, N. Y. 1930
Wiepert, D. D., 413 Eighth St., Brooklyn, N. Y. 1931
Wiggins, Ira L., Curator, Dudley Herbarium, Stanford University, Cal. 1932
Wilcox, Prof. Alice Wilson, 750 North Chester Ave., Pasadena, Cal. 1915
Wild, William, 249 Walnut St., East Aurora, N. Y. 1930
Wiley, Miss Farida A., Museum Natural History, 77th St. & Columbus Ave., New York, N. Y. 1927
Wilkens, Hans, 241 S. 11th St., Reading, Pa. 1927
Williams, Miss Carrie Hammond, 1428 Park Ave., Baltimore, Md. 1904
Willis, Warren J., 24824 Eighty-ninth Ave., Belle Rose, N. Y. 1923
Wilson, Leonard R., Dept. of Botany, University of Wisconsin, Madison, Wis. 1932
†Winslow, Evelyn James, 222 Grove St., Auburndale, Mass. 1902
Winslow, Miss Inez J., Orleans, Vt. 1911
Woolman, Miss A. C., 21 N. Highland Ave., Lansdowne, Pa. 1927
Worthen, Mrs. Effie Adams, 5½ Clarke Rd., Amesbury, Mass. 1921
Wright, Miss Mary F., Ambler, Pa. 1925
Wright, S. Fred, 52 S. Jefferson St., Orange, N. J. 1926

Young, John P., Ithaca, N. Y. 1920

Vol. 22 April-June, 1932 No. 2

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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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.

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American Fern Journal

VOL. 22 APRIL–JUNE No. 2

The Pteridophytes of San Diego County, California

IRA L. WIGGINS

Munz and Johnston[1] published a valuable paper on the Pteridophytes of southern California in which they gave the general distribution of all species recognized by them for southern California. But since accurate lists based on a smaller geographic area make possible more accurate mapping and aid in locating a particular fern when one unfamiliar with the country is in the field, this paper is offered with the hope that it will supplement the information contained in their earlier and more comprehensive one. The information included here was obtained during work in the field, herbarium and library while studying the flora of San Diego County.

San Diego County lies in the extreme southwestern corner of the United States. It was one of the original twenty-seven counties into which California was divided by the State Legislature in 1851, but at that time comprised, in addition to its present 4,221 square miles, all of Imperial County and a part of what is now Riverside County.

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[1] Munz, Philip A., and Ivan M. Johnston, "The Distribution of Southern California Pteridophytes," AMER. FERN JOURN. 12: 69–77, 101–122. 1922; 13: 1–7. 1923.

[Volume 22, No. 1, of the JOURNAL, pages 1–32, plates 1–3, was issued April 19, 1932.]

Like southern California as treated by Munz and Johnston, the county can be divided into three physiographic areas; a coastal region, the highland area, and the interior desert area. The highland area makes up the bulk of the county and dominates the physiography of the region. The elevation rises from sea-level to 6,515 feet at the summit of Cuyamaca Peak forty miles inland. From the crest of the main mountain range the elevation drops rapidly eastward to an elevation of only a few feet above sea-level as the slope approaches the Salton Sink located in Imperial and Riverside Counties.

The Lower Sonoran, Upper Sonoran, and Arid Transition Life Zones are represented within the area. The Lower Sonoran Zone occurs along the eastern base of the mountains and an insignificant belt extends northward for a short distance from the International Boundary along the coastal slope, giving way to the Upper Sonoran near San Diego. The Arid Transition occupies comparatively small areas in the Palomar, Cuyamaca, and Laguna Mountains, and the Upper Sonoran Zone dominates by occupying nearly, or quite eighty per cent., of the total area of the county.

In addition to the modifying effects of altitude and direction of exposure, the character of the country rock exerts a profound influence upon the flora of different localities. The geology of the coastal belt is characterized by sedimentary rocks, mostly shales and sandstones, of Tertiary age. Lying between the coastal sedimentaries and the crystalline igneous complex of the main mountain mass, a narrow wedge of felsite and porphyritic intrusives extends from the Mexican border northward to a point a few miles east of Oceanside. The bulk of the highland area is made up of crystalline igneous rocks which are chiefly granites, gabbros and diorites. These rocks are coarse grained and weather fairly read-

ily, so that many of the mountain slopes and valley floors are covered with granitic detritus supporting sparse growths of vegetation.

The rainfall varies from an average annual rainfall of 9.69 inches at San Diego to 40.37 inches at Cuyamaca Lake at an altitude of 4,677 feet above the sea. Also a rather wide range in temperature fluctuations is noted for various stations throughout the county, the thermometer often registering several degrees below freezing at Cuyamaca during the winter months, while temperatures of 100 to 110 degrees Fahrenheit are not uncommon in the San Felipe Valley.

With such complex sets of factors acting upon the environments of the plants growing in the county, habitats vary from granitic detritus containing little organic matter to shaded valley floors heavily blanketed with leaf mold; from loose, sandy desert slopes to heavy clay on the mesas; from rocks constantly wet with the spray from miniature cataracts to parched southern slopes where only such xerophytic Pteridophytes as *Pellaea*, *Selaginella*, *Notholaena*, and *Cheilanthes* can withstand the rigorous onslaught of drought and high temperature.

It is not particularly surprising, then, that San Diego County, with an area of slightly less than ten per cent. of that of southern California, should support thirty-three of the fifty-seven species and varieties of Pteridophytes found in southern California.

All of the species included here are illustrated in Abrams' Illustrated Flora of the Pacific States,[2] and a number of them are figured in Jepson's Manual.[3] Sinee

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[2] Abrams, LeRoy, Illustrated Flora of the Pacific States 1: 1–50. *f. 1–109.* 1923.

[3] Jepson, Willis Linn, A Manual of the Flowering Plants of California 25–44. *f. 1–33.* 1925.

these illustrations are accessible in these books and not scattered through the literature they are not cited.

The scheme of classification used is that of Dr. Maxon in Abrams' Illustrated Flora, and differs somewhat from that found in Jepson's Manual and from that of Munz and Johnston in their paper cited above.

Unless otherwise noted all specimens cited have been examined while studying the flora of San Diego County. Those cited are in the Dudley Herbarium of Stanford University unless the citation is followed by one of the following abbreviations denoting the herbarium in which it is deposited:

(U. C.) University of California.
(P.) Pomona College.

I gratefully acknowledge the kindness of Dr. W. A. Setchell and Dr. Philip A. Munz in giving me free access to the material in the herbaria under their care. I am indebted also to Dr. LeRoy Abrams and Mrs. Roxana S. Ferris for many helpful suggestions while working as a graduate student in the Dudley Herbarium.

1. OPHIOGLOSSUM CALIFORNICUM Prantl. Occasionally attaining a height of 10 cm. but in San Diego County seldom over 3 cm. high, this fern is very inconspicuous and lasts for a few weeks only on the clay mesas and grassy, rocky hillsides along the coastal belt of the county. It is locally abundant in small patches from near Fallbrook southward to the southern border of the county and has been collected as far south as Ensenada in Lower California.

Specimens examined: Mesas near San Diego, *Mrs. T. S. Brandegee*, Feb., 1905; *C. C. Parry*, April, 1882; *Cleveland 1478*, (U. C.); *Lemmon*, April, 1882, (U. C.).

2. FILIX FRAGILIS (L.) Gilib. This fern is rather rare in San Diego County and is found in moist places along

shaded canyon slopes in the higher parts of the Arid Transition Zone. In the Vallecitos Canyon a small clump was found under a projecting rock moistened by the trickle of a small tributary rill. About half of the fronds were in good fruiting condition.

Specimens examined: Spencer Valley near Julian, *Abrams 3798;* Talley's Ranch, alt. 6000 ft., *Susan G. Stokes,* July, 1895; Vallecitos Canyon below Resort, Laguna Mountains, alt. 5100 ft., *Wiggins 2835.*

3. POLYPODIUM CALIFORNICUM Kaulf. Common on shaded slopes and rocky ledges in the Upper Sonoran and lower Arid Transition Zones from near sea-level to an altitude of nearly 5000 feet. It seems to be confined to the coastal side of the range, for I have seen no specimens from the desert side. It extends southward into Lower California at least as far as the Sierra San Pedro Martir, where it was collected by Brandegee, (Zoe **4**: 210. 1893). On the Potrero Grade between San Diego and Campo this fern is very abundant and grows in keen competition with such introduced grasses as *Hordeum murinum, Bromus rubens, Bromus rigidus,* and a native grass, *Festuca megalura.* In a small canyon between Lakeside and Ramona it covers a rocky canyon wall almost to the exclusion of other plants.

Specimens examined: Sandy ledges, Torrey Pines, *F. E. & E. S. Clements,* April 4, 1914, (U. C.); La Jolla, *Brandegee,* April 17, 1894, (U. C.); Ramona, *Brandegee,* April 3, 1894, (U. C.); Mussey Grade, between Ramona and Lakeside, *Wiggins 2532.*

4. POLYSTICHUM MUNITUM (Kaulf.) Presl. Although this fern reaches its finest development in the Humid Transition Zone of the coastal slopes from central California to Washington, in our area it extends downward to the uppermost edges of the chaparral belt. It usually grows on the coastal slopes but is also found in several

small ravines on the desert slopes of the Laguna Mountains at an altitude of about 5100 feet. These plants are very much smaller than the typical form on the westward slopes but the shape and arrangement of the pinnae, nature of the indusia and character of the rhizomes clearly indicate their identity with the larger forms.

Specimens examined: Cuyamaca Lake, alt. 4700 ft., *Munz & Harwood 7231;* crest of ridge south of Doane Valley, Palomar Mts., alt. 5000 ft., *Munz 8212;* Shaw's Ranch, Cuyamaca Mts., *Susan G. Stokes*, July, 1895; Palomar Mt., *Jones*, July 27, 1926; Stonewall Peak, alt. 5200 ft., *Wiggins 2135;* Vallecitos Canyon below Resort, Laguna Mts., alt. 5100 ft., *Wiggins 2829, 2833.*

4a. POLYSTICHUM MUNITUM IMBRICANS (D. C. Eaton) Maxon. The usual range for this fern is in the Canadian Zone from Vancouver Island to the southern Sierra Nevada and to Mendocino County in the California Coast Ranges. It occurs infrequently with the commoner form in Monterey County and in the higher mountains of Los Angeles County, and one collection has been made in San Diego County. It may be overlooked by collectors who mistake it for the typical variety because it occasionally is imbricated only at the base of the frond and would escape notice unless given careful scrutiny.

Specimens examined: Under projecting granite boulder, summit of Cuyamaca Peak, alt. 6500 ft., *Wiggins 2712.* This is, so far as I know, the first record of this fern having been collected south of the San Gabriel Mountains in Los Angeles County.

5. DRYOPTERIS ARGUTA (Kaulf.) Watt. Common on shaded slopes and in rocky ravines of the higher Upper Sonoran and in the Arid Transition Zones. When growing in the chaparral the fronds sometimes attain a height

of five or six feet and are called "Fern Brake" by the layman who confuses the sturdy specimens with *Pteridium aquilinum pubescens.*

Specimens examined: Palomar Mt., *Jones,* July 27, 1926; Mussey Grade, between Lakeside and Ramona, *Wiggins 2522.*

Dryopteris feei has been reported from Los Angeles County and Riverside County north of San Diego County and from the mountains of northern Lower California but I have seen no specimens from our area. There are similar gaps in the distribution of several other plants which drop out in the San Bernardino or San Jacinto Mountains and then reappear in Lower California. If this fern is found in our region it will probably be located in the Palomar Mountains.

6. WOODWARDIA CHAMISSOI Brack. In deep canyons and along shaded stream banks of the Upper Sonoran and Arid Transition Zones, both on the coastal and desert slopes of the mountains. The Cuyapipe Indians use the fronds of this fern in thatching their summer huts.

Specimens examined: Alpine, *Mearns 4033;* Shaw's Ranch, near Julian, *Susan G. Stokes,* July, 1895; Vallecitos Canyon, Laguna Mts., alt. 4000 ft., *Munz 8416,* (P.); *Wiggins 2843.*

7. ASPLENIUM VESPERTINUM Maxon. This delicate little fern is found growing in moist places under overhanging rocks and on canyon walls of the coastal foothills of the county. It ranges northward to the San Gabriel Mountains of Los Angeles County and southward into northern Lower California.

Specimens examined: San Miguel Mt., (Type locality), *Kimball,* March, 1910, (P.); Witch Creek, *Alderson 757;* Coast mountains of San Diego County, *Parish Bros. 519;* Potrero Grade, *Carlotta C. Hall,* June 5, 1912, (U. C.).

8. PITYROGRAMMA TRIANGULARIS (Kaulf.) Maxon. Very abundant on shaded slopes under chaparral and overhanging rocks in the Upper Sonoran and lower parts of the Arid Transition Zones. There are two forms of this species, the commoner with yellowish-ceraceous powder on the lower surface of the fronds, and the other with whitish instead of yellow powder. In Lower California the latter form becomes the predominant one, the yellow-powdered plant appearing much less commonly. There seems to be no morphological character correlated with the color of this powder that is constant enough to warrant separating the two consistently.

The powder on the fronds comes off easily and accurate prints can be made by placing the frond on a dark cloth or paper and then striking it a sharp blow with the open palm.

Specimens examined: near Fallbrook, alt. 750 ft., *Munz & Harwood 3863;* Potrero, *Alice McAlmond,* March 18, 1898, (P.); Moreno Dam, *Wiggins 2366;* below Julian on road to Banner, *Wiggins 2020;* near Campo, *Wiggins 1007.*

8a. PITYROGRAMMA TRIANGULARIS VISCOSA (D. C. Eaton) Weatherby. Growing in the same sort of habitats as the species, but less common and with a more restricted range. Its northern limit is Los Angeles County, whereas the species is fairly common clear to British Columbia. The variety differs from the species in having reddish brown instead of dark brown stipes and in being quite viscid on the upper surface of the fronds.

Specimens examined: Hillside 3 miles west of Dulzura, *Wiggins 2223;* roadside 1½ miles east of Dulzura, *Wiggins 1793;* Jamul, *Wiggins 1912;* Mussey Grade, *Wiggins 2505;* near Campo, *Wiggins 1045.*

9. PTERIDIUM AQUILINUM PUBESCENS Underw. This is the most abundant fern in the county, forming exten-

sive growths on partially shaded hillsides in the Arid Transition Zone and growing less frequently but more luxuriantly along streams in the Upper Sonoran Zone at much lower levels. In a number of places, especially in the vicinity of Cuyamaca and Julian, this fern forms practically pure stands several acres in extent. The shrubs most commonly associated with it are *Rosa adersoni*, *Rubus ursinus* and *Symphoricarpos mollis*.

The Indians gather the young fronds while they are still coiled and use them for food, cooking them as we do asparagus.

Specimens examined: Vallecitos Canyon, Laguna Mts., alt. 4000 ft., *Munz 8415*, (P.); Cuyamaca Lake, *Munz & Harwood 7237*, (P.); northern slope of North Peak, *Wiggins 2644*.

10. ADIANTUM JORDANI C. Müll. Quite common in moist shaded places and under overhanging rocks in the chaparral of the Upper Sonoran and lower Arid Transition Zones. Its range extends from the mountains of northern Lower California to southwestern Oregon. It is one of our most beautiful and prized ferns. Its delicate fronds sometimes cover considerable areas on seepy canyon walls.

Specimens examined: Dulzura, *Wiggins 1791, 2219;* Jamul, *Wiggins 1911;* Mussey Grade about 7 miles north of Lakeside, *Wiggins 2520*.

11. ADIANTUM CAPILLUS-VENERIS L. The following range is given for this fern by Maxon in Abrams, Ill. Fl. Pacif. States **1**: 24. 1923, "Upper and Lower Sonoran Zones; Virginia to Florida, west to Missouri, Utah, southern California, and the Mexican Border Region." And although this does not definitely place the fern within the county it probably occurs there. I have seen specimens from Riverside County, but none from San Diego County.

12. CHEILANTHES CALIFORNICA (Hook.) Mett. At the base of cliffs and about rocks wet by seepage, Upper Sonoran and lower Transition Zones. On the coastal slopes this fern ranges from San Diego County northward to Humboldt County, and less commonly in the Sierra Nevada Mountains to Butte County, California. It seems not to have been collected very extensively as only a few specimens were seen in the herbaria.

Specimens examined: Vernal Vale Farm, Foster, *Minnie Reed*, April 1, 1897; Mussey Grade, 7 miles north of Lakeside, *Wiggins 2504.*

13. CHEILANTHES VISCIDA Davenp. The viscid Lipfern is an inhabitant of the southwestern deserts, barely entering San Diego County along the western edge of the Colorado Desert. It grows in shaded places under rocks and along dry canyon walls.

Specimens examined: Mountain Springs, western edge of the Colorado Desert, alt. 2600 ft., *Pierson*, April 13, 1922, (P.); *Wiggins 2281; Parish 9029.*

(*To be continued*)

STANFORD UNIVERSITY,
CALIFORNIA

Notes on Ophioglossum Engelmanni

ERNEST J. PALMER

That interesting little elf of the plant world, the common Adder's Tongue (*Ophioglossum vulgatum* L.), has a wide distribution in both hemispheres, and in America it extends across the continent from Prince Edward Island to Alaska and as far south as Florida and eastern Texas. It is generally found in moist meadows and pastures in the northern states, and in rich woods farther south. The colonies are usually small, consisting of only a few or single plants, and in most parts of the country it is sufficient of a rarity to give a thrill of pleasure to the botanical explorer who has the good fortune to come upon it.

A second species (*Ophioglossum Engelmanni* Prantl), which is not so familiar to most botanists, is found in the south-central and middle states, from Virginia to Texas and Arizona. This species was described in 1883,[1] but it has frequently been confused with the common Adder's Tongue, although the two are easily distinguishable, and many specimens collected both before and since the publication of Prantl's description have been labeled *Ophioglossum vulgatum* and may still be found in herbaria under that name.

Fresh material or herbarium specimens of Engelmann's Adder's Tongue can be distinguished from the common species by the distinctly apiculate tip of the sterile frond, which is always present in uninjured specimens, and by the finer secondary network of veins under the rather more fleshy epidermis. The plants are also usually more stocky, with shorter stem portion, and with the fertile segment, when present, less exserted.

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[1] Ber. Deut. Bot. Ges. I. 351, 1883.

In habit of growth and habitat the two species are very different. Engelmann's Adder's Tongue is a pronounced calciphile, and it is usually on limestone ledges or in glades, where it occupies a belt of thin soil, which becomes saturated with seepage water during the spring rains, but which later may become quite dry and sterile. This is its favorite habitat, although I have sometimes found it growing on banks of clay and gravel, but always in calcareous regions where marl or limestone were abundant near-by. Conditions peculiarly favorable for this little plant are found in many of the glades and barrens of the Ozark region of Missouri and Arkansas, and it is apparently most abundant in that part of its range, where it certainly cannot be regarded as a rarity, and it is perhaps the commonest fernwort of the region. In certain favorable spots large colonies of hundreds or thousands of plants spring up, almost as thick as grass, over several square metres of surface, on exposed slopes or sometimes in the partial shade of cedar trees or scattered shrubs. Here in the thin rich soil under the stimulus of the hot sun and the abundant supply of moisture, they grow rapidly, develop their spores, and after a few days die down and leave no trace until another rainy season. The normal vegetative period in the Ozarks is in May or early June, but this varies considerably with the season, and rarely in a wet autumn a second growth appears. The fact that so few botanists who have visited the regions where *Ophioglossum Engelmanni* grows have found or mentioned it is doubtless due largely to the short vegetative period, rather than to its inconspicuous appearance or rarity.

In many of the colonies, especially where the conditions are not optimum in all respects, most or all of the plants produce only sterile fronds. Owing to this fact and its inability to compete with more aggressive plants

except in extremely limited areas where an unusual combination of ecological conditions are found, *Ophioglossum Engelmanni* must perhaps be regarded as a disappearing species, or at least one that is likely to be exterminated in many places as the country becomes more densely settled, through clearing of land, the introduction of new plant or animal competitors or enemies, and especially from the trampling and rooting of cattle and hogs.

It is a plant of considerable interest both to the taxonomist and the ecologist, and to the student of plant geography and the origin and distribution of species it is particularly significant as an example of the survival of an ancient type and a relic of an earlier flora, of which many other interesting examples are found in the Ozark glades and barrens.

Ophioglossum Engelmanni is much more restricted in its range, especially northward, than *O. vulgatum*, and although the latter is usually absent from most of the territory occupied by Engelmann's Adder's Tongue, it overlaps it in isolated stations nearly throughout.

In the middle states I have collected *Ophioglossum vulgatum* in western Kentucky, western Tennessee, southern Illinois, and in three of the lowland counties of southeast Missouri, and I have also seen or collected specimens in southwestern Arkansas and eastern Texas.

Several years ago I reported my first discovery of *Ophioglossum Engelmanni* in the FERN JOURNAL,[2] and since that time I have been much interested in observing it in the field and have made numerous collections in several states. A list of these is given below in the hope of adding something to the definite knowledge of the range and abundance of the species. I have also recently examined the material in the Gray Herbarium

[2] Vol. IV., no. 2, 66–68, 1914.

and a list of the specimens preserved there is included so as to make the record as complete as possible.

VIRGINIA: Natural Bridge Sta., Breckenridge Co., *Bayard Long and E. B. Bartram*, May 28, 1909; same locality, dry ledges, bluffs along James River, *Geo. G. Kennedy*, May 10, 1887.

KENTUCKY: Barren Co., *Joh. Hussey*, May, 1874; Bowling Green, amongst limestone rocks, under Junipers, *Sadie F. Price;* Russelville, Logan Co., on Mississippian limestone, *E. J. Palmer*, no. 17748, June 5, 1920.

TENNESSEE: Knoxville, open woods, *A. Ruth*, no. 570, Aug. 7, 1900; near Lavergne, Rutherford Co., Cedar glades, *R. M. Harper*, May 17, 1923; same locality, with *Leavenworthia stylosa*, *Anemone carolinina*, &c., *A. Gattinger*, May 16, 1882.

ILLINOIS: Cave-in-Rock, Hardin Co., on Mississippian limestone, *E. J. Palmer*, no. 15469, June 11, 1919.

MISSOURI: Rolla, *F. C. Greene*, May 30, 1916; Independence, *B. F. Bush*, no. 822, May 20, 1894; Tuscumbia, Miller Co., on Ordovician dolomite, *E. J. Palmer*, no. 39221, May 2, 1931; Columbia, Boone Co., on Mississippian limestone, *E. J. Palmer*, no. 39266, May 4, 1931; Eagle Rock, Barry Co., along Arkansas state line, on Ordovician dolomite, *E. J. Palmer*, no. 39479, June 3, 1931; same locality, *E. J. Palmer*, no. 35686, May 11, 1929; Seligman, Barry Co., on Ordovician dolomite, *E. J. Palmer*, no. 29805, April 28, 1926; Turnback, Dade Co., on Mississippian limestone, *E. J. Palmer*, no. 35606, May 5, 1929; Eldorado Springs, Cedar Co., on Mississippian limestone, *E. J. Palmer*, no. 35669, May 6, 1929; Pontiac, Ozark Co., on Mississippian limestone, *E. J. Palmer*, no. 34791, June 27, 1928; Big Cave Bluff, near Cole Camp, Benton Co., on Mississippian limestone, *E. J. Palmer*, no. 30093, May 12, 1926; Bald Joe, at junction of James and White Rivers, Stone Co., on Ordovician dolomite, *E. J. Palmer*, no. 24619, April 30, 1924; Galena, Stone Co., on Mississipian limestone, *E. J. Palmer*, no. 5633, May 19, 1914; same locality and habitat, *E. J. Palmer*, no. 24619, April 30, 1924; Melugin, Jasper Co., on Mississippian limestone, *E. J. Palmer*, no. 15306, June 4, 1924; Alba, Jasper Co., on Mississippian lime-

stone, *E. J. Palmer*, no. 20792, April 18, 1922; Carthage, Jasper Co., on Mississippian limestone, *E. J. Palmer*, no. 20851, April 21, 1922; same locality and habitat, *E. J. Palmer*, no. 21672, June 2, 1922; Noel, McDonald Co., on Mississippian limestone, *E. J. Palmer*, no. 17207, April 15, 1920; Arcadia, Iron Co., on Cambrian? limestone, *E. J. Palmer*, 18098, June 27, 1920; Thayer, Oregon Co., on Ordovician dolomite, *E. J. Palmer*, no. 14686, April 2, 1919.

KANSAS: Neodesha, Wilson Co., on Pennsylvanian limestone, *E. J. Palmer*, no. 21169, May 5, 1922; same locality and habitat, *E. J. Palmer*, no. 21371, May 22, 1922.

ARKANSAS: Fayetteville, Washington Co., on Mississippian limestone, *E. J. Palmer*, no. 8189, July 7, 1915; Kessler Mountain, near Fayetteville, Washington Co., on Pennsylvanian limestone, *E. J. Palmer*, no. 23300, June 14, 1923; Fulton, Hempstead Co., on clay and gravel overlying marly Cretaceous limestone, *E. J. Palmer*, no. 20709A, April 5, 1922.

OKLAHOMA: Navina, Logan Co., open plain, creek valley, *G. W. Stevens*, no. 177, April 25, 1913; Hugo, Choctaw Co., on Cretaceous limestone, *E. J. Palmer*, no. 22484, April 26, 1923.

LOUISIANA: Red River, *J. Hale* (without date).

TEXAS: Comanche Springs, *F. Lindheimer*, May, 1849 (type collection); Texas (without other locality or date), *Wright;* Houston, *E. Hall*, no. 858, April, 1872; Houston, Harris Co., on clay banks, *E. J. Palmer*, no. 11447, April 2, 1917; College Station, Bryan Co., on calcareous clay, *E. J. Palmer*, no. 13667, May 22, 1918; San Augustine, San Augustine Co., on Eocene marly limestone, *E. J. Palmer*, no. 7102, March 30, 1915.

ARNOLD ARBORETUM.

The Botrychiums of Indiana

E. W. GRAVES

Through the very generous courtesy of Mr. Chas. C. Deam, research forester of Indiana, I was privileged to examine all the Botrychiums which he had collected for several years past, as he sent me his whole collection asking that I determine them for him.

It appears that Mr. Deam is a very keen observer, and in his work as research forester he has collected extensively throughout his state, and has brought together a fine collection of the Indiana Botrychiums. In the collection there were 34 sheets from 23 counties. There were 17 of *Botrychium obliquum*, 10 *of Botrychium dissectum*, 4 of *Botrychium ternatum* var. *intermedium*, and 2 sheets that contained specimens of a new variety or possibly a new species. Of these last specimens I will speak later.

To those that hold to the theory that *B. dissectum* is always found in company with *B. obliquum*, I will say, that from the study of Mr. Deam's collection conclusions do not point that way. Of the ten stations where Mr. Deam had collected *B. dissectum*, only three were with *B. obliquum*. This conclusion was formed from studying the labels, and I also wrote Mr. Deam asking if I should understand that *B. obliquum* was not present with *B. dissectum* when not mentioned on the label, and he replied that that was correct. He also added that in the north part of the state where *B. dissectum* was more often found, *B. obliquum* was quite rare. But in the south part of the state where *B. obliquum* was common, *B. dissectum* was rare.

There were seven stations where *B. dissectum* grew alone. These seven stations were, one each in Porter, Allen and Delaware Counties, and two in Wells County

of the north part of the state, and one each in Owen and Posey Counties, in the south. *B. dissectum* grew in company with *B. obliquum* in Laporte and Cass County, of the north part of the state, and Spencer County of the extreme south. *B. dissectum*, then, was found at seven stations in six of the northern counties, and three in the south. On the other hand *B. obliquum* was found once each in Wayne, Shelby, Decatur, Franklin, Jennings, Jackson, Jefferson, Scott, Clark, Perry, Spencer, and Knox Counties, of the south part of the state. In the north part is was found once in each of the following counties: Howard, Wells, Allen, Cass, and Laporte—five stations in the north.

I had reported in my article on "The Botrychiums of the Central States" in Vol. 21, No. 4, of the JOURNAL, that the station at Millers, Indiana, in Lake County, was the farthest south that I had any record of for *B. ternatum* var. *intermedium*. In Mr. Deam's collection there is one station still farther south. At Garrott, in Dekalb County, Mr. Deam collected two fertile specimens. He also collected two specimens at one station, and one at another station in Steuben County, which lies just north of Dekalb County, and two specimens at a station in Porter County. The five stations that I record here from Indiana are all in the north tier of counties, except the one in Dekalb County, which is in the second tier.

There were two specimens on one sheet of Mr. Deam's collection, from the locality of Mt. Carmel, Illinois. It was not made clear whether they were collected on the Illinois side or the Indiana side. If they were collected in Indiana it would make 35 sheets from Indiana instead of 34 as I stated at the beginning of my article. These specimens seemed to be of a different variety, and had been determined *B. ternatum australe*. But *B. australe*

R. Br. is a native of Australia, and has possibly been found in Argentina, South America. But I am not acquainted with that fern, having never seen it, so I cannot say whether it is *B. australe* or not. *B. australe* has never been recorded before from North America, although D. C. Eaton at one time applied that name to the largest and most divided of our forms of the ternatum group (*B. silaifolium* Presl). I am inclined to call this specimen *B. obliquum.* The more I study the Botrychiums the more puzzling I find them to deal with.

There were two sheets in Mr. Deam's collection that contained specimens which I feel were really a new variety, that had never been brought to my attention before. One sheet having no number (here called No. 2) Mr. Deam had purchased from Mr. W. S. Blatchley, of Indianapolis. It had been collected in Marion County, Sept. 28, 1902. Marion County is near the center of the state. Another sheet, No. 18564, contained two specimens collected by Mr. Deam in Crawford County, of the south part of the state. These specimens were both fertile, but one was slightly different from the other in that its pinnules were just a little more roundish in shape. These specimens from the two counties of Indiana are of such a different variation from the true type of *B. obliquum* that I have decided to describe it as a new variety. Owing to the oblong shape of its pinnules and upper pinnae I am calling it *B. obliquum* var. *oblongifolium.*

Botrychium obliquum var. *oblongifolium*, var. nov.[1]

A robust plant with thick heavy stalk. The first pair of pinnae are divided. The pinnules are oblong with

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[1] BOTRYCHIUM OBLIQUUM, var. **oblongifolium,** var. nov., planta robusta, pinnis imis partitis, pinnulis oblongis subobtusis basalibus proximalibus oblongo-auriculatis, pinnis jugi a basi secundi oblongis auriculatis, superioribus oblongis leviter serratis.

The Type Specimen of Botrychium obliquum, var. oblongifolium

blunt points. The first pinnule below on the lower pinnae being oblong also has an oblong ear on inner side. The second pair of pinnae is oblong in shape with oblong appendages. The upper pinnae are oblong and slightly serrate. I am using No. 2 as the type specimen.

The plants from Crawford County have more slender stalks than the plant from Marion County, but one is identical in shape with the type except for the upper pinnules on the first pair of pinnae which were more round in shape, and the second pair of pinnae had a roundish shaped pinnule near the stalk both above and below. The remaining pinnae were oblong with blunt points as in the type. The other plant from Crawford County had roundish shaped pinnules above and below on both the first and second pair of pinnae. The remaining pinnae were oblong, but not quite so blunt-pointed as in the other two plants.

Mr. Deam has kindly photographed the type for the benefit of members of the fern society and the photograph is here reproduced (plate 4).

BENTONSPORT, IOWA.

Recent Fern Literature

David, Walter W. Ferns of the Lake Dunmore Region, Salisbury, Vermont. Bull. Boston Soc. Nat. Hist. **62**: 3–11, figs. 1–3. 1932.

This is a thorough piece of work. It opens with an account of the topographic conditions and soils of the area and a brief glossary of botanical terms. The 29 species observed are then listed in five groups according to habitat; finally, a simple descriptive key to all, using obvious macroscopic characters, is given. A few species might have been added, such as *Asplenium platyneuron* which has been found at Lake Dunmore; occasionally,

helpful characters, such as the stalked and sessile sterile segments in *Botrychium dissectum* and *B. virginianum* respectively, are overlooked in the key; and the term "triangular" is somewhat loosely used. As applied to the frond of *Cystopteris fragilis* and the lower pinnae of *Thelypteris spinulosa* var. *intermedia* it is surely out of place.

The current issue of the *British Fern Gazette* (vol. vi, no. 5, Dec., 1931) opens with a good plate of a crested form of *Dryopteris dilatata*. There is a report of the annual meeting from which it appears that it costs the British Society about 46 pounds to publish 137 pages of Gazette, with incidental expenses. As with us, publication is by far the largest item. There are useful descriptions of the scales characteristic of various species, and several notes on forms of British ferns.

Mousley, H. Further Notes on the Birds, Orchids, Ferns and Butterflies of Quebec, 1929–1930. Canad. Field Nat. **46**: 1–6. 1932.

Mr. Mousley's activities during the two seasons here reported on produced a small, but interesting, grist of material relating to ferns. He gives the first authentic record of *Thelypteris simulata* from Quebec; it was found near Bedford by Mr. Terrill. New stations for *Asplenium Trichomanes* and *Thelypteris fragrans*, and a plant of *Botrychium angustisegmentum* 27.5 cm. in height were discovered by Mr. Mousley.

Ching, R. C. The Studies of Chinese Ferns, VI. Genus Vittaria of China and Sikhim-Himalaya. Sinensia **1**: 175–192. 1931.

This article includes keys, bibliography, citation of specimens and critical comment on the 21 species recognized. Seven new ones are described and illustrated.

Schaffner, J. H. Propagation of Equisetum from Sterile Aerial Shoots. Bull. Torr. Bot. Club **58**: 531–535. 1932.

Some two years ago Mr. Blaydes of the Ohio State University noticed that aerial shoots of *Equisetum prealtum* which he had had for some time in a jar of water had developed roots from the submerged nodes. Starting with this discovery, Prof. Schaffner found, by experiment, that propagation from sections of stem was easily possible in both *E. prealtum* and *E. arvense.* He takes this as additional evidence that the specialization of cell function is a matter of direction of development determined by environment—that every cell has many potentialities.

Looser, G. El Généro Pleurosorus en Chile. Revista Universitaria **16**: 707–714, 3 figs. 1931. Sinopsis de los Helechos Chilenos del Género Dryopteris. Anal. Univ. Chile 1931. 191–205, 5 figs.

Our fellow member, Sr. Gualterio Looser, of Santiago, continues his studies on Chilean ferns. In the two publications at hand he gives a careful and detailed account of the four species of *Dryopteris* occurring in the country, with descriptions, illustrations, bibliography, citations of specimens, critical notes, a brief history of the genus and a sensible discussion of its nomenclature. In the other, he describes and discusses the curious little fern of central Chile and Argentina, *Pleurosorus papaverifolius,* "an *Asplenium* without an indusium." There are only two other species of the genus, one in Spain and one in Australasia. All are ferns of dry rocks; all show a pretty obvious affinity with such species of *Asplenium* as *A. Ruta-muraria* and *A. magellanicum.*

Shorter Notes

A CURIOUS PHENOMENON IN THE CHRISTMAS FERN.—The plant from which the accompanying sketches were made was originally found in Florence, Vermont, and is now growing in the garden of Mrs. Maud L. Chisholm at Proctor. It is of the bipinnatifid form (*Polystichum acrostichoides* f. *multifidum* Clute). This form is usually sterile; last year, however, fronds on Mrs. Chisholm's plant produced small upper pinnae which tried to be fertile. Like the other pinnae, they are deeply

cleft; the curious thing is that the cleavage appears to be along the lines of the sorus-bearing veins, to extend from the margin to the point on the vein at which the sorus is borne, and to be stopped there, as it were, by the receptacle. The result is that each sorus is at the bottom of a sinus and, strangely, as definitely on the edge of the frond as in the filmy ferns. In them, the indusium has one face on each surface. In this abnormal Christmas fern, the indusium is abortive, but the

receptacle appears to pass across the margin so as to impinge on both surfaces and some of the sporangia appear to arise from the upper surface—an anomaly in ferns. The sporangia are fairly numerous and some of them apparently normal; in the specimen seen, however, they are rather young and it is doubtful whether they would produce good spores.

The sketches may make clearer this unusual development.—C. A. W.

DRYOPTERIS FLORIDANA (HOOK.) KUNTZE IN NORTH CAROLINA.—Early in April, 1931, the writer was one of a party, composed mostly of George Washington University botany students under the leadership of Dr. Robert F. Griggs, which visited the Coastal Plain section in eastern North Carolina. April 6th and 7th found us camped on the north shore of beautiful Lake Waccamaw in Columbus County. The lake at this point is separated only by a narrow ridge of sand, a few yards in width, from a cypress swamp. Along the north edge of this swamp is an area, wet and muddy but not perpetually inundated, lying between the water and the higher, cultivated ground. Here the writer found a colony of several dozen plants of *Dryopteris floridana* (Hook.) Kuntze (*J. E. Benedict, Jr.*, no. 1247). In addition to being the first record of this fern in the state of North Carolina it is a northward extension of its range of approximately 120 miles, the former most northerly station being in the vicinity of Charleston, S. C. The Waccamaw plants are noteworthy also in being of unusually large size, one fruiting frond in the collection of the writer being 118 centimeters long. Specimens have been deposited in the U. S. National Herbarium in Washington and in the herbarium of the Academy of Natural Sciences in Philadelphia.—J. E. BENEDICT, JR., *Washington, D. C.*

THE MARCH OF IMPROVEMENT IN FLORIDA.—I was very much interested in your articles on Conservation, for nowhere is it more needed than here. There are in this county a number of spots, off the main highways, where I go from time to time, to study the plant life and enjoy the beauties that Nature has provided and then, sometime, I will go back, to find ruin and devastation, instead of peaceful beauty—ferns chopped out, climbers and smaller plants destroyed and the little stream denuded of its *Myriophyllum*—and for what reason? I haven't been able to find out. Beyond the cemetery is a marsh, which all summer is worth going miles to see, as it is almost a solid growth of nearly all the different species of our marsh *Hibiscus*, literally thousands of blossoms, from the almost white variety of *H. grandiflorus* to the flaming *H. coccineus*. The city has acquired the area and is now draining it, will fill in and make a park and in a year or two it will be a dreary waste of white sand, dotted with round beds of Cannas and little annuals. And there is no reason for a park out there; it will have no neighbors but the city of the dead. At the other extreme edge of the city limits is already a 25-acre park, heavily wooded and with the greatest variety of plant life to be found within a similar area in the county. A varying elevation of 5–25 feet above sea-level, a small stream meandering through most of it, partly through a deep ravine, combined with other features, make it an ideal site for a native Arboretum, in which could be grown plants from all but the most tropical portions of the State, and I have been trying for several years to get this accomplished. Not long ago I went out in that neighborhood just after reading in the morning paper that the park commissioner had cleaned out Boone Park. He had. All the fallen leaves and pine needles had been raked into piles and burned,

destroying a lot of young *Ilex vomitoria*, Andromedas and other shrubs, round beds of Cannas set in the bare, windswept earth and, in a swath about six feet wide along the stream bed, every bit of vegetation had been chopped out. Forest fires have driven our best plant life into the moist places along streams and swamps and the destruction carried on in those places is going to send many species the way of the *Franklinia*. And the same thing is occurring all over the state on a larger scale. Paines' Prairie, the absolutely unique Seminole Springs and many other places are in grave danger of destruction.—MARY W. DIDDELL, *Jacksonville, Florida.*

NOTE ON BOTRYCHIUM.—Mr. Graves' note on *Botrychium* in the October–December JOURNAL (1931) calls attention to a possible difference in the fruiting time of two species geographically associated. Some years ago my attention was called to a similar pairing of geographically associated species of *Botrychium* in different parts of North America: in Jamaica, in the Pacific Coast, and in the southern states. At that time, I reported on the differentiation of *Botrychium* and *Ophioglossum* species in three short articles published in *Torreya* and later more in detail in the *North American Flora*. Copies of these articles have recently been deposited in the Library of the American Fern Society and may be borrowed according to the arrangements made last year. In my work at that time, I reached the conclusion that the American species are all separable from the old world types, so that instead of the name *Botrychium ternatum*, the combination *B. siliafolium* was used for the type which Mr. Graves calls *B. ternatum*. It is certain, however, that the *Botrychium* group is most difficult to work with and that there is plenty of basis for difference of interpretation regarding specific characteristics and limits.—R. C. B.

ANOTHER SUGGESTION REGARDING BOTRYCHIUM DISSECTUM AND B. OBLIQUUM.—Mr. Louis Eisman recently found a plant of *B. obliquum* growing in very close association with three plants of *B. dissectum*. In examining the roots, he felt reasonably certain that he found a definite underground connection between the two forms. If this could be established certainly, it would, of course, settle finally the question of the possible relationship between these two forms. The suggestion is made that members of the Fern Society be on the lookout for situations involving close association of plants of these two forms, and that they endeavor to determine whether an actual connection ever occurs. If such a connection is found, the specimen should be dug up carefully and photographed to show the attachment, and then carefully preserved as a herbarium specimen.—R. C. B.

BOTRYCHIUM ALABAMENSE IN NORTH CAROLINA.—Recently Mr. F. W. Gray of Marlinton, West Virginia, sent me several Botrychiums he had collected near Charlotte, North Carolina, asking me to determine them for him. Among the specimens were two plants of *Botrychium alabamense* Max. They were both typical specimens, and among the largest I have ever seen of that species. I have collected a good many specimens in the vicinity of Mobile, Alabama, but I have never observed any that were larger than the ones that Mr. Gray sent me from North Carolina. The largest plant was fully eighteen inches high, and the sterile frond had a spread of ten inches.

Mr. Gray wrote me that there are three places near his old home at Charlotte, North Carolina, where the fern grows plentifully. It is very interesting to know that this station will extend the range of *Botrychium alabamense* much farther north than we had expected to

find it. The only localities heretofore known to me for this fern were in the vicinity of Mobile, Alabama. Mr. C. A. Weatherby informs me that the Gray Herbarium contains specimens only from the Mobile district.

I might state here that *Botrychium alabamense* does not grow on the level Coastal Plain, but on damp slopes along creeks in the hills west of Mobile near the village of Spring Hill, also in the hills about twenty miles north of Mobile. I have never found it on the east side of Mobile Bay, although the character of the country is nearly the same as on the west side of the Bay.

This new station at Charlotte, North Carolina, will carry the species up from the Coastal Plain into the Piedmont district. If others have found this fern at other stations we should be very glad for them to report it.—E. W. GRAVES, *Bentonsport, Iowa.*

FERN INDUSTRY.—*The Business Week* for February 24 says: "Ferns from the great evergreen forests of Western Washington find a ready market in Middle West and eastern centers, according to distributors who operate out of Chehalis, Wash. This is a new industry which is developing rapidly and reaches the annual production peak during the holiday season. Last year's turnover was $100,000, of which about 75 per cent. is paid to pickers, some of whom earn up to $4 daily."

It may be added to the above that fronds of *Polystichum munitum* were freely used by florists in Boston last winter—the first time that I had noticed them there.—C. A. W.

American Fern Society

Report of the President for 1931

We have, all, long been assured and reassured that there is "nothing new under the sun." To disprove the aphorism, your President, having delayed unduly the writing of a report of the usual sort for 1931, purposes to offer one that will contain no word of review of the Society's many activities of the past year, no discussion of things planned or accomplished (including field trips and increased membership), no proper tender of thanks even to our Board of Editors or of appreciation to the Brooklyn Botanic Garden—though the last temptation is strong—and merely to quote from Thoreau's "Autumn" the following paragraph, which is not only stimulating but reflects a point of view far too rare in these days.

"Oct. 4, 1859. It is only when we forget all our learning that we begin to know. I do not get nearer by a hair's breadth to any natural object, so long as I presume that I have an introduction to it from some learned man. To conceive of it with a total apprehension, I must for the thousandth time approach it as something totally strange. If you would make acquaintance with the ferns, you must forget your botany. Not a single scientific term or distinction is the least to the purpose. You would fain perceive something, and you must approach the object totally unprejudiced. You must be aware that no thing is that you have taken it to be. In what book is this world and its beauty described? Who has plotted the steps toward the discovery of beauty? You must be in a different state from common. Your greatest success will be simply to perceive that such things are, and you will have no communication to make to the Royal Society. If it were required to know the position of the fruit dots or the character of indusium, nothing could be easier than to ascertain it; but if it is required that you be affected by ferns, that they amount

to anything, signify anything, to you, that they be another sacred scripture and revelation to you, helping to redeem your life, this end is not so easily accomplished.''

With minor allowance, is this not ''good medicine''?

Respectfully,

WILLIAM R. MAXON,
President.

I hereby certify that I have received from the Judge of Elections for Officers of the American Fern Society for the year 1932 the following report of the elections held last November:

''Chas. S. Lewis,
Secretary, American Fern Society,
Plattsburgh, N. Y.

''As Judge of Elections for 1931 I have the honor of reporting that 96 perfect ballots were cast, unanimously electing

President .....William R. Maxon
Vice-President .....Carlotta C. Hall
Secretary .....Charles S. Lewis
Treasurer .....J. G. Underwood

Three other ballots were received, one blank, one illegible and another partial.

''Along with the ballots were numerous personal greetings and messages which made the occasion doubly interesting.

''(Signed) H. E. RANSIER.''

And I further certify that the above is a correct copy and that those mentioned are therefore duly elected for the year 1932, as officers of the American Fern Society.

CHARLES S. LEWIS,
Secretary.

Plattsburgh, March 18, 1932.

LIST OF BOOKS AND PAMPHLETS ADDED TO THE AMERICAN FERN SOCIETY COLLECTION IN 1931

AMERICAN FERN JOURNAL, vols. 19–21, 1929–1931.

Andersson-Kottö, Irma.

A genetical investigation in Scolopendrium vulgare. (Reprinted from Hereditas, vol. 12, 1929. pp. 109–178.)

———. The genetics of ferns. (Reprinted from Bibliographia Genetica, vol. 8, 1931. pp. 269–294.)

———. Variegation in three species of ferns (Polystichum angulare, Lastraea atrata, and Scolopendrium vulgare). (Reprinted from Zeitschrift für induktive Abstammungs- und Vererbungslehre, Bd. 56, heft 2, 1930. pp. 115–207.)

Barnhart, John Hendley.

The published work of Lucien Marcus Underwood. (Reprinted from the Torrey Botanical Club Bulletin, v. 35, pp. 17–38, 1908.)

Benedict, Ralph Curtiss.

Artificial varieties under natural conditions. (Reprinted from the Journal of Heredity, vol. 14, no. 3, 1923. pp. 115–116.)

———. The Boston fern and some of its varieties. (Brooklyn Botanic Garden. Leaflets, ser. 3, no. 8, 1915.)

———. The conservation of beauty. (Brooklyn Botanic Garden. Leaflets, ser. 12, no. 2, 1924.)

———. Do ferns hybridize? (In Science, n. s., v. 33, no. 842, Feb. 17, 1911. pp. 254–255.)

———. Evolution as illustrated by ferns. (Brooklyn Botanic Garden. Leaflets, ser. 10, no. 3, 1922.)

———. Fern books to lend. (Reprinted from the AMERICAN FERN JOURNAL, vol. 21, no. 1, 1931. pp. 34–48.)

———. Ferns as house plants. (Brooklyn Botanic Garden. Leaflets, ser. 10, nos. 9–10, 1922.)

———. Ferns as house plants. (Reprinted from Journal of the New York Botanical Garden, vol. 29, 1928. pp. 45–48.)

———. The genera of the fern tribe Vittarieae, their external morphology, venation, and relationships. (Reprinted from Torrey Botanical Club. Bulletin, vol. 38, no. 4, 1911. pp. 153–190.)

———. The genus Antrophyum—I. Synopsis of subgenera, and the American species. (Reprinted from Torrey Botanical Club. Bulletin, vol. 34, 1907. pp. 445–458.)

———. The genus Ceratopteris: a preliminary revision. (Reprinted from Torrey Botanical Club. Bulletin, vol. 36, Sept., 1909. pp. 463–476.)

Benedict, Ralph Curtiss.

How shall we save rare plant species from extinction? (Brooklyn Botanic Garden. Leaflets, ser. 16, no. 4, 1928.)

———. Is the distribution and naturalization of the hart's tongue scientifically defensible? (Reprinted from the AMERICAN FERN JOURNAL, vol. 17, no. 1, 1927. pp. 19–23.)

———. The moss-leaved fern. (Reprinted from the Journal of Heredity, vol. 15, no. 1, 1924. pp. 19–24.)

———. New bud sports in Nephrolepis. (Brooklyn Botanic Garden. Contributions, no. 32, 1923.)

———. A new Cuban fern. (Reprinted from the AMERICAN FERN JOURNAL, vol. 1, Feb., 1911. pp. 40–43.)

———. New hybrids in Dryopteris. (Reprinted from Torrey Botanical Club. Bulletin, vol. 36, Jan., 1909. pp. 41–49.)

———. Notes on ferns seen during the summer of 1908. (Reprinted from Torreya, vol. 8, no. 12, 1908. pp. 284–286.)

———. The origin of new varieties of Nephrolepis by orthogenetic saltation. I. Progressive variations. II. Regressive variation or reversion from the primary and secondary sports of Bostoniensis. (Brooklyn Botanic Garden. Contributions, no. 13, 1916; no. 27, 1922.)

———. Osmundaceae. (In North American Flora, vol. 16, pt. 1, 1909. pp. 27–28.)

———. The plant wards of New York State. (Brooklyn Botanic Garden. Leaflets, ser. 18, no. 5, 1930.)

———. A revision of the genus Vittaria J. E. Smith. (Reprinted from Torrey Botanical Club. Bulletin, vol. 41, Aug., 1914. pp. 391–410.)

———. Some modern varieties of the Boston fern at their source. (Reprinted from Journal of the New York Botanical Garden, vol. 16, Sept., 1915. pp. 194–197.)

———. Studies in the Ophioglossaceae. I. A descriptive key to Ophioglossum in the United States. II. A descriptive key to

Botrychium in North America: group of B. lanceolatum. III. Key to Botrychium in North America: group of B. ternatum. (Reprinted from Torreya, vol. 8, no. 4, 1908; no. 5, 1908; vol. 9, no. 10, 1909.)

———. Tropical ferns; issued in connection with the Tropical Fern Exhibition of the Massachusetts Horticultural Society, September 22–25, 1921. 7 p.

———. The type and identity of Dryopteris Clintoniana (D. C. Eaton) Dowell. (Reprinted from Torreya, vol. 9, no. 7, 1909. pp. 133–140.)

———. Variation among the sporelings of a fertile sport of the Boston fern. (Brooklyn Botanic Garden. Contributions, no. 42, 1924.)

———. Which Boston fern is best? Prospectus of an experiment to answer this question. (Reprinted from the Journal of Heredity, vol. 13, no. 6, 1922. pp. 255–263.)

———. Wild plant conservation in Connecticut, a suburban state. (Brooklyn Botanic Garden. Leaflets, ser. 11, no. 5, 1923.)

British Fern Gazette. vol. 4, nos. 7–12, 1920–1922; vol. 5, nos. 1 and 6, 1923–1925.

Britten, James.

European ferns; with colored illustrations from nature by D. Blair. N. Y., Cassell & Co., Ltd., n. d. 196 p.

Britton, Elizabeth G.

The preservation of our native plants.

Christensen, Carl.

Pteridophyta. (Plantae Sinenses II.) (Reprinted from Meddelanden fran Göteborgs botaniska trädgard, v. 1, pp. 41–110, 1924.)

Clute, Willard Nelson.

The fern allies of North America north of Mexico. N. Y., Stokes, 1905. 278 p. il. pl.

———. Our ferns in their haunts; a guide to all the native species. N. Y., Stokes [c. 1901.] 332 p. il.

Domin, Karel.

Cerosora, a new genus of ferns. (Reprinted from Acta Botanica Bohemica, vol. 8, 1928. 4 p.)

———. Generis Asplenii L. species duo novae africanae. (Reprinted from "Preslia," vol. 8, 1929. 3 p.)

———. Generis Pityrogrammra (Link) species ac sectiones in clavem analyticam dispositae. (Publications de la Faculté des Sciences de l'Université Charles, no. 88, 1928. 10 p.)

———. The hybrids and garden forms of the genus Pityrogramma (Link.) Praha, 1929. 80 p. pl.

———. Pteridophyta. Praze, 1929. 276 p.

———. Pteridophyta of the island of Dominica with notes on various ferns from tropical America. Praha, 1929. 259 p. pl.

———. Species of the genus Cyathea J. E. Sm. (Reprinted from Acta Botanica Bohemica, vol. 9, 1930. pp. 85–174.)

Eaton, Daniel Cady.

The ferns of North America. Colored figures and descriptions, with synonymy and geographical distribution, of the ferns (including the Ophioglossaceae) of the United States of America and the British North American possessions. Salem [v. 1] Boston [v. 2], 1879–80. 2 v. pl.

Espinosa Bustos, Marcial R.

Anotaciones sobre helechos chilenos. (Reprinted from Boletin del Museo Nacional, Santiago de Chile, vol. 13, 1930. pp. 110–124.)

Hu, Hsen Hsu, and Ching, Ren Chang.

Icones filicum sinicarum. Nanking, 1930. Fasc. 1, pl. 1–50.

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Asifonógamas vasculares. (Reprinted from Revista Chilena de Historia y Geografia, vol. 2, 1930. pp. 200–202.)

———. Género Trismeria en Chile. (Reprinted from Revista Chilena de Historia Natural, vol. 34, 1930. pp. 164–169.)

———. Historia de los helechos chilenos. (Reprinted from Revista Universitaria, vol. 15, no. 7, 1930. pp. 693–718.)

———. Localidades del helecho Polystichum mohrioides (Bory) Presl en Chile central. (Reprinted from Revista Chilena de Historia Natural, vol. 35, 1931. pp. 26–28.)

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A new genus of Davallioid ferns. (Reprinted from the Journal of the Washington academy of sciences, v. 3, no. 5, 1913.)

———. A new name for Kaulfussia Blume, a genus of Marattiaceous ferns. (Reprinted from the Proceedings of the Biological society of Washington, v. 18, pp. 239–240, 1905.)

———. On the identity of Cyathea multiflora, type of the genus Hemitelia R. Br. (Reprinted from the Torrey Botanical Club Bulletin, v. 38, pp. 545–550, 1911.)

———. The relationship of Asplenium Andrewsii. (Reprinted from Contributions from the U. S. Herbarium, v. 16, pt. 1, February, 1912.)

———. A remarkable new fern from Panama. (Smithsonian Miscellaneous Collections, v. 56, no. 24, 1911.)

———. Three new club-mosses from Panama. (Smithsonian Miscellaneous Collections, v. 56, no. 29, 1912.)

Newman, Edward.

History of British ferns, and allied plants. London, VanVoorst, 1844. 424 p.

North American Flora. vol. 16, pt. 1, 1908.

Shreve, Forrest.

Studies on Jamaican Hymenophyllaceae. (Reprinted from Botanical Gazette, vol. 51, 1911. pp. 184–209.)

Underwood, Lucien-Marcus.

American ferns—VIII. A preliminary review of the North American Gleicheniaceae. (Reprinted from the Torrey Botanical Club Bulletin, v. 34, pp. 243–262, 1907.)

———. Our native ferns and their allies, with synoptical descriptions of the American pteridophyta north of Mexico. 3d ed. rev. N. Y., Holt, 1888. 156 p.

———. A review of the genera of ferns proposed prior to 1832. (Reprinted from Torrey Botanical Club. Memoirs, vol. 6, Dec., 1899. pp. 247–283.)

——— and Benedict, Ralph Curtiss.

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Waters, Campbell E.

Ferns: a manual for the northeastern states, with analytical keys based on the stalks and on the fructification. N. Y., Holt, 1903. 362 p. il. pl.

Wilson Bulletin, a magazine of field ornithology; publ. by the Wilson Ornithological Club at Sioux City, Iowa. vol. 43, no. 1–4, 1931.

The Journal has two apologies to make, with sincere regret for the errors of omission which occasion them.

The name of Mr. O. A. Farwell in the recently issued list of members of the Fern Society should have been preceded by a dagger. Mr. Farwell is a life member.

The photograph of the party at Brown's Mills published in the preceding number was taken by Mr. A. T. Beals and used by his courtesy. We particularly regret the failure to make this acknowledgment and trust Mr. Beals will be able to believe that our thanks are none the less warm because their expression was accidentally delayed.

Vol. 22 July-September, 1932 No. 3

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

The American Fern Society

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An illustrated quarterly devoted to the general study of ferns.

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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. 22 JULY–SEPTEMBER, 1932 No. 3

Diagnostic Key to the Species of Equisetum*

JOHN H. SCHAFFNER

The following key, with diagnostic descriptions, to the twenty-three recognized species of Equisetum has been prepared in order that a general presentation might be available for identifying these interesting plants both when they are in the reproductive condition and when no cones are present. The characters which have been found most reliable for determination have been used and the sequence of these is such that the easier determinations come first and the most difficult ones last. Thus such closely related species as *E. moorei* and *E. hiemale; E. kansanum* and *E. funstoni; E. xylochaetum* and *E. giganteum; E. myriochaetum, E. ramosissimum,* and *E. debile* will be found side by side for the final disposition of the case in hand. Having had much experience, both in the field and in many large herbaria, the writer has naturally acquired considerable knowledge of the real difficulties encountered by any one intent on accurate determination of the material as it is usually found. A much shorter key might be constructed which would answer very well for all ideal and complete specimens, but would nevertheless lead to very pronounced

* Papers from the Department of Botany, The Ohio State University, No. 303.

[Volume 22, No. 2, of the JOURNAL, pages 33–68, plate 4, was issued July 1, 1932.]

errors when specimens having considerable fluctuation are to be determined. It is quite evident, when one examines the determinations of Equisetum species by thoroughly competent systematists, that the most ridiculous mistakes are made even with species which have characters so definite that even a beginner should not go astray. This condition of things is no doubt due to the unsatisfactory nature of most of the keys at present available, in which the most unreliable characters are often used when constant and unique characters are present which would make determination absolutely certain. The closely related species are difficult to distinguish even when a thorough knowledge of all the available differences has been acquired. In some cases certain species at present considered valid cannot be easily recognized unless one knows their geographic limits. But it is believed that the present treatment will enable any one to determine these most interesting plants after only an elementary knowledge of their morphology has been attained.

In the second part, the recognition characters have been presented for each species rather than a uniform type of description. When one has learned the combination of recognition characters for each species, identification can usually be made instantly, especially in the field. The species are carefully arranged in their correct phylogenetic sequence from the lowest to the highest types and when one has acquired this orthogenetic, serial arrangement, many remarkable harmonies and progressions at once become evident both as to form and habit. One immediately sees that the lowest species can be collected as one stands on the equator, while the last and highest species can be gathered for a farewell bouquet as one steps from the farthest northern lands onto the ice of the Arctic Ocean.

DIAGNOSTIC KEY.

1. Aerial stems green or with green branches, with or without cones ..... 2.
1. Aerial stems without or with very little chlorophyll and unbranched at first or permanently; always with cones, which are without a point ..... 24.
2. Main, aerial stems without a central internodal cavity, with 6 prominent internodal ridges and 3 teeth on the campanulate sheaths, evergreen, small, slender, tufted, curly, flexuous; stomata in lines, cone minute, apiculate ..... *E. scirpoides.*
2. Main stem with central internodal cavities or, if not, the plants decidedly not as above ..... 3.
3. Teeth of the lower sheaths of the main stem cohering in 3 or 4 broad lobes, comparatively long, bright reddish-brown and translucent, not deciduous; branches of the whorls prominently compound, horizontal or often curving downward, especially on the fertile shoots; stomata in bands; internodal ridges with or without 2 rows of siliceous spinules; cone not apiculate ..... *E. silvaticum.*
3. Teeth of the sheaths of the main stem not united in 3 or 4 broad lobes nor bright reddish-brown, deciduous or persistent ..... 4.
4. Internodal ridges, or part of them, of the main stem or of the branches, or of both, with a double row of rounded tubercles, these sometimes in 2 irregular rows; or the branch ridges biangulate, two ridges to a sheath tooth ..... 5.
4. Internodal ridges of the main stem and branches not with a double row of tubercles, but with a single row, or with cross bands of silex, or smooth; if with 1–3 rows of prominent siliceous spinules, then with whorls of slender, 3-angled branches 11.
5. Teeth definitely deciduous as "pagoda caps" or individually, but occasionally long persistent as a fluctuation; sheath segments with a central grove; stems unbranched or sporadically branched; stomata in lines; persistent evergreens but sometimes rather delicate; cone apiculate ..... 6.
5. Teeth persistent, not with an abscission layer ..... 7.

6. Sheaths of the main stem long and ampliated, remaining green for a long time; internodal ridges with an irregular double row of tubercles or cross bands of silex; persistent but rather subject to winter killing ..... *E. moorei.*

6. Sheaths of the main stem short, cylindrical, soon discolored; internodal ridges or most of them with 2 regular rows of tubercles; stems hardy, evergreen ..... *E. hiemale.*

7. Stems not branched or rarely very slightly so, evergreen; stomata in lines; cone prominently apiculate ..... 8.

7. Stems with whorls of branches, occasionally rather simple, annual; stomata in bands; cone not apiculate, rarely with a slight point ..... 9.

8. Sheaths cylindric, tight, often crusty, partly or completely black; stems rather large to medium, sometimes rather slender ..... *E. trachyodon.*

8. Sheaths campanulate, usually discoloring tardily; stems mostly very slender and small
E. variegatum.

9. Main stem with a large central cavity; plants usually large and robust, dimorphic, those with green branches normally entirely sterile, the fertile without chlorophyll and without branches
E. telmateia.

9. Main stem with a small central cavity or solid, plants not dimorphic, both the sterile and fertile shoots green, rather small ..... 10.

10. Teeth of the sheaths of the main stem membranous, some of the internodal ridges of the branches often not biangulate. Central and South America.
E. bogotense.

10. Teeth of the sheaths of the main stem stout and appressed; internodal ridges of the prominently whorled branches generally biangulate. Himalaya Mountains region ..... *E. diffusum.*

11. Central cavity of the main stem very large, more than four-fifths the diameter of the internode, the wall tissue very narrow, containing very small carinal cavities and no vallecular cavities except at the base of very large shoots; stems not

dimorphic, annual, with or without whorls of branches; stomata in bands; sheaths cylindrical, their teeth persistent; cone not apiculate. North Temperate Zone ..... *E. fluviatile.*

11. Central cavity not extremely large for the size of the stem, or if so the plant quite different, the wall with distinct vallecular cavities ..... 12.

12. Stems not branched or only sporadically branched, not with definite whorls; stomata in single lines ..... 13.

12. Stems with definite whorls of branches in properly developed plants ..... 17.

13. Sheath teeth persistent, not with a definite abscission layer; sheath segments with a central groove above; stems rarely with sporadic branches, slender, annual, cone strongly apiculate. *E. nelsoni.*

13. Sheath teeth deciduous, sometimes, however, not falling off; sheath segments usually tricarinate, rarely some of them with a central groove and then the shoots perennial; stems often sporadically branched, and mostly rather robust ..... 14.

14. Sheaths short, cylindrical, soon becoming tight and discolored, splitting in age; shoots prominently evergreen; cone strongly apiculate.... *E. praealtum.*

14. Sheaths long, ampliated; usually not discolored until advanced age; aerial stems evergreen but delicate; or annual ..... 15.

15. Aerial stems evergreen but delicate, comparatively large; cone apiculate ..... *E. laevigatum.*

15. Aerial stems definitely annual in regions of frost, medium in size; cone not apiculate, usually obtuse or merely acute ..... 16.

16. Not with numerous prostrate or spreading basal sterile shoots around the fertile shoots; stems usually very smooth, sometimes rather rough with cross bands of silex on the ridges; limb of the long, green sheath dilated upwards, the teeth normally soon deciduous. United States and Southern Canada ..... *E. kansanum.*

16. Usually with a cluster or rosette of small, branched spreading or horizontal, sterile shoots around the

base of the erect main shoots; stems very rough with cross bands on the ridges; limb of the rather short sheath usually strongly incurved in age, the teeth tardily deciduous. Southern California and Northern Lower California ..... *E. funstoni.*

17. Stomata in bands of 2–4 or more rows each, or scattered in the grooves. Large plants of the Central and South American region, or small plants of the North Temperate and Arctic regions ..... 18.

17. Stomata in single lines, or if sporadically in double lines, the plants not in the American region ..... 22.

18. Large persistent Central and South American plants, the whorls of branches commonly with cones, central cavity of the main stem very large; sheaths cylindrical; cone apiculate ..... 19.

18. Small plants of the North Temperate and Arctic regions, with annual stems; central cavities small or medium in diameter, cones entirely absent, or if present not apiculate ..... 20.

19. Sheath segments of the main stem flat, without a central ridge, at least above; teeth rigid, shining black, linear, giving out a twanging sound when picked, often breaking off but the base persistent. *E. xylochaetum.*

19. Sheath segments of the main stem with a definite central ridge, 3–5-carinate; teeth membranous, friable or fragile, breaking off or imperfectly deciduous ..... *E. giganteum.*

20. Branches several-angled, their internodes with a small central cavity; stems not dimorphic, those with cones the same as the sterile ones; vallecular cavities of the main stem nearly as large as the central cavity ..... *E. palustre.*

20. Branches 3–4-angled, solid; vallecular cavities of the main stem considerably smaller than the central cavity; shoots dimorphic ..... 21.

21. Teeth of the branches not subulate-tipped, deltoid, merely acute or long-acute, white-membranous; branches 3-angled, very slender; fertile stems developing green branches after the spores are shed. *E. pratense.*

21. Teeth of the branches with subulate tips; branches 3–4-angled; fertile stems withering after the spores are shed ..... *E. arvense.*

22. Very much branched, large plants of the Central American and Andean region; teeth fragile; branches usually with cones; terminal cone large, with a point ..... *E. myriochaetum.*

22. Moderately branched plants of the Eastern Hemisphere, the branches normally without cones.....23.

23. Sheaths of the main stem cylindrical, elongated, about twice as long as wide in well-developed plants, in smaller plants short and somewhat ampliated. Europe, Africa, and Temperate Zone of Asia ..... *E. ramosissimum.*

23. Sheaths of the main stem short, about as long as wide, somewhat ampliated. Southeastern Asia south of the Himalaya Mountains, eastward to the Philippines and in the East Indies to the Fiji Islands ..... *E. debile.*

24. Sheaths bright reddish-brown and translucent, their teeth cohering in 3 or 4 broad lobes, comparatively long; fertile stem finally developing whorls of compound green branches; internodal ridges sometimes with rows of siliceous spinules. *E. silvaticum.*

24. Teeth not cohering in 3 or 4 broad lobes, not translucent and not reddish-brown ..... 25.

25. Teeth of the sheaths with long, bristle-like tips; stems and cones usually very robust. *E. telmateia.*

25. Teeth of the sheaths ending in a gradually narrowing point, not bristle-like; stems and cones usually much smaller and more slender ..... 26.

26. Teeth of the sheaths light brown, membranous, usually soon becoming green; stems soon developing whorls of 3-angled, green branches, with deltoid, membranous teeth; internodal ridges sometimes with rows of spinules ..... *E. pratense.*

26. Teeth of the sheaths dark brown, rigid, only slightly membranous at the margins; stems withering promptly after the spores are shed; sheaths rarely slightly green; internodal ridges not with spinules. *E. arvense.*

COLUMBUS, OHIO.

(To be continued.)

Hunting Scott's Spleenwort in Alabama

H. E. RANSIER

The Ransiers spent the first three days of May, 1928, at Havana, Alabama, lured 75 miles off our regular schedule by the long suppressed desire of seeing *A. ebenoides* in its "ravine near Havana, Ala." Upon arrival there we inquired of a local store keeper as to the location of a camp site. He suggested a shady spot at the rear of a school ground. When we questioned the propriety of setting up there he said, "Well, I gave them the land and I reckon I can let you camp there."

As it was late, we quickly made ourselves snug for the night. Next morning, scholars began arriving before we were up. In fact they woke us by their subdued talk and speculations about our trailer outfit. We washed, made breakfast ready, ate and washed the dishes, with an increasing crowd of scholars surrounding us. The following morning Mrs. Ransier suggested that they sing for us, and sing they did. Two girls in particular treated us to a seemingly endless folklore song. Perhaps it was improvised! The school bell was all that stopped it, anyway.

Then all the people felt it their duty to call on us, even an old tottering man and his wife. When it became known that we were going to look for "ebenoides," one of the better class ladies volunteered the information that they grew upon her land, that she was just starting for home, and that she would be happy to take us right to the "ravine" but that "College Professors" had searched wihout finding any.

We were dropped about half a mile out and started down the gully at once. It was extremely hot and sultry and the footing fierce. A quarter of a mile and sure

enough we did find small ebenoides, on the right side going down stream, usually growing upon moss covered rocks in dense shade.

Farther along, on a more perpendicular rock outcrop, more small but unmistakable specimens appeared. Here at the base of the rock, where a slight seepage favored them, some small filmy ferns were observed.

The ebenoides were almost invariably located where they had scant opportunity of developing to any size worth mentioning, both from lack of soil and moisture. Nearly all were too small to photograph to advantage and the lack of strong light was a further handicap to both their development and to the work of photography. Moreover, there were no specimens of *A. ebeneum* in the immediate vicinity, though there were some across the ravine many hundred feet down stream. An intensive search did not reveal a single walking fern in the entire area. This puzzled me but I concluded that it had been destroyed by drought or in some other unknown way, as well as all mature ebenoides and that the few puny specimens seen would be wiped out by the next drought and the fame of the ravine would cease.

My films when developed were so wretched, that I went back for another try the next day. I hesitated reporting the existing conditions and am glad I did not, for when I read the January–March, 1930, Fern Journal, Wherry & Trudell's note proved that I HAD NOT BEEN even NEAR the original station. We had been misled by the local lady, by the "ravine near Havana" and by my "nose," sixth sense, or fern instinct which failed to function entirely.

My main satisfaction of course is that we have extended the fern's known range a little and others may reasonably look for it in other favored spots with more promise of finding it at considerable distances from the

old station. But 30 small specimens were found in all, the largest having fronds 4 inches long and many were but an inch or so. The heat and humidity were at the limit of our endurance, so believing our mission accomplished, we prepared to move on. One of the natives said "Do you all mean to tell us that you all came all that long ways, just for one LITTLE FERN?"

One of our tires went flat while we were away after ferns and after it had been repaired, the Professor came over after school and said he was glad it was fixed, as twenty boys had called his attention to the flat and had asked him to tell us about it!

We were pressed by the kids to attend their "Literary Meeting" and both of us had to make an address after routine business was over.

One evening there was a spelling contest on, between the local community and a neighboring one. Every one turned out and refreshments were served afterwards, using the school house for all purposes.

We heard a great deal about some "caves" that we should visit, so I asked "are they damp? Do we need a lantern? What kind of clothes should we wear? What makes them interesting?" and about all we learned was that the coloring made them attractive. And when a pupil piloted our car there, on his way home after school, we found the place to be immense ravines, where the soil from time to time "caved" off, or slid in slices, two or three feet thick, from the whole face of the cliff-like sides, revealing finely tinted layers of soil, buff, lavender, pink, etc.

If good fortune favors us, we may make another more extended visit to the locality.

MANLIUS, N. Y.

Range-Extensions and other Observations, 1931-32

EDGAR T. WHERRY[1]

PELLAEA BRIDGESII IN OREGON.—On June 30, 1931, Dr. Francis W. Pennell and I drove from the largely abandoned village of Cornucopia, Baker County, Oregon, five miles westward up an exceedingly steep road to the Union Mine, to collect plants on the mountain there. On ledges of granite rock along a trail leading up to some old workings, we found several colonies of a fern which was obviously a *Pellaea,* but differed from any I had previously seen in having the soral band well in from the margin. This was subsequently identified as *P. bridgesii* Hooker. Specimens distributed by Cusick many years before may have come from the same general region, but they lacked definite locality data; and in Abrams' "Illustrated Flora of the Pacific Coast," Maxon gives the range of the species as "California, from Nevada County southward to Mineral King, Tulare County; also in Boise National Forest, Idaho." The newly recorded find therefore represents a distinct extension of the heretofore recognized range.

CHEILANTHES GRACILLIMA AS AN EXAMPLE OF NON-CIRCINATE VERNATION.—My first acquaintance with this species in its native haunts occurred at the locality mentioned in the preceding note. The new fronds for the season were just beginning to develop, and proved to show the same type of non-circinate vernation already reported for *C. tomentosa* and several other ferns.[2]

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

[2] AMER. FERN JOURN. **16**: 107, 109. 1926; **18**: 31. 1928.

Pellaea Bridgesii. Five miles west of Cornucopia, Baker Co., Oregon. Showing fronds of preceding year below, and of present year above.

A VISIT TO A STATION FOR THE APPALACHIAN FILMY-FERN.—For some years I have desired to see *Trichomanes boschianum* in its native haunts, but the roads leading to reported localities of it would always prove to be impassable at the times of my visits to the region. In July, 1932, Mr. J. E. Benedict and I were driving through northern Alabama during a period of drought, and decided to hunt up a station located by Mr. E. W. Graves along the Sipsey River. We found the Jasper topographic sheet to be quite useless, as the culture has completely changed since the time it was surveyed, so some data as to the route followed may be added here for the benefit of others who may wish to visit the place. We went north on the paved highway (No. 5) from Jasper, Walker County, about 5 miles to the outskirts of the village of Manchester, and there turned northeastward on an improved dirt road, going 6 miles to a road fork. Here the left-hand road was taken, and after 3 miles of rather rough travelling, we reached Duncan's Bridge over the Sipsey River. Parking on the north side, we walked east along a trail which followed the talus-piles at the base of the cliffs. About a quarter of a mile in from the bridge, the long-sought filmy-fern was found on the face of a deeply inset, moisture-laden sandstone stratum. Its soil-reaction proved to be low mediacid, active acidity 100. Referring the locality to the nearest settlement in the same county, it may be designated as: 3 miles south of Mellville, Winston County, Alabama.

THE ALABAMA COLONY OF SCOTT'S SPLEENWORT.—Three years ago, as recorded by myself and Mr. Harry W. Trudell,[3] a visit was made to the station for *Asplenium ebenoides* near Havana, Alabama. At that

[3] AMER. FERN JOURN. 20: 30. 1930.

Cheilanthes gracillima. Same locality as Plate 5. A few of the lowermost fronds showing non-circinate vernation.

time only 25 adult plants were seen, although there were numerous young ones. On July 13, 1932, I revisited the locality, this time in company with Mr. J. E. Benedict, Jr., and was glad to find that many of the young plants formerly observed have reached maturity, and at least 85 adult ones were counted in the same area as was previously examined. As before, there was no Walking-fern on those rock ledges, but subsequently Mr. William A. Knight, of Biltmore Forest, N. C., has informed me that there is a colony on the opposite side of the same stream where this fern does grow with its offspring.

DR. KESTNER'S RESULTS WITH HYBRID ASPLENIUMS.—The experiments in growing ferns from spores being carried on by Dr. Paul Kestner of Lausanne, Switzerland, have already been referred to in this JOURNAL.[4] Spores from several of the presumably hybrid Asplenniums from our eastern states have been sent to him for trial, and he has communicated to me the results which form the basis for the following notes.

Of all the spores of *Asplenium ebenoides* which he has received from various parts of this country, only those from the above-mentioned Alabama colony have proved to be viable. Evidently in most of its occurrences this fern represents a hybrid, which has not attained fertility; but at this single locality one cross, at some past time, chanced to produce viable spores, and its descendants have remained fertile, so that it has become a true species.

The spores of *Asplenium stotleri* have germinated well, and a pressed plant only two years old sent me by Dr. Kestner reproduced in a most striking way all the features shown by those in the original colony. It therefore likewise represents a hybrid (presumably of *A. pinnatifidum* × *A. platyneuron*) which chanced to

[4] AMER. FERN JOURN. **19**: 60. 1929; **21**: 29. 1931.

attain fertility, and, successfully reproducing itself, has become a species. Growing as it does only on a single small cliff (in Jefferson County, West Virginia), it is to be regarded as an example of an endemic in the restricted sense, *i.e.*, a plant occupying a small area on the earth's surface because it is of too recent origin to have become dispersed more widely. Perhaps it will become extinct before being able to spread, for as the result of a series of excessively dry seasons the original colony has dwindled considerably. But at least it will be preserved in cultivation in the collection assembled by Dr. Kestner.

On the other hand, the spores of all specimens of *A. trudelli* sent thus far (from Georgia and Pennsylvania) have proved to be imperfect and non-viable, clearly indicating that the particular plants from which the spores came represented first-generation hybrids (of *A. montanum* × *A. pinnatifidum*). Search for a colony in which fertility has been attained will, however, be continued. At this point the hope may perhaps be expressed that some members of the American Fern Society in our own country will take up the growing of these rarer ferns from spores. I should be only too glad to cooperate by furnishing spore material and data as to soil acidity preference of each species or hybrid.

FURTHER OCCURENCES OF THE ROCKY MOUNTAIN CLIFF-FERN IN THE EAST.—The eastern relative of *Woodsia scopulina* has been recorded thus far[5] from three stations in Virginia, one in West Virginia, and two in North Carolina. Two new finds of it may here be noted. First, Mr. Arthur N. Leeds of the Academy of Natural Sciences of Philadelphia discovered on August 3, 1931, an additional one in the first-named state, on the west side of the Cowpasture River north of Longdale, Alleghany County. Then, in July, 1932, I had the pleasure of

[5] AMER. FERN JOURN. **19**: 101. 1929.

visiting the fern garden of Mr. William A. Knight, at Biltmore Forest, North Carolina, and found that he had growing there several clumps of an unidentified rock-fern from the cliffs of the Nolichucky River in Unicoi County, Tennessee. On examination it proved to represent this as yet undescribed *Woodsia*, thus extending its known range into an additional eastern state.

THE LIMESTONE ADDERSTONGUE IN NORTHERN VIRGINIA.—Mr. Palmer's recent article on *Ophioglossum engelmanni*[6] gives a good account of the occurrence of this fern, but his locality list, being based on only two herbaria, does not represent a complete statement of its distribution. Two states in which it is known are not mentioned: its discovery in Ohio was announced by Miss Braun several years ago,[7] and in the newly issued "Ferns of Florida," Dr. Small states that "Recent exploration has discovered this adders-tongue in abundance in the western part of northern Florida."

In Virginia only two occurrences near Natural Bridge are cited by Mr. Palmer; the county name of these, given as "Breckenridge," should read Rockbridge. It has also long been known near Staunton, Augusta County, and attention may here be called to its occurrence still further north. In August, 1925, as reported in this JOURNAL[8] I found it in association with a new species of *Opuntia* near Luray, Page County. In June of the present year, while accompanying Miss Lena Artz of Woodstock, Shenandoah County, in a search for native plants in that vicinity, another extensive colony of this cactus was observed on similar limestone ledges $2\frac{1}{2}$ miles northeast of the town, and I suggested that a search for the fern be made there. A few days later she was suc-

[6] AMER. FERN JOURN. **22**: 43. 1932.
[7] AMER. FERN JOURN. **17**: 138. 1927.
[8] AMER. FERN JOURN. **16**: 2. 1926.

cessful in finding it, and reports that still later, following a long-awaited rain, it came up in abundance. This extends its previously known range 15 miles northward, to latitude 38° 55′.

THE CLIMBING FERN IN NORTH CAROLINA.—In the list of ferns of this state recently published by Mr. Blomquist,[9] *Lygodium palmatum* is indicated as occurring only in the western part, that is, in the Blue Ridge physiographic province. Several years ago I was guided by Dr. P. O. Schallert, of Winston-Salem, to the Cascades near Danbury, in the Piedmont province, and in wet woods near by found this fern in the greatest profusion. In March, 1932, Mr. Rogers McVaugh, a graduate student in the Department of Botany of the University of Pennsylvania, found the same species two miles west of Warsaw, in Duplin County, on the Coastal Plain. So it is evidently widely distributed over the state.

PHILADELPHIA, PA.

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[9] AMER. FERN JOURN. 21: 86. 1931.

The Pteridophytes of San Diego County, California

IRA L. WIGGINS

(*Continued from page 42*)

14. CHEILANTHES COVILLEI Maxon. Although this fern is not restricted to the deserts it grows on the drier ridges and canyon walls from the Lower Sonoran to the lower Arid Transition Zones. It is fairly abundant in dry places on both the coastal and desert sides of the range.

Specimens examined: Vallecitos Canyon, *Wiggins 2832;* Laguna, *Mearns & Schoenfeldt 3608;* Mountain Springs, *Wiggins 2282;* dry ridges between Julian and Banner, *Wiggins 2030A;* rocky ridge above Cottonwood Creek, 1 mile northeast of Buckman Springs, *Wiggins 2412;* dry hills near Campo, *Abrams 3578; Wiggins 1005.*

15. CHEILANTHES CLEVELANDII D. C. Eaton. This fern takes the place of *C. covillei* on dry ridges in the foothills of the coastal slope from northern Lower California to Santa Barbara County, California. One collection was made in the Palomar Mountains at an altitude of 4000 feet, but it is usually found only in the chaparral belt.

Specimens examined: Oak Grove trail to Palomar Mt., alt. 4000 ft., *Munz 10393,* (P.); Alpine, *Grant,* May 10, 1906; Cottonwood grade, near Potrero, *Abrams 3742;* hillside 1 mile west of Campo, *Wiggins 1048;* Campo, *Parish 10822;* Moreno Dam, *Wiggins 2365.*

16. PELLAEA ANDROMEDAEFOLIA (Kaulf.) Fée. The Coffee-fern is one of the commoner ferns of the dry hillsides of the chaparral belt and one of the first ferns to become known to me by its scientific name. The broad

leaf-segments, more or less truncate at the apex, and the flesh-colored stipes distinctly separate it from any other western *Pellaea*. Growing with it one usually finds *Selaginella bigelovii*.

Specimens examined: near Fallbrook, dry hillsides, alt. 750 ft., *Munz & Harwood* 3865, (P.); Mussey Grade, 7 miles north of Lakeside, *Wiggins 2531;* desert slopes between Julian and Banner, *Wiggins 2021*.

17. PELLAEA MUCRONATA (D. C. Eaton) D. C. Eaton. The Bird's-foot Cliff-brake is found on dry hillsides and about rocks from northern Lower California to Mendocino and Butte Counties, California. Sheepmen claim that when eaten by sheep the stiff, wire-like stipes puncture the animals' intestines and cause death.

Specimens examined: Jacumba, *Wiggins 2317;* Buckman's Springs, *Wiggins 2411;* Mussey Grade, *Wiggins 2507;* between Jamul and Barrett Dam, *Wiggins 1959;* Moreno Dam, *Wiggins 2367;* 5 miles west of Alpine, *Wiggins 2159;* between Julian and Banner, *Wiggins 1974;* San Diego, *Grant*, May, 1916; Campo, *McGregor 1096;* Cameron's Ranch, Laguna, *Mearns & Schoenfeldt 3695;* Alpine, *Grant*, May 16, 1906.

18. NOTHOLAENA NEWBERRYI D. C. Eaton. This pretty little fern, with its fronds covered with a tawny tomentum, is an inhabitant of dry, rocky hillsides in the Upper Sonoran Zone from Lower California to Los Angeles County, California. It is one of those ferns which has an irresistible appeal for the collector, not common enough to become tiresome, nor so rare as to seem unattainable.

Specimens examined: near Fallbrook, alt. 750 ft., *Munz & Harwood 3864*, (P.); Mussey Grade, *Wiggins 2506;* Foster, *Minnie Reed*, March 11, 1896.

19. NOTHOLAENA CALIFORNICA D. C. Eaton. This Cloak-fern is much rarer than *N. newberryi*, or at least

is collected less frequently, and ranges along the desert slopes of the Riverside and San Diego County mountains. It also occurs on Santa Catalina Island off southern California, and ranges eastward to Arizona and south into Lower California. It is found in crevices of rocks in the Lower and Upper Sonoran Zones.

Specimens examined: Spring Valley, *Miss L. F. Kimball,* (no date or number, P.).

20. MARSILEA VESTITA Hook. & Grev. Margins of ponds and along muddy ditches, Lower Sonoran to Arid Transition Zones, northern Lower California to British Columbia and eastward to the Mississippi Valley. About the margins of Cuyamaca Lake this attractive plant carpets the drying mud over large areas. During favorable seasons it looks as though acres were bearing four-leafed clover. Very good fruiting material can always be obtained here during the late summer, a few minutes collecting usually securing several hundred fine sporocarps.

Specimens examined: Cuyamaca Lake, *Abrams 3852; Wiggins 2119; 2637;* Laguna, *Wiggins 2789; 2796;* Mystic Lake, near Moreno, *Munz & Johnston 5154.*

21. PILULARIA AMERICANA A. Br. In small pools and depressions on the clay mesas in the vicinity of San Diego and extending northward in similar habitats to southern Oregon. It is very local in its distribution, but where found is very abundant.

Specimens examined: mesas near San Diego, literally filling the pools on the mesas, *Tracy 801,* (P.); Ramona, in clay depressions, *Brandegee 3376.*

22. AZOLLA FILICULOIDES Lam. This little *Azolla* is very abundant on the surfaces of pools and quiet streams in the Sonoran and Transition Zones, and

ranges from the State of Washington southward through Mexico into South America. It frequently completely covers small ponds and renders their surfaces a light green which turns to a bright red as the fronds mature. Large quantities are easily scooped up from such pools. Although it normally grows floating about on the surface of the water, larger fronds with better fruit are produced when the rootlets strike into the sand or mud along the margins of the stream or pond.

Specimens examined: old dam at summit of Potrero Grade, *Wiggins 1835;* Sweetwater Valley, *Susan G. Stokes,* June, 1895; San Luis Rey River, 4 miles west of Pala, *Wiggins 3064.*

23. ISOETES HOWELLII MINIMA (A. A. Eaton) Pfeif. This Quillwort is known only from the type collection taken at San Diego by C. R. Orcutt in May, 1903. I have not seen the specimen. Miss Pfeiffer believes that this plant is often overlooked in material of *I. nuttallii.*

24. ISOETES NUTTALLII A. Br. This is the little *Isoetes* which grows in shallow vernal pools from Washington to northern Lower California. It sometimes nearly chokes the small spring-time pools of the Sacramento Valley, and occurs in isolated patches in both the Upper Sonoran and Transition Zones.

Specimens examined: San Diego, *Brandegee,* March 6, 1895.

25. ISOETES ORCUTTII A. A. Eaton. Similar to the last species but smaller, with smaller megaspores which are brown instead of white when wet. It grows in like habitats but extends northward only to the Sacramento Valley.

Specimens examined: mesas near San Diego, *Tracy 799*, (P.).

26. EQUISETUM TELMATEIA Ehrh. Not uncommon in moist places in all Zones from the Lower Sonoran to the Canadian, from northern Lower California to British Columbia.

Specimens examined: Noble's Ranch between Pine Valley and Laguna, *Mearns 3973;* small stream 8 miles north of Henshaw Dam, *Wiggins 3110.*

27. EQUISETUM FUNSTONI A. A. Eaton. This little representative of the Scouring Rushes is quite different in general appearance from the larger species listed above. Its stems are heavily coated with silica and both sterile and fertile stems are gray instead of the usual vivid green. Nor does it grow in quite such moist places, usually occurring along a bank or on a slope some distance above the stream. It is essentially a plant of the desert and semi-desert areas from northern Lower California to Santa Barbara and Inyo Counties, California. It is found along the dry washes of the desert streams and is known only from the Lower and Upper Sonoran Zones.

Specimens examined: stream bank 12 miles east of Ramona, *Wiggins 2611;* Henshaw Dam, *Wiggins 3118.*

28. EQUISETUM KANSANUM Schaffn. This Horse-tail, so common in the Mississippi Valley, is rare in southern California but has been collected in a few places south of the Tehachepi Mountains. In central California and northward to British Columbia it grows in shaded, moist places in the Upper Sonoran and Transition Zones.

Specimens examined: Cuyamaca Lake, *Wiggins 3189.*

29. SELAGINELLA BIGELOVII Underw. On dry ridges and about rocks and chaparral from northern Lower

California northward in the Upper Sonoran Zone to Santa Clara County, California. Enormous quantities of this peculiar xerophyte grow in some localities and in years of low rainfall when the grass is scarce it is cropped very closely by cattle, burros and sheep. Tufts of the plant so thoroughly dried by the scorching sun that they crumble at the slightest touch, spring into life and turn a bright gray-green almost over night if placed in water. In this respect it is truly a "resurrection plant."

Specimens examined: San Miguel Mt., *Kimball,* March 12, 1899; Julian, *Alderson 704;* Jamul Creek at El Nido P. O., *Mearns 3881;* Lakeside, *Grant 6869;* Mussey Grade, *Wiggins 2508;* Moreno Dam, *Wiggins 2761;* Otay Mesa, *Wiggins 3270.*

30. SELAGINELLA CINERASCENS A. A. Eaton. This plant is found on clay soil in the Lower and Upper Sonoran Zones on the coastal side of the mountains from San Diego County, southward two hundred miles or more into Lower California. The stems are prostrate-creeping and form a fine mat over great areas. The mass of stems and rootlets hold the soil tenaciously and some of the small *Neomammillaria* and *Ferocactus* plants push up the soil in small circles, and when they die, leave numerous miniature craters in the soil to mark the sites of their former existence. The mat formed by the *Selaginella* helps to hold the soil and these little craters retain their outlines for a number of years, the depression soon becoming covered with the same growth.

Specimens examined: bare hillsides, San Diego, *Parish 8710;* Poway Grade, *Parish 10765;* Mussey Grade, *Wiggins 2517;* dry hills near Old Town, San Diego, *Parish 9134;* Mission Hills, San Diego, *Abrams 3399.*

31. SELAGINELLA ASPRELLA Maxon. This is a small, rare plant of rocky ridges in the Arid Transition Zone known only from the San Antonio and San Bernardino Mountains and from one locality in San Diego County. I have never seen the plant in San Diego County, but Dr. Munz told me he had collected it near Resort, in the Laguna Mountains. I have not seen the specimens.

STANFORD UNIVERSITY, CALIFORNIA.

Recent Fern Literature

Lawton, Elva. Regeneration and Induced Polyploidy in Ferns. Am. Journ. Bot. 19: 303–333. 1932.

It has been found experimentally possible by fern workers to cause the production of prothallia directly from ordinary fern leaves. Miss Elva Lawton recently carried on such experiments with eleven American species which had not previously been worked with. According to her method, she first grew young fern plants from spores and then made use of young leaves. These were placed in a culture solution and left for development. Apparently, the first and second leaves were best for this purpose.

As a result of the regeneration of prothallia from leaf tissue, the cells of the new prothallia would contain twice as many chromosomes as are normal for this tissue. When new fern plants developed from this regenerated prothallia, their cells should also contain a number twice that of normal leaves. Since differences in chromosome number are well recognized as a basis for changes in in the form of the plant, it is to be expected that the new fern plants would be different. So far, they are not old enough to show what their final characteristics will be, but they are distinctively different, although recognizable as belonging to the species.

This article of Miss Lawton's has considerable interest, not only scientifically, but from the standpoint of less technical fern workers. This experiment was begun at the University of Michigan, and is still being continued in the greenhouses of the Brooklyn Botanic Garden.—R. C. BENEDICT.

Small, John K.—Ferns of Florida. Science Press. 1931. $3.00. Ferns of Tropical Florida. Published by author. 1918. $1.55. Ferns of Royal Palm Hammock (Florida). Published by author. 1918. $.50.

Not infrequently inquiries come to the editors for references to fern books covering local areas which members may be expecting to visit. With the publication of Dr. Small's book "Ferns of Florida" there is now an excellent reference for the state which has the richest fern flora in the whole country. As Dr. Small notes there are 107 species of ferns and other pteridophytes native to Florida, representing 48 genera, 14 families, and 6 orders.

"These many fern-plants are available for study and collection at all times of the year—there is no closed season for ferns in Florida. The plants of the species growing in northern Florida are quite hardy and do not wither during the periodic cold spells. Those growing in the peninsula, although as a rule of more tender kinds, occur in habitats—hammocks and grottoes—protected from the cold waves that occasionally sweep down from the north.

"Consequently, the fern student in Florida has the advantages of a very great variety in fern life and an all-year season for exploration and study."

Dr. Small's little book (of 237 pages) is beautifully illustrated with careful line drawings of the species

represented. In his introduction, he lists the specific habitats and the particular ferns to be expected in each habitat. Seven of these are noted as peculiar to Florida.

The text and its illustrations certainly furnish a keen stimulus to any fern lover to visit the state of Florida and follow Dr. Small's leads in becoming acquainted with its fern species.

It may be noted further that Dr. Small has recently presented copies of these three books to the Fern Society Library.—R. C. BENEDICT.

Brother Victorin has added three short notes to his already long and interesting series on pteridophytes. One describes *Lycopodium tristachyum*, var. *boreale*, a single-spiked variant collected by the brothers Porsild at Great Bear Lake, very far from the previously recorded range of the species. In addition, a lesser extension of range for typical *L. tristachyum* (Charlton Island in James Bay) is reported.

The other two notes deal with *Botrychium minganense*. A probable collection of it at Great Bear Lake (also by the Porsilds) is put on record. Apropos of certain western collections, it is again discussed, this time in contrast with *B. pumicola*, and a revised key to *B. Lunaria*, *B. minganense*, *B. simplex* and *B. pumicola* is given.

As in the original key, the primary divisions rest mainly on a difference in the size of the spores, "24–32" microns in one, "32–44" in the other.[1] Aside from the difficulty of placing a plant with spores 32 microns in diameter (and experience teaches that, in the natural

[1] There is a secondary contrast, the sterile lamina of *B. Lunaria* being referred to as "simple" and that of *B. minganense* as "pinnatisequé." Bro. Victorin has, very kindly, informed me that this manner of statement was due to an error. What was meant was that the sterile lamina is practically never ternate in *B. Lunaria;* in two of the other three three species it commonly is.

depravity of things, such a plant is sure to turn up), this manner of division throws *B. minganense* with *B. simplex.* This is an apparently artificial grouping; surely, in all but the size of the spores, *B. minganense* is like *B. Lunaria* rather than *B. simplex.*

If it be argued that a key is a practical device and is not required to hold to natural groupings, the answer is that for practical purposes some character more obvious and easier to get at than microscopic measurements of spores should be chosen; and that, if no other can be found, there is proper ground to doubt the specific distinctness of *B. minganense.*

I have gone into the matter too little to speak with assurance, but there is evidence to indicate that in *B. Lunaria* and *B. minganense* the low, wart-like markings of the spores, present in all the Botrychia I have examined, are finer and more numerous than in other east-American species. This, taken together with the pinnate manner of division of the sterile lamina and the normally long common stalk, may well furnish a natural basis of distinction between the group of *B. Lunaria* and that of *B. simplex,* with its more coarsely verrucose spores and normally short common stalk, and its tendency to enlargement of the lowest pinnae of the sterile lamina and consequent ternate division in well-developed plants.

The obstacle to this otherwise excellent division lies in the queer and problematic little plant (not considered by Victorin here) which A. A. Eaton called *B. tenebrosum.* It has the pinnately parted sterile lamina and the generally long common stalk of the group of *B. Lunaria,* but there the resemblance ceases. Its spores, though somewhat variable, are in size and marking more like those of *B. simplex*; like that species, the number of its pinnae is small; and the whole architecture of its lamina is so like that of young and poorly developed individuals

of *B. simplex* that it is often not too easy to tell the two apart. It thus falls more or less across the lines drawn above. It has been treated as a species (Underwood, Benedict, Victorin) and as a variety of *B. matricariaefolium* (Clute); it has been reduced outright to that species (Davenport) and to *B. simplex* (Robinson). Curiously, it has, so far as I know it, a natural range, very similar to that of the Massachusetts fern. So, from its obscure haunts—dim hollows in deeply shaded woods—it still defies convincing classification. It neither stands firmly on its legs as a separate species nor fits comfortably within the limits of any other.

It may be added, parenthetically, that in my present opinion (subject to revision without notice) *B. minganense* and *B. onondagense* are only leaf-forms of *B. Lunaria*, with segments subspatulate, flabellate and lunate respectively and grading into each other. I only wish I could arrive at as definite an opinion in regard to *B. tenebrosum*[2].—C. A. WEATHERBY.

Professor Alfred S. Goodale of Amherst College has for some years been studying the flora of the Connecticut River watershed in Massachusetts,—the whole west-central portion of the state. By way, he says, of a report of progress, he has issued a check list of the pteridophyta of the region, printed on one side of the page only, the other being left blank for notes by the user. The nomenclature of Gray's Manual is used as a basis; synonymy and bibliographic references in cases of departure from the Manual are given. The little pamphlet (7 pages) is well printed on good paper and should be useful to fern students of the region covered.

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[2] Frère Marie-Victorin. Sur quelques ptéridophytes Nord-Américains. Contrib. Lab. Bot. Univ. Montréal no. 21. 1932.

The current number of the British Fern Gazette opens with a photograph of "*Polypodium v. Cambricum Barrowii*" a luxuriant bipinnatifid form of the polypody. There is an obituary of the late G. C. Druce and a brief account of a well-known English fern-grower, Mr. Henry Bolton. There are articles on difficulties (and successes) in growing refractory ferns, on preparing ferns for exhibit, manure for ferns, old age in ferns and other topics of interest to the grower. The supposed larvicidal properties of *Chara fragilis* are denied. A brief historical summary of old theories of the method of reproduction in ferns is given. Altogether, the number is a pleasantly varied and interesting one.

Dr. R. C. Ching, who is continuing his studies of Chinese ferns in the second volume of the *Bulletin* of the Fan Memorial Institute of Biology, illustrates, in one of them, the manner in which old "cosmopolitan" species are being whittled away by modern taxonomists. In the days when Hooker and Baker's "Synopsis Filicum" ruled over the classification of ferns, *Woodwardia radicans* ranged from the Azores through Mediterranean Europe and southern and eastern Asia to western North America and Central America. Some years ago the American element was separated, first as one species, *W. spinulosa*, then as two, *W. spinulosa* and *W. Chamissoi*. Dr. Ching now removes the Asiatic plant as *W. unigemmata*, leaving *W. radicans* only southern Europe and the Atlantic Islands.

Shorter Notes

FERNS AS WEEDS IN NEW ZEALAND.—Further data on this subject are to be found in an article recently contributed to the Journal of the Linnaean Society of London (49: 13–45, pls. 3–7. 1932) by three New Zealand botanists, Messrs. Cockayne, Simpson and Thomson. In addition to the bracken, two other species with far-creeping rootstocks, *Histiopteris incisa* and *Paesia scaberula*, are frequently very troublesome weeds in pastures. *Lycopodium fastigiatum* is also a weed in grassland in some localities.

It is as forest weeds, however, that New Zealand ferns function most vigorously. A weed, from the forester's point of view, may be defined as any plant which hinders the establishment and proper development of seedlings of timber trees. At least one tree-fern, *Dicksonia squarrosa*, and several semi-tree-ferns, species of *Blechnum*, send out runners from the base of the trunk which are capable of producing new plants in great abundance. In established forest this sort of propagation is more or less held in check, but in clearings the ferns have a nearly free field and, since the growth of their runners is rapid, soon form dense colonies within which little else can grow. They are not fatally damaged by fire and form a very considerable obstacle to the reestablishment of timbered forests.

DIPLAZIUM PETERSENII AS AN ESCAPE.—As instances of ferns acting as escapes are decidedly infrequent, it may be well to describe a new case in some detail. *Diplazium Petersenii* (Kuntze) Christ is a widespread fern of southern and eastern Asia. Consequently its appearance in eastern Brazil (*L. B. Smith & A. C. Brade* no. 2268) is unexpected, to say the least.

I happen to remember the circumstances of collecting it rather clearly. Mr. A. C. Brade, botanist and fern specialist from the national museum of Rio de Janeiro, had taken me out collecting in the classical region of the Organ Mountains on April 7, 1929. We took the train for Petropolis, the old summer capital, but left it at Meio da Serra halfway up the seaward slope of the Organs and struck into the matto, as the Brazilian jungle is expressively termed. Then followed a day such as one often dreams of but rarely realizes. Ferns everywhere, and it seemed as if each clump was a different kind. As we came to each Mr. Brade called off its name, with one exception. Here he confessed himself stumped and asked me to report the name to him if I ever came across it.

On returning to the Gray Herbarium with my collections, this fern again stood out as the puzzle of the lot. Finally it was run to earth by Dr. E. B. Copeland who recognized it as the Asiatic *Diplazium Petersenii.*

In looking back it is very difficult to explain its occurrence. We collected it in the forest along with such typical Brazilian ferns as *Asplenium serra, A. regulare, Alsophila armata, Dryopteris submarginalis,* and *Polypodium paradiseae.* It is possible for spores to have spread from material carried on the railroad, in which case one would expect the fern to be established more commonly. Yet I collected repeatedly within the city limits of Rio de Janeiro and never ran across it.—L. B. SMITH, *Gray Herbarium, Cambridge, Mass.*

THE COLOR OF THE YOUNG ROYAL FERN LEAVES.—Dr. A. H. G. Alston of the British Museum, London, who prompted the inquiry regarding possible differences in pigmentation between American and European royal ferns has now contributed comment based on the young

leaves of 1932. "The English form of the Royal Fern has slightly brownish leaves."

He has forwarded a specimen of a leaf in the crozier state which shows a considerable amount of light brown cottony scaly covering and a rather dark brown leaf tissue. Observations from others will be welcome.—R. C. B.

It may be worth while to add, by way of starting the ball of observation rolling, that in two large colonies of the American form in Connecticut, examined by me in the spring of 1932, green and red-tinged plants were present in about equal numbers.—C. A. W.

Miss Nellie M. Sadler sends in the following list of ferns collected in Onondaga County, New York—the region in which this year's field meeting of the Fern Society was held and which has long been famous as one of the American localities for hart's-tongue. Nomenclature is that of Gray's Manual.

Polypodium vulgare
Phegopteris polypodioides
" *hexagonoptera*
" *Dryopteris*
Adiantum pedatum
Pteris aquilina
Pellaea atropurpurea
Cryptogramma Stelleri
Woodwardia virginica
Asplenium platyneuron
" *angustifolium*
" *acrostichoides*
" *Trichomanes*
" **Ruta-muraria*
" *Filix-femina*
Scolopendrium vulgare
Camptosorus rhizophyllus
Polystichum acrostichoides
Aspidium Thelypteris
" *noveboracense*
" *marginale*
" *Goldianum*
" *cristatum*
" "
**var. Clintonianum*
" *spinulosum*
" *intermedium*
Cystopteris bulbifera
" *fragilis*
Woodsia ilvensis
" *obtusa*
Dicksonia punctilobula
Onoclea sensibilis
" *Struthiopteris*
Osmunda regalis
" *Claytoniana*
" *cinnamomea*
*Botrychium *onondagense*
" **simplex*
" *ramosum*
" *obliquum*
" "
var. dissectum
" *ternatum,*
var. intermedium
" *virginianum*
*Ophioglossum *vulgatum*
Marsilea quadrifolia
Azolla caroliniana

Species marked with an asterisk were collected in the case of *Botrychium onondagense* by Dr. John B. Todd, in the other cases by Miss Minnie L. Overacker.

American Fern Society

Mr. F. G. Floyd, Sierra Madre, California, has a few specimens of *Cheilanthes californica* (Nutt.) Mett. which he will distribute to members of the Society who will send him ten cents to cover postage.

Mr. Allan MacCaskill, Jr., Coleraine, Victoria, Australia, would like to acquire, by exchange or otherwise, North American specimens of the following: *Botrychium Lunaria, simplex, virginianum, pinnatum, ternatum, lanceolatum, ramosum, obliquum, pumicola, minganense; Asplenium Bradleyi, Trudelli, Stotleri, Gravesii; Dryopteris dilatata,* var. *americana; Polypodium virginianum,* f. *cambricoides; Marsilea vestita, uncinata; Azolla caroliniana; Selaginella Sherwoodii, rupestre, tortipila, acanthonota, Underwoodii, Sheldoni.*

Mr. Irving W. Knobloch, Buffalo City Hospital, 462 Grider St., Buffalo, N. Y., would like to exchange living specimens of species and varieties of pteridophytes with members of the Society.

New members:

Fagley, Frederick L., 40 Ridgeview Ave., White Plains, N. Y.
Foote, J. R., 1341 Scott Ave., Winnetka, Ill.
Miller, Erskine R., 701 Silver Spring Ave., Silver Spring, Md.
Sener, Miss Ruth, 233 Charlotte St., Lancaster, Pa.
Williamson, Mrs. S. J., 2405 University Ave., Des Moines, Iowa.

Change of address:

Ammons, Miss Nellie, 299 Glendon Ave., Morgantown, W. Va.
Farwell, Oliver A., Box 265, Lake Linden, Mich.
Flett, J. B., R. D. 2, Bremerton, Wash.
Hewitt, Judith D., 72 East 93rd St., New York City.
Humphrey, George S., 19 Hyatt St., Staten Island, N. Y.
Hombersley, Archdeacon A., 16B Gray St., Port of Spain, Trinidad, B. W. I.
Kaufman, Miss Pauline, Hotel Narragansett, Broadway & 94th St., New York City.
Nicholson, Miss Zaida, 121 Madison Ave., New York City.
Osterlund, P., 131–15 140th St., South Ozone Park, New York, N. Y.
O'Rourke, Miss Nina T., 119 Haight St., San Francisco, Cal.
Porter, Miss May N., Apartment A–7, 3 Greenridge Ave., White Plains, N. Y.
Prince, S. Fred, 4634 Adams St., Lincoln, Neb.

This number of the JOURNAL is late, because, at the time when it should have gone to the printer, there was not enough copy on hand to fill it. At the present writing (October 15th), there is not enough for no. 4; that also will, in all probability, be late.

Other numbers have been behind hand for other reasons, but it is a long time since there has been a shortage of copy. Why there should be now is not apparent; it is to be hoped that the condition is accidental and will right itself in due time. Meanwhile, possible contributors are asked to bear in mind that the JOURNAL is almost wholly dependent on them and can be issued only when, as and if they furnish the wherewithal to fill it. All are urged to send in notes and articles on anything of interest relating to ferns which may have come to their notice.

Vol. 22 October-December, 1932 No. 4

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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C. A. WEATHERBY ..... Cambridge, Mass.

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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. 22 OCTOBER–DECEMBER, 1932 No. 4

The Ferns and Fern Allies of Missouri

ERNEST J. PALMER AND JULIAN A. STEYERMARK

The fern flora of eastern North America attains its maximum development in the number of species as well as in the luxuriant abundance of many of them, in the northeastern states and in the Appalachian Mountains. The number of species diminishes gradually westward, and most of them have disappeared in the plains states, although some few extend to the Rocky Mountains, where they meet many species from the west and south, and a few of the latter range eastward as far as the Mississippi Valley.

The State of Missouri, situated about half-way between the northern and southern boundaries and somewhat east of the geographical center of the United States, embraces the western range limit of several species of ferns and fern allies. Both on account of its central geographical position and of the great diversity of its topography and of its rocks and soils, the fern flora of the state is somewhat richer and more diverse than that of most of the surrounding states.

Three distinct topographical regions are found in the state, and several more or less well-marked subdivisions of these might be recognized on the basis of geological formations and soils. The three main divisions from

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[Volume 22, No. 3 of the JOURNAL, pages 69–104, plates 5 and 6, was issued Oct. 29, 1932.]

north to south are the Prairie region, the Ozark region, and the Southeastern lowland region.

The Prairie region occupies most of the area north of the Missouri River as well as a wedge-shaped strip along the west side of the state, with its thin edge at the southwestern corner. This region is more exactly a borderland or transition zone between the semi-mountainous, broken, Ozark plateau and the western prairies and plains. Wide strips of prairie occupying the uplands are divided by wooded valleys along the larger streams, and there are often narrow borders of small trees along their tributaries. Most of the area north of the Missouri River was invaded by the glacial ice of the Kansan epoch, and deposits of transported soil, clay and gravel cover much of the surface. Small areas near the junction of the Missouri and Mississippi rivers escaped glaciation, and stratified limestones and sandstones of early Paleozoic age frequently outcrop along stream bluffs and hills. To the westward and over most of the area, the glacial drift is underlaid by the sandstones and shales of the Pennsylvanian series, and there are some local deposits of limestone at several places. A narrow strip of Mississippian limestone and chert extends from the western slopes of the Ozark plateau into the unglaciated part of the prairie region south of the Missouri River.

Ferns are not generally very abundant in this region, and the species found are mostly those having a wide distribution in other parts of the state. The only fern that has been discovered that seems restricted to this region in the state is the Ostrich Fern (*Pteretis nodulosa*), which is known from one station just within the northern border.

The Ozark region is a dissected plateau over which rock formations of great variety and of several geological ages are exposed. The low domes and peaks of the Iron

Mountains in the eastern part are composed largely of granite, porphyritic trachyte, and other igneous rocks, and surrounding them are concentric bands of sedimentary rocks, mostly sandstones and limestones of early Paleozoic age. The soils resulting from the disintegration of the igneous and siliceous rocks are largely acid, and several ferns that can be classed as oxylophiles reach the western limit of their distribution here.

Beds of magnesian limestone or dolomite and of sandstone, of Cambrian or Ordovician age, underlie much of the region to the west, and these are overlaid by strata of the purer limestone of the Mississippian series. Both the Ordovician dolomite and the Mississippian limestone contain large quantities of chert at certain horizons, and this often remains as a surface deposit after the more soluble rocks have been removed by erosion or solution. The soils resulting from the disintegration of the dolomite and limestone are more or less alkaline, and they support calciphile plants, but on ridges and slopes where the lime has been leached out and where residual deposits of chert have been left, the soils are often acid or sub-acid.

Rock exposures along bluffs, hillsides, and in glades are frequent throughout the region, while accumulations of rich soil and humus are found along the shaded bases of cliffs and in the deep cañons and valleys, and the numerous springs issuing in such places sometimes produce boggy areas of small extent. Such a variety of conditions naturally furnishes suitable habitats for many ferns, although the long dry summers restrict or inhibit others. Nearly all of the species of wide distribution in other parts of the state are found throughout the Ozarks, and many others are restricted to this region.

The Southeastern lowlands region occupies several counties in that corner of the state bordering on the Mis-

Chert Barrens near Joplin, Missouri, with
Cheilanthes lanosa, etc.

sissippi River and on the State of Arkansas. It is an area of slight relief, broken only by a line of low hills, known as Crowley Ridge, through the central part. There are practically no outcrops of solid rock in this region. The whole area was originally heavily forested and much of it was swamp land. Many southern plants are found here, and the region is topographically a northward extension of the coastal plain; it belongs to the Lower Sonoran life zone, while nearly all of the rest of the state is Upper Sonoran. Not many species of ferns are found in the swamps and low woods, but species of *Osmunda, Onoclea, Athyrium, Equisetum* and *Selaginella apoda* are characteristic, and several other genera and species are found on Crowley Ridge. *Woodwardia areolata* has been found in the state only in this region.

In compiling this list of the Ferns and Fern Allies of Missouri, and in working out their distribution in the state we have examined the material in the Gray Herbarium and in the herbarium of the Missouri Botanical Garden, and this has been supplemented by collections and records made by the authors and by notes furnished by Mr. B. F. Bush, Mr. J. H. Kellogg and others. The ecological data is largely based upon observations and field notes of the two authors. While we have tried to make the list and notes on distribution as complete as the present knowledge of the fern flora of the state would permit, we have included only species of which authentic specimens have been seen, and several that have previously been credited to the state have not been verified and are omitted for that reason. For such species as are found over most or all of the state the range is given as general, while for the more restricted species the region is indicated and in some cases the distribution by counties is given.

We have endeavored to bring the nomenclature up to

date according to the latest usage, and while no complete synonomy is attempted, where the names adopted differ from those published in the general manuals and might therefore be unfamiliar to many readers, the names previously used are shown as synonyms. The parenthetical abbreviation (G) refers to the name used in the Seventh Edition of Gray's Manual, and (B & B) to that found in the Second Edition of Britton & Brown's Illustrated Flora.

We wish to express our thanks to Mr. C. A. Weatherby for his assistance and interest, as well as to others who have contributed notes and information.

This list may be considered as supplementary to a general Catalogue of the Phanerogamous Plants of Missouri, which the authors expect to publish soon, and those who are interested in a fuller description of the state and its flora should consult that work.

Family POLYPODIACEAE

POLYPODIUM VIRGINIANUM L.

Polypodium vulgare of Auth., not L. (G), (B & B).
See Rhodora **24**: 141. 1922.

Dry shaded bluffs or ledges of sandstone, granite or porphyritic trachyte. Oxylophile. Eastern Mo.: Lincoln, Warren, Callaway, Montgomery, St. Charles, St. Louis, Franklin, Jefferson, Ste. Genevieve, St. Francois, Iron, Madison, Texas and Phelps counties.

POLYPODIUM POLYPODIOIDES (L.) Watt.

On trees in the southeastern lowlands, and on trees or more frequently on sandstone or chert rocks in the Ozark region. Oxylophile. Southern Mo., northeast on St. Peter sandstone to St. Louis Co.

NOTHOLAENA DEALBATA (Pursh) Kunze.

Limestone and dolomite cliffs and ledges. Calciphile. Southern and western Mo., and locally along the Missouri River: Holt, Platte, Jackson, Boone, Jasper, McDonald, Barry, Greene, Stone, Taney and Ozark counties.

ADIANTUM PEDATUM L.

Rich woods or rarely on moist cliffs. Circumneutral. General.

ADIANTUM CAPILLUS-VENERIS L.

Usually on wet calcareous or siliceous cliffs, rarely in woods, as in Saline Co. Calciphile to circumneutral. Southern Mo., and north to Saline and Jefferson counties.

PTERIDIUM LATIUSCULUM (Desv.) Hier., Wiss. Ergebn. Schwed. Rhod. Kongo-Exped. 1911–1912. **1**, heft. 1: 7. 1914.

Dry open woods. Oxylophile. Southern Mo.

PTERIDIUM LATIUSCULUM var. PSEUDOCAUDATUM (Clute) Maxon, Am. Fern Journ. **9**: 44. 1911.

Pteris aquilina var. *pseudocaudata* Clute (G).

Dry open woods in cherty, sandstone, or granitic regions. Oxylophile. Southern and central Mo., north to Phelps and St. Louis counties.

CHEILANTHES ALABAMENSIS (Buckley) Kunze.

Shaded ledges of dry calcareous bluffs. Calciphile. Southwestern Mo.: McDonald and Taney counties.

CHEILANTHES LANOSA (Michx.) Watt.

On dry siliceous, granitic, or porphyrite trachyte rocks. Oxylophile. Southern and central Mo.

CHEILANTHES FEEI Moore.

On dry calcareous cliffs and boulders. Calciphile. Southern and central Mo., and north along Mississippi River to Pike and Ralls counties.

PELLAEA ATROPURPUREA (L.) Link.

Calcareous cliffs and boulders, and rarely on granitic or siliceous rocks. Calciphile to circumneutral. General.

PELLAEA ATROPURPUREA var. CRISTATA Trelease.

Limestone cliffs. Eureka, St. Louis Co.

PELLAEA GLABELLA Mett.

Pellaea atropurpurea var. *Bushii* Mackenzie, Man. Fl. Jackson Co., Mo. 5. 1902, and including *Pellaea atropurpurea* var. *minima* Eggert, ex Farwell, Am. Mid. Nat. **12**: 281, in synon. 1912.

Usually on calcareous cliffs or boulders. Calciphile. Southern and central Mo., north to Jackson, Cooper and Marion counties.

ASPLENIUM PINNATIFIDUM Nutt.

Shaded sandstone and porphyritic trachyte cliffs and boulders. Oxylophile. Southeastern Ozark region: Madison, Ste. Genevieve, Iron and Shannon counties. Rare.

ASPLENIUM EBENOIDES R. R. Scott.

Chert or limestone boulders. Scattered in eastern and southern Mo.: St. Louis, Wayne and Ozark counties. Associated with *Asplenium platyneuron* and *Camptosorus rhizophyllus*, of which it has been proved to be a hybrid. Rare.

ASPLENIUM PLATYNEURON (L.) Oakes.

Open woods and thickets and on sandstone, chert

or granitic rocks and ledges. Circumneutral to oxylophile. General.

ASPLENIUM PLATYNEURON f. SERRATUM (E. S. Miller) Hoffm., Bost. Soc. Nat. Hist. **36**: 193. 1922.

Asplenium platyneuron var. *serratum* (E. S. Miller) BSP. (G).

Rocky woods and ledges. Occasional with the species. Southern and central Mo.: Jackson, Stone and Jasper counties.

ASPLENIUM RESILIENS Kunze.

Asplenium parvulum Mart. & Gal. (G).

Usually on calcareous cliffs and boulders. Calciphile. Southern Mo., and recorded locally from Jackson Co.

ASPLENIUM TRICHOMANES L.

Usually on granitic, sandstone, or chert cliffs and boulders, rarely on calcareous rocks. Oxylophile. Southern Mo.

ASPLENIUM CRYPTOLEPIS Fernald, Rhodora **30**: 41. 1929.

Asplenium Ruta-muraria of Auth. in part, not L. (G), (B & B).

Calcareous cliffs and ledges. Calciphile. Southern and east-central Mo.: Jefferson, Washington, Perry, St. Francois, Iron, Wayne, Shannon, Carter and Stone counties.

ASPLENIUM BRADLEYI D. C. Eaton.

Usually on granitic, chert or sandstone cliffs. Oxylophile. Southern and central Mo.: Ste. Genevieve, Perry, Madison, Ripley, St. Clair, Vernon, Greene and Ozark counties. Scattered and rare.

ATHYRIUM ANGUSTIFOLIUM (Michx.) Milde.

Asplenium angustifolium Michx. (G).
Asplenium pycnocarpon Spreng. (B & B).

Rich woods. Circumneutral. Southern and central Mo.

ATHYRIUM ACROSTICHOIDES (Sw.) Diels.

Asplenium acrostichoides Sw. (G).
Athyrium thelypteroides (Michx.) Desv. (B & B).

Rich woods. Circumneutral. Eastern Mo.: Adair, Pike, St. Louis, Jefferson, Franklin, Ste. Genevieve, Stoddard and Scott counties.

ATHYRIUM ASPLENIOIDES (Michx.) Desv.

Asplenium Filix-femina of Am. Auth., in part (G).
Athyrium Filix-femina Am. Auth., in part (B & B).

Rich woods, and rarely on moist sandstone or granitic cliffs. Circumneutral. Southern and central Mo.: Boone, St. Louis, Jefferson, Ste. Genevieve, Cape Girardeau, Madison, Iron, Shannon, Center, Scott, Dunklin, Butler, Ripley, Vernon, Jasper and McDonald counties.

ATHYRIUM ANGUSTUM (Willd.) Presl var. RUBELLUM (Gilbert) Butters, Rhodora **19**: 193. 1917.

Woods. Circumneutral. Scattered: Lewis, Ralls, St. Louis and Jackson counties.

ATHYRIUM ANGUSTUM var. ELATIUS (Link) Butters, Rhodora **19**: 191. 1917.

Low woods and moist banks. Circumneutral. Scattered: Clark, Wayne and Iron counties.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link.

On shaded calcareous cliffs and boulders, rarely on siliceous or granitic rocks. Calciphile. Southern and

central Mo., north along the Mississippi River to Lincoln Co. Common in the Ozark region.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott.

Rich woods and rarely on moist siliceous rocks. Circumneutral to oxylophile. General.

POLYSTICHUM ACROSTICHOIDES f. INCISUM (Gray) Gilbert.

Polystichum acrostichoides var. *Schweinitzii* (Beck) Small (G).

Occasionally found with the typical form. Boone, Ste. Genevieve, Madison, Ozark, Stone and McDonald counties.

THELYPTERIS HEXAGONOPTERA (Michx.) Weatherby, Rhodora **21**: 179. 1919.

Phegopteris hexagonoptera (Michx.) Fée (G).
Dryopteris hexagonoptera (Michx.) C. Chr. (B & B).

Rich woods. Indifferent. Southern Mo., and northward along the Mississippi River to Marion Co.

THELYPTERIS PALUSTRIS (Salisb.) Schott var. PUBESCENS (Lawson) Fernald, Rhodora **31**: 34. 1929.

Aspidium thelypteris of Am. Auth., in part, not Sw. (G, in part).
Dryopteris thelypteris Am. Auth., in part (B & B).

Wooded banks of streams, wet thickets and boggy ground. Oxylophile. Southern and central Mo.: Pike, St. Louis, Jefferson, Ste. Genevieve, Madison, Iron and Jackson counties.

THELYPTERIS MARGINALIS (L.) Nieuwland, Midland Nat. **1**: 226. 1910.

Aspidium marginale (L.) Sw. (G).
Dryopteris marginalis (L.) Gray (B & B).

In shaded places on granitic, chert, or sandstone

bluffs. Oxylophile. Southern and central Mo., and north along the Mississippi River to Lewis Co.

THELYPTERIS SPINULOSA (Muell.) Nieuwland, Midland Nat. **1**: 226. 1910.

Aspidium spinulosum (Muell.) Sw. (G).
Dryopteris spinulosa (Muell.) Kuntze (B & B).

Shaded clefts and ledges of sandstone cliffs. Jefferson Co.

THELYPTERIS SPINULOSA var. INTERMEDIA (Muhl.) Nieuwland, Am. Midland Nat. **2**: 278. 1912.

Aspidium spinulosum var. *intermedium* (Muhl.) D. C. Eaton (G).
Dryopteris intermedia (Muhl.) Gray (B & B).

On shaded granitic and siliceous bluffs and ledges. Oxylophile. Eastern Mo.: Jefferson, St. Genevieve and Madison counties.

WOODWARDIA AREOLATA (L.) Moore.

Wet woods. Oxylophile. Butler Co.

CYSTOPTERIS FRAGILIS (L.) Bernh.

Rich woods and moist shaded ledges. Circumneutral. General and common.

CYSTOPTERIS BULBIFERA (L.) Bernh.

Shaded calcareous cliffs and ledges, rarely on siliceous or granitic rocks. Calciphile. Southern and central Mo., and north along the Mississippi River to Clark Co.

WOODSIA OBTUSA (Spreng.) Torr.

On calcareous, siliceous or granitic ledges and banks. Indifferent. General and common.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore.

Dicksonia punctilobula (Michx.) Gray (G).

Sandstone cliffs and ledges. Oxylophile. Southeastern Ozark region: Ste. Genevieve and Madison counties.

ONOCLEA SENSIBILIS L.

Wet woods and swampy ground. Circumneutral. General.

ONOCLEA SENSIBILIS f. OBTUSILOBATA (Schkuhr) Gilbert.

Rarely occurring with the species. Stone Co.

PTERETIS NODULOSA (Michx.) Nieuwland, Am. Midland Nat. **4**: 334. 1916.

Onoclea Struthiopteris of Auth. in part, not Hoffm. (G).

Matteuccia Stuthiopteris of Auth. in part (B & B).

Shaded banks. Oxylophile. Putnam Co. Rare.

Family OSMUNDACEAE

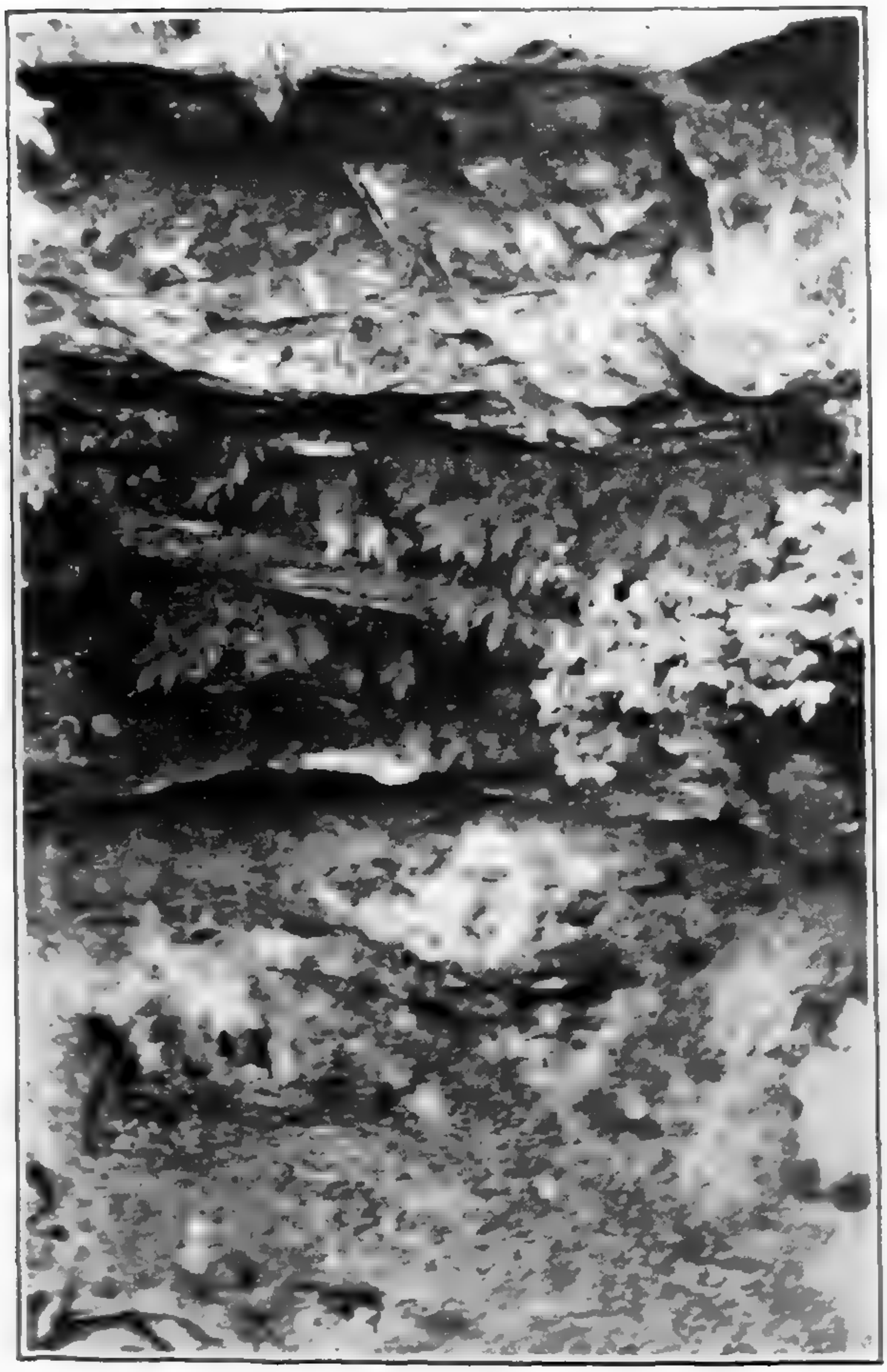
OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray.

Osmunda regalis of Am. Auth. in part (G), (B & B).

Boggy ground or on moist cliffs and ledges, in siliceous or granitic regions. Oxylophile. Southern and central Mo., mostly in the eastern counties, and scattered westward to Jackson and Vernon counties.

OSMUNDA CLAYTONIANA L.

Moist rich or swampy woods. Circumneutral to oxylophile. Scattered and local, mostly along the Mississippi and Missouri rivers. Clark, Marion, Ralls, Pike, St. Louis, Jefferson, Madison and Jackson counties.



OSMUNDA CINNAMOMEA AS A ROCK FERN.
REYNOLDS CO., MO.

OSMUNDA CINNAMOMEA L.

Boggy ground or on moist cliffs and ledges. in siliceous or granitic regions. Oxylophile. Eastern Mo., and in a few scattered stations westward.

Family OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L.

Rich woods. Circumneutral. Southeastern Mo.: Bollinger, Stoddard and Butler counties. Rare.

OPHIOGLOSSUM ENGELMANNI Prantl.

Limestone and dolomite glades. Calciphile. Southern and central Mo., north to Jackson and Boone counties. Common in the Ozark region.

BOTRYCHIUM DISSECTUM Spreng.

Botrychium obliquum var. *dissectum* (Spreng.) Clute (G).

Rich woods. Circumneutral. Eastern Mo.: St. Louis, Jefferson and Iron counties. Rare.

BOTRYCHIUM DISSECTUM var. OBLIQUUM (Muhl.) Clute.

Botrychium obliquum Muhl. (G), (B & B).

Rich woods. Circumneutral. Local and scattered. St. Louis, Franklin, Jefferson, Ste. Genevieve, Madison. Dunklin, Butler, Jackson and Jasper counties.

BOTRYCHIUM DISSECTUM var. TENUIFOLIUM (Underw.) Farwell, Papers Mich. Acad. Sci. **3**: 89. 1924.

Botrychium obliquum var. *tenuifolium* (Underw.) Gilbert (G).

Low wet woods. Circumneutral. Southeastern Mo.: Dunklin and Butler counties.

BOTRYCHIUM VIRGINIANUM L.

Rich woods. Circumneutral. General and common.

Family SALVINIACEAE

AZOLLA CAROLINIANA Willd.

Ponds and ditches. Local and scattered. Pike, St. Louis, Perry, Scott, Dunklin, Clay and Jackson counties.

SALVINIA NATANS (L.) All.

Sloughs. Bois Brule bottoms, Perry Co. Intro-

duced at this locality and not found since Demetrio's original collection. This is the only authentic record of this plant in North America.

Family EQUISETACEAE

EQUISETUM ARVENSE L.

Low ground, gravelly banks of streams, and along railroads and roadsides. Circumneutral. General.

EQUISETUM ARVENSE f. NEMOROSUM A. Br.

Wet banks. Jackson, Jasper and Newton counties.

EQUISETUM ARVENSE f. DIFFUSUM (A. A. Eaton) Clute.

Equisetum arvense var. *diffusum* A. A. Eaton.

Occasionally found with the typical form. Jackson Co.

EQUISETUM LAEVIGATUM A. Br.

Equisetum hyemale var. *intermedium* A. A. Eaton (G).

Low ground and along banks of streams. Circumneutral. Scattered: Putnam, Boone, Jackson, Greene, Ozark and Dunklin counties.

EQUISETUM VARIEGATUM Schleich.

Reported from Jackson Co.

EQUISETUM HYEMALE L. var. ROBUSTUM (A. Br.) A. A. Eaton.

Low ground and banks of streams. Circumneutral. General.

EQUISETUM HYEMALE var. AFFINE (Engelm.) A. A. Eaton.

Equisetum hyemale of Auth., in part, not L. (B & B).

Low ground. Circumneutral. Scattered. Jackson and McDonald counties.

Family LYCOPODIACEAE

LYCOPODIUM LUCIDULUM Michx.

Along moist shaded sandstone cliffs. Oxylophile. Eastern Mo., mostly near the Mississippi and Missouri rivers. Lincoln, Montgomery, Warren, St. Charles, St. Louis, Jefferson, Ste. Genevieve and Madison counties.

LYCOPODIUM LUCIDULUM var. POROPHILUM (Lloyd & Underw.) Clute.

Along moist sandstone cliffs. Oxylophile. Occurring with the typical var., but less common. Southeastern Ozark region: Perry and Ste. Genevieve counties.

LYCOPODIUM COMPLANATUM L. var. FLABELLIFORME Fernald.

Dry sandy banks and ledges in Pine woods. Oxylophile. Southeastern Ozark region: Madison and Ste. Genevieve counties.

Family SELAGINELLACEAE

SELAGINELLA RUPESTRIS (L.) Spring.

Dry sandstone, chert, or granitic rocks. Oxylophile. Eastern Mo. and locally in other parts of the state: Adair, Lincoln, Montgomery, Warren, St. Charles, St. Louis, Jefferson, Franklin, Washington, St. Francois, Ste. Genevieve, Madison, Iron, Shannon, Carter, St. Clair, Jasper and Newton counties.

SELAGINELLA APODA (L.) Fernald, Rhodora, **17**: 68. 1915.

Selaginella apus Spring (G), (B & B).

Low wet ground or on wet siliceous or granitic rocks. Oxylophile. Southern Mo., north to Jefferson Co.: Jefferson, Madison, Shannon, Butler, Ripley, Ozark, Taney, Barry and McDonald counties.

ARNOLD ARBORETUM, JAMAICA PLAIN, MASS.
MISSOURI BOTANICAL GARDEN, ST. LOUIS, MO.

Diagnostic Key to the Species of Equisetum

JOHN H. SCHAFFNER

(*Continued from p. 75*)

RECOGNITION CHARACTERS OF THE SPECIES.

EQUISETACEAE Mx. 1803. Horsetail Family.

I. EQUISETA PRIMITIVA. Primitive Horsetails.

1. **Equisetum xylochaetum** Mett. 1859. Woody-toothed Horsetail. (Incl. *E. martii* Milde). Aerial stems large, persistent, with whorls of branches; stomata in bands of 2 or more lines each; sheaths of the main stem cylindrical; sheath segments flat at least above; teeth rigid, black, linear, giving out a twanging sound when picked, often breaking off but the base persistent; cone apiculate. South America.

2. **Equisetum giganteum** L. 1753. Giant Horsetail. (Incl. *E. pyramidale* Goldm. and *E. schaffneri* Milde). Aerial stems large and long, persistent, with whorls of branches; stomata in bands of 2 or more lines each; sheaths of the main stem cylindrical; sheath segments with a definite central ridge, 3–5-carinate; teeth membranous, friable and breaking off or imperfectly deciduous; cone apiculate. Southern Mexico and Haiti to Argentina and Chile.

II. EQUISETA HIBERNA. Winter Horsetails and Scouring-rushes.

3. **Equisetum myriochaetum** Schlecht. & Cham. 1830. Much-branched Horsetail. Aerial stems large, persistent, very smooth, often barely showing ridges, with whorls of branches; stomata in single lines; sheaths of the main stem cylindrical or only slightly ampliated, with deciduous teeth; sheath segments 3-keeled; cone apiculate. Southern Mexico to Peru.

4. **Equisetum ramosissimum** Desf. 1800. Branched Horsetail. (Incl. *E. sieboldi* Milde, *E. ramosum* DC.). Aerial stems rather tall, with whorls of branches, evergreen, but delicate in regions of frost; stomata in single lines or sporadically in bands of 2 or more lines; sheaths typically about twice as long as wide, somewhat ampliated, with deciduous teeth; cone apiculate. Azores and Canaries, through Europe, Africa and temperate zone of Asia.

5. **Equisetum debile** Roxb. 1822. Weak Horsetail. (*E. timorianum* Vauch.). Aerial stems medium-sized, mostly with whorls of branches; delicate perennial; stomata usually in single lines; sheaths about as long as wide, ampliated, teeth typically deciduous; cone apiculate. From India to the Philippines through the East Indies to the Fiji Islands.

6. **Equisetum laevigatum** A. Br. 1844. Smooth Scouring-rush. (*E. hiemale intermedium* A. A. Eat.). Aerial stems evergreen, but somewhat delicate, unbranched or sporadically branched, of medium size to large; stomata in single lines; sheaths elongated, ampliated, tardily discolored, sheath segments tricarinate, teeth deciduous; internodal ridges with a row of tubercles or cross bands of silex; cone apiculate. North America.

7. **Equisetum praealtum** Raf. 1817. Tall Scouring-rush. (*E. robustum* A. Br., *E. hiemale affine* (Engelm.) A. A. Eat., *E. hiemale robustum* (A. Br.) A. A. Eat.). Aerial stems of medium size to large, evergreen, unbranched or sporadically branched; stomata in single lines; sheaths short, cylindrical, soon discolored and finally splitting, sheath segments normally tricarinate, sometimes with a central groove, teeth deciduous; internodal ridges with 1 row of tubercles; cone apiculate. North America.

8. **Equisetum moorei** Newm. 1854. Moore's Scouring-rush. (*E. hiemale schleicheri* Milde, *E. occidentale* Hy, *E. hiemale* × *ramosissimum* Samuelsson). Aerial stems of medium size, unbranched or with sporadic branching, evergreen but delicate in regions of frost; stomata in single lines; sheaths long and ampliated, remaining green for a long time, teeth promptly deciduous; sheath segments with a central groove; internodal ridges with an irregular double row of tubercles or cross bands of silex; cone apiculate. Europe.

9. **Equisetum hiemale** L. 1753. Winter Scouring-rush. Aerial stems evergreen, of medium size to large, unbranched or sporadically branched; stomata in single lines; sheaths short, cylindrical, soon discolored, sheath segments with a central groove, teeth deciduous; cone apiculate. Western North America through Asia and Europe to the British Isles and Iceland.

III. EQUISETA AMBIGUA. Ambiguous Scouring-rushes.

10. **Equisetum kansanum** Schaffn. 1912. Kansas Scouring-rush. (*E. laevigatum* A. A. Eat. not A. Br.). Aerial stems of medium size, annual, unbranched or with sporadic branches; stomata in single lines; sheaths long, ampliated, not discolored except in age, the limb not incurved; sheath segments tricarinate, teeth differentiated

and normally early deciduous; internodal ridges with a single row of tubercles or cross bands of silex, sometimes nearly smooth; cone not apiculate, the tip rounded or acute. Temperate zone of North America.

11. **Equisetum funstoni** A. A. Eat. 1903. Funston's Scouring-rush. (*E. mexicanum* of authors, not Milde.). Aerial stems of medium size, annual; main stem not branched or only sporadically branched, but typically with a peculiar cluster or rosette of more or less spreading or horizontal branches around the base; sheaths long, not discolored except in age, ampliated, with a strong tendency to be incurved at the top; teeth deciduous but commonly long persistent, sheath segments tricarinate; internodal ridges very rough with projecting cross bands of silex; cones not apiculate. Southern California and Northwestern Mexico.

IV. EQUISETA PUSILLA. Little Scouring-rushes.

12. **Equisetum nelsoni** (A. A. Eat.) Schaffn. 1926. Nelson's Scouring-rush. (*E. variegatum nelsoni* A. A. Eat., *Hippochaete nelsoni* (A. A. Eat.) Farw.). Aerial stems slender, normally annual, rarely branched; stomata in single lines; internodal ridges with a single row of tubercles or cross bands of silex; sheaths long-campanulate or ampliated, teeth persistent, with a prominent central groove toward the base, the sheath segments quadricarinate at this point; cone strongly apiculate. Northern United States and Southern Canada.

13. **Equisetum trachyodon** A. Br. 1839. Rough-toothed Scouring-rush. (Incl. *E. variegatum jesupi* A. A. Eat., *E. hiemale doellii* Milde, *E. mackaii* Newm., *Hippochaete hiemalis jesupi* (A. A. Eat.) Farw., *E. hiemale jesupi* (A. A. Eat.) Marie-Victorin, *E. hiemale* × *variegatum*.). Aerial stem robust to rather slender,

evergreen, of medium size, strict; stomata in single lines; internodal ridges with a double row of tubercles; sheaths cylindrical, black and crusty to banded with gray or white, teeth persistent, sheath segments with a central groove and thus quadricarinate; cone prominently apiculate. Northern part of North Temperate Zone.

14. **Equisetum variegatum** Schleich. 1807. Variegated Scouring-rush. (Incl. *E. variegatum alaskanum* A. A. Eat.). Aerial stems strict, small, evergreen, rarely with any branches; stomata in single lines; internodal ridges with a double row of tubercles or somewhat bicarinate; sheaths campanulate; teeth persistent, quadricarinate; cone prominently apiculate. Northern part of North Temperate and Arctic Zones.

15. **Equisetum scirpoides** Mx. 1803. Dwarf Scouring-rush. (*E. hiemale tenellum* Lilj.). Aerial stems without central cavities, very small, curly flexuous, evergreen, rarely branched; internodal ridges 6 (3 pairs); stomata in single lines; sheaths campanulate, teeth 3, persistent, quadricarinate; cone small, apiculate. Northern part of North Temperate Zone.

V. EQUISETA AESTIVALIA. Summer Horsetails.

16. **Equisetum fluviatile** L. 1737 and 1753. Water Horsetail. (Incl. *E. limosum* L., *E. heleocharis* Ehrh.). Aerial stems annual, rather tall, with or without whorls of branches; stomata in bands; central cavity very large with a very narrow wall, the tissue containing very small carinal cavities and no vallecular cavities except at the base of very large shoots; sheaths of the main stem short, cylindrical, their numerous teeth persistent; branches hollow, their teeth equaling the internodal ridges; cone not apiculate. North Temperate Zone.

17. **Equisetum palustre** L. 1753. Marsh Horsetail. (Incl. *E. litorale* Kuehl.). Aerial stems annual, usually

rather small, usually with whorls of branches; stomata in bands; central cavities of the main stem quite small, with 5–10 vallecular cavities nearly equalling the centrum; sheaths of the main stem loose and ampliated, with persistent teeth; branches with small central cavities, their sheath teeth equalling the internodal ridges; cone not apiculate. Northern part of North Temperate Zone.

18. **Equisetum bogotense** H. B. K. 1815. Bogota Horsetail. Aerial stems rather small, annual, usually without central cavities, with sporadic or irregular whorls of solid branches; stomata in bands; sheaths of the main stem loose, ampliated, their segments and membranous, persistent teeth prominently 2-keeled, with or without a broad central groove; at least part of the internodal ridges of the branches biangulate; cone not apiculate or only slightly so. Central and South America.

19. **Equisetum diffusum** D. Don. 1825. Spreading Horsetail. Aerial stems rather small, annual, with small central cavities, and with whorls of solid branches; stomata in bands; sheaths of the main stem loose, their segments and rigid, appressed, persistent teeth strongly 2-keeled with a complete, broad central groove; branches solid with strongly biangulate internodal ridges; cone not apiculate. Himalaya Mountains region.

VI. EQUISETA HETEROPHYADICA. Spring Horsetails.

20. **Equisetum silvaticum** L. 1753. Wood Horsetail. Aerial stems annual, sometimes with rows of tiny spinules, dimorphic, with prominently compound branches in horizontal or slightly drooping whorls, the fertile at first without branches or chlorophyll; stomata in bands; leaf sheaths of the main stem typically reddish-brown and translucent, the teeth coherent into 3–4 broad lobes; branches solid, 3–5-angled, their sheath

teeth with subulate tips; cone not apiculate. Northern part of North Temperate Zone.

21. **Equisetum pratense** Ehrh. 1784. Meadow Horsetail. Aerial stems annual, usually with rows of tiny spinules, dimorphic, the fertile at first without chlorophyll or branches; stomata in bands; branches of the whorls usually simple, 3-angled, their sheaths with deltoid, white-membranous teeth; teeth of the sheaths of the main stem not cohering in definite lobes; cone not apiculate. Northern part of North Temperate Zone.

22. **Equisetum telmateia** Ehrh. 1787. Ivory Horsetail. (*E. maximum* of Lam. was probably *E. fluviatile* L., *E. majus* Gars.). Aerial stems annual, large, dimorphic, the sterile with whorls of branches, the fertile unbranched and without chlorophyll; stomata in bands; branches of the whorls solid with twice the number of internodal ridges as the bicarinate sheath teeth; fertile stem withering promptly when the spores are shed, generally unbranched, its sheath teeth with long bristle-like tips; cone commonly 2–3 inches long, not apiculate. Temperate Zone in Europe, Asia, and Pacific Coast of North America.

23. **Equisetum arvense** L. 1753. Field Horsetail. (Incl. *E. saxicola* Suksd. and *E. boreale* Bong.). Aerial stems annual, of medium size, dimorphic, the sterile with whorls of 3–4-angled, solid, simple or somewhat compound branches, the fertile stem unbranched; stomata in bands; sheath teeth of the branches unicarinate, with subulate points; teeth of the main stem not cohering into 3 or 4 broad lobes and not bright reddish-brown; fertile shoot withering promptly, generally without branches or chlorophyll, its sheath teeth not bristle-like but ending in a gradually narrowing point; cone not apiculate. North Temperate and Arctic Zones.

COLUMBUS, OHIO.

More about Isoetes Lechleri Mett.

T. CHALKLEY PALMER

Material representative of this species is now becoming available from a somewhat extended range in South America, and some of recent collection reveals a tendency to variation in important characters. In addition to the plants of Killip and Smith from Colombia, on which was based the variety *Colombiana* (AMERICAN FERN JOURNAL, Vol. 19, p. 18, et seq.), I have received from Dr. W. R. Maxon the following:

"Venezuela. Laguna di Apontaderos, Mér. floating on water, January 21st, 1929." H. Pittier, No. 13242. U. S. N. Herb. No. 1440618. These plants have the small corm of the species. The leaves are long and slender, often 30 cm. as compared with the 10–13 cm. of Braun's description for *I. Lechleri*, and 6–7 cm. for *I. Karstenii* from Venezuela; which latter was afterwards included in the former. As compared with the var. *Colombiana*, the tips of the leaves are less acute, and the equatorial ridge of the megaspore is better developed. Diameter of megaspore, 376–517 μ. Microspores were not discovered. The velum seems to be complete.

Bolivia. La Paz. "In einem kleinen See, in der Kordillera. Alt. sobre Mar 4300 m." Dr. Otto Buchstein. No date. U. S. N. Herb. No. 1541653. The corm is small, as usual, and the leaves are about 11 cm. long, bright green, tips brown but not setaceous. Wings at base with some brown color, mostly in lines. Velum apparently complete. Ligule dull salmon, large, ovate, apparently mineralized, brittle. Sporangium thin-walled, small. Megaspores 330–396 μ diameter, either pure white or suffused with a pale shade of chocolate brown, mostly smooth, often polished, occasionally slightly wrinkled. The equatorial ridge of medium de-

velopment. Microspores so far as seen (they are very scarce) are of a brownish yellow color. The velum is apparently complete. There being but one small plant, a thorough technical study was not possible without destruction of the specimen. But I have no hesitation in calling it *I. Lechleri.*

Ecuador. "Province of Riobamba. Mount Chimborazo, alt. 4400 m. In small shallow ponds of the Paramo. A. Rimbach, No. 131." U. S. N. Herb. No. 1543081. Additional data: "Rooting 2–3 cm. deep in the mud. In the dry season the ends of the leaves stand out in the air. In the rainy season the whole plant is submerged. In this region frosts and snowfalls are frequent." There are 20 to 30 plants of this gathering. No date is given. Again there is a very small corm. The leaves, as many as 12 to the plant, frequently reach a height of 16 cm. They are slim, upright, thin but not fragile, long-attenuate to a brown tip not very sharp. Wings at the base are not prominent. There are no bast bundles, and stomata are not evident, but occasional brown cells are found over the leaves. Ligule brown, fleshy, irregular. Megaspores mostly white, smooth and polished, occasionally a diluted chocolate brown, the equatorial ridge well developed, 282–376 μ diameter. Microspores nearly white, sparsely short-spined, 27–32 μ long. Velum not complete, thick, mostly with a dark rim. This also is *I. Lechleri.*

The next lot seems worthy of varietal rank, and I offer the following, at any rate provisionally, and with a realization that the form is in some respects close to Karsten's Venezuelan plant collected in 1853. (A. Braun. 1862. Verh. Bot. Ver. Brandenburg 4.)

ISOETES LECHLERI var. **anomala,** var. nov.[1] Corm bi-

[1] ISOETES LECHLERI, var. **anomala,** var. nov., velo quartam partem ad dodrantem sporangii tegente, multiplice, tegumento ex-

lobed. Leaves about 30, 6 cm. long, stout, attenuate from the middle to a setaceous brown tip 1–1½ mm. long; membranous wings at base extending to one-half the height, with brown edge carried slightly higher; bast bundles none, stomata few or absent. Ligule brown, fleshy, irregularly triangular. *Velum covering one-fourth to three-fourths sporangium, complex, the outer layer thick, brown-rimmed, the inner more delicate, edges of the two not always coincident.* Megaspores smooth, often polished, white or tinted brown, ridges bold, equatorial ridge well developed, 330–470 μ (average 376 μ) diameter. Microspores brown-red to colorless, prominently short-spined, 30–40 μ long.

Type: Rimbach No. 171, Equador. Mt. Chimborazo. U. S. N. Herb. No. 1543082. The collector gives no date, but notes: "Submerged in water of shallow pond. Rooting in mud. 4200 m."

In the absence of Rimbach's No. 131 from this same Mt. Chimborazo, the impulse would be to call this a new species. But under existing circumstances, I think it merely an extreme condition of the species; and it is thinkable, also, that Rimbach's No. 131 is an emersed form of the same variety, No. 171 being the submerged form—similar contrasts as to leaves and aspect being not uncommon in many species.

The matter of the *complex velum* needs to be taken up and studied. A similar feature may exist in other South American species and varieties. I suspect it, for instance, in other forms of this same species, and perhaps it may occur in *I. montana.* The prerequisite is, a larger stock of the material. An investigation of the velum is very destructive of specimens.

The *tinted megaspores,* which occur plentifully in the above plants, and frequently in the same sporangium with the pure white ones, are otherwise identical with

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terno crasso margine brunneo-tincto, interno tenuiore, duorum marginibus nonnunquam inaequalibus.

the latter. The first thought was, that although fully formed, they were poor in exospore silica. This, however, is found not to be so. On ignition these spores blacken at first, and then as the heating continues, they become a pure white, quite indistinguishable from the others. Moreover, spirits of turpentine removes the color entirely.

DELAWARE COUNTY INSTITUTE OF SCIENCE, MEDIA, PENNA.

Recent Fern Literature

Mr. Stanley A. Cain has been studying the plants of Spring Mill State Park, Lawrence County, Indiana. The first installment of his work lists 21 species and varieties of ferns and fern-allies from an area of about one thousand acres, overlying Mitchell limestone and full of sink-holes.[1]

In an article on the evolution of degree of divergence between carpel and foliage leaf, Prof. Schaffner uses narrow-leaved spleenwort, narrow-leaved chain-fern and sensitive fern as illustrating progressive stages in the specialization of the fruit-bearing fronds.[2]

In the Journal of the Indian Botanical Society[3] N. P. Chowdhury writes interestingly of a peculiar "freak" in the Asiatic variety of *Osmunda Claytoniana* (var. *vestita* (Wall.) Milde). In this form some pinnules of a sterile frond are more or less fertile, bearing normal sporangia on the lower surface. The interesting point is that these sporangia are gathered into groups at least

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[1] Proc. Indiana Acad. Sci. **41**: 97–98. 1932.

[2] Ohio Journ. Sci. **32**: 367–378. 1932.

[3] **11**: 137–145, pl. 1, text-figs. 1–3. 1932.

approximating sori. The author interprets this phenomenon as a reversion to an ancestral state and, with the support of evidence from fossil ferns referred to the family *Osmundaceae*, concludes that the primitive condition in the family was the superficial—that is, the sporangia were borne in sori on the lower surface of the leaf, as in the majority of other ferns today.

In his recent article on the ferns of central Chile (FERN JOURNAL **20**: 1930), Señor Gualterio Looser stated that he knew of but one station for *Polystichum mohrioides* in the latitude of Santiago, though it is common in southern Chile. Within a year thereafter, he and other collectors added four other stations in central Chile; these he lists in detail in an article in the Revista Chilena de Historia Natural.[4] The specimens from these localities show much variation; Señor Looser considers that the described South American varieties of the species are inconstant and "of doubtful taxonomic value" and are better treated as forms, as has been done by the Argentine pteridologist, Hicken.

He points out further that *P. mohrioides*, f. *latifolia* Hicken is the same as var. *elegans* (Remy) C. Chr.

In the same number of the Revista Chilena, Prof. Marcial R. Espinosa states that, according to authentic specimens in the National Museum at Santiago, *Cystopteris fragilis* (?), var. *pubescens* Phil. (about which Philippi himself was, as the question mark shows, doubtful) is only a juvenile state of *Hypolepis rugosula*.[5]

In other notes[6] he gives a redescription of *Adiantum Pearcei* Phil. and a photograph of the type specimen;

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[4] 35: 26–28. 1931.

[5] Sobre un Helecho chilena, p. 18.

[6] Anotaciones Botánicas, pp. 38–41.

and a list of the first collection of ferns (five species) known to have been made in Chile. They were taken in the region of the Straits of Magellan by the English navigator George Handisyd about 1690; the specimens are in the Sloane herbarium at the British Museum.

Several recent pteridologists have expressed the opinion that three of the generally recognized genera of tree ferns—*Cyathea*, *Hemitelia*, and *Alsophila*—based, as they are, almost wholly on rather inconstant characters of the indusium, are artificial and of doubtful value. Dr. E. B. Copeland has gone so far as to unite all the Asiatic species of the three under *Cyathea*, the oldest name. Prof. Domin of Prague now accepts this view and has published a list, with full bibliographic data, of all species published under the three names, transferring all under *Hemitelia* and *Alsophila* which he regards as valid to *Cyathea*. New names for several American species described in recent years by Dr. Maxon and others result.[7]

Prof. C. L. Porter of the University of Wyoming has published a complete list of the pteridophytes of that state known to him. Mr. Hanna's recent list in the JOURNAL (**22**: 1–11. 1932) included only the true ferns; Prof. Porter adds the fern allies and also four ferns which he believes to be previously unrecorded—*Botrychium Lunaria*, *B. Coulteri*, *B. silaifolium* and *Phegopteris Dryopteris*.[8]

Judith Carlock of Phoenix, Arizona, mentions among unexpected desert plants in that region two ferns, *Notholaena Standleyi* and *Cheilanthes Feei*—unexpected

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[7] Acta Botanica Bohemica **9**: 85–174. 1930.

[8] Torreya **32**: 116–118. 1932.

because ferns are commonly associated with shade and moisture. The former species is comparatively sensitive to heat; an increase of a few degrees of temperature after the cool weather and moisture that make its growth possible cause its leaves to roll up, and in this condition they remain until more favorable weather. *Cheilanthes Feei*, with its dense covering of hairs, can endure more heat and drouth and grows more profusely.[9]

Shorter Notes

THE INTERRUPTED FERN.—The Ransiers spent ten weeks this summer, touring New England, New Brunswick and Quebec, out to the mouth of the St. Lawrence River.

One thing that impressed us was the abundance and general distribution of the interrupted fern. I had never been in New England before and was greatly astonished to find that a fern which was uncommon in central New York could be so conspicuous in neighboring states, even to one merely touring through.

One day, while in Massachusetts, I started to dig out the root system of a fine specimen of the interrupted fern. but "START" was as far as one could get! The soil was so full of stones and other root systems that the job was hopeless.

While in Maine, awaiting the eclipse, we spent many days in a fine pine grove near Madison. A "Jack of all trades" in summer and a trapper in winter told us that he gathered "Fiddle-Heads" for "greens" each spring and that 20 bushels were easily disposed of in a day, at a dollar a bushel. I was unable to learn what kind of ferns he gathered, other than that they were the

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[9] Desert 4: 69–70. 1932.

"smooth" ones, *i.e.*, without hairs. I have every reason to believe that interrupted ferns were used. Of course we have known for a long time that "bracken" fiddle heads have been so used, but never knew of any other kind.—H. E. RANSIER, *Manlius, N. Y.*

THE CLIMBING FERN DISCOVERED IN OHIO.—It is not often possible to add such a rare and local fern as *Lygodium palmatum* (Bernh.) Sw. to a state list. but Elizabeth E. Inmann, of Ohio University, Athens, Ohio. found this species the past season in the Carbondale State Pine Forest in Athens County. This locality is far west of the distribution range as given in the Gray and Britton Manuals.—JOHN H. SCHAFFNER, *Ohio State University, Columbus, Ohio.*

In the herbarium of the New York Botanical Garden is a specimen of *Isoetes* from Bolivia, Cordillera Real, Cumbre, altitude 15,200 feet, G. H. H. Tait, No. 18, Ladew Expedition, February, 1926. This is without mature megasporangia, and cannot be described. But it almost certainly is an entirely new and remarkable species. It is devoutly to be wished that more and better material of this form be brought to light.—T. CHALKLEY PALMER, *Media, Pa.*

In the AMERICAN FERN JOURNAL, Vol. 21, p. 134, I have used the name *Isoetes montana*, sp. nov., for specimens collected on Mt. Poas, Costa Rica, by H. E. Stork. I find that I have inadvertently used a species name long ago preempted by Ulrich Weber for an Andean species (Hedwigia, Bd. 63, p. 254). The forms are quite distinct. I now desire to substitute for the above the name **Isoetes Storkii**, sp. nov.—T. CHALKLEY PALMER, *Media, Pa.*

American Fern Society

As an appendix to Mrs. Tanger's article on the ferns of Lancaster County, Pennsylvania, and as a suggestion and inspiration to other local groups of fern enthusiasts, we print the following extract from a letter of hers to one of the editors:

"We have a very enthusiastic group of fern students here in Lancaster, none of whom have been at it for more than the past year and a half. We have had no end of pleasure in identifying the ferns and fern allies on this list. Dr. Wherry has been with us a number of times to see the rarer species and hybrids, so we are sure we are not making any mistaken claims in our list.

"We make weekly trips all the year round. Lately we have been intensively hunting the chain ferns and a few other remaining possibilities, so far without success, but when cold weather ends our hope of finding them for this year we will begin our winter botanizing by concentrating on the Aspleniums. Last winter was full of thrills, and we hope this season to find many more new stations in the wild and rocky ravines of our river hills.

"We think that hunting with a small group is much more effective than doing so individually, and it is so much more fun. New and rare finds can be so much better acclaimed with enthusiastic companions."

A correspondent, Mr. Irving W. Knobloch, suggests that it would be interesting to learn the number and size of hardy fern collections in the United States. The editors concur and will be glad to compile and, if possible, to publish a list of them. Any reader who has anything of the sort, however, small and modest, will confer a favor by sending to any one of the editors answers to the following two questions:

1. Have you a garden collection of hardy ferns?

2. If so, how many species and varieties does it contain?

Miss Nancy Darling, a member of the American Fern Society since 1909, died at Woodstock, Vermont, October 13th, 1932, as a result of cerebral hemorrhages, at the home of her sister, Mrs. A. B. Morgan.

Miss Darling was born in Woodstock, Vermont, December 26, 1862, and in 1865 went with her parents to dwell on the farm now known as Sky Farm in Hartland, Vermont, where she lived until 1926. She graduated from Green Mountains Perkins Academy, South Woodstock, in 1884; from Framingham, Massachusetts, Normal School in 1887. She commenced her teaching career at the age of fifteen and continued this valuable work for over twenty-five years. She taught in the public schools at Hartland, Plymouth and Woodstock, Vermont; in schools at Cataumet and Hyannis, Massachusetts; in Oshkosh, Wisconsin, Normal School; in the Tileston Normal School, Wilmington, North Carolina; in Goddard Seminary, Barre, Vermont, as preceptress from 1892–96, and later in the Royal Normal College for the Blind in London, England, and in the Wright-Humason School for the Deaf in New York City.

Miss Darling had many avocations, being especially interested in nature study, genealogical and historical research. She published a History of the Universalist Church of Hartland, in 1902, and a History of the Town of Hartland in the Vermonter in 1913. She was one of the four original founders of the Hartland Nature Club, a club which celebrated its twenty-fifth anniversary this year. Her funeral, by a strange coincidence, was on Nature Club day, the members of the Club attending in a body. Among the floral tributes was a blanket of ferns containing a few fronds of *Aspidium filix-mas* (L.) Sw.,

discovered for the first time in the United States east of the Rocky Mountains by Miss Darling on September 14, 1905. Driving to the village from her farm home Miss Darling espied an unusual fern by the roadside and upon examination and considerable study found it to be the rare male fern, so common in England but then known in the United States only from the Northwest. Her station consisted of only a few plants. Later some of her friends were surprised to find larger colonies of this fern in the adjacent towns of Bridgewater, Woodstock, and Barnard. Some of these stations have disappeared entirely, but Miss Darling's station, although not increasing in size to any extent, remains.

Although held captive by ill health for many years Miss Darling spent a great deal of time in botanical study and became widely known, not as an amateur, but as an authority on the plants of Vermont. It was the writer's good fortune in early days to come under the influence of Miss Darling. Already interested in plants, his interest was fostered by his enthusiastic teacher.—HAROLD GODDARD RUGG.

Readers of the JOURNAL are reminded that the editors are always glad to receive questions and suggestions as to subjects to be treated in our pages. We cannot agree always to supply what is wanted, but we will try.

The editors wish to express their very hearty and appreciative thanks for the generous response to their call for copy. Our immediate and most pressing needs are met; but contributors are asked to remember that there is always need and that we are always glad to receive accounts of their observations and experiences regarding ferns.

New member:

DeBevoise, Mrs. C. I., Cronamere Alpine Nurseries, Shore Road, Green's Farms, Conn.

Change of address:

Barry, E. T., East Chatham, N. Y.
Bill, Mrs. G. E., c/o Dr. J. P. Bill, Wayland, Mass.
Demaree, Delzie, R. D. 17, Box 149, Indianapolis, Ind.
Gray, Rev. F. W., Philippi, West Virginia.
Houck, Wm. G., 56 East 53rd St., New York City.
Lawton, Elva, Hunter College, Park Ave. and 68th St., New York City.
Lewis, Rev. C. S., 66 South Swan St., Albany, N. Y.
Winslow, E. J., Chesterfield Road, Brattleboro, Vt.

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ERRATUM

Page 54, line 15. For Généro, read Género.

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

VOLUME XXIII

1933

LANCASTER, PENNSYLVANIA

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa. under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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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.

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American Fern Journal

VOL. 23 JANUARY–MARCH, 1933 NO. 1

Additions to the Fern Flora of New York State

H. D. HOUSE

New York State has been rather thoroughly explored for interesting and rare specimens of the ferns and fern allies by botanists in general and fern students in particular. Hence the discovery of two species new to the fern flora of the State constitutes an event of some consequence to fern enthusiasts.

ASPLENIUM VIRIDE Huds. Moist shale cliff in Whetstone Gulf, Lewis County, *Neil Hotchkiss* 2613, 1927. No attempt has heretofore been made to give undue publicity to this interesting find although it has recently been recorded by Mr. Hotchkiss in his "Botanical Survey of the Tug Hill Plateau" (N. Y. State Museum Bulletin 287, page 58, 1932). Only a few individual fronds and no roots were collected from the few sparsely scattered plants and it is to be sincerely hoped that others who visit the locality will be fully as considerate.

WOODSIA OREGANA D. C. Eaton. Ledge overlooking Canandaigua Lake, South Bristol, Ontario County, *E. H. Eaton*, July 20, 1929, and July 15, 1931. First found there by Mr. Eaton in August, 1925. The first collection sent to me by Mr. Eaton was submitted to both Mr. C. A. Weatherby, of the Gray Herbarium, and Dr. William R. Maxon, of the National Museum. Dr. Maxon stated that the specimens were not satisfactory

[Volume 22, No. 4 of the JOURNAL, pages 105–144, plate 7, was issued Jan. 31, 1933.]

for positive identification but that he would call it tentatively *Woodsia Cathcartiana* Robinson. At the Gray Herbarium, Mr. Weatherby compared the specimens with the type of *Woodsia Cathcartiana* and agreed that it should be tentatively referred to this species, adding that similar material had come to him from northeastern Minnesota and that like the New York material, it is smaller than the type of *Woodsia Cathcartiana.* In Britton and Brown's "Illustrated Flora," *Woodsia Cathcartiana* is referred to *Woodsia scopulina.* Mr. Weatherby further suggests that *Woodsia Cathcartiana* may be only a form of *Woodsia oregana,* making a geographic connecting link between its western area and the outlying stations for it on the Gulf of St. Lawrence. It would appear that the status of *Woodsia Cathcartiana* is not satisfactorily settled.

The July 15, 1931, collections by Mr. Eaton contain larger and more representative fronds and these compare very closely with collections of *Woodsia oregana* from Bic, Rimouski County, Quebec (Fernald & Collins 294; Jacques Rousseau 26490, 26617), and are much closer to this eastern form of *Woodsia oregana* than to any specimens of *Woodsia scopulina* available for comparison. For this reason and until the status of *Woodsia Cathcartiana* is satisfactorily settled I am referring the New York collections made by Mr. Eaton to *Woodsia oregana.*

Mr. Eaton has succeeded in propagating a number of small plants from spores and some of the material has been outplanted near Albany in the hope that more abundant material may finally be secured.

The following notes are mainly concerned with additional records of distribution of certain species in New York State.

BOTRYCHIUM LUNARIA L., var. ONONDAGENSE (Underw.) Clute. LeRoy, Genesee County, *M. S. Baxter*, May 23, 1921. Mr. Baxter also sends three specimens of this rare fern collected by him on the limestone area fifty miles south of the city of St. Petersburg, Russia, June, 1891. They are exact counterparts of New York State specimens and the occurrence of this variety in the limestone region of Russia suggests very strongly the possibility that it is correctly placed as a variety of *B. Lunaria*. It also suggests the desirability of a careful examination of European literature and collections for additional information regarding this form of the moonwort fern.

BOTRYCHIUM SILAIFOLIUM Presl. (*B. ternatum* var. *intermedium* D. C. Eaton). Chenango Lake, Chenango County, *E. E. Davis*, August 9, 1928. Minerva, Essex County, *House* 13531, October 5, 1926. Pottersville, Warren County, *House* 10675, September 18, 1924. North Creek, Warren County, *House* 15496, August 18, 1927.

BOTRYCHIUM OBLIQUUM f. ELONGATUM (Gilbert & Haberer) Hoffman. Windom, Erie County, *C. A. Zenkert*, October 2, 1928.

BOTRYCHIUM OBLIQUUM var. ONEIDENSE (Gilbert) Waters. Windom, Erie County, *C. A. Zenkert*, October 2, 1928.

OSMUNDA CINNAMONEA f. FRONDOSA (T. & G.) Britton (Pl. 1), Wet soil, mountain west of Berlin, Rensselaer County, *House* 19430, July 6, 1932. Several plants in a small colony with the wet soil around the plants more or less covered with hardened road tar from highway construction close by. Normal spore-bearing fronds were entirely absent, every frond being fertile at the tip only, as shown in the illustration. Since abnormal forms are often associated with certain types of injury

OSMUNDA CINNAMONEA, f. FRONDOSA

or unnatural conditions the presence of the road tar is possibly to be associated with the development of these spore-bearing leafy fronds.

CRYPTOGRAMMA STELLERI (S. G. Gmel.) Prantl. "Ice Gorge" near Hague, Warren County, *Mrs. Orra Parker Phelps*, June 29, 1926.

THELYPTERIS BOOTTII (Tuckerm.) Nieuwl. Three Mile Harbor, Suffolk County, *Roy Latham*, September 1, 1926.

WOODSIA OBTUSA (Spreng.) Torrey. Woods near Green Lake, Jamesville, Onondaga County, Dr. John B. Todd, November 2, 1924.

POLYSTICHUM BRAUNII (Spenner) Fée. This fern, somewhat rare in New York State, still grows in a deep ravine near Summit, Schoharie County, where it was found by Dr. C. H. Peck (31st Report of the New York State Museum, p. 53, 1879). Burns Mountain, near Olmstedville, Essex County, *House* 19006, October 5, 1931 (locality first discovered by Mrs. Bailey Burritt).

POLYPODIUM VIRGINIANUM f. ACUMINATUM (Gilbert) Fernald. Burns Mountain, near Olmstedville, Essex County, *House* 19005, October 8, 1931.

EQUISETUM LAEVIGATUM A. Br. Margin of South Pond, Sandy Creek, Oswego County, eastern end of Lake Ontario, *Neil Hotchkiss* 3107, July 25, 1928. Felt's Mills, Jefferson County, *House* 16494, July 11, 1929.

EQUISETUM LITORALE Kuehl. Lewis Point, shore of Oneida Lake, Madison County, *House* 14209, June 14, 1927, Cleveland, Oswego County, *House* 11737, June 13, 1926 (*forma elatius* Milde). Between North and South Sandy ponds, eastern end of Lake Ontario, Oswego County, *Neil Hotchkiss* 2974, July 14, 1928.

EQUISETUM SCIRPOIDES Michx. Boggy evergreen woods east of Minerva, Essex County, *House* 14539, June 30,

1927. Moxham Pond, south of Minerva, *House* 14645, July 3, 1927. Along the Kayaderesseras Creek above Ballston Springs, Saratoga County, *House* 13715, May 5, 1927.

LYCOPODIUM CLAVATUM L. The variety *laurentianum* Victorin (Les Lycopodinées du Quebec, 23, 103, 1925) is described as having "strobiles usually 2 (4–7) cm. long, on one common peduncle, each with a distinct pedicel 1–8 mm. long." This character is exactly matched by specimens from Bavaria (*Dr. H. Gluck*, Sept., 1901, and October, 1894), and also by New York material from North Elba (*Peck*), and the Catskill Mountains (*Mary F. Miller* 246). The common form in this state has the strobiles more closely joined at the base and not distinctly pedicellate. While the so-called var. *laurentianum* may be the prevailing form in the region covered by Fra. Victorin's studies, it occurs also in Europe and in New York State it appears to merge into the common form with sessile or nearly sessile strobili. A large series of specimens seems to indicate that the varieties *laurentianum* and *subremotum* Victorin (*l.c.*, 24, 103), and the variety *tristachyum* Hooker, are scarcely deserving of systematic recognition.

LYCOPODIUM SABINAEFOLIUM Willd. Labrador Pond, Onondaga County, *Wiegand and Young* 14989, October 6, 1923. Oniskethau, Albany County, *House* 16046, May 18, 1929.

LYCOPODIUM SABINAEFOLIUM var. SITCHENSE (Rupr.) Fernald. Delhi, Delaware County, *Neil Hotchkiss* 2045, May 10, 1927. Near Indian Lake, Hamilton County, *House* 15351, August 16, 1927.

LYCOPODIUM TRISTACHYUM var. HABERERI (House) Victorin. In addition to the type specimens cited (*House*, N. Y. State Museum Bul. 176: p. 36. 1915), this club-moss, now to be regarded as a variety of *L.*

tristachyum, has been found at Parkers, Lewis County, *Hotchkiss*, and at Little Moose Lake, Herkimer County, *Dowell* 4450, July 5, 1905. Mr. Hotchkiss has also collected material in Albany and Rensselaer Counties which is even closer to typical *L. tristachyum* in character.

LYCOPODIUM SELAGO L. Near Hopkinton, St. Lawrence County, *Mrs. Orra Parker Phelps*, April 28, 1916.

ISOETES BRAUNII Dur. When the level of the Adirondack lakes is low, as is often the case during August, this quillwort is very abundant and easy to find. During seasons when the water is high in August it is either rare, dormant or difficult to locate. During August, 1927, with ideal water conditions this species was found in abundance in shallow water and even emersed upon muddy shores from which the water had receded, at Loon Lake near Chestertown, and Tripp Lake, Warren County; Minerva Brook near Minerva, Schroon Lake, Lake Sanford, Lake Harris, Rich Lake and Hewitt Lake in Essex County; Long Lake, Little Tupper Lake and Indian River in Hamilton County.

ISOETES ENGELMANNI A. Br. Chiefly emersed on muddy shores, sometimes also in shallow water. Myosotis Lake, Rensselaerville, Albany County, *House* 13176, August 22, 1926. Kinderhook Lake, Columbia County, *House* 15542, August 25, 1927. Steer's Pond, Preston, Chenango County, *House* 16906, August 11, 1929. Outlet of Lower Chateaugay Lake, Franklin County, *Muenscher & Maguire* 618, September 12, 1930.

ISOETES TUCKERMANI var. BOREALIS A. A. Eaton. Camp Riverdale, Hamilton County, *Alfred A. H. Povah*, August 9, 1926.

ISOETES TUCKERMANI var. HARVEYI (A. A. Eaton) Clute. South inlet of Titus Lake, Franklin County, *Muenscher and Maguire* 670, July 13, 1930.

NEW YORK STATE MUSEUM, ALBANY, N. Y.

Is Polypodium vulgare L. var. Churchiae Gilbert a Polypodium?

ARTHUR N. LEEDS

One can hardly read the discussion with which Gilbert accompanies his publication of *Polypodium vulgare* var. *Churchiae*[1] without noticing his lack of certainty as to its status and the feeling that he had assigned his variety to that species partly because no more satisfactory disposition of it seemed possible. His description was based on a plant with two fronds, one of which he preserved as the type. Unfortunately, his herbarium was left to a high school, where, according to report, it has been lost or destroyed, and a reference to his type is therefore impossible.

No other example of the variant was known until three years ago, when Miss Elsie M. Kittredge found a specimen near Florence, Vermont.[2] It was taken up and transplanted to Mrs. Chisholm's garden in Proctor. In September, 1931, Miss Kittredge brought one of its fronds to the Fern Society's meeting at Brown's Mills, N. J., where it excited much interest and surprise, and later she very kindly contributed it to the Academy of Natural Sciences of Philadelphia. With stalked pinnae and a stipe abundantly clothed with scales, it looked more like a form of *Polystichum acrostichoides* than a polypody, and the more attentively one examined it, the more difficult became the acceptance of Gilbert's identification of it as a variety of *Polypodium vulgare*.

Last August Dr. E. T. Wherry and I visited Mrs. Chisholm and had the satisfaction of seeing the curious and puzzling little plant alive and growing in her fasci-

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[1] The Fern Bulletin 14: 39. 1906.

[2] AMERICAN FERN JOURNAL 20: 124. 1930.

nating garden. After a brief examination, Dr. Wherry suggested that it was neither a *Polypodium* nor a *Polystichum*, but a highly modified form of *Dryopteris marginalis*. While its general appearance bears little enough resemblance to that fern, a careful study of it amply confirms the correctness of his suggestion.

Mrs. Chisholm permitted us to remove another, well-developed frond (Plate 2), and the following notes are based on it and the one mentioned above.

It is a dwarfed, forked, and crested monstrosity. The lower pinnae are barely three-quarters of an inch long and, instead of being pinnate, are simple and stalked. Farther up the frond the pinnae become still smaller and adnate and are finally reduced, below the cresting, to short confluent segments. Such an extreme modification of the normal form, while rare, is not entirely unique. Under the name of *Lastrea filix-mas* var. *multicristata*, a remarkably close parallel in a related species has been described and figured by Lowe in "Our Native Ferns," Vol. I, p. 267, 1865.

The stipe is channeled as in *Dryopteris marginalis*, not terete as in the polypody. It is densely clothed with scales at the base, with diminutive scales occurring sparingly along the rachis almost throughout its length. In color, shape, and cell characters, they closely resemble those of *D. marginalis* and are not like the scales of the Christmas fern or those on the rhizomes of the polypody. The lower pinnae are stalked, and the expanded bases of the pedicels are attached to the edges of the channeled stipe exactly as are those of the marginal fern. The veins on the upper surface are impressed—"more or less sunk in the parenchyma," as Gilbert says—not raised as in *Polypodium*. Where the venation is not distorted by the cresting of the pinnae, it is either simple or forked and corresponds with that of the

DRYOPTERIS MARGINALIS, f. CHURCHIAE

smaller pinnules toward the tip of a normal frond of the marginal fern. The veins extend almost to the margin; not "quite to the edge," as Gilbert says, but noticeably nearer than those of the polypody. The contour of the margins and the texture of the upper and lower leaf surfaces are those of the marginal fern and not of the polypody.

Gilbert describes his variety as having a "naked" stipe. This point is important, and should not be minimized. However, he did not find the fern himself and it is not clear from his account whether he saw the whole plant or only the frond which he preserved, and, if the latter was the case, it is perhaps possible that the scales on the stipe were rubbed off in handling before the specimen reached him and that he failed to notice the traces left or the diminutive ones on the rachis. He also states that the "lower part" of the stipe "is dark, the upper stramineous." In our specimens the stipe is stramineous below and green above. Despite these differences, his full and detailed description tallies so closely in all other respects that there need be little hesitation about identifying Miss Kittredge's plant with it.

As already said, Gilbert was evidently in doubt about the status of his variety and not quite sure that he was dealing with a *Polypodium*. The stalked pinnae and the venation troubled him; the channeled stipe and impressed veins, which he notes but does not comment on, might well have done so; and if, in addition, his specimen had not been bereft of its scales (assuming that that is what happened), it would have been impossible for him to have included it among the varieties of *Polypodium vulgare*. Others seem to have shared his doubts. The English specialist, C. T. Druery, remarked at the time that "stalked pinnae in this genus, to say nothing of the particular species, are quite anomalous."[3]

[3] The Fern Bulletin **14**: 85. 1906.

In view of the evidence furnished by this fresh material, which Miss Kittredge and Mrs. Chisholm have so happily made available, it would seem that *Polypodium vulgare* L. var. *Churchiae* Gilbert, already reduced to a forma and transferred to *Polypodium virginianum* L. by Prof. Fernald,[4] should be transferred again, becoming *Dryopteris marginalis* (L.) A. Gray *forma* **Churchiae** (Gilbert) comb. nov.

ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, PA.

EDITORIAL NOTE.—Through Mrs. Chisholm's kindness, I was privileged to examine her puzzling little fern shortly after Dr. Wherry and Mr. Leeds had seen it. As a result, I can add the following points in support of their convincing and carefully worked out argument as to its identity. (1) The rootstock is short and thick, not at all like the long and comparatively slender rhizome of the polypody. (2) So far as could be determined without destroying the plant, the stipes show no trace of the joint at the base which in the polypody they have. (3) Where the veining is not too much distorted, the mid-veins of the pinnules leave the costa in the manner characteristic of the wood ferns—that is, first at a very sharp angle, so as to run almost parallel to the costa, then with an abrupt bend outward.

This, if it add anything of worth, may serve as some atonement for my having too easily accepted Gilbert's ascription of the plant to Polypodium when I first determined it, from a frond and a photograph. It may be added that when Prof. Fernald transferred Gilbert's variety to *P. virginianum* he had seen no specimens, but worked wholly from the original description.—C. A. W.

[4] Rhodora 24: 125. 1922.

Ferns and Fern Allies of Lancaster County, Pennsylvania, 1931 and 1932

LOUISE F. A. TANGER

During the years 1931 and 1932 the following ferns and fern allies have been found in Lancaster County, Pennsylvania, by a group of half a dozen fern students, beginners all.

Lancaster County, an area of over 960 square miles, is a very beautiful region of varied topography and soil belts and consequently has a rich and diversified flora. The great Susquehanna River valley, along its southern edge, in which the rocks are predominantly mica-gneiss, is rich in the rare Aspleniums. The lovely river glens, moist and shady, with a deep accumulation of rich leaf-mold, contain a greater number of species than any other section. To the north is a mountainous region of red sandstone soil. The great central basin is a limestone region, comprising some of the richest farm land in the country. To the southeast is a serpentine belt. The whole offers a remarkable inspiration and challenge to the botanist.

OPHIOGLOSSUM VULGATUM L. One station, a swampy field near the Dillerville swamp.

BOTRYCHIUM MATRICARIAEFOLIUM A. Braun. Two stations. About twenty-five plants in a ravine at Martic Forge and one plant, very large and healthy, in the Muddy Run ravine.

BOTRYCHIUM OBLIQUUM Muhl. Common.

BOTRYCHIUM DISSECTUM Spreng. Common.

BOTRYCHIUM ANGUSTISEGMENTUM (Pease and Moore) Fernald. Two stations. Five plants in a ravine at Martic Forge and nine in the Muddy Run ravine.

BOTRYCHIUM VIRGINIANUM (L.) Sw. Common.

OSMUNDA REGALIS L. Common.

OSMUNDA CINNAMOMEA L. Common.

Forma BIPINNATIFIDA Clute. Gleisner's swamp, near New Providence, and the Muddy Run ravine.

Forma AURICULATA (Hopkins) Kittredge. Two stations near Penryn Park. At one of the Penryn stations and in the ravine at Fite's Eddy a form both bipinnatifid and auricled was collected.

Forma FRONDOSA (A. Gray) Clute. Near Hull's Tavern, northern Lancaster County, and in Gleisner's swamp.

OSMUNDA CLAYTONIANA L. Common.

ONOCLEA SENSIBILIS L. Common.

Forma OBTUSILOBATA (Schkuhr) Gilbert. Occasional.

MATTEUCCIA STRUTHIOPTERIS (L.) Todaro. On an island in the Susquehanna River, off Washingtonboro.

WOODSIA OBTUSA (Spreng.) Torr. Common.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. Common.

The forked form pictured in "The Fern Lover's Companion" by Tilton, p. 167, was found in the Muddy Run ravine.

CYSTOPTERIS BULBIFERA (L.) Bernh. Common in the limestone section.

CYSTOPTERIS FRAGILIS (L.) Bernh. Common.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott. Common.

Forma INCISUM (Gray) Gilbert. Common.

Forma MULTIFIDUM Clute. Two plants in the Muddy Run ravine, having both fertile and sterile fronds.

A close approach to forma GRAVESII Clute. More than half the pinnae of many of the fronds show the projecting bristle and cup. Eight plants were found in the ravine at Turkey Hill, six of them with numerous fertile fronds, and two plants, all sterile, in the ravine at Haines's Station.

Bipinnate forms in great variety.

One plant in a ravine near Fite's Eddy in which the tips of the pinnae were forked, then twisted like the petals of a cactus dahlia.

A form much crested at the tips of the pinnae and forking once or more at the tips of the fronds was found at Rock Springs, southern Lancaster County, and at Geiger's Quarry. These plants were only occasionally fertile at the very tips.

Intergrading forms of all but the last two above were found in great variety.

DRYOPTERIS NOVEBORACENSIS (L.) A. Gray. Common.

DRYOPTERIS THELYPTERIS (L.) A. Gray. Common.

DRYOPTERIS CRISTATA (L.) A. Gray. Common.

DRYOPTERIS CLINTONIANA (D. C. Eaton) Dowell. Two stations. Near Hull's Tavern, northern Lancaster County, and the ravine at Fite's Eddy. At the latter station some of the tallest fronds measured fifty-seven inches in height.

DRYOPTERIS GOLDIANA (Hook.) A. Gray. Ravine at Fite's Eddy.

DRYOPTERIS MARGINALIS (L.) A. Gray. Common.

Forma ELEGANS (J. Robinson) F. W. Gray. Frequent.

DRYOPTERIS SPINULOSA (Muell.) Kuntze. Frequent in swamps.

DRYOPTERIS INTERMEDIA (Muhl.) Gray. Common.

DRYOPTERIS BOOTTII (Tuckerm.) Underw. Ravines at Martic Forge, Muddy Run, and Fite's Eddy.

DRYOPTERIS MARGINALIS × CRISTATA. Two ravines at Martic Forge and at Muddy Run. Total of seven plants.

DRYOPTERIS MARGINALIS × INTERMEDIA. One plant in the Muddy Run ravine.

DRYOPTERIS MARGINALIS × SPINULOSA. One plant in ravine at Benton; one plant at Colemanville.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr. Common.

DRYOPTERIS LINNAEANA C. Chr. (*D. Dryopteris* Britton). Two ravines at Martic Forge.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Common.

Forma AURICULATUS R. Hoffm. Frequent.

Forma ANGUSTATUS F. W. Gray. Near Marticville.

Forma INTERMEDIUS (Arthur) Clute. Frequent.

Lacinate and forking forms, freaky in the extreme. Some are forked three and even four times, although two forks are more frequent.

ASPLENIUM TRICHOMANES L. Common.

ASPLENIUM PLATYNEURON (L.) Oakes. Common.

Forma SERRATUM (E. S. Miller) R. Hoffm. Occasional.

Forma HORTONAE (Davenp.) L. B. Smith. Several plants along the Little Conestoga Creek, near Millersville, in a thicket of blackberries.

Forma **proliferum** (D. C. Eaton), n. comb. *A. ebeneum,* var. *proliferum* D. C. Eaton, Bull. Torr. Bot. Club 6: 307. 1879. Fourteen of the small proliferous plants were found at Camp Kiwanis, on Mill Creek, and one in the ravine at Fite's Eddy.

ASPLENIUM EBENOIDES R. R. Scott. A total of twenty-five plants at nine stations, all in the limestone section.

ASPLENIUM PINNATIFIDUM Nutt. Frequent on mica-schist in southern Lancaster County.

ASPLENIUM MONTANUM Willd. Occasional on mica-schist in southern Lancaster County. Seven stations have been found, just half as many as for pinnatifidum.

ASPLENIUM BRADLEYI D. C. Eaton. On mica-schist in Tucquan glen and a ravine at Martic Forge.

ASPLENIUM TRUDELLI Wherry. Martic Forge ravine, Tucquan, McCall's Ferry ravine and Muddy Run.

ASPLENIUM RUTA-MURARIA L. Two stations along the Conestoga Creek, near Lancaster. Another has been reported to us along the Cocalico Creek, in northern Lancaster County, but we have not located it yet.

ASPLENIUM ANGUSTIFOLIUM Michx. Ravine at Shenk's Ferry.

ATHYRIUM THELYPTEROIDES (Michx.) Desv. Common.

A form that suggests *Athyrium Filix-foemina* in general appearance, the pinnules being farther apart than usual, and serrate, with the upper pinnule nearest the rachis auricled on many of the pinnae. Stipe reddish toward the base.

ATHYRIUM FILIX-FEMINA (L.) Roth.

A great variety of forms.

ADIANTUM PEDATUM L. Common.

PTERIDIUM AQUILINUM (L.) Kuhn. Common.

PELLAEA ATROPURPUREA (L.) Link. Common on limestone.

POLYPODIUM VIRGINIANUM L. Common.

Forma ACUMINATUM (Gilbert) Fernald. Occasional.

Forma DELTOIDEUM (Gilbert) Fernald. McCall's Ferry ravine.

Forms with the tips of the pinnae, as well as the tip of the frond forked.

EQUISETUM ARVENSE L. Common.

EQUISETUM HYEMALE L. Common.

EQUISETUM SYLVATICUM L. Swampy wood on a branch of Muddy Creek, northern Lancaster County, beyond Hopeland.

LYCOPODIUM LUCIDULUM Michx. Common.

LYCOPODIUM OBSCURUM L. Common.

LYCOPODIUM OBSCURUM L. Var. DENDROIDEUM (Michx.) D. C. Eaton. Penryn Park.

LYCOPODIUM CLAVATUM L. Occasional.

LYCOPODIUM COMPLANATUM L. Var. FLABELLIFORME Fernald. Common.

LYCOPODIUM TRISTACHYUM Pursh. Sunny hillside at Lake Grubb, near the Marietta Pike.

SELAGINELLA APUS Spring. Common.

In 1925 or 1926 one of our group, Mr. William H. Auxer, found *Lygodium palmatum* (Bernh.) Sw, in the neighborhood of Penryn Park. He was not then interested in ferns and did not realize that it was an unusual find, although he collected a specimen for his herbarium. We have searched for it since, but so far unsuccessfully.

We also found *Dryopteris simulata* just across the river, in York County, but not within our own county limits.

LANCASTER, PA.

Miscellaneous Notes on Equisetum

JOHN H. SCHAFFNER

EXUDATION OF LIQUID WATER BY YOUNG SHOOTS OF EQUISETUM.—The growing shoots of various species of Equisetum exude large drops of water from the nodes during their development. In greenhouse plants the drops of water can be seen prominently in the morning. It is not necessary to cover the plants but they need an abundant supply of water in the soil. This phenomenon has been observed in greenhouse plants of *E. praealtum*, *E. hiemale*, *E. variegatum*, and *E. arvense*.

PHOTOTROPISM OF THE YOUNG SHOOTS OF EQUISETUM PRAEALTUM.—The rigidly erect character or negatively geotropic reaction of the aerial shoots of *Equisetum praealtum* Raf. is a very striking and well known phe-

nomenon, but it is probably not so commonly known that the young shoots when they are from six inches to a foot high show considerable phototropic bending toward a source of light. A considerable number of young shoots have been tested and they showed a decided bending toward the source of light in from ten to thirty hours.

FLEXUOUS SHOOTS OF EQUISETUM.—Various species of Equisetum commonly develop flexuous shoots among the usual straight shoots. These flexuous shoots are especially noticeable in *Equisetum praealtum* Raf. The question arose as to whether this flexuous condition was the result of a hereditary change in the bud from which the shoot developed, or whether it was due to other causes. A large number of such flexuous shoots have been tested out by vegetative propagation, and in every case the new shoots, developed directly from the nodes of the old flexuous shoots or from the rhizomes developed from them, have been perfectly straight. The cause of the flexuousness, therefore, is not a change of hereditary potentiality but a change in hereditary expression. The straight shoots have the potentiality for flexuousness, and the flexuous shoots have the potentiality for straightness. The flexuousness is thus of the nature of "intermittent heredity," and requires some special physiological condition of the bud to bring it into play. At the top of the general series to which *E. praealtum* belongs in *E. scirpoides* Mx. In this species the flexuous condition is normal, all the shoots normally developing flexuousness. The intermittent hereditary potentialities for flexuousness have evolved to the condition where they come into activity regularly in all ordinary environments.

EQUISETA OF SAN DIEGO COUNTY, CALIFORNIA.—In "Pteridophytes of San Diego County, California" re-

cently published in the AMERICAN FERN JOURNAL by Ira L. Wiggins, only three species of Equisetum are listed, namely, *E. kansanum* Schaff., *E. funstoni* A. A. Eat., and *E. telmateia* Ehrh. I have these three species in my private herbarium from San Diego Co., and four additional species as follows: *E. laevigatum* A. Br.—below Lake Hodges, four miles west of Escondido; near San Diego; Mission Valley near San Diego; all from F. M. Cota. *E. praealtum* Raf.—Cuyamaca Mts., F. M. Cota. *E. hiemale* L.—Cuyamaca Mts., Azealea Creek, San Diego Co., F. M. Cota. *E. arvense* L.—near Montezuma Mines; Boulder Creek; Deer Creek; all from F. M. Cota. *E. arvense* must be near its southern limit, although it is possible that it may extend farther south into Lower California. I have all these seven species from other collectors from localities a little farther north.

OHIO STATE UNIVERSITY, COLUMBUS.

The Way It Works

FREDERICK L. FAGLEY

For a number of years we had been bringing in ferns and planting them around our cottage at Lake Sunapee, N. H. We knew nothing about ferns except that they were nice to have around the place, so we planted them and they grew. Then one day in the summer of 1930 a friend, Rev. Wm. F. Frazier, of Burlington, Vt., happened to be visiting us and as we walked out a path he said, "Well you have about all the native ferns growing here," and I said, "Are these different kinds?" and with that he turned over a few leaves and said, "This is a Lady Fern—this is a Marginal Shield Fern and this a Mountain Wood Fern."

That was all, but I thought then if these ferns had names I was going to learn what they were. So I went to the book store and got a copy of "How to Know the Ferns." With this I began last summer to try to classify the ferns on the place. I was terribly mixed by the varieties of Lady Ferns and also by the fact that not all the *Dryopteris marginalis* had rounded pinnules, etc. Then I went to the book stores in Boston and found Clute's "Ferns in Their Haunts," Durand's "Field Book" and Tilton's "Fern Lover's Companion." To find these I had to visit all the leading book stores and three second-hand ones. Evidently there is not much demand for such books.

Then here my troubles began again for I would find a certain frond illustrated as *Dryopteris Linnaeana* while another book illustrated the same frond as *Thelypteris Dryopteris*. Then again one book gave a chapter to *Boulder Ferns* while the other mentioned no such fern. The table in Durand's book helped out, but I am still somewhat at sea on names!

Well, I collected the ferns about the place and classified them as best I could and then sent a duplicate set of twenty-three specimens to the National Museum at Washington for identification and, Glory be! when the return came, the classifications we had made were all correct, even to *Dryopteris marginalis* var. *elegans*. With the classification sheet came a delightful letter from Dr. William R. Maxon inclosing a leaflet on the American Fern Society and offering to propose my name for membership. But I had already joined the Society. In my study I asked every one I met if they knew anything about ferns, for I wanted help. In this way I was told to write to Mr. E. J. Winslow at Brattleboro, Vt. This I did and he told me of the Society and also identified the sample I sent him. Another friend knew Mr.

Harold Rugg at Hanover, N. H., and said "Mr. Rugg knew all the ferns of New Hampshire." A very short visit to Mr. Rugg helped me with several questions and he was kind enough to give me fronds of *Aspidium Filix-mas* and of *Asplenium ebeneum*. When I go back to New Hampshire next summer I promise myself some more help from Mr. Rugg.

Well, the summer is over but I now have an herbarium of forty-four varieties; but this is not the smallest part of the good. It is true that several very pleasant evenings have been spent with the herbarium this fall but what matters most is the new interest that has come to me.

For example, some weeks ago I had occasion to spend a few days at Massena, N. Y. One afternoon I visited a woodland where I found fourteen varieties of ferns and another swampy woodland four miles distant where I found seven I had seen in the first locality and nine others, thus making twenty-three varieties. But best of all I found the fertile fronds of *Dryopteris cristata*. I had found at Sunapee many sterile fronds but no fertile ones—and these found at Massena were beauties too. Then I found for the first time *Dryopteris Clintoniana* and saw *Cystopteris bulbifera* growing on a hillock, in the swamps, the long fronds with bulblets twining upward through the undergrowth. During this one afternoon I found *Dryopteris Boottii, D. cristata, D. Filix-mas, D. marginalis, D. noveboracensis, D. dilatata, D. intermedia, D. spinulosa, D. Thelypteris, D. Linnaeana* and *D. Phegopteris*, which seemed to me to be a family well represented.

Following this on a visit to Jacksonville, I called on Mrs. D. W. Diddell, a member of the Society, and there I had my introduction to the rich fern life of Florida.

Mrs. Diddell surely knows her ferns and her collection of growing plants was intensely interesting.

I spent a week in Florida and you know the thrill I got from seeing *Adiantum Capillus-Veneris* the first time. It was growing in the old fort at St. Augustine. Also to find *Polypodium incanum*—covering the roof of the old Mission Church there—or in driving past Mr. John D. Rockefeller's home at Ormond to find the *Polypodium aureum* growing out of the shelly bark of a palm tree, or at Demorest, Ga., in a little woody glen finding my first *Dryopteris hexagonoptera* and underneath its generous shade five plants of *Botrychium obliquum*. There are several ferns I am now hunting—the walking fern, lowland lady fern, the lip fern and the Virginia chain fern. But here are my two worries. Where can I find some help in books (I do not like to trouble my friends too much) where I can find out the names of new ferns? I have several from Florida and elsewhere not mentioned in any books I have. And second, what is a fellow going to do for thrills when he has found all there are?[1] I have extra pressed ferns of some varieties I would like to exchange with some one who would care for them.

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[1] Dr. J. K. Small's "Ferns of Florida," published by the Science Press, Lancaster, Pennsylvania, will remove any worries about ferns of that state. Current manuals for different parts of the United States, such as Gray's and Britton & Brown for the northeast, Small's Flora for the southeast, Rydberg's for the prairie region and the Rocky Mountains, Abrams' or Jepson's for the Pacific Coast, generally include ferns and can be borrowed from city libraries if one does not wish to go to the expense of buying them. As to what next, if Mr. Fagley has acquired a real and lasting interest in ferns (as is to be hoped, for nothing gives more durable pleasure), he can go on, not finding new ones, but finding out new things about the old ones—their soil preference and other habits, life histories, really distinctive characters, etc.—for the rest of his life.—C. A. W.

Recent Fern Literature.

Craw, Joe E. Hydrogen-ion Reaction of Native Indiana Fern Soils. Butler University Botanical Studies 2: 151–158. 1932.

Several articles on the soil-reactions of ferns native to the northeastern states have already appeared, but supplementary data are always welcome. Notable features of Mr. Craw's studies are (1) the large number of samples examined, amounting to over 90 in some cases; and (2) the determination of the hydrogen-ion activity electrometrically in the laboratory, both of which favor the obtaining of especially accurate data as to the preferences of the plants. The results are tabulated so as to bring out the reaction-ranges and optima for thirty-four species and varieties; in a few cases, since only Gray Manual names are used, the exact variety represented is uncertain.

The results in general agree so closely with those of previous writers that the soil-reaction preferences of the plants concerned can be regarded as now known with a considerable degree of finality. There are in fact but two cases of apparently discordant results. In *Asplenium platyneuron* the reviewer had previously decided the optimum reaction to be mediacid, whereas the new results indicate it to be but minimacid. The difference here is simply a matter of geography, as high acidity characterizes the especially luxuriant colonies of this fern on the southern Coastal Plain, but in the northeastern states the relations are the same as in Indiana. In the case of *Asplenium pinnatifidum*, however, the situation is not so clear. Previous tests at eastern localities to the number of 50 or more have clearly pointed to mediacid soil preference, whereas Craw found three samples from Pinnacle Rock near Shoals, Martin County, Indiana, to be neutral in reaction. It is to be

hoped that this fern can be studied from the soil-reaction standpoint at other of its western outliers, to see whether neutrality is characteristic of its habitats under the climatic conditions of the interior states.—EDGAR T. WHERRY.

The Fern Society Library has just received the first three numbers of the *Acta Phytotaxonomica et Geobotanica*, published under the auspices of The Phytogeographical Society, Botanical Institute, Kyoto Imperial University, Japan. Included in the first two numbers are three articles on ferns, printed partly in English and partly in Japanese. In the latter articles, the names are given in their Latin form.

Oishi, Jisaburo. "On the fossil Dipteridaceae." The fern family Dipteridaceae has been found of special interest in matters of comparative morphology. Modern types found in the Oriental tropics have been carefully studied by Dr. F. O. Bower and others. The present paper contains illustrations of leaf division patterns as well as lists of some 40 species included in six genera of this family. Note is made of the paper because of its technical interest.

Tagawa, M. By this author there are contributed two articles under the general title of "Spicilegium Pteridographiae Asiae Orientalis, (I & II)." In these it is interesting to note the occurrence of a number of our own genera, including also occasionally identical species.

Tatewaki, M., & Kimoto, U. "Florula of the island of Kaibato (Todomoshiri)." These writers list a considerable number of pteridophytes. The following types are of special interest to American readers: *Botrychium Lunaria; Ophioglossum vulgatum; Adiantum pedatum; Athyrium acrostichoides* and *A. Filix-femina; Cystopteris fragilis; Dryopteris dilatata, fragrans, Linnaeana,*

Phegopteris, Thelypteris; Matteuccia Struthiopteris; Onoclea sensibilis; Polypodium vulgare; Polystichum Braunii; Pteridium aquilinum; Scolopendrium vulgare; Osmunda cinnamomea, O. regalis; Equisetum arvense, hyemale, palustre; Lycopodium annotinum, clavatum, complanatum, obscurum.

The inclusion of so many forms common to our own eastern United States flora brings to mind the similarity of floras between eastern Asia and eastern North America first noted by Asa Gray. The question arises, however, as to the possibility that some of these may really deserve separation as distinct species.—R. C. B.

Andersson-Kotto, Irma. Observations on the Inheritance of Apospory and Alternation of Generations. Svensk Botanisk Tidskrift. 1932. Bd. 26, H. 1–2.

Some of Mrs. Andersson-Kotto's work has previously been reviewed in the FERN JOURNAL, and the Fern Society Library now has copies of three earlier and extensive papers. It so happens that these three copies are on loan to one of our members who is interested in special culture methods with ferns.

The present paper describes another unusual type of *Scolopendrium*. To this type, the writer gives the name of "peculiars" because of the very striking appearance. A single plant may bear twenty-five small leaves. It is delicate and thrives only under a bell jar. Its special peculiarity lies in the fact that "The fronds never develop sori or sporangia, and there is, except for the vascular system, no differentiation of tissue in the leaf-blade, all cells being straight-walled and similar to those of the gametophyte. Occasional stomata are found. Fully grown fronds are several cell-layers thick except at the edge. The leaf-blade thus consists of only prothallial tissue beside the *Scolopendrium* venation.

"Gradually the whole edge, or parts of it, grows out into a prothallium with normal sexual organs. The latter upon fertilization give rise to similar sporophytes, the process being repeated in the following generations. Though the nuclear size increases in successive sporophyte generations of the peculiars, neither chloroplast size nor cell size does so. The prothallium-like cells of the leaf-blade, especially those situated towards the basal part of the leaf-blade, are larger than those of the prothallium. The cell-size is, however, gradually adjusted to the normal as the frond grows out into the prothallium."

This is certainly a peculiar type of fern leaf, one in which what corresponds to leaf-blade is prothallial tissue bearing normal archegonia and antheridia. It is noted that the "peculiars" variety arose from spores of the variety *crispum muricatum*. In the spore progeny in this culture, 90 plants were normal and 29 "peculiars," an obvious suggestion of a simple Mendelian ratio. This expectation was borne out in the F-2 cultures. The "peculiars" gave only their own sort. From the normal type, there were raised two cultures, with a total population of 296 normal to 91 "peculiars."

It is noted further that the peculiarity is inherited on both the female and male side. This paper is to be followed by a more extensive report with illustrations.—R. C. B.

Shorter Notes

WOODSIA SCOPULINA IN TENNESSEE.—While on a collecting trip in this section during the past summer, Dr. Edgar T. Wherry visited the writer's garden and among the ferns growing there saw one that he pronounced *Woodsia scopulina*. He seemed rather surprised at the

statement that it was collected in Tennessee and evidently reported the matter to Dr. Wm. R. Maxon, for a request for specimens later came from the latter. These were collected and sent to him from the largest station known to the writer and as Dr. Maxon states that this extends the recorded range of this fern, its location is here given.

The station is in Unicoi County, Tenn., three miles south of Erwin on U. S. Route No. 23 at a point where this route crosses the Nolichucky River. From the south end of the bridge a trail leads upstream, across the face of a rocky bluff, and the fern grows all along this section of the trail. The fern associates are *Cheilanthes lanosa* and *C. tomentosa* and an occasional *Woodsia obtusa* and *Asplenium resiliens.*

This station is interesting otherwise, as on the bluff is quite a profuse growth of wild bleeding heart (*Dicentra eximia*) and below the trail for several hundred yards are scattering specimens of *Buckleya distichophylla,* a parasitic shrub heretofore known, to the writer at least, only from a rather restricted area along the French Broad River.—WILLIAM A. KNIGHT, *Biltmore, N. C.*

BOTRYCHIUM DISSECTUM FROM NORTH MICHIGAN.—During the fall of 1932 Mr. Fred G. Knowlton, of Barksdale, Wisconsin, sent me three specimens of *Botrychium* to determine for him. He numbered them 1, 2, 3, stating that he took them all to be *B. dissectum.* These he had collected in northwestern Michigan on the Black River, which is southwest of the Porcupine Mountains near the Wisconsin border. Although Nos. 1 and 2 had slight lacerations on some of their pinnules it was very evident they were *B. ternatum* var. *intermedium.* With No. 3 it was quite different; every pinnule was

deeply lacerate; it was a typical specimen of *B. dissectum*. Mr. Knowlton stated that he had collected Nos. 2 and 3 growing in moss on a rotten log one end of which was under water. Mr. Knowlton said his party, which consisted of himself, his son, and Dr. Conklin, of Superior, found twelve plants of *B. dissectum*, four of them having fertile fronds, and the remaining eight having only sterile fronds. This is one instance of *B. dissectum* growing with *B. ternatum* var. *intermedium*. Both specimens of *B. ternatum* var. *intermedium* had ripe spores, but the fertile frond of *B. dissectum* was perfectly green. The three specimens were collected in August, and as *B. ternatum* var. *intermedium* ripens its spores by August, and *B. dissectum* does not ripen its spores until the last of September, this should help to determine the identity of the specimen.

Mr. Knowlton stated that he had dug up several of the plants of *B. dissectum*, and had replanted them with *B. ternatum* var. *intermedium* at his home in Barksdale. In November he wrote me that the plants of *B. dissectum* had turned a bronzed color, but *B. ternatum* var. *intermedium* still retained its green color. I have two live plants of *B. ternatum* var. *intermedium* growing in my fern garden, which were sent to me by Mrs. J. H. Somerville, of Superior, Wisconsin, which remain green throughout the winter, while *B. dissectum* and *B. obliquum* growing by their side take on the bronzed color as winter advances. It seems to me that this is a very strong point in separating *B. obliquum* from the *B. ternatum* class.

This station of *B. dissectum* in north Michigan is very near the Wisconsin line, and it may yet be found in Wisconsin. This station seems to be the farthest north of any station in the west. The Quebec station mentioned by Mr. Mousley in Vol. 14, No. 4, of the FERN JOURNAL

is the only station extending farther north than the north Michigan station.

In connection with this record I might state that Mr. Knowlton sent me a specimen of *Dryopteris Filix-mas* which he said his son and Dr. Conklin found near Ironwood, Wisconsin. As Steil and Fuller did not list it in their report on the ferns of Wisconsin, this I believe is the first report of *Dryopteris Filix-mas* from the state of Wisconsin.—E. W. GRAVES, *Bentonsport, Iowa.*

American Fern Society

The death is reported of Miss Minnie L. Overacker, of Syracuse, a member of the American Fern Society since 1915. In a newspaper account, it is recorded that Miss Overacker began teaching botany in a Syracuse high school 59 years ago, in 1873. She continued in this service until her retirement in 1920. During that period, she was always active and interested in botanical work and numbered among her friends the late Professors Atkinson, of Cornell, and L. M. Underwood, who was for some time a professor of botany at Syracuse University.

The writer would like to record his own relationship and indebtedness to Miss Overacker for early help and inspiration. I first made her acquaintance as a first or second year high school pupil in one of her botany classes. While I had before that been generally interested in outdoors and living things, through her my special interest became centered on ferns and, on that basis, I can claim a continuous 35-year period of interest in this group of plants. I would suggest to all who have received special help or stimulation from some one or more teachers, that Miss Overacker richly deserves a full tribute.—R. C. BENEDICT.

The Society Library has recently received contributions of scientific papers from three different foreign countries—from England, Japan, and China.

Reviews of the paper from England by Irma Andersson-Kottö, "Observations on the Inheritance of Apospory and Alternation of Generations," and of the fern articles from Japan are included in this number.

The fern papers from China by Dr. R. C. Ching, botanist of the Metropolitan Museum of Natural History, Nanking, China, are listed below and will be reviewed later.

In addition, two paragraphs from a recent letter from Dr. Ching are included as a separate note, and it is suggested that some members will be interested to respond to his request for specimens.

AMERICAN FERN SOCIETY LIBRARY

Ching, R. C. Studies of Chinese Ferns. I. (Sinensia. Vol. I, No. 4.)

———. Studies of Chinese Ferns. II. (Fan Memorial Institute of Biology. Bulletin. Vol. I, No. 9.)

———. Studies of Chinese Ferns. III. (Fan Memorial Institute of Biology. Bulletin. Vol. II, No. 1.)

———. Studies of Chinese Ferns. IV. (Fan Memorial Institute of Biology. Bulletin. Vol. II, No. 2.)

———. Studies of Chinese Ferns. V. (Fan Memorial Institute of Biology. Bulletin. (Vol. II, No. 10.)

———. Studies of Chinese Ferns. VI. Genus Vittaria of China & Sikkime-Himalaya. (Sinensia. Vol. I, No. 12.)

———. Studies of Chinese Ferns. VII. A revision of the genus Tectaria from China and Sikkime-Himalaya. (Sinensia. Vol. II, No. 2.)

Ching, R. C. On the genus Egenolfia Schott. (Fan Memorial Institute of Biology. Bulletin. Vol. II, No. 16.)

Ching, R. C. Some new species of ferns from Kwangsi, China. (Sinensia. Vol. I, No. 1.)

Ching, R. C. Species Nova Descripta. (Hooker's *Icones Plantarum*, t. 3158, 1932.)

Note: Items sent to the American Fern Society Library by the author.

"I am forwarding to your Society in your care a set of my papers on ferns, a set as complete as they are available here, as I remember there are still some other small papers on ferns I left at my home in Nanking. And I am sure you will receive all my subsequent papers on the ferns, principally from the eastern Continental Asia.

"If it is possible, I would like to receive from you some American ferns, particularly, the species of genera of ferns peculiar to your country. In return, I can forward you an equivalent of the Chinese ferns, if you so desire."—R. C. CHING.

The following erratum should have been listed in the last number:

[AMERICAN FERN JOURNAL, vol. 22] p. 49, line 19. For Garrott, read Garrett.

Report of the Treasurer for 1931

GENERAL FUND

RECEIVED

Cash on hand Jan. 1		$ 1,342.26
Membership dues	$ 507.72	
Subscriptions to JOURNAL	84.74	
Reprints	37.08	
Advertising	4.00	
Library List	4.67	
Interest	40.00	
Exchange	.25	
Illustrating Fund, gifts	16.50	
Emergency Fund, Back Nos.	88.23	
		$ 783.79
Total		$ 2,125.45

PAID OUT

JOURNAL *Expense*

Printing	$ 438.28	
Illustrating	85.82	
Mailing and Postage	40.66	
Stencils	2.04	
Total JOURNAL expense	$ 566.80	
Reprints	61.98	
Special Library bought	35.00	
Exchange	.10	
Treasurer's expense	31.89	
Secretary's Expense	2.00	
Election Expense	9.60	
Total		707.37
Balance on hand, Dec. 31		$ 1,418.08

This Balance is made up as follows:

ILLUSTRATING FUND

Balance on hand	$ 3.50	
Received	16.50	
	$ 20.00	
*Paid out	20.00	
On hand	0.00	

EMERGENCY FUND

On hand	$ 373.70	
Back Numbers sold	80.15	
	$ 453.85	$ 453.85
Appropriated for Expenses of Herbarium	25.00	
Unappropriated	939.23	
	$1,418.08	

SPECIAL RESERVE FUND

On hand Jan. 1	$ 973.34
Interest	34.07
On hand Dec. 31	$ 1,017.41

The Treasurer wishes to apologize for the delay in making this report. As a result of the depression he has had to give an unusual amount of time to adjusting his own business to the new conditions. The Fern Society

* This amount included in JOURNAL Expense, Illustrating, above.

work had to be neglected. This will not occur the coming year.

JAY G. UNDERWOOD, *Treasurer*

232 East Walnut Street,
Oneida, N. Y.

December 31, 1932

Rev. C. S. LEWIS,
Secretary, American Fern Society,
Plattsburg, N. Y.

Dear Sir:

As Judge of Elections for 1932 I report as follows:

73 perfect ballots were cast.

For

President—William R. Maxon	73
Vice President—Mrs. Carlotta C. Hall	73
Secretary—Charles S. Lewis	72
" R. C. Benedict	1
Treasurer—J. G. Underwood	73

Therefore Mr. Maxon, Mrs. Hall, Mr. Lewis, Mr. Underwood are reelected for the year 1933.

Two blank ballots were received.

(Sgd.) NELLIE MIRICK

I hereby certify that the above is a correct copy of the report of the Judge of Elections.

CHARLES S. LEWIS, *Secretary*

Albany, N. Y., Feb. 11, 1933

Mr. Fred G. Knowlton, Barksdale, Wisconsin, would like to exchange ferns of northern Wisconsin for named living plants of species of *Woodsia* and *Cheilanthes*.

New members:

Dix, W. L., Jefferson School, Brunswick Ave. and Southard St., Trenton, N. J.

Knobloch, Irving W., 1358 Fillmore Ave., Buffalo, N. Y.

Change of address:
Mrs. E. Peterson, Rt. 1, Box 468, Miami, Fla.

Just as this number of the JOURNAL is about to go to press, we learn with keen regret of the death of an old and valued member of the Society, Mr. W. R. McColl. Mr. McColl was born at Sarnia, Ontario, 78 years ago. For over forty years he had been a merchant and insurance agent in Owen Sound. He had two hobbies—coins, his collection of which is said to be the second best in Canada, and ferns. No reader of his articles in the JOURNAL a few years ago will need to be reminded of the infectious enthusiasm with which he pursued and wrote about the latter, in a region famous as one of the American haunts of the hart's-tongue and the home of several other rarities almost as notable. His fern herbarium is now at the University of Toronto.

Vol. 23 April-June, 1933 No. 2

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of Octob[illegible] authorized on July 8, 1918.

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Council for 1933

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MRS. CARLOTTA C. HALL, Stanford University, Calif., *Vice-president*
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J. G. UNDERWOOD, Hartland, Vt. ..... *Treasurer*

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American Fern Journal

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C. A. WEATHERBY ..... Cambridge, Mass.

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.

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Matter for publication should be addressed to R. C. Benedict at 1819 Dorchester Road, or Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn, N. Y.

Orders for back numbers should be sent to the Secretary of the Brooklyn Botanic Garden, Brooklyn, N. Y. Other business communications should be addressed to E. J. WINSLOW, Auburndale, Mass.

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. 23 APRIL–JUNE, 1933 No. 2

Looking Backward

C. E. WATERS

Forty years ago, if he could have foreseen this occasion,[1] an orderly soul would have made a memorandum of the name of the magazine in which he saw the call to organize the Fern Chapter of the Agassiz Association, the date of his application for membership, and other pertinent details which would now come in quite handy. Lacking these aids to the memory, the writer can still recall that some time during the summer of 1893 he read somewhere Mr. Clute's notice that all who were interested were invited to join the new Fern Chapter. He had been given a friendly push into the study of botany in the summer of 1888, and had learned the names of a few ferns, but had done practically nothing until after 1890, when he joined a high school Chapter of the same Association. So it seemed doubtful whether he was eligible for membership in the Fern Chapter. What a relief it was to learn that his credentials were satisfactory!

If he could be a member, almost anybody could, and in all the years since then the Fern Society has been willing to accept everybody who is sufficiently interested. The veriest greenhorn and the highest authority have always

[Volume 23, No. 1, of the JOURNAL, pages 1–36, plates 1 and 2, was issued April 9, 1933.]

[1] The editors are most grateful to Dr. Waters for thus pleasantly emphasizing the fact that this year marks the fortieth anniversary of the founding of the American Fern Society. We wish that more reminiscences might be forthcoming from others of the older members.

been on an equal footing as members. There have been some who could hardly tell a leaf of meadow rue from a fern, and others whose knowledge of the subject made them authorities. One of the latter was L. M. Underwood, whose little book was so valuable and popular. At one time it seemed almost the last word in technical fern literature. His quizzical smile and untimely end are not forgotten. There was B. D. Gilbert, a courtly and affable man, a delightful correspondent; not exactly a species splitter, but in the writer's opinion too much inclined to give names to obviously freak forms. His *Polypodium vulgare* var. *Churchiae*, about which we read in the first number of this JOURNAL for 1933, is a case in point. And there was George E. Davenport, whose eyes always filled with tears at the mention of Asa Gray. He named several of the western species of *Cheilanthes*, and first showed the diagnostic value of the buds of the species of *Botrychium*. The writer found and was puzzled by Davenport's *Dryopteris simulata* two months before his description was published, but would probably not have felt impelled to name it, for who would look for such big beds of a distinct new species in this part of the world? Once recognized, it is as distinct as the two species it simulates, and the wonder is that Davenport and Raynal Dodge, its real discoverer, held back so long before describing it in print.

The Fern Bulletin was our pride, though at first almost small enough to be carried in a vest pocket, with all the other miscellanies that are advertised as appropriate for that repository. By the end of its tenth year it had become large enough to print a cluster of fern students,[2] photographed at their best, and seven of them authors of fern books. The other three have written enough short papers to make a book or two, each.

[2] Reproduced on page 212 of G. H. Tilton's Fern Lover's Companion.

The writer long ago dropped active work on the ferns, and can not say whether one feature of the early days still exists. That is the active correspondence of the members with one another, which resulted in many pleasant friendships by mail. We did not then have such luxuries as life members and an honorary member or two, nor did the Treasurer's reports show such balances as the last one, but considering everything, it was a nice little Society.

WASHINGTON, D. C.

Notes on the Fern Flora of Iowa

A. S. LYNESS

The most complete published list of Iowa Ferns and their allies which the writer has seen, is the one prepared by T. J. and M. F. L. Fitzpatrick and published in the Fern Bulletin under the date of July, 1903. At the time this report was made it gave in a thorough and interesting manner the status of native ferns in Iowa.

But now after thirty years, obviously some additions and corrections should be made to such a list. Workers in the field during the past three decades have located some new species, new varieties of old species have been found and new stations for nearly all the species known in 1903 have been detected. It is with the object of supplying this information and bringing the facts concerning the distribution of our native ferns and their allies up to date, that this paper is written.

A list prepared by the writer early in 1932 contains fifty-six species and varieties of *Pteridophytes* for the State of Iowa. Herbarium specimens have been seen for

all these and their determination carefully checked, except for *Isoetes melanopoda* J. Gay which is included upon the authority of Dr. Pfeiffer who has reported two herbarium specimens of this species from Iowa (1), one now in the Gray Herbarium and the other in the Herbarium of the Missouri Botanical Gardens.

Fitzpatrick's List contains forty-seven plants with the mention of a forty-eighth in the variety *intermedius* of *Camptosorus rhizophyllus* (L.) Link, reported from Muscatine County by Arthur. Since the writer knows of no herbarium specimen by means of which its identity might be determined, it seems best not to include it in a list of Iowa ferns.

Similarly, several persons have reported from time to time the finding of *Thelypteris noveboracensis* (L.) Nieuwl. in Iowa. Mrs. Tuttle reported having found it on Indian Head Bluff in Mitchell County (2). There are no herbarium specimens in either the University Herbarium or the Herbarium of the Iowa State College, neither has the writer found it in any of the smaller herbaria visited. It might be a case of mistaken identity, even though Iowa is in the range of the New York Shield Fern as Fitzpatrick says. Therefore, since there is no specimen with which to verify these reports, good judgment would seem to dictate the omission of this species from the Iowa list.

The elimination of these two plants leaves forty-six in Fitzpatrick's list, to which ten distinct forms of Iowa Ferns and Fern-like Plants should be added, the names, descriptions and distributions of which are given in the paragraphs that follow.

The station for *Botrychium dissectum* Spreng., described by Graves in a recent article in the FERN JOURNAL (3), is the only station for this species in Iowa. This information has already been published by Graves in another article in the FERN JOURNAL (4) in which the dis-

tribution is shown on Plate 11 of Volume 21. The writer has visited this station and has seen specimens from it in the State Herbaria at Ames and at Iowa City.

The *Botrychium dissectum* Spreng., var. *obliquum* (Muhl.) Clute reported by Fitzpatrick as having been found by Dr. Fink in Fayette County in 1893 and named *B. ternatum* (Thunb.) Sw. by the collector was found in Robinson's Woods and is now in the State Herbarium at Ames. The label on the specimen sheet was changed by some one, possibly by the curator of the herbarium, and perhaps before 1903, but it has since been changed again to *Botrychium ternatum* (Thunb.) Sw., var. *intermedium* D. C. Eaton. The writer has seen this specimen and is confident that this latter determination is correct. It is certainly much more like Fig. 6 on page 49 of Gray's Manual, Seventh Edition, than like Fig. 5a on the same page. This again, was reported by Graves in the FERN JOURNAL (4) and the one station for this fern in Iowa correctly located on Plate 11, Volume 21.

To the distribution of *Botrychium dissectum* Spreng., var. *obliquum* (Muhl.) Clute given by Graves in the FERN JOURNAL, Plate 11, Volume 21 (4) should be added one more station. It was found by Dr. Anderson in 1931 near Homestead in Iowa County. This variety is almost as rare as typical *dissectum* in the state.

It seems that there has been considerable confusion in the past about the correct determination of some of the scouring rushes. In recent years botanists in this state, especially those who have used Gray's Manual primarily as a basis for the determination of the species of *Equisetum*, have generally been inclined to call everything *Equisetum hyemale* L. in cases where the plant was definitely known to be either that or *Equisetum prealtum* Raf. This may have been due to the fact that the species is considered a variety of *E. hyemale* in Gray's Manual

and some have an aversion to using any varietal names unless it is absolutely necessary. Still more recently practically all the herbarium specimens of this so-called *E. hyemale* have been carefully checked and found to be, with few exceptions, *E. prealtum*. Generally speaking, then, there is no true *hyemale* in the state.

There are, however, three specimens in the University Herbarium at Iowa City, which were collected by Dr. Shimek in Dubuque County, that are undoubtedly *E. hyemale*. That constitutes the only station for this species in the state. *E. prealtum*, on the other hand, is locally common in Iowa, being found either scattered, growing in prairie soil, or in large beds along the banks of streams. At least, *E. hyemale* is not "probably frequent" as Fitzpatrick suggests.

The counties in which *Equisetum prealtum* Raf. has been collected are as follows: Boone, Cerro Gordo, Clayton, Decatur, Dickinson, Dubuque, Emmet, Henry, Johnson, Kossuth, Linn, Marshall, Muscatine, Shelby, Van Buren, Winnebago, Woodbury.

Equisetum kansanum Schaffner is rather widely scattered in its distribution, being found mostly in the western part of the state. It is an annual form evidently derived from *Equisetum laevigatum* A. Br. The distribution by counties of this species in Iowa follows: Cerro Gordo, Dickinson, Emmet, Linn, Lyon, Pottawattamie, Scott, Shelby, Story, Union, Webster.

In addition to the two counties mentioned in the 1903 list for *Equisetum pratense* Ehrh., Allamakee and Fayette counties should be included to make the distribution complete.

Equisetum sylvaticum L. is rather rare in Iowa as Fitzpatrick says but it has also been collected in Franklin, Hardin, Iowa, Linn and Webster counties.

Equisetum variegatum, var. *Jesupi* A. A. Eaton is very rare in Iowa and strangely enough has been found only in two widely separated portions of the state—the southeast corner and the northwest corner. Specimens are in the local herbaria from Des Moines, Dickinson and Lee counties.

Buchanan and Chickasaw counties should be added to the distribution of *Lycopodium complanatum* L. and to that of *Lycopodium lucidulum* Michx. the following counties: Allamakee, Chickasaw, Delaware, Iowa and Lee. The writer has seen no specimen of *Lycopodium lucidulum* from Winneshiek County.

All the club mosses are rare in Iowa. The two forms mentioned above have been found more frequently than the other three.

There is but one station in this state for *Lycopodium complanatum*, var. *flabelliforme* Fernald. It was found by Berry in Buffalo Township, Linn County. This is the one that is sometimes called Ground Pine. Specimens of Berry's collection are in the Herbarium of the University of Iowa.

Lycopodium obscurum, var. *dendroideum* (Michx.) D. C. Eaton was seen and collected by Reed in Pine Hollow, Dubuque County and one specimen of it is now in the Herbarium of the Iowa State College at Ames. This form, commonly known as the Tree Club Moss, has not been found in any other locality in the state.

Osmunda cinnamomea L. was mentioned in Fitzpatrick's paper as native to three counties of Iowa but the writer has seen specimens from but one county—Muscatine. There are other places in the state where it is cultivated in gardens.

Using the key characters given for *P. glabella* and *P. atropurpurea* (L.) Link given in Schaffner's Manual of the Flora of Ohio (5), all the specimens in the University

Herbarium and in the state Herbarium at Ames were submitted to a microscopic test to determine the nature of the teeth on the rhizomes and the appearance of the spores and although they had all been previously labelled *P. atropurpurea* they were found to be *P. glabella*, the usually smaller, northern form of the genus that one would naturally expect to find in Iowa. This state is almost out of the range of the Purple Cliff Brake but Graves found one station for it in Van Buren County in the southeast corner of the state. He has sent a specimen of it to each of the two largest herbaria in the state and these are the only available specimens of *Pellaea atropurpurea* (L.) Link from the only station for this species in the state. *Pellaea glabella* Mett. is common all over eastern Iowa wherever there are limestone ledges. It has been collected in the following counties: Allamakee, Buchanan, Cedar, Clayton, Clinton, Delaware, Dubuque, Fayette, Hardin, Jackson, Johnson, Jones, Linn, Mitchell, Muscatine, Scott, Van Buren, Webster, Winneshiek.

There are available specimens of *Polystichum acrostichoides* (Michx.) Schott from Jackson and Lee counties but none from Fayette and Scott. Other counties that should be mentioned in the distribution are Cedar, Henry, Johnson and Linn.

Allamakee and Bremer counties should be added to the distribution given in the earlier publication of *Selaginella rupestris* (L.) Spreng. The writer has not seen specimens of this from Benton County.

Brackens whose leaf characters closely fit the brief description for *Pteridium latiusculum* (Desv.) Hieron., var. *pseudocaudatum* (Clute) Maxon in Gray's Manual, Seventh Edition, p. 36 have been found in Iowa and Johnson counties. This variety is probably locally common in the eastern one-third of the state.

Some of the species of the genus *Thelypteris*, which is represented by ten forms in Iowa, should have other counties added to the distributions given in Fitzpatrick's paper as follows:

Thelypteris cristata (L.) Nieuwl.—Chickasaw County.

Thelypteris Goldiana (Hook.) Nieuwl.—Mahaska, Scott and Webster counties.

Thelypteris hexagonoptera (Michx.) Weatherby—Cedar, Clayton, Hardin and Louisa.

Thelypteris spinulosa (O. F. Muell.) Nieuwl.—Allamakee, Emmet and Webster counties.

The writer has seen no specimens of *Thelypteris Phegopteris* (L.) Slosson from Hardin and Fayette counties, no specimens of *Thelypteris Robertiana* (Hoffm.) Slosson from Fayette County, and no specimen of *Thelypteris spinulosa* (O. F. Muell.) Nieuwl. from Lee County.

Another form of *Thelypteris*, very rare in the state, is *Thelypteris spinulosa* (O. F. Muell.) Nieuwl., var. *intermedia* (Muhl.) Nieuwl. Herbarium specimens may be seen here from Hardin and Muscatine counties where it is usually found growing on sandy banks in dense shade.

Woodsia ilvensis (L.) R. Br., the Rusty Woodsia, was found by Dr. Shimek in 1901 northeast of Hesper in Winneshiek County, growing on outcroppings of St. Peter's Sandstone. This is the only station for this fern in Iowa.

Woodsia obtusa (Spreng.) Torr. could hardly be said to be "infrequent" for specimens are available from twelve counties of the state and it is often found as far west as Boone and Webster counties. It is rather common and widely distributed with us, often found growing on the moss covered tops of limestone ledges. This is the distribution by counties: Boone, Decatur, Dubuque, Fayette, Hardin, Jackson, Johnson, Mahaska,

Muscatine, Van Buren, Webster, Winneshiek.

For the following species Fitzpatrick did not attempt to give a list of the counties in which they might be or had been found. Perhaps the county distribution will give a better idea than a description in words of their relative frequency in the state:

ADIANTUM PEDATUM L.

Allamakee, Appanoose, Boone, Bremer, Buchanan, Calhoun, Cedar, Chickasaw, Clayton, Delaware, Dubuque, Emmet, Fremont, Hardin, Henry, Iowa, Jackson, Johnson, Jones, Lee, Louisa, Mahaska, Muscatine, Pottawattamie, Poweshiek, Shelby, Taylor, Van Buren, Warren, Webster, Winnebago, Winneshiek.

ATHYRIUM ACROSTICHOIDES (SW.) Diels.

Allamakee, Cerro Gordo, Delaware, Dubuque, Iowa, Jackson, Johnson, Jones, Mahaska, Muscatine.

ATHYRIUM FILIX-FEMINA (L.) Roth.

Allamakee, Boone, Cerro Gordo, Chickasaw, Clayton, Delaware, Des Moines, Dickinson, Dubuque, Emmet, Fayette, Floyd, Hardin, Iowa, Jackson, Jefferson, Johnson, Jones, Lee, Lyon, Mahaska, Muscatine, Pottawattamie, Poweshiek, Ringgold, Story, Van Buren, Warren, Webster, Winnebago, Winneshiek.

BOTRYCHIUM VIRGINIANUM Swartz.

Allamakee, Boone, Bremer, Cerro Gordo, Cherokee, Chickasaw, Clayton, Delaware, Dubuque, Emmet, Fayette, Hardin, Henry, Iowa, Jackson, Jasper, Johnson, Jones, Lee, Linn, Mitchell, Muscatine, Pottawattamie, Shelby, Story, Van Buren, Warren, Webster, Winnebago, Winneshiek.

CAMPTOSORUS RHIZOPHYLLUS Link.

Allamakee, Boone, Cedar, Clayton, Delaware, Dubuque, Fremont, Hardin, Harrison, Jackson, Johnson, Jones, Linn, Mahaska, Story, Van Buren, Webster, Winneshiek.

CHEILANTHES FEEI Moore.

Allamakee, Clayton, Dubuque, Jackson, Jones, Winneshiek.

CRYPTOGRAMMA STELLERI (Gmel.) Prantl.

Cedar, Cerro Gordo, Clayton, Delaware, Dubuque, Fayette, Hardin, Jackson, Johnson, Webster, Winneshiek.

CYSTOPTERIS BULBIFERA (L.) Bernh.

Allamakee, Buchanan, Cerro Gordo, Chickasaw, Clayton, Clinton, Delaware, Dubuque, Fayette, Floyd, Hardin, Johnson, Jones, Lee, Linn, Muscatine, Tama, Van Buren, Webster, Winneshiek.

CYSTOPTERIS FRAGILIS (L.) Bernh.

Allamakee, Appanoose, Boone, Cerro Gordo, Chickasaw, Clayton, Dallas, Decatur, Delaware, Dubuque, Emmet, Grundy, Hardin, Henry, Iowa, Jackson, Johnson, Lee, Linn, Louisa, Marion, Marshall, Muscatine, Pottawattamie, Ringgold, Story, Taylor, Van Buren, Webster, Winneshiek.

EQUISETUM ARVENSE L.

Allamakee, Boone, Cerro Gordo, Chickasaw, Clayton, Dallas, Decatur, Dubuque, Emmet, Fayette, Hancock, Hardin, Henry, Jackson, Jefferson, Johnson, Lee, Linn, Lyon, Madison, Marion, Marshall, Muscatine, Pottawattamie, Poweshiek, Story, Webster, Winnebago, Winneshiek.

EQUISETUM FLUVIATILE L.

Chickasaw, Emmet, Dickinson, Hancock, Hamilton, Iowa, Winnebago.

EQUISETUM LAEVIGATUM A. Br.

Boone, Bremer, Cerro Gordo, Dallas, Emmet, Harrison, Jasper, Johnson, Lee, Linn, Lyon, Muscatine, Poweshiek, Story, Union, Winnebago.

ONOCLEA SENSIBILIS L.

Black Hawk, Chickasaw, Clayton, Decatur, Delaware, Dubuque, Emmet, Fayette, Hardin, Iowa, Lee, Linn, Marion, Mitchell, Muscatine, Poweshiek, Ringgold, Wapello, Winneshiek.

OSMUNDA CLAYTONIANA L.

Allamakee, Appanoose, Chickasaw, Clayton, Decatur, Delaware, Dubuque, Hardin, Henry, Jackson, Jasper, Johnson, Jones, Lee, Marshall, Muscatine, Story, Van Buren, Webster, Winneshiek.

POLYPODIUM VIRGINIANUM L.

Allamakee, Boone, Clayton, Hardin, Jackson, Lee, Lyon, Marion, Muscatine, Webster, Winneshiek.

PTERETIS NODULOSA (Michx.) Nieuwl.
Allamakee, Chickasaw, Clayton, Decatur, Dubuque, Emmet, Fayette, Hardin, Jackson, Johnson, Linn, Madison, Muscatine, Polk, Shelby, Story, Van Buren, Warren, Webster, Winneshiek.

PTERIDIUM LATIUSCULUM (Desv.) Hieron.
Allamakee, Benton, Buchanan, Clayton, Delaware, Dubuque, Floyd, Hancock, Hardin, Iowa, Johnson, Jones, Lee, Muscatine, Tama, Winnebago, Winneshiek.

THELYPTERIS PALUSTRIS (Salisb.) Schott, var. PUBESCENS (Lawson) Fernald.
Cerro Gordo, Chickasaw, Clayton, Delaware, Fayette, Hancock, Johnson, Muscatine, Story, Winnebago, Winneshiek.

Athyrium angustifolium (Michx.) Milde is a very rare fern in Iowa. There are available specimens from only two counties—Delaware and Jackson.

To the distribution of *Asplenium platyneuron* (L.) Oakes should be added Johnson, Lee and Van Buren counties.

Azolla caroliniana has also been found in Decatur County.

Geologists are now agreed that there is no *driftless area* in Iowa mentioned in paragraph two of Fitzpatrick's paper (6). The area referred to as "driftless" probably belongs to the Nebraskan Ice Sheet. The writer has tried to discover some existing relationship between the drift areas of Iowa and the distribution of our native ferns but there seems to be no direct, positive correlation between them. If there is such a relationship, it must of necessity be vicarious in nature.

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(3). Graves, E. W. *Botrychium dissectum from Minnesota.* AMERICAN FERN JOURNAL, Vol. XXI, pp. 21–24. (1931.)
(4). Graves, E. W. *Botrychiums of the Central States.* AMERICAN FERN JOURNAL, Vol. XXI, pp. 125–132. (1931.)
(5). Schaffner, J. H. *Field Manual of the Flora of Ohio.* R. G. Adams & Co. (1928.)
(6). Kay and Apfel. *Pre-Illinoian Pleistocene Geology of Iowa.* Iowa Geological Survey, Vol. XXXIV, p. 13. (1929.)

Troubles of a Novice

W. L. DIX

One of the greatest difficulties of a novice in the identification of ferns is his inability to use the text and methods of a botanist, and the weakness of popular handbooks on ferns in their failure to segregate some characteristic that really defines. Much of their text is merely descriptive. It is very interesting and often helpful, but much of the description is applicable to three or four other ferns. The difficulties of the novice are not apparent to the scientist.

A good illustration of this weakness is the use of such phrases as "delicate beauty, peculiar form" as *distinguishing marks* of the maiden-hair fern, *Adiantum pedatum*. Now, no one is likely to mistake the maiden-hair fern from a good description, or from an illustration. Neither is he likely to identify it by such a characterization as that above. Either *Cystopteris fragilis* or *Asplenium trichomanes* will qualify for "delicate beauty," and every fern is "peculiar in form" till the novice discovers a similar one. The scientist, out of the abundance of his experience, must select simple, accu-

rate, and qualifying terms for unique characteristics. Description will not take the place of definition.

In the beginning of my study of ferns, I examined hundreds of Lady Ferns in the hope of finding the Silvery Spleenwort, because the *silvery* appearance of the back of the fronds had been emphasized as the distinguishing feature of this fern. All Lady Ferns have this appearance in the early stages of fructification. Why didn't the author mention the very evident hairiness of the fronds of the Silvery Spleenwort which I believe will distinguish it from practically all similar ferns?

I encountered the same difficulty with *Cystopteris fragilis* and the Common Woodsia (*Woodsia obtusa*). Before I found the Woodsia, I examined countless Brittle Ferns. My handbook says that the pinnae of the Woodsia are *blunter*. Blunter means nothing when one has only one species, and the individual plants of that species exhibit all degrees of angularity and bluntness. The book further enlightens the student that the sori of the Woodsia are *star-shaped*. Star-shaped is not a very accurate term to define the sori of a fern. When I did really find the Woodsia, when I had it in my hands, the first characteristic I noticed was the minute hairs on the stalks. No slightest mention of this was made in the handbook. I think I am right in saying that this feature will separate these two ferns.

These popular guide books offer many other misleading descriptions as means of identification. I refer to the usual description of *Thelypteris americana* as having longer lower pinnules on the bottom pair of pinnae to differentiate it from the two closely related forms. Following this description I misnamed *T. intermedia* which often has pinnules over two inches long and three times the length of the upper pinnules. The fronds of *T.*

americana are also said to be broader. With the different species of Thelypteris taking all kinds of liberties, not only in respect to shape, but in almost every detail, including habitat, the term *broader* doesn't help the novice very much.

Practically every handbook on ferns gives the habitat of *T. spinulosa* as "rich, deep woods." I have never found it in woods except along the borders. I have found it in very rocky fields, sometimes with its roots reaching down ten or twelve inches for soil and moisture. Although this fern is accounted as rare in many localities, it is quite common in Wayne County, Pennsylvania, if it has been correctly identified. Two fern specialists have identified it as such for me. In the wooded hillsides of this locality this fern is replaced by *T. intermedia.* It does not grow there on wet swampy ground as one author writes.

I suspect that I underrate the difficulty of writing an accurate popular handbook on ferns. I am sure that I have not exaggerated the difficulty in following them. Nothing that I have said about these books should be interpreted as meaning that I do not appreciate and enjoy them. I am indebted to them for many pleasurable hours indoors and afield.

My attempt to add to my fern list of Lake Shehawken, Pa., as published in Vol. 22, No. 2, of the FERN JOURNAL, has resulted in the elimination of *Dryopteris simulata,* which belongs to my list of New Jersey ferns, in a change of *Botrychium obliquum* to *B. ternatum* var. *intermedium*, as identified by Mr. Graves, of Bentonsport, Iowa. Additions to the Shehawken list include *Asplenium trichomanes, Camptosorus rhizophyllus,* and *Cystopteris bulbifera.*

I was as surprised as delighted to find the Walking Fern in this locality, as I had believed it to be a "cliff-

dweller.'' I found six stations of it less than a mile apart. In each instance, it was growing on the *top* of large rocks *torn loose* from the hillside, rather well down toward the base of the hill, and always on the north-easterly side of the hill. Apparently the Walking Fern is not a heliophile, if I may coin that word.

The Walking Fern was found in the little gully at the outlet of the lake. This addition makes a list of eighteen species in an area of less than an acre. Isn't this a record?

TRENTON, NEW JERSEY.

Asplenium ebenoides R. R. Scott in Lawrence County, Indiana.

RALPH M. KRIEBEL

Since this rare hybrid has not been reported from Indiana for many years, and since the new stations are from another county in the state than those reported heretofore, it may be of interest to fern enthusiasts to learn of the rediscovery and to know about the conditions under which it is growing.

Before describing the different colonies, a few words concerning the physiography and geology of Lawrence County may not be amiss. The county comprising the area in which most of the observations and collections were made is wholly within the unglaciated south-central portion of the state, often referred to as the ''Knobs.'' The surface rocks of the area belong to the Mississippian Period and are of six geological formations, of which the best known is the Salem limestone (Indiana Oolitic limestone) used so extensively in the building industry. Named in the order of their age or

area of outcrop from east to west they comprise the (1) Borden or Knobstone shales and limestones, (2) Harrodsburg limestone (Warsaw), (3) Salem limestone, (4) Mitchell limestones (St. Louis and St. Genevieve), (5) Chester limestones and sandstones, and (6) Mansfield sandstone of the Pottsville division of the Pennsylvanian.

It is in the section underlaid by the Mitchell group of limestones that the hybrid asplenium has been found. The topographic tendency of this area, comprising a broad belt that passes from northwest to southeast, expresses itself in caves, sinkholes, and sinkhole ponds, all characteristic of underground drainage.

The shaded limestone outcrops throughout this area afford ideal growing conditions for *Camptosorus rhizophyllus* (L.) Link, since it is seemingly partial to calcareous rock. On shaded cliffs, boulders, and on some dryish ledges it forms large sheets of intermingled fronds. In point of number of individual plants, it is considered one of the most plentiful ferns, being outnumbered only by *Cystopteris fragilis* (L.) Bernh. Also not uncommon in this county is *Asplenium platyneuron* (L.) Oakes. It flourishes here on rich moist banks and in rocky open woods of both the limestone and sandstone sections. It, however, is not as plentiful as Camptosorus.

Camptosorus rhizophyllus and *Asplenium platyneuron* frequently have been seen growing in close proximity to each other, which always suggested *Asplenium ebenoides*. On November 28, 1932, while observing the ferns that had not yet been hurt by the early frosts, a place was reached about two miles west of Bedford on the property of Mrs. Lulu Quackenbush where the limestone deposits crop out at the edge of the flood plain of Salt Creek. The top of the steep bank is approximately eighty feet above the level of the flood plain. Out of this rocky bank and within twenty feet of the top is flowing a sub-

terranean stream—a common occurrence in this cavernous region. The stream has cut a deep sinus or bay into the bank. The cavity has rather steep rocky walls shaded by *Quercus Muhlenbergii, Maclura pomifera. Gleditsia triacanthos, Gymnocladus dioica, Ulmus fulva, Fraxinus quadrangulata, Celtis* sp., and others.

In this recess, the mossy limestone boulders were carpeted with *Camptosorus rhizophyllus,* and all about and

intermingled with them were plants of *Asplenium platyneuron*. Immediately the possibility of finding *Asplenium ebenoides* was suggested. Every boulder that harbored ferns was closely scrutinized.

Finally one boulder covered with Camptosorus and containing eight or ten plants of *A. platyneuron* and some frozen *Cystopteris bulbifera* (L.) Bernh. was discovered to contain a small colony of *A. ebenoides* growing near the ground line. The boulder was shaded by *Symphoricarpos orbiculatus* and *Gleditsia triacanthos*. The colony consisted of four plants, of which one was collected to be deposited in some herbarium so that the record of its presence here can be based on an authentic specimen. One fertile frond with a broken stipe, which was collected also, has a beautiful proliferous tip with two small leaves already formed. (See figure).

On January 5, 1933, another colony of this fern was found in a rocky woods near Avoca, about five miles northwest of Bedford. These plants are growing on two separate limestone boulders located on quarry land belonging to the Indiana Limestone Corporation. The boulders are about thirty feet apart. The larger one with an exposed surface of approximately sixty square feet has scattered on it six mature hybrid ferns and at least three sporelings which were definitely identified as those of the hybrid. The other boulder has but a single hybrid on it. The plants at this station are all small, the largest fruiting frond being only four inches in length. This small size was attributed to the fact that they are growing under somewhat adverse conditions. The food supply is rather scarce and some of the surrounding trees have been cut away exposing the rocks too much to direct sunlight. Both the parent plants grow on the same rocks. The plants of Camptosorus show that they are exposed to too much sunlight, while

conditions seem quite favorable for *Asplenium platyneuron.* Another fern growing on the same rocks is *Woodsia obtusa* (Spreng.) Torr. and associated with all are *Hydrangea arborescens* and *Heuchera sp.* The forest is made up of *Acer saccharum, Gleditsia triacanthos, Ulmus americana, Crataegus sp., Aesculus glabra, Fraxinus quadrangulata,* and others.

It may be worthy of note that both the parents of the hybrid spleenwort at this station are what some taxonomists class as varieties of the species. The plants of *Asplenium platyneuron* all have their pinnae deeply jagged-serrate as described for the var. *serratum* (E. S. Miller) BSP. The colonies of Camptosorus throughout this ravine have among them many plants with much elongated auricles as described for the variety *auriculatus.* Specimens of the latter have been collected from these rocks with acuminated auricles more than four inches long, some of which were rooting at the main acumination and at both of the much elongated basal lobes.

The third place where the hybrid is growing is on a limestone bluff in a deep ravine about one and one-half miles north of Bedford. This was found on February 1, 1933. It, too, is on quarry land of the Indiana Limestone Corporation. There is but a single plant at this station. Careful search did not reveal any others. This sturdy plant is growing in a thick mat of mosses on a perpendicular face of the outcrop. Several inches above it is a small group of Camptosorus and on top of the rock directly above are three plants of *A. platyneuron.* The associated plants are practically the same as those at the Avoca station, with the exception that *Cystopteris bulbifera* flourishes here and *Pellaea atropurpurea* (L.) Link is growing on the higher and more exposed parts of the bluff.

Samples of soil from around the roots of the hybrid at the three stations were carefully collected and sent to the Department of Botany of Butler University where their hydrogen-ion reaction was determined by the use of the Youden electric method. Eight samples were submitted, three from the first station, four from the Avoca station, and a single sample from the third station. From one to three duplicate tests were made of all but two of the samples. The results obtained are tabulated in Table I.

TABLE I

Hydrogen-ion reaction of soils about roots of *A. ebenoides*

Sample	EMF	pH	Active acidity	Average active acidity	pH of average
1 a	126	6.112	8.0		
	143	6.4	4.0	6.1	6.19
	131	6.19	6.2		
1 b	178	6.99	.05		
	185	7.11	.55 alk	.25	7.04
1 c	215	7.61	4.1 alk		
	170	6.86	.70 alk	2.4	7.45
2 a	192	7.23	1.15 alk		
2 b	178	6.99	.05 acid	.25	7.04
	185	7.11	.55 alk		
2 c	191	7.21	1.05 alk		
	182	7.06	.30 alk	.55	7.11
	182	7.06	.30 alk		
2 d	185	7.11	.55 alk		7.11
3 a	167	6.8	1.00 acid		
	177	6.97	.15 acid		
	180	7.03	.15 alk	.05	6.99
	188	7.16	.80 alk		

The soil reaction preference according to the results obtained proved to be mostly minimalkaline, which differs somewhat from that observed by Wherry and Trudell[1] for the hybrid spleenwort at Havana, Alabama.

The fern has not been collected in Indiana for many years. The published records for the state are those of Coulter,[2] in which he reports the hybrid from Crawford Co., (*Blatchley*) and from Jefferson Co., (*J. M. Coulter*); Underwood,[3] in which the specimen above reported from Jefferson Co. is said to be in the herbarium of Wabash College; and Greene,[4] in which he duplicates the records from Crawford and Jefferson Co.

In answer to an inquiry regarding the specimen at Wabash College, Prof. Bechtel writes,

> "It is a single frond about seven inches long, three inches of which is length of the blade. This frond is mounted on a sheet along with a luxuriant specimen of *Asplenium ebeneum* Ait. Remainder of the data is: 'Hanover, Indiana, July 29, 1876. J. M. Coulter.' A note to this single frond is in lead pencil as follows: '*A. ebenoides* R. R. Scott. (L. M. Underwood).'"

The fact that this fern has been found here at three different places in as many months, and all within several miles of each other, would lead to the inference that it is more plentiful than has been thought. What further search may discover, cannot, of course, be foretold. Certainly, the ecological conditions here are favorable for the growth of the parent plants. Success in encountering this rare hybrid is attributed to diligent search.

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[1] Wherry, Edgar T. and Trudell, Harry W. The *Asplenium ebenoides* Locality near Havana, Alabama. AMERICAN FERN JOURNAL. Vol. 20: 30 (1930).

[2] Coulter, Stanley. Indiana Geol. Nat. Hist. Surv. 1899: 612.

[3] Underwood, L. M. Indiana Acad. Sci. Proc. 1893: 256.

[4] Greene, F. C. Fern Bulletin 19: 110. (1911).

Then, too, winter time may be an ideal time to look for it. There are fewer green plants to attract one's attention.

Sincere appreciation is expressed to Dr. John E. Potzger for making the soil readings, and to Dr. Ray C. Friesner for helpful suggestions.

BEDFORD, INDIANA.

Making a Fern Garden

AMY W. SMITH

For years we had wanted a fern garden. We had tried to make ferns grow successfully in our city yard, and although we lost a good many, the aspidium varieties thrived better than anything else. Strange as it may seem, Goldianum, now eight years old, is very tall and large.

We did not waste any more time in the city garden, but transferred our energies to our camp beside a lake in southern New Hampshire at an altitude of fourteen hundred feet above sea-level.

The place selected for the ferns was the northerly slope of what had been a heavily wooded area. This was shaded by half-grown beeches, white and black birches, and swamp maples. Those trees furnished necessary shade, and an excellent windbreak, for the wind blows a great deal beside a lake. We were obliged to pull out many stumps and roots, leaving deep, rich leaf mould and many rocks—just the ideal soil and place for ferns. We made walks through this area and edged them with stones. All was in readiness now for the planting—our purpose being to try and grow as many varieties as possible. We can truthfully say we have never lost a fern yet.

The best fun of all was to find the specimens, for one who explores for plants, experiences thrills second to nothing else out-of-doors. We went to a fertile spot on an island in the lake, and transplanted gigantic ostrich ferns (*Onoclea struthiopteris*) which must have been many years old. Here we also took cinnamon (*Osmunda cinnamomea*) and interrupted ferns (*Osmunda claytoniana*), the largest we had ever seen. We found also one beautiful large marginal shield fern (*Aspidium marginale var. elegans*). Higher up on a ledge grew rusty woodsia (*Woodsia ilvensis*), not so common here in New Hampshire as in Vermont, and hay-scented fern (*Dicksonia punctilobula*). We took up common brake (*Pteris aquilina*), both the sterile and fertile fronds. Here also grew little oak fern (*Phegopteris dryopteris*) and long beech fern (*Phegopteris polypodioides*) in great abundance.

We have never found more than one variety of polypody (*Polypodium vulgare*). Great mats of this grew on big boulders. We placed several of these mats on our large rocks in the garden, and they are growing very luxuriantly. Large Christmas ferns (*Polystichum acrostichoides*) grew by the hundreds about two miles from the camp, and these we used plentifully in the borders. Silvery spleenworth (*Asplenium acrostichoides*), New York fern (*Aspidium noveboracense*), Massachusetts fern (*Aspidium simulatum*), lady fern (*Asplenium filix-femina*), marsh fern (*Aspidium thelypteris*), royal fern (*Osmunda regalis*), and sensitive fern (*Onoclea sensibilis*), were common, and grew readily in our garden.

Marsh fern (*Aspidium thelypteris*) died down three times this summer from drought, but rain always revived it, and fresh fronds appeared.

Rather than take maiden hair fern, (*Adiantum pedatum*), (considered by many our most graceful species) about the camp as it was rare, we went to Vermont to a station about half a mile long beside the road where it is mowed down like brush each summer. Here also grew marginal shield (*Aspidium marginale*), bulblet bladder (*Cystopteris bulbifera*) and fragile bladder (*Cystopteris fragilis*). The latter produced thick, thrifty clumps.

In our own woods grew literally thousands of evergreen ferns, and we brought to the garden the spinulose wood fern (*Aspidium spinulosum*), its variety (*Aspidium spinulosum var. intermedium*), the crested shield (*Aspidium cristatum*), the hybrid, Boott's shield fern (*Aspidium boottii*), and a few *Aspidium dilatatum* which are not evergreen. These twenty-seven varieties completed my list in a rather small area about our camp.

We next went to the western part of Massachusetts and very carefully transported the following ferns, together with a bushel of earth in which to plant them:—maidenhair spleenwort (*Asplenium trichomanes*), ebony spleenwort (*Asplenium platyneuron*), walking fern (*Camptosorus rhizophyllus*), purple cliff break (*Pellea atropurpurea*) and obtuse woodsia (*Woodsia obtusa*).

A deep rich woods near the latter place furnished us with beautiful Goldie's fern (*Aspidium goldianum*) and Clinton's wood fern (*Aspidium cristatum var. Clintonianum*), broad beech fern (*Phegopteris hexagonoptera*), narrow-leaved spleenwort (*Asplenium angustifolium*), and rattle-snake fern (*Botrychium virginianum*). Never had we seen such large and beautiful colonies of these ferns. These were easily cultivated and added grace to our garden.

We found a station in the Adirondacks for Braun's holly fern (*Polystichum braunii*) and Virginia chain

fern (*Woodwardia virginica*) grew very abundantly in central Massachusetts. We found also in our rambles an incised variety of Christmas fern (*Polystichum acrostichoides* var. *incisum*).

We have planted just two ferns bought at a nursery, these being narrow-leaved chain (*Woodwardia angustifolia*) and adder's-tongue fern (*Ophioglossum vulgatum*). We are a bit doubtful about the latter wintering. We have not tried many grape ferns, but the common one (*Botrychium obliquum*) and its variety *dissectum* are thriving.

Another little fern, variegated in color, *Asplenium goeriangianum pictum*, is growing nicely and likes lime mixed in the soil. This is called a Japanese fern, and came from the garden of the late Clarence Lown in Poughkeepsie, New York.

Two clumps of climbing or Hartford fern (*Lygodium palmatum*) have survived two winters, and we are proud of our large station for it in central Massachusetts.

This brings our list to forty-seven, including the varieties and hybrids, and we hope to increase it this year.

Some very rare species which we have seen growing on limestone cliffs we do not even attempt to transplant. Why take them when they will only die and be wasted?

Carefully transplanting ferns to the proper soil as early in the season as possible, and not placing them too near together, helps toward the success of a garden. A plentiful covering of leaves and having the ground as full of moisture as possible when it freezes will bring the ferns through the winter better.

WORCESTER, MASSACHUSETTS.

Shorter Notes

THE HART'S TONGUE IN THREE CONTINENTS.—"The well into which he was looking was as ancient as the village itself, and from his present position appeared as a long circular perspective ending in a shining disk of quivering water at a distance of a hundred feet down. There was a lining of green moss near the top, and nearer still the hart's tongue fern."

The above quotation from Thomas Hardy's "Jude, the Obscure," brings out the familiarity of this fern in English scenes; it may often be a dooryard plant. An amusing illustration of its commonness in England is reported in connection with the field trip at one of the Jamesville (N. Y.) Green Lakes last summer when the American Association for the Advancement of Science held a summer meeting at Syracuse. The local botanist serving as leader had promised his group a find of special interest. Presently he stopped and pointed to a plant with strap-shaped leaves. His pride received a shock from the English botanist who spoke of its dooryard commonness in England.

One point further in the Hardy quotation is worth emphasizing. Has anyone tried raising this fern on well-curbs in this country? Years ago I once saw the Japanese holly fern (*Cyrtomium falcatum*) apparently well established near Orange, New Jersey, and a similar case has recently been reported in Connecticut by Mrs. F. C. Hubbard (FERN JOURNAL 21: 76. 1931). The sides of an old stone well would probably furnish an excellent habitat for *Scolopendrium*; there would be moist air and some moderation of temperature.

It came as news to me last fall to read in a Japanese botanical periodical of the collection of the hart's tongue in the Asiatic region. At that time I wrote to Professor M. Tatewaki of the Botanical Institute, Hakkaido Im-

perial University of Japan, to ask further information. He has just responded most kindly by sending me two herbarium specimens. One of these was collected at Sapporo, Hakkaido, Japan, by Prof. Tatewaki; the other was collected by Professor T. Miyake at Kaibato, S. Saghalien, Japan. Both specimens seem to be like our American material. They will be deposited in the Herbarium of the Brooklyn Botanic Garden.

Plant distribution is sometimes peculiar and difficult of explanation; such for example as the occurrence of the ebony spleenwort in South Africa and the eastern United States. For the hart's tongue fern, however, it would appear probable that it is one of a number of circum-north temperate species and probably a relic of an earlier land connection.—R. C. BENEDICT.

EQUISETUM KANSANUM IN MISSOURI.—In recent years I have passed through Missouri between St. Louis and Kansas City many times and was always looking for *Equisetum kansanum* Schaffn. I never discovered any and I note that Palmer and Steyermark do not list it in their recent report on the ferns and fern allies of Missouri. It should occur in the western and northern parts of the state and I have the following definite records of specimens seen by myself. In the Herbier Barbey-Boissier, Geneva, I found a specimen of *E. kansanum* labeled as coming from St. Louis, Mo., 1841. As St. Louis is within the transition between the prairie and the Ozark forest it may easily have existed in that region and might still be present. In the Kew Herbarium, London, I found a typical specimen of *E. kansanum* labeled as coming from Adonis, Mo. Adonis is in the northeastern part of Polk County toward the southwestern part of the state.—JOHN H. SCHAFFNER, *Columbus, Ohio.*

EDIBLE FERNS.—I noted with interest Mr. H. E. Ransier's reference to the probable use of the "fiddle-heads" of the interrupted fern as greens in Maine. There are reliable reports that the "fiddle-heads" or young petioles of all three of our Osmundas—royal fern, cinnamon fern, and Clayton's fern—are used as pot-herbs. Various other species of ferns are used in a similar way. In addition to the eagle fern, mentioned by Mr. Ransier, the young leaves of the ostrich fern are boiled as greens. I have eaten none of these except the eagle fern which was not at all bad and one could probably soon acquire a fern taste if one lived where these edible species are abundant.—JOHN H. SCHAFFNER, *Columbus, Ohio.*

Apropos of Mr. Ransier's communication about fiddle-heads for greens, it may be noted that in northern Maine the ostrich fern is the species so used. I learned that when we were at Fish Lake and Red River two years ago. I remarked to my guide on the abundance of the ostrich fern and he said "Those are fiddle-heads; people eat them for greens." Fiddle-heads was his only name for the species.

It must depend on the locality which "fiddle-heads" are eaten.—RACHEL L. LOWE, *Portland, Maine.*

THE FAMILY ISOËTACEAE IN MISSOURI.—

ISOËTES MELANOPODA J. Gay.

Boggy open ground and wet swales in glades. Oxylophile. Southern Mo.: Madison, Jackson, Barry, Jasper and Newton counties.

ISOËTES BUTLERI Engelm.

Wet prairies and swales in glades. Calciphile to circumneutral. Southern and central Mo.: St. Louis, Jef-

ferson, Taney, Barry, Stone, Jasper, Newton and McDonald counties.

ISOËTES ENGELMANNI A. Br.

Rocky Hills. St. Louis Co.

Trough an oversight, the family *Isoëtaceae,* data as to which are given above, was omitted from the enumeration of the Ferns and Fern Allies of Missouri in the October–December, 1932, number of the JOURNAL.

The following corrections should also be made: On title under the second plate, p. 118, read St. Genevieve County, instead of Reynolds County; and under synonymy of *Pellaea glabella,* p. 112, read Eggert, ex Farwell, Am. Mid. Nat. 12: 281. 1931, instead of (year) 1912.—E. J. PALMER AND J. A. STEYERMARK.

A FURTHER NOTE ON OPHIOGLOSSUM ENGELMANNI IN VIRGINIA.—I should like to add another word in regard to the distribution of *Ophioglossum Engelmanni* in Virginia. Dr. E. T. Wherry reports (AM. FERN JOURNAL, Vol. 22, p. 85) that this has been found at Woodstock, Shenandoah County, stating "this extends its previously known range 15 miles northwards." I have collected this adder's-tongue on two or three occasions in dry fields near limestone outcrops and in the limestone cedar glades on the north side of Cedar Creek at Meadow Mills, which extends its range still another fifteen miles northward into Frederick County, the northernmost county in the state.—F. W. HUNNEWELL, *Cambridge, Massachusetts.*

CYSTOPTERIS MONTANA IN GLACIER NATIONAL PARK.—In July and August of 1932 it was my good fortune to be able to do a considerable amount of botanizing in Washington, Oregon, and in Glacier National Park, Montana. In Seattle two members of the American

Fern Society took me on several excursions and showed me ferns which I had never seen before. Among these were *Polystichum Lemmoni* Underw.; *Polystichum scopulinum* (D. C. Eaton) Maxon; *Polystichum Andersoni* Hopkins; *Polystichum californicum* (D. C. Eaton) Underw. After leaving Washington and Oregon where I saw many other ferns new to me, I went to Glacier Park where I hiked about seventy miles over the wonderful government trails. Near Gunsight Pass, at an elevation of about 6,900 feet, it was my good fortune to find near a damp, rocky ledge a small colony of *Cystopteris montana* (Lam.) Bernh. This fern is not listed in Standley's Flora of Glacier Park which I had with me. Later on I was able to consult a copy of Rydberg's Flora and there learned that the plant had been found in the United States only in Alaska and Colorado. It was indeed a treat to see this lovely little fern similar in shape to the oak fern, but more delicate in outline. I had seen it once before near Emperor Falls in the Mt. Robson country, British Columbia. I have deposited specimens in the Gray Herbarium and in the U. S. National Herbarium.—HAROLD GODDARD RUGG, *Hanover, New Hampshire.*

A UNILATERALLY FERTILE FROND OF DRYOPTERIS THELYPTERIS.—The frond of marsh fern (*Dryopteris Thelypteris* (L.) Gray) represented at about one-third natural size in the accompanying illustration was collected by the writer in Chamberlain, a subdivision of Bristol, Maine, in August, 1932. Its striking peculiarity is that one-half of the frond (the left, as viewed from the back) is fertile, with the revolute pinnule-margins normal in this state, while the other is sterile, with flat and consequently much broader pinnules. The pinnae of the left half of the frond are fertile throughout, except that from 1 to 3 pairs of the basal pinnules in the

lowest 4 or 5 pinnae are without sori. The 10 lower pinnae of the right side of the frond are completely sterile, except for 2 abortive sori on the 9th pinna. The remaining 7 complete pinnae bear from 1 to 10 scattered sori, and the reduced tip of the frond is about equally fertile on both sides. The blade measures 25 cm. in length, the stipe 19.5 cm.

This frond was picked casually from a colony growing on the edge of a thicket, and its peculiarity was not noticed until it was in hand, too late for correlation with any features of environment or exposure. It would appear extremely unlikely, however, that its bilateral dimorphism was due merely to a difference in exposure of the two sides. If a difference in exposure to the sun of the two sides of a frond could produce a variation of this sort, fronds of this type would be very much more common than they are. The cause of the heteromorphy of this frond must, I believe, have been internal rather than external.—S. F. BLAKE, *Bureau of Plant Industry, Washington, D. C.*

American Fern Society

Report of the President for 1932

It is a source of great satisfaction to be able to report a year that, in spite of continued depression, has proved favorable to the Society. Membership has held up well, the diversity and excellent quality of material contributed to the JOURNAL are marked, and our activities in varied other lines have continued successfully in the usual way, with rather more attention given to the cultivation of hardy ferns. This last feature is of fascinating interest, and one in which, with the information now available as to suitable soil reactions, success will be appreciably easier. Probably more of us have small fern

Unilaterally Fertile Marsh Fern

gardens than has been realized. Our membership is so wide that we have an excellent opportunity of greatly increasing these through the exchange of living plants, and at the same time picking up useful hints of one sort or another as to culture and habitat requirements. Much of this information will presumably be worth putting into the JOURNAL, in connection with the lists which it has recently been suggested be published. If space for a fern garden be narrowly limited, preference may naturally be given to one or more rockeries, in which the smaller ferns will be grown in combination with small sedums, phloxes, and the like. It is astonishing, the amount of attention that can be given to the arrangement of materials and to guarding against mischance from beasts and weather! A collecting trip too has an added zest if one is on the lookout for just the right fern to fit snugly into a niche that has been saved expressly for it.

The new year is of special interest to us as being the fortieth anniversary of the founding of the Society, originally the Linnaean Fern Chapter of the Agassiz Association, and we are indebted to Dr. Waters for contributing an interesting account of this event and the early days of the Chapter. We have every right to be proud of our long and unbroken record of activity.

WILLIAM R. MAXON, *President.*

Miss Louise W. Roberts, a member of the Society since 1915, died in Syracuse, New York, January 15, 1933, in her eighty-fourth year. Miss Roberts was for forty-five years a teacher in the public schools of Syracuse; for five (1907–1912) she was president of the local teachers' association. Outside her profession she took active part in various civic enterprises, such as the Visiting Nurse Association. She was particularly interested in the work

of the Womens' Christian Temperance Union and in botany. She was a charter member of the Onondaga Botanical Society which has done so much to make known the unusual floristic features of the region about Syracuse.

The editors wish to acknowledge, with hearty thanks, the gift of a copy of D. C. Eaton's "Ferns of the Southwest," by Archdeacon Arthur Hombersley, of Trinidad.

New members:

Allen, Fulton, Salisbury, Md.
Powell, T. Y., Thornburg, Arkansas.
Rose, Mrs. E., 46 Weston St., Nutley, N. J.
Taylor, Prof. Thomas M. C., Dept. of Botany, University of Toronto, Toronto 5, Canada.
Youmans, William Barton, Western Kentucky Teachers College, Bowling Green, Ky.

Changes of address:

Boydston, Mrs. Kathryn E., 559 Clinton Place, River Forest, Ill.
Cornman, Mrs. Leighton R., Salona Beach, California.
Hall, Mrs. H. M., 345 Forest Ave., Palo Alto, Cal.
Hazen, E. H., 212 College St., New Haven, Conn.
Houck, William G., Jr., 56 East 53rd St., New York City.
Lownes, Albert E., P. O. Box 1531, Providence, R. I.
McAvoy, Miss Blanche, 400 West Mulberry St., Norwal, Ill.
Prince, Prof. S. Fred., 4643 Knox St., Lincoln, Nebraska.
Rhodes, Charles O., 103 Clark St., Groton, N. Y.
Williamson, Mrs. S. J., 1215 23rd St., Des Moines, Iowa.

Mrs. Kathryn E. Boydston, with aid from various other members of the Society, has prepared an exhibit of North American ferns containing, at last accounts, one hundred species, which is now on view in the Horticultural Building at the Century of Progress Exposition in Chicago. In connection with it an attractive illustrated pamphlet of 28 pages has been issued, partly

in the hope that its sale might help to meet expenses incident to the gathering and setting up of the exhibit. It contains brief articles on various aspects of ferns by Dr. Maxon, Dr. Benedict, Dr. Wherry and Mr. Standley and a list of species exhibited, with descriptive notes on each, by Mrs. Boydston herself.

Any member of the Society can obtain a copy by sending fifteen cents to Mrs. Kathryn E. Boydston, 559 Clinton Place, River Forest, Illinois, and will have the double satisfaction of getting rather more than his money's worth and of helping with an excellent piece of work.

Twenty copies or more in one order can be had for 10 cents each.

Vol. 23 July-September, 1933 No. 3

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

LIME & GREEN STS., LANCASTER, PA.

AUBURNDALE, MASS.

Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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RALPH C. BENEDICT ..... 1819 Dorchester Road, Brooklyn, N. Y.
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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.

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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. 23 JULY–SEPTEMBER, 1933 No. 3

New Tropical American Ferns—X[1]

WILLIAM R. MAXON

The two species described herewith are from Costa Rica. The *Lindsaya*, oddly enough, is most closely related to an undescribed species from the mountains of Haiti. The *Dryopteris* is of interest not only because of its doubtful relationship, but as coming from the vicinity of La Palma, which more than any other portion of the Republic has been visited and revisited by botanists.

Lindsaya pratensis Maxon, sp. nov.

§ *Eulindsaya*. Rhizoma breviter repens, paleis imbricatis fulvo-brunneis dense praeditum. Folia disticha inter se haud distantia erecta plura, stipitibus castaneis quam laminis multo brevioribus; laminae lineares, usque ad 60 cm. longae, ad basin versus attenuatae, 1-pinnatae, rachi valida lateraliter compressa dorso forte herbaceo-carinata; pinnae numerosae spongiosae, simplices et integrae, inferiores minores et distantes (infimae minutissimae), plurimae imbricatae, breves, oblique subdeltoideae, margine inferiori forte falcatae, apice saepe cornutiformes, margine superiori sorum continuum elongatum unicum gerente; indusium herbaceum, amplum, marginem aequans.

§ *Eulindsaya*. Rhizome short-creeping, 2–3 mm. thick, densely imbricate-paleaceous; scales persistent, 2.5–4.5 mm. long, 0.8–1.5 mm. broad, pointed-oblong to deltoid-

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

[Volume 23, No. 2, of the JOURNAL, pages 37–72, plate 3, was issued July 12, 1933.]

ovate, attenuate, firmly attached at the rounded subcucullate base, bright brown, entire, clathrate, the cells inflated, with transparent yellowish outer walls. Fronds numerous, distichous, 5–7 mm. apart, erect, 25–60 cm. long, the stipes shorter than the blades, 1–1.5 mm. thick, castaneous, paleaceous at base, terete dorsally, broadly sulcate on anterior face; blades linear, 20–50 cm. long, 1.5–3 cm. broad, acutish at apex, attenuate toward base, simply pinnate, the rachis stout, strongly compressed laterally (up to 2.5 mm. broad), developing a strong, rigidly herbaceous, erose dorsal keel; pinnae numerous (40–55 pairs), subopposite to alternate, mostly imbricate, only those of the basal portion distant and gradually reduced, the lowest ones vestigial, 2–5 cm. apart; pinnae in general spreading, sessile, 1–1.5 cm. long, 5–10 mm. broad at base, obliquely triangular, entire, the lower margin strongly upcurved, the upper margin horizontal and joining the lower at apex in a frequently incurved blunt acumen (apex cornutiform), the inner margin vertical, straight to strongly excavate; veins concealed, flabellately forked, 10–16 ultimate branches reaching the margin; sporangia borne in a single uninterrupted sorus from base to apex, the indusium herbaceous, 1 mm. broad, equaling the margin. Leaf tissue spongiose, glabrous, dull green above, paler beneath.

Type in the U. S. National Herbarium, no. 182123, collected in the interior mountain region of Costa Rica by C. Wercklé and transmitted by him to the National Museum.

Of this interesting species two other specimens are at hand. The first of these is from a cultivated plant in the garden of Doña Ampara de Zeledón, San José, Costa Rica, which is said by Wercklé to have been obtained by him at La Palma, alt. 1400 meters, though these locality data must be regarded as doubtful. The second is an excellent specimen from Cerro de las Caricias, north of San Isidro, Province of Heredia, Costa Rica, alt. 2000–2400 meters, collected on a wet, open, grassy bank, March 11, 1926, by Paul C. Standley and Juvenal Valerio (no. 52245). Though agreeing closely with the type speci-

men in morphology, both collections represent a less robust state of the species.

In general appearance *L. pratensis* is not unlike *L. Seemanni* J. Sm., of which several specimens (including an excellent sheet of the type collection) are at hand from Colombia; but in that species, among many differences, the pinnae are membranous, few-veined and regularly inciso-lobate, bearing 2 to 4 separate sori. It is, perhaps, more closely related to a very slender, membranous-leaved plant from Haiti (*Ekman* 10243), shortly to be described as a new species by Dr. Christensen. From this it differs, nevertheless, in many essential characters.

Dryopteris crassiuscula C. Chr. & Maxon, sp. nov.

§ *Steiropteris* (?). Folia magna, stipitibus validis squamosis quam laminis dimidio brevioribus; laminae lanceolatae basi abrupte reductae, apice acuminatae, pinnato-pinnatifidae, rachi stipiti simillima; pinnae numerosae alternae sessiles basi aerophoro elongato magno instructae, inferiores 3–4-jugae distantes multo reductae (infimae minutae), mediae ca. 20 cm. longae oblongo-lanceolatae attenuatae falcatae inciso-pinnatifidae (costis subtus furfuraceis puberulisque), segmentis acute oblongis integris ciliolatis falcatis, costulis subtus strigillosis; venae immersae simplices, infimae ad sinum angustum excurrentes, ibidem conniventes, membrana pellucida lineari interposita; sori inframediales lineares nudi; parenchyma subcoriacea, subtus glabra, supra strigillosa.

§ *Steiropteris* (?). Rhizome woody, short-creeping, about 2 cm. in diameter, sparsely brown-paleaceous. Fronds several, approximate, rigidly ascending, about 1.25 meters long, the stipes half as long as the blades, stout (1 cm. thick at base), light brown, broadly sulcate, minutely brownish-puberulous, densely and persistently scurfy-paleaceous throughout with smallish, thin, light brown, lance-ovate, appressed scales; blades lanceolate, about 90 cm. long, 30 cm. broad below the middle, very abruptly reduced at base, acuminate at apex, pinnate-

pinnatified, the rachis puberulous like the stipe, subpersistently squamose; pinnae 25–30 pairs, alternate, sessile, furnished with a large, firm, elongate, brown aerophore at base below, the lower 3 or 4 pairs distant and much reduced (the lowermost appearing as wartlike protuberances), the largest 20 cm. long and 2.8 cm. broad, falcate, narrowly lance-oblong, attenuate at apex, pinnately incised more than half way to the costa, the costa broad, brownish-puberulous, subpersistently scurfy-paleaceous at the sides beneath, appearing marginate; segments pointed-oblong, 5–8 mm. long at distal sinus, 4–4.5 mm. broad at base, acute, entire, rigidly ciliolate, falcate (especially those of the proximal side), the basal ones somewhat reduced, most so in the lower pinnae, the costules minutely strigillose beneath; veins concealed, 14–16 pairs, simple, oblique, the basal pair connivent toward the narrowly acute sinus, separated only by a linear cartilaginous membrane; sori 8–12 pairs, inframedial, elongate, commonly linear, exindusiate; sporangia glabrous. Leaf tissue rigidly chartaceo-herbaceous, yellowish green and glabrous beneath, the upper surface darker, sublustrous, and finely strigillose with minute transparent yellowish hairs.

Type in the U. S. National Herbarium, nos. 1181715–7, collected in the vicinity of La Palma, on the road to La Hondura, Costa Rica, alt. 1500–1700 meters, on steep bank at edge of forest, July 18, 1923, by William R. Maxon and A. D. Harvey (no. 8040). No. 8085, with identical data, is a smaller specimen of the same.

An outstanding species, its systematic position within the genus not very clear. In most characters it agrees with the subgenus *Steiropteris*, though lacking the characteristic "keel" running from sinus to costa. From all species of this subgenus, however, it differs in its elongate (even linear) naked sori and its strongly furfuraceo-paleaceous vascular parts. It is probably nearest to the polymorphic *D. glandulosa* (Desv.) C. Chr., which is itself a doubtful member of the *Steiropteris* group of species.

WASHINGTON, D. C.

Further Notes on the Pteridophytes of San Diego County, California

F. M. COTA

The recent contribution of Ira L. Wiggins on the "Pteridophytes of San Diego County, California,"[1] forms another link in the series of papers dealing with the California ferns and fern allies. This chain was first started in the Fern Bulletin by Parish,[2] later continued by Parish[3] and Munz and Johnston[4] for Southern California and now localized by Wiggins for San Diego County. Miss Kimball in 1911[5] published in the Fern Bulletin a short article on the San Diego County ferns but due to the difficulty of field trips she was unable to report on our mountain and desert species.

Wiggins, when one considers that the Pteridophytes were only a small part of his research work on the San Diego County Flora, has covered the county in a very satisfactory manner. Any one who has ever had the pleasure of collecting in this region can well appreciate the work that he has done.

The following additional stations (all easily reached by car) are now added to those already recorded by Wiggins, together with several species new to his check-list. Specimens examined are either in our local Natural History Museum, in Miss Kimball's collection or in my own personal herbarium.

Thanks are due to Miss Kimball for her assistance in identification of the species.

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[1] AMER. FERN JOURN., Vol. 22, Nos. 2–3, 1932. Wiggins.

[2] Fern Bulletin, Vol. XII, No. 1, 1904. Parish.

[3] Southern California Ferns. AMER. FERN JOURN., Vol. V, No. 4, 1915. Parish.

[4] The Distribution of Southern California Pteridophytes. AMER. FERN JOURN., Vols. XII–XIII, 1922–1923. Munz & Johnston.

[5] San Diego County Ferns. Fern Bulletin, Vol. XIX, No. 2, 1911. Miss Laura Kimball.

OPHIOGLOSSUM CALIFORNICUM Prantl. Numerous on the Camp Kearney Mesa, 6 miles from San Diego, growing either in sunny or shady locations. Found also on the Clay mesas near the new State College.

Miss Kimball has found this plant on the mesas at the foot of San Miguel Mountain.

The best time for collecting it is either in February or late March.

FILIX FRAGILIS (L.) Gilib. Santa Ysabel Creek under shady cliffs near stream-bed, about 5 miles below Mesa Grande at 2600 ft. elevation; Manzanita Ranch. Cuyamaca Mts., 4000 feet; Pine Valley, near highway bridge over Pine Creek; shady cliffs and under rocks, Deer Creek in the Cuyamaca Mts., at 4500 ft. elevation.

POLYPODIUM CALIFORNICUM Kaulf. Found throughout San Diego County except in the desert region; in all the small canyons bordering the northern limits of the city of San Diego; growing to exceptional size in Mission Gorge, San Diego River.

This is one of the ferns that does well under cultivation, although losing its leathery appearance when cultivated.

POLYSTICHUM MUNITUM (Kaulf.) Presl. Smith Mountain near Ramona (specimens in the Natural History Museum); Azalea Creek, North Peak, Cuyamaca Mts., at 4500 feet.

DRYOPTERIS ARGUTA (Kaulf.) Watt. San Pascual Grade between Ramona and Escondido; Cedar Creek. Cuyamaca Mts., at 4500 feet elevation; above highway between Julian and Banner, 4000 ft. elevation; Mission Gorge, San Diego River, near San Diego; Mt. Helix and Grossmont Peak near La Mesa; Spook Canyon, near Escondido. The last is one of the best locations for this plant.

WOODWARDIA CHAMISSOI Brack. Mussey Grade between Ramona and Lakeside, about two miles from the foot of the grade, under large boulders kept moist by seepage of water; along highway between Rincon and Lake Henshaw about 4 miles below the lake; Montezuma Mines, Montezuma Valley, at 4500 feet; Palm Canyon, Borrego Valley in the Colorado Desert; Boulder Creek about 5 miles below Cuyamaca Dam.

ASPLENIUM VESPERTINUM Maxon. Under large boulders, Mission Gorge, San Diego River; shady locations under boulders near Santa Ysabel and Witch creeks; growing to exceptional size under a boulder near streambed, Santa Ysabel Creek about 5 miles below Mesa Grande, at 2500 feet elevation; Dobe Falls below Murray Dam near La Mesa.

PITYROGRAMMA TRIANGULARIS (Kaulf.) Maxon. The gold-back form of this species seems to be the most common in our range from about 2600 feet to the top of the Cuyamaca range. I have found very few localities near the coast where the gold-back form may be collected.

A peculiar form found near Boulder Creek seems to be somewhat different from the ordinary silver-back. It has the covering of white powder on the under surface of the front and scattered over the upper surface and along the stem. This condition I have never observed in any of the silver-backs found in other localities.

PITYROGRAMMA TRIANGULARIS VISCOSA (D. C. Eaton) Weatherby. Balboa Park, San Diego; common on the Miramar Grade between Miramar and Poway; near Miramar on the Camp Kearney Mesa under scrub oaks.

ADIANTUM JORDANI C. Muell. Balboa Park, San Diego; canyons bordering Mission Valley, northern limits of the city of San Diego; Camp Kearney Mesa, near San Diego.

ADIANTUM CAPILLUS-VENERIS L. This is one of our most rarely collected ferns, probably because of the inaccessible places in which it is to be found.

Miss Kimball has collected it along the Sweetwater Valley near the Otay Flume; I myself have never seen this locality. Other stations are: Palm Canyon and Devil's Canyon, Borrego Valley, western edge of the Colorado Desert; Santa Ysabel Creek below Mesa Grande at about 2500 feet elevation (only a few fronds found here); Clear Creek Falls, San Diego River. The last station will probably be lost when the new El Capitan Dam is completed.

CHEILANTHES CALIFORNICA (Hook.) Mett. Spook Canyon, near Escondido (a good station for this beautiful plant); under boulders near the highway between Ramona and Poway; Barona Ranch east of Mussey Grade between Ramona and Lakeside; Mission Gorge of the San Diego River; under boulders near Barrett Junction, highway between San Diego and Campo; near Lake Hodges spillway, Escondido.

CHEILANTHES VISCIDA Davenp. This seems to be a common species throughout the western edge of the Colorado Desert. Specimens have been collected from Palm Canyon in Riverside County to Palm Springs, Devil's Canyon, Mason Valley and along the western edge of Borrego Valley; also in the Narrows and San Felipe Valley.

CHEILANTHES COVILLEI Maxon. San Felipe Valley and the Narrows, western edge of the Colorado Desert; Santa Ysabel Creek below Mesa Grande, at 2500 feet elevation; Montezuma Mines, Montezuma Valley at 4500 feet; Palm Canyon and Devil's Canyon, Borrego Valley; Cuyamaca Lake, Cuyamaca Mts., at 4500 feet; Pine Valley; near Tecate, 2 miles north of the Mexican border.

PELLAEA ANDROMEDAEFOLIA (Kaulf.) Fée. Deer Creek, Cedar Creek in the Cuyamaca Mts., at 4500 feet elevation; Camp Kearney Mesa near San Diego; Mission Gorge of the San Diego River; Boulder Creek about 6 miles below Cuyamaca Dam; San Vicente Creek between Lakeside and Ramona; Spook Canyon near Escondido.

PELLAEA MUCRONATA D. C. Eaton. Common on the Camp Kearney Mesa near Miramar; Balboa Park, San Diego; growing to exceptional size near the highway above Santa Ysabel Creek between Mesa Grande and Ramona; San Felipe Valley near the Colorado Desert; Palm Canyon on the Colorado Desert.

At North Peak, Cuyamaca Mts., and on the Poway Grade between Ramona and Poway, specimens are found which seem to grade into *P. compacta*. I have never yet found specimens at either of these two stations which did not seem to show typical fronds of both *mucronata* and *compacta*. These two localities are not at all similar either in elevation or soil formation.

NOTHOLAENA NEWBERRYI D. C. Eaton. Common in Mission Gorge around ledges and under boulders; crevices in cliffs below Lake Hodges spillway near Escondido; growing in sunny location below Murray Dam near La Mesa; numerous along highway between Spook Canyon and Lake Hodges.

MARSILEA VESTITA Hook. & Grev. Murray Dam near La Mesa.

PILULARIA AMERICANA A. Br. One of our rarest plants, not as common as our literature leads us to believe. This is due to the fact that its natural habitat is being gradually destroyed by the clearing of mesa lands for pasture and the growth of wild European grasses.

The Ramona locality mentioned by Wiggins has been lost because nearly all the mesa lands there have been cleared for cattle. We now have only two known stations (one found April, 1933) for this plant, both on the Camp Kearney Mesa near San Diego and both near the state highway, one 9 and one 15 miles from the city of San Diego.

AZOLLA FILICULOIDES Lam. Mission Gorge, San Diego River; Santa Ysabel Creek below Mesa Grande at 2600 feet; Balboa Park, pond under Cabrillo Bridge.

ISOETES ORCUTTII A. A. Eaton. Common on Camp Kearney Mesa either in sunny or shady locations; found in winter pools or overflow from such pools, about February or March.

ISOETES HOWELLII MINIMA (A. A. Eaton) Pfeiffer. In water in a sunny location on Camp Kearney Mesa. Previously known only from the type collection made by C. R. Orcutt in May, 1903.

SELAGINELLA BIGELOVII Underw. Common throughout San Diego County and may be found in all types of locations. One of the best localities is in Mission Gorge of the San Diego River. Stations are so numerous that it would require considerable space to list them.

SELAGINELLA CINERASCENS A. A. Eaton. Balboa Park, San Diego; Camp Kearney Mesa. The latter is one of the best localities for this species. The type station has been destroyed, due to the growth of National City.

SELAGINELLA EREMOPHILA Maxon. Forming thick mats over the desert foot-hills, Borrego Valley, western edge of the Colorado Desert; Palm Canyon, Mason Valley and the Narrows.

During the hot summer months this plant rolls itself into tight little balls, which reopen again immediately after the first rains. It may be listed in the group called "resurrection plants."

SAN DIEGO, CALIFORNIA

Six Interesting Characters of Sporadic Occurence in Equisetum*

JOHN H. SCHAFFNER

Among the many extraordinary peculiarities of the genus Equisetum is a group of characters decidedly intermittent or sporadic in expression. These characters have to some extent been recognized for a long time and have usually been regarded as abnormalities or monstrosities. But they appear from time to time in various shoots and are therefore hereditary in the broad sense of the term although one cannot predict their appearance at any given time or point except in terms of probable ratios. Their expression in any given shoot apparently depends on some special physiological state or condition brought about by internal local disturbances which may be entirely absent in an adjoining shoot or branch developing at the same time in essentially the same environment.

The writer has been studying six of these intermittent potentialities for a number of years as follows: Short internodes, flexuous stems, dichotomous or twin shoots, spiral sheaths, sterile and semi-sterile cones, and proliferation of the cones. As stated, all of these peculiari-

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* Papers from the Department of Botany, The Ohio State University No. 330.

ties have been known for a long time but it seems that they should receive much more serious attention from botanists in general than they have heretofore; for a careful consideration of them will immediately bring up challenging questions about the nature of heredity, fluctuation, character expression in the individual part, and the sudden changes taking place in the ontogenetic, physiological gradients with consequent changes in the differentiation processes.

FLEXUOUS STEMS. Flexuous stems are usually quite common in *E. praealtum* Raf. The flexuous stems with their wavy outline make a striking contrast to the rigidly straight normal shoots among which they grow (Figs. 1, 2). These flexuous stems have been observed to occur in a number of species of Equisetum but are studied to best advantage in *E. praealtum.* The flexuous stems develop side by side from the same rhizome as the straight stems. and branches from the flexuous shoots are mostly straight. Rarely there is a spiral twist of the shoot accompanying the flexuousness.

The flexuousness must be due to a special hereditary factor or group of factors that are very sporadic and indefinite in coming into activity, and apparently the growing bud must be in a very definite physiological condition before any reaction takes place. It is therefore of special interest to note that in *E. scirpoides* Mx., which is on a much higher evolutionary level, the flexuous potentiality is so definite in reaction that all the stems become flexuous at maturity. Such a condition is quite common in the evolution of many characters in many phylogenetic lines. At the first appearance of the character in a taxonomic series it may be very unreliable in expression but as the series advances the potentiality in question usually becomes completely dependable in

action, and expression of the character becomes certain under all ordinary environmental conditions.

SHORT INTERNODES. The internodal system evolved in Equisetum is of special interest when one considers the rather low position these plants have in the general series of vascular plants. Most species of Equisetum show short internodes occasionally but they are unusually prominent in *E. praealtum*. There is much fluctuation in the development of the zones of short internodes. There may be only one in a shoot or there may be any number up to ten or more in a zone. The shortened internodes may all be of about the same length (Fig. 14) or there may be a gradation of shorter and shorter internodes in the zone (Fig. 13). The internodes may be so undeveloped that the sheaths are completely telescoped (Figs. 10, 11). Some zones may have both short internodes and completely telescoped sheaths. The zones of short internodes may be at the base of the shoot, anywhere along the middle portion, or at the very tip. There may be two zones or even more of short internodes separated by one, two, three, or more long, normal internodes (Fig. 12). Other shoots from the same rhizome, growing close beside the shoot with short internodes may have all normal internodes. Branches coming from the shortened internodes may have all long internodes. On the other hand, branches coming from the region of normal internodes may have zones of short internodes. Zones of short internodes also develop in the rhizome.

The production of short internodes is evidently caused by a failure of the internodal potentiality to come into proper activity at the given point. Imagine what an awkward condition mankind would be in if the joints of our fingers were as sporadic in expression as these Equisetum internodes. The internodes of Equisetum repre-

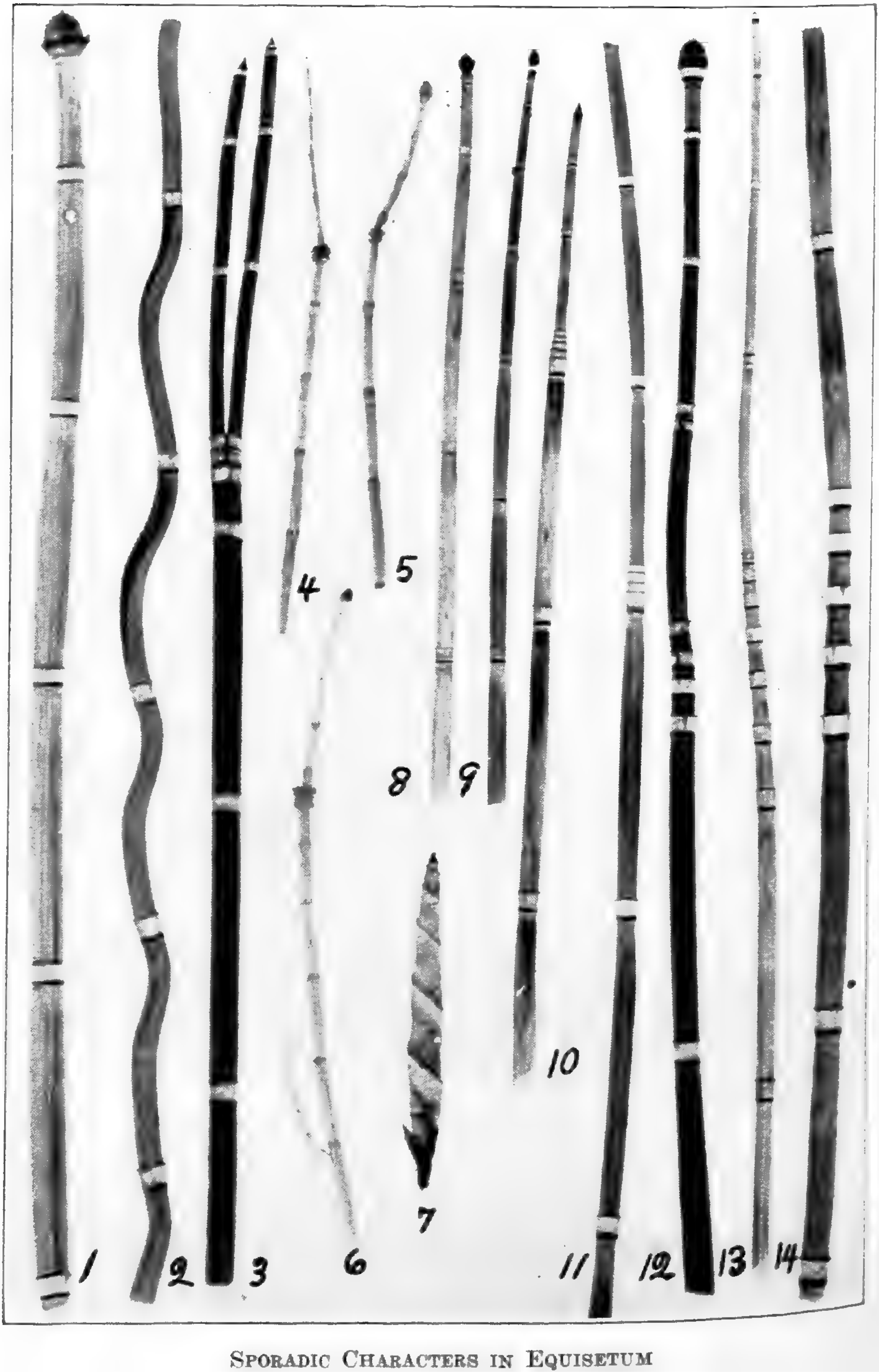
sent an early appearance of the character in the phylogenetic history and the potentiality is thus not so perfected but that the reaction can be easily inhibited by slight changes of physiological conditions.

DICHOTOMOUS OR TWIN SHOOTS. Twinning of the aerial shoots is rather common in *E. praealtum* and is found occasionally in other species. The dichotomy takes place in both sterile and reproductive shoots (Fig. 3). It may occur anywhere from near the base of the shoot to the very tip. In fertile shoots it may appear so late that the single cone may merely have two points instead of one. Just as is the case with the flexuous stems or as with those having shortened internodes, the twin shoots develop side by side at the same time and from the same rhizome as the normal shoots. The twin branches may be very similar or they may be very unlike in various characters. As stated, the dichotomous shoots are comparatively common in *E. praealtum* and with a little patient search one can soon accumulate an interesting collection of twins that will give many suggestions as to the rôle played by environment, physiological condition, and hereditary potentialities in the expression of the general characteristics of an organism.

SPIRAL SHEATHS. The development of spiral sheaths is a very striking phenomenon in Equisetum, especially when they extend throughout the entire length of the shoot as shown in figure 7, which represents a shoot with spiral sheath of *E. laevigatum* A. Br. In some species it occurs occasionally while in others it is apparently very rare. Spiral sheaths seem to be especially rare in *E. praealtum* but are more abundantly produced in *E. palustre* L., *E. laevigatum*, *E. arvense* L., and *E. telmateia* Ehrh. As indicated, the sheath develops as a continuous spiral and may extend from the base to

the apex of the shoot. More commonly, however, the spiral is developed in only a short portion of the stem with normal nodes and internodes above and below. Such character expressions are usually regarded as monstrosities but they are apparently the expression of the more primitive spiral potentiality of the vascular plants which is manifest in the structure of the cellulose cell walls themselves and in the spiral arrangement of the leaves through the correlative interaction of the cells of the growing stem bud. The reactions for the development of nodes and internodes in the shoot are inhibited or modified and the primitive, fundamental spiral potentiality has a special and controlling influence, for the time being, on the general hereditary reactions of the cells during the growth and differentiation of the shoot.

STERILE AND SEMISTERILE CONES. In the higher vascular plants the shoot usually is differentiated either as a normal vegetative shoot or a normal reproductive shoot or flower. There is no half-way expression between the two unless a special, disturbing hereditary factor is evolved in the system. But in all species of Equisetum one can find every gradation from perfect spore-bearing cones to the normal determinate vegetative tip. It might be stated that in all living Equiseta there are three types of tips—the indeterminate tip of the rhizome, the determinate tip of the strobilus, and the determinate vegetative tip of the sterile aerial shoots and sterile branches. The extreme, sterile cones have only minute. rudimentary sporophylls and sporangia, and the sporangia may be entirely wanting. These intermediate cones are often very common in the lower species of the several phylogenetic series of Equisetum as in *E. fluviatile* L., *E. palustre*, *E. laevigatum*, and *E. praealtum*, but are usually quite rare in the highest species as in *E. arvense*.



SPORADIC CHARACTERS IN EQUISETUM

A few stages in the series from normal, fertile cone to determinate vegetative tip in *E. praealtum* are indicated by figures 1, 12, 8, 9, and 10. In the lowest vascular plants the fundamental evolution of determinateness of the shoot is associated with the reproductive process and sooner or later nearly all the advancing lines of vascular plants evolved such determinate reproductive shoots or flowers. In the Equiseta as well as in certain other phylogenetic lines vegetative determinate shoots were also evolved, and it seems then that one or the other kind of determination is usually normally accomplished, but in many shoots half-way physiological states may develop that will induce a reaction intermediate between the normal reproductive determination and the normal vegetative determination, and thus give rise to tips which are neither normally reproductive nor normally vegetative.

PROLIFERATED CONES. The Equiseta were among the very earliest of flower-producing plants, and, as is the case with low type flowers in all the main phylogenetic lines, proliferation is very common unless special hereditary factors are introduced which may prevent it. Proliferation, which is really a return at the given point to the original indeterminate condition, is frequently seen in such low forms as *Lycopodium clavatum* L., *L. complanatum* L., species of Araucaria, *Cunninghamia sinensis* R. Br., and in species of Rosa and other genera. Proliferations in Equisetum cones have been observed for *E. fluviatile, E. palustre, E. silvaticum* L., *E. pratense* Ehrh., and *E. arvense,* but the writer has never, after long and diligent search, found a proliferated cone of *E. praealtum.* The development of the hardened, spine-like point probably interferes with the continued growth of the apex under all ordinary physiological conditions that might arise in the cells. On the other hand,

proliferation is quite common in *E. fluviatile* (Figs. 4, 5, 6), one of the lowest members of the annual horsetails without apiculate cones. The cone may produce a short sterile proliferation (Fig. 5) or even a second cone after several vegetative internodes have been developed (Figs. 5, 6). This second cone may also proliferate, thus producing a series of vegetative and reproductive zones, as in *Lycopodium lucidulum* Mx. and the ferns in general. Proliferation of the cone or flower is to be regarded as a failure of the factors for determination to come into activity and is therefore not a monstrosity in the ordinary sense of the word but simply the activity of the more primitive reaction system or fundamental heredity of the plant.

There are other peculiar expressions to be observed in species of Equisetum but the ones mentioned above will go far in supplying material to any botanist intent on the development of a unique freak herbarium.

COLUMBUS, OHIO.

EXPLANATION OF PLATE

All the figures are *Equisetum praealtum*, except 4, 5, and 6 which are *E. fluviatile* and 7 which is *E. laevigatum*. 1, normal fertile shoot; 2, flexuous shoot; 3, dichotomous or twin shoot. 4, 5, 6, shoots with proliferated cones; 7, shoot with continuous, spiral sheath; 8, 9, shoots with small sterile cones; 10, 11, shoots with short internodes and telescoped sheaths; 12, 13, 14, shoots with short internodes.

The Pteridophytes of Muskogee County, Oklahoma

ELBERT L. LITTLE, JR.

A list of the pteridophytes of an Oklahoma county will emphasize the relative scarcity of ferns in the grass-land interior of the country. Although more than fifty species have been collected in the state, many of these are restricted to the eastern forested parts and several others are western species of limited distribution in Oklahoma.

In a detailed study of the flora and vegetation of Muskogee County made by the writer[1] from 1925 to 1929, a list of the pteridophytes was included. The collection of Muskogee County specimens has been deposited in the Herbarium of the University of Oklahoma. Although about 800 species of seed plants were collected, only 11 ferns and fern allies were noted. This is probably a greater number of pteridophytes than can be found in most counties in central and western Oklahoma.

Muskogee County, having an area of 826 sq. mi., is located in northeastern Oklahoma in the transition zone between the oak-hickory forest on the east and the grass-land on the west. Ferns do not grow in the commonest type of native vegetation, the tall grass prairie. Low hills of sandstone in the county are covered with the oak-hickory forest and support ferns on the rock outcrops and rocky soil. One sandstone hill, appropriately named Fern Mountain, has a variety of ferns. It is the only known station in the county for two species and one of two stations for a third fern. Limited outcrops of lime-stone, which have a mesophytic maple-oak forest, occur on hillsides at the western border of the Ozark plateau.

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[1] Little, E. L., Jr. A botanical survey of Muskogee County, Oklahoma. Unpublished thesis, Univ. of Chicago. 1929.

These limestone bluffs on Braggs Mountain have a richer display of ferns than is found in any other part of the county.

The Ozark plateau a short distance eastward has a larger list of ferns, including species which apparently do not reach Muskogee County. Two of these, *Adiantum pedatum* L. and *Polystichum acrostichoides* (Michx.) Schott, are common in Cherokee County only two miles from the Muskogee County line.

The Muskogee County list of eleven species, with brief notes, follows:

OPHIOGLOSSUM ENGELMANNI Prantl. Found at one station on moist soil, maple-oak forest, Braggs Mt.

ASPLENIUM PLATYNEURON (L.) Oakes. Limestone and sandstone ledges.

ASPLENIUM RESILIENS Kunze. Limestone ledges, Bragg's Mt.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Shaded sandstone rocks, Braggs and Fern Mts.

CHEILANTHES LANOSA (Michx.) Watt. Dry sandstone ledges, oak-hickory forest, Fern Mt. Bush[2] also cites a specimen: Muskogee, Muskogee County, *Palmer* 11202. Nov. 3, 1915.

FILIX FRAGILIS (L.) Gilib. Limestone and sandstone ledges.

NOTHOLAENA DEALBATA (Pursh) Kunze. Dry open limestone ledges, Braggs Mt. and vicinity.

PELLAEA ATROPURPUREA (L.) Link. Limestone and sandstone ledges.

POLYPODIUM POLYPODIOIDES (L.) Watt. Dry sandstone bluff, Fern Mt.

WOODSIA OBTUSA (Spreng.) Torr. Rock crevices and sandy soil, open oak-hickory forest. This is the com-

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[2] Bush, B. F. Ferns of Oklahoma. Amer. Midland Naturalist 12: 91–112. 1930.

monest and most widely distributed pteridophyte in the county and perhaps in the state.

EQUISETUM PRAEALTUM Raf. Found only in sandy soil along bank of Canadian River.

SOUTHWESTERN STATE TEACHERS COLLEGE, WEATHERFORD, OKLA.

Shorter Notes

POLYPODIUM VULGARE (?) CHURCHIAE.—Mrs. Chisholm has kindly sent me a frond from her plant of this form. The first impression on seeing the frond was that it did not in any way resemble a Polypodium, and a close examination of the entire specimen confirmed this impression.

The frond was about 18 centimeters in length, but evidently not all of the stipe was present. The article by Leeds in the January-March number might have been written about this particular frond, and it is unnecessary to again state the points of resemblance and difference he mentions. It should be added that not only the surface texture is like that of *Dryopteris marginalis*, but also the appearance by transmitted light. When held close to an electric light bulb and examined with a strong magnifying glass the cellular structure can just be made out indistinctly. The tissues seen in this way are exactly like those of the *Dryopteris*, and do not at all resemble those of the *Polypodium*.

The exterior of the stipe is that of *Dryopteris marginalis*. It is grooved in front, and obscurely ridged on each side. The ridges on the stipe of the *Polypodium* are conspicuous, and are set more to the front of the stipe than those of the *Dryopteris*. The ridges on the latter can be seen best by glancing light from an electric bulb.

When the stipe of *Polypodium vulgare* is cut across as closely as possible to the end and examined with a lens, it is seen to have three roundish fibrovascular bundles. Unless the frond is very large, a cut 3 or 4 millimeters above the first will show only two bundles, while still farther up there is only one bundle. All the species of *Dryopteris* related to *D. marginalis* have normally two bundles towards the front of the stipe, and usually three at the back, with the middle one larger than the other two. In *D. goldiana* there are almost always five bundles at the back, and there may be the same number in unusually large stipes of the other species. Only in very small stipes will there be less than three bundles at the back. In no case do the bundles run together so soon as in *Polypodium vulgare*. The stipe of var. *Churchiae* has typical bundles of *Dryopteris marginalis*, two in front, and three at the back, with the middle one distinctly larger than the two next to it.

The facts presented by Leeds were convincing, and the results of my examination do no more than help to confirm his conclusions.—C. E. WATERS, *Washington, D. C.*

ISOETES MELANOPODA IN THE WICHITA MOUNTAINS, OKLAHOMA.—A record of *Isoetes melanopoda* var. *pallida* Engelm. in Oklahoma may justify brief mention. The only published records[1] of this genus of quillworts in the state seem to be based on two species collected by George D. Butler[2] at Limestone Gap, now in Atoka County, southeastern Oklahoma, in 1875 and 1877.

[1] See Pfeiffer, Norma E. Monograph of the Isoetaceae. Ann. Mo. Bot. Gard. 9: 79–232. 1932; Bush, B. F. Ferns of Oklahoma. Amer. Midland Naturalist 12: 91–112. 1930; Jeffs, R. E., and E. L. Little, Jr. A preliminary list of the ferns and seed plants of Oklahoma. Publ. Univ. Okla. Biol. Surv. 2: 33–101. 1930.

[2] Butler, G. D. A list of some of the most interesting plants collected in the Indian Territory. Bot. Gaz. 3: 65–68, 74–78. 1878.

These were determined by Dr. George Engelmann[3] as *Isoetes melanopoda* J. Gay and *I. butleri* Engelm., the latter a new species.

On April 16, 1932, the writer discovered immature plants of *Isoetes* near Craterville, in the Wichita Mountains, Comanche County, southwestern Oklahoma. Mature specimens collected July 16 were kindly determined by Dr. T. Chalkley Palmer as *Isoetes melanopoda* var. *pallida* Engelm. Specimens have been deposited in the United States National Herbarium and in the Herbarium of the American Fern Society.

At its Wichita Mountain station *Isoetes* was growing in water several inches deep in two hollowed out granite boulders on an exposed granite hillside. Other hydrophytes growing in these pools were *Callitriche, Ilysanthes anagallidea, Heteranthera limosa,* and *Spirogyra.*—ELBERT L. LITTLE, JR., *Southwestern State Teachers College, Weatherford, Okla.*

CONCERNING OSMUNDA CINNAMOMEA F. FRONDOSA.—In a recent number of the FERN JOURNAL (**23**: 3. 1933) the writer reported and illustrated this form of the cinnamon fern found along a roadside on the mountain west of Berlin, Rensselaer County, New York. It was stated that normal spore-bearing fronds were entirely absent in the colony (of about 20 plants), every frond being fertile at the tip, as illustrated. It was further observed that the presence of road tar about their roots might be a factor responsible for this condition. The specimens were collected July 6, 1932 (a month later than the normal fruiting period in this locality), and specimens have since been distributed to a number of herbaria.

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[3] Engelmann, G. The species of Isoetes of the Indian Territory. Bot. Gaz. 3: 1. 1878.

On June 7, 1933, the station was revisited and it was noted that of the original colony only about 5 plants had survived the road tar treatment and were fruiting in the normal way. Two of these were plants which had been staked and from which some of the "frondosa" forms had been collected the previous July.

It is evident that, in this case at least, the frondosa form was directly caused by injury due to road tar about their roots and the surviving plants have resumed their normal fruiting method.—H. D. HOUSE, *New York State Museum, Albany, N. Y.*

NEW LAWS FOR PLANT CONSERVATION.—On March 1, 1933, a statute went into effect in Arizona forbidding the collection of all Polypodiaceae, cacti and Crassulaceae on land not owned by the collector, and the taking of all plants growing within 200 yards of any highway. A penalty of a fine not to exceed $300 for each offense is provided. In order to remove plants, permits from the State Commission of Agriculture and Horticulture and also from the owner of the land are required.

Texas also has a recent statute forbidding the taking of "shrubs, vines, flowers and moss" from the enclosed land of another. Fines of one to ten dollars are provided for.

To protect the beauty of roadsides by prohibiting the taking of plants seems likely to become a popular device. West Virginia, in the east, has such a law; and other states which attract visitors by their scenery will probably follow suit, if any noticeable damage along the roadsides occurs.

AN EXTREME PHASE OF OSMUNDA CINNAMOMEA, FORMA AURICULATA.—The accompanying photograph illustrates a phase of *Osmunda cinnamomea*, forma *auriculata*

Osmunda cinnamomea f. auriculata

(Hopkins) Kittredge so extreme that it seems to warrant notice in the AMERICAN FERN JOURNAL.

I discovered three plants, two near to each other and one about one-fourth of a mile away. They were found on Bailey Island in Casco Bay, off the coast of Maine, at both ends of a swamp. The fronds are two and one-half to four feet tall and are similar in all respects to any other *Osmunda cinnamomea*, except in the characteristic basal lobe of the pinnae. The first pinnule, greatly elongated, protrudes forward at just about a ninety-degree angle from the rest of the pinna. In some instances the second, third and even the fourth pinnules are somewhat elongated and protruding.

The photograph shows the first five pairs of pinnae of one frond. The pinnule of the upper right pinna is four and one-half inches long, one-fourth of an inch longer than the pinna. The pinnules are most abnormal on the fourth or fifth pinna from the base and then diminish in size until at the top there is hardly any variation from a normal frond.

In all specimens which I found the elongated pinnule grew from the inferior side of the mid-rib except one. That is shown on the superior side of the lower left pinna in the photograph.—BLAISDELL KULL, *New Brunswick, New Jersey.*

NOTES ON TENNESSEE FERNS.—Explorations this season in Tennessee have resulted in the discovery of two ferns hitherto unreported from the State.

Thelypteris cristata (L.) Nieuw. was found for the first time on June 15, 1933, growing in a sphagnum bog in Shady Valley, Johnson Co. With it was associated *Thelypteris palustris* (Salisb.) Schott, var. *pubescens* (Lawson) Fernald, which has been reported but once[1] before from Tennessee.

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[1] AMER. FERN JOURN. **20**: 145, 146.

Dryopteris Phegopteris (L.) C. Chr. was added to the State list June 25, 1933, when a colony of this species was discovered at an elevation of about 5500 ft., on Roaring Fork Creek, Mt. LeConte, Sevier Co. This collection represents an interesting extension of the range of this fern.

Fronds of the above ferns have been deposited in the following herbaria: The University of Tennessee; J. K. Underwood, University of Tennessee; U. S. National Herbarium; Gray Herbarium; Brooklyn Botanic Garden; and The New York Botanical Garden.—J. K. UNDERWOOD AND AARON J. SHARP, *Knoxville, Tennessee.*

American Fern Society

Some of our readers may possibly remember that about a year ago we asked for reports from members of the Society who had fern gardens, no matter how small, hoping thus to get a sort of census of ferns in cultivation in the United States and to gather a fund of information which would be of interest in itself and might serve as a clearing house of useful suggestions. The response was disappointing; just three reports were received. These are here printed, in the hope that they may yet arouse some interest in the matter.

Some time ago the editors of the FERN JOURNAL, responding to a suggestion by the writer, called for information regarding the number and size of hardy fern collections among lovers of these fascinating members of the plant kingdom.

The species and varieties listed here are to be found on the grounds of the Buffalo City Hospital. This collection was begun in the spring of 1932 with the gathering of our local species insofar as our rather rigid policy

of conservation permitted. As the practically limitless and interesting educational possibilities of a representative collection of North American ferns and their allies came to be realized, correspondence was opened with friends and members of the society with the result indicated below. I use the word "hardy" with definite reservations as it is quite uncertain which of our introduced species will prove hardy and which will winterkill. It may be said with certainty that we have grave doubts regarding a few of the ferns such as *Adiantum Capillus-Veneris*, and *Cheilanthes Feei*, although Buffalo is in latitude 42° 52′ and has a fairly equable climate due to the tempering influence of Lake Erie.

For the most part, the woodland and bog ferns, demanding as they do acid conditions, were mulched with peat-moss and decayed leaves. For the calcicolous ferns a rockery was constructed of limestone but it became early evident that very little lime was leaching out and consequently it was deemed advisable to water with a little lime water every two weeks. *Phyllitis*, *Camptosorus*, and *Pellaea* responded quickly by throwing up several new fronds.

Evidently such a collection calls forth endless experimentation in simulating, as near as is possible, the natural habitat from which each fern came. We invite correspondence and exchange with any one interested in a similar enterprise.

POLYPODIACEAE

Polypodium Scouleri Hook. & Grev.
Polypodium virginianum L.
Polypodium vulgare L. var. *columbianum* Gilbert.
Polypodium vulgare L. var. *occidentale* Hook.
Adiantum pedatum L.
Adiantum Capillus-Veneris L.
Adiantum emarginatum Hook.
Pteridium latiusculum (Desv.) Hieron.
Cheilanthes Feei Moore.
Cheilanthes gracillima D. C. Eaton.

Pellaea andromedifolia Fee.
Pellaea atropurpurea Link.
Pellaea ornithopus Hook.
Woodwardia areolata Moore.
Woodwaria radicans Smith.
Asplenium platyneuron Oakes.
Asplenium Trichomanes L.
Phyllitis Scolopendrium (L.) Newman.
Athyrium acrostichoides (Sw.) Diels.
Athyrium angustifolium (Michx.) Milde.
Athyrium angustum (Willd.) Presl.
Athyrium angustum (Willd.) Presl. var. *californicum* Butters.
Camptosorus rhizophyllus Link.
Polystichum acrostichoides (Michx.) Schott.
Polystichum Braunii (Spenner.) Fee.
Polystichum munitum Presl.
Polystichum Andersonii Hopkins.
Polystichum aculeatum (L.) Roth.
Polystichum angulare Presl.
Thelypteris cristata (L.) Nieuwl.
Thelypteris cristata (L.) Nieuwl. var. *Clintoniana* (D. C. Eaton) Weatherby.
Thelypteris Filix-mas (L.) Nieuwl.
Thelypteris fragrans (L.) Nieuwl.
Thelypteris Goldiana (Hook.) Nieuwl.
Thelypteris hexagonoptera (Michx.) Weatherby
Thelypteris marginalis (L.) Nieuwl.
Thelypteris noveboracensis (L.) Nieuwl.
Thelypteris palustris Schott.
Thelypteris simulata (Davenp.) Nieuwl.
Thelypteris spinulosa americana (Fisch.) Weatherby.
Thelypteris spinulosa intermedia (Muhl.) Nieuwl.
Gymnogramme triangularis Kaulf.
Cystopteris bulbifera (L.) Bernh.
Cystopteris fragilis (L.) Bernh.
Woodsia alpina (Bolton) S. F. Gray.
Woodsia ilvensis (L.) R. Br.
Woodsia obtusa (Spreng.) Torr.
Dennstaedtia punctilobula (Michx.) Moore.
Onoclea sensibilis L.
Pteretis nodulosa (Michx.) Nieuwl.
Lomaria spicant Desv.
Aspidium nevadense D. C. Eaton.
Aspidium rigidum argutum D. C. Eaton.

SCHIZAEACEAE

Lygodium palmatum (Bernh.) Sw.

OSMUNDACEAE

Osmunda cinnamomea L.
Osmunda Claytoniana L.
Osmunda regalis L. var. *spectabilis* (Willd.) Gray.

OPHIOGLOSSACEAE

Ophioglossum vulgatum L.
Ophioglossum Engelmanni Prantl.
Botrychium lanceolatum angustisegmentum Pease and Moore.
Botrychium obliquum Muhl.
Botrychium obliquum Muhl. var. *dissectum* (Spreng.) Clute.
Botrychium ramosum (Roth) Aschers.
Botrychium ternatum intermedium D. C. Eaton.
Botrychium virginianum (L.) Sw.

MARSILEACEAE

Marsilea quadrifolia L.

SALVINIACEAE

Azolla caroliniana Willd.
Salvinia natans (L.) All.

EQUISETACEAE

Equisetum arvense L.
Equisetum fluviatile L.
Equisetum hyemale affine (Engelm.) A. A. Eaton.
Equisetum scirpoides Michx.
Equisetum prealtum Raf.

LYCOPODIACEAE

Lycopodium clavatum L.
Lycopodium complanatum flabelliforme Fernald.
Lycopodium lucidulum Michx.
Lycopodium obscurum L.
Lycopodium obscurum dendroideum (Michx.) D. C. Eaton.
Lycopodium tristachyum Pursh.

SELAGINELLACEAE

Selaginella apus (L.) Spring.

CERATOPTERIDEAE

Ceratopteris thalictroides Brongn.

—IRVING WILLIAM KNOBLOCH, *Buffalo, N. Y.*

I have had a fern garden for a good many years. In fact, I have had a fern garden the 25 years I have been studying ferns except one year. I have moved seven times in the twenty-five years and I have had a fern garden 24 summers out of the 25 years. I have 39 species or subspecies growing in my garden now. Here is the list:

1. *Ophioglossum* *vulgatum.*
2. " *engelmanni.*
3. *Botrychium* *obliquum.*
4. " *dissectum.*
5. " *ternatum* var. *intermedium.*
6. " *virginianum.*
7. *Adiantum* *pedatum.*
8. *Onoclea* *sensibilis.*
9. *Pteretis* *nodulosa.*
10. *Polypodium* *virginianum.*
11. *Pellaea* *atropurpurea.*
12. " *glabella.*
13. *Asplenium* *platyneuron.*
14. " *trichomanes.*
15. *Athyrium* *angustifolium.*
16. " *acrostichoides.*
17. " *asplenioides.*
18. *Camptosorus* *rhizophyllus.*
19. *Polystichum* *acrostichoides.*
20. " " *incisum.*
21. " *munitum.*
22. " *braunii.*
23. " *lonchitis.*
24. *Dryopteris* *hexagonoptera.*
25. " *thelypteris.*
26. " *goldiana.*
27. " *marginalis.*
28. " " var.
29. " *spinulosa.*
30. " " *intermedia.*
31. " *filix-mas.*
32. *Cystopteris* *fragilis.*
33. " *bulbifera.*
34. *Woodsia* *obtusa.*
35. " *cathcartiana.*
36. " *glabella.*
37. *Osmunda* *regalis.*
38. " *claytoniana.*
39. " *cinamomea.*

—E. W. GRAVES, *Bentonsport, Iowa.*

In answer to your questions regarding collections of hardy ferns I wish to state I have in answer to—

No. 1. Yes.

No. 2. Seventy-eight (46 N. Am., 32 foreign).

—ERNEST CLAYTON, *San Anselmo, Cal.*

On September 21st, 1933, the Delaware County Institute of Science, Media, Pennsylvania, observed the 100th anniversary of its organization. The Institute held open house during the morning; this was followed by a reception to visiting delegates from other scientific institutions and societies, a luncheon and afternoon and evening meetings. In response to an invitation from the Institute, President Maxon appointed Mr. Arthur N. Leeds and Dr. Edgar T. Wherry as delegates of the Fern Society for the occasion.

Vol. 23 October-December, 1933 No. 4

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

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ANNUAL SUBSCRIPTION, $1.25; FOREIGN, $1.35

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Entered as second-class matter at the post office at Lancaster, Pa., under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 8, 1918.

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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.

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American Fern Journal

VOL. 23 OCTOBER–DECEMBER, 1933 No. 4

New Tropical American Ferns—XI[1]

WILLIAM R. MAXON

In continuation of the present series of short papers two new ferns are herewith described from the lowland tropics of eastern Peru. Both belong to subgroups represented in America by very few species, and indicate the advantage to be gained by intensive exploration of the kind conducted by the collectors.

Polypodium loretense Maxon, sp. nov.

§ *Phymatodes.* Rhizoma funiforme, paleis integris firmis concoloribus castaneis attenuatis dense vestitum. Folia subsessilia; laminae simplices integrae elliptico-lanceolatae, basi acuminatae, apice abrupte acuminato-caudatae, papyraceae, omnino glabrae et nudae, subpellucidae, venis omnibus prominulis; areolae paracostales maximae plerumque in 3–8 areolas secundarias inaequales divisae fertiles, soris eparaphysatis rotundis magnis supra medium compitalibus, 20–30 jugis, non impressis, inter costam et marginem mediis.

§ *Phymatodes.* Rhizome wide-creeping, funiform, 1.5–2 mm. thick, densely imbricate-paleaceous; scales persistent, appressed, subulate-attenuate, 7–9 mm. long, about 1 mm. broad in the peltately attached basal third, hair-pointed, light castaneous, concolorous, lustrous, firm, the margins entire, not scarious. Fronds subdistant (inserted 2–12 cm. apart), 15–25 cm. long, subsessile; blades simple, lance-elliptic, 2.5–5 cm. broad, acu-

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

[Volume 23, No. 3, of the JOURNAL, pages 73–104, plates 4 and 5, was issued November 30, 1933.]

minate at base, abruptly acuminate-caudate at apex (the tip 2–5 cm. long), entire, firmly papyraceous, translucent, glabrous, naked; costa slender, strongly elevated beneath; venation manifest throughout, prominulous, the costal areoles narrow, mostly with 1 or 2 simple or forked included veinlets; paracostal areoles large, obliquely oblong, extending more than half-way to margin, in fertile fronds sometimes undivided and subphlebodioid in soriation, but mostly composed of 3–7 minor areoles (these appendiculate or not), rarely with 8–10 minor areoles, as frequently in sterile blades; distal areoles arranged in 2–3 rows, irregularly angulate; sori 20–30 pairs, uniserial, nearly medial between costa and margin, 5–6 mm. apart, mostly compital, borne beyond the middle of the paracostal areoles, superficial, 2–3 mm. in diameter, round or rarely oval, the sporangia very numerous; paraphyses wanting.

Type in the U. S. National Herbarium, no. 1480064, collected at Balsapuerto, in the lower Río Huallaga basin, Dept. Loreto, eastern Peru, altitude 150–350 meters, climbing on shrubs in dense forest, Aug. 30, 1929, by E. P. Killip and A. C. Smith (no. 28602). Other specimens at hand are as follows:

PERU: The type locality, alt. 150–550 meters, *Killip & Smith* 28392, 28500. Iquitos, Dept. Loreto, alt. 100 meters, *Killip & Smith* 27285. Santa Rosa, lower Río Huallaga below Yurimaguas, Dept. Loreto, alt. 135 meters. *Killip & Smith* 28790. Mishuyacu, near Iquitos, Dept. Loreto, alt. 100 meters, *Killip & Smith* 29890. Puerto Bermudez, Dept. Junín, alt. 375 meters. *Killip & Smith* 26556.

BRAZIL: Cachoeira Caranguejo, Rio Canabury, State of Amazonas, *Holt & Blake* 552.

A well-marked species, agreeing in its glabrous fronds, nonparaphysate sori, and general pattern of venation with *P. persicariaefolium* Schrad., but differing in its abruptly acuminate-caudate blades, subcoriaceous texture, somewhat less oblique primary veins, and particularly in its short sori, which are round or at most very rarely oval, as opposed to the oblong to linear, oblique sori of *P. persicariaefolium*.

Pteris Killipii Maxon, sp. nov.

§ *Litobrochia.* Folia 1.5 m. plus minus longa, stipitibus bicoloribus hirtellis laminas multo superantibus; laminae subdeltoideae pinnato-pinnatifidae, pinnis paucijugis sessilibus oblique patentibus, infimis bipartitis, harum partibus duobus et pinnis ceteris lineari-lanceolatis attenuatis; segmenta oblonga apice rotundata, ala costali latissime conjuncta; venae prominulae, basales biarcuatae, ceterae in areolas 2–3 seriatas breves inter costas costulasque et marginem anastomosantes; sori lineares e sinubus fere ad apicem egredientes, indusio angusto manifeste antrorse hirsuto; costae costulaeque pilis septatis copiose vestitae; parenchyma membranaceo-herbacea, supra strigillosa, subtus villosula.

§ *Litobrochia.* Rhizome ascending; scales linear-attenuate, 4–5 mm. long, castaneous, lustrous, denticulate-subfibrillose. Fronds erect, 1.35–1.8 meters long; stipes nearly twice as long as blades, 3–4 mm. thick at subterete castaneous base, rounded and castaneous on dorsal face throughout, sulcate and tawny-olive ventrally, hirtellous; blades subdeltoid, 50–65 cm. long, 50 cm. broad, pinnate-pinnatifid; pinnae 4 pairs (and a terminal one), opposite, inserted 6–10 cm. apart, mostly sessile (uppermost semiadnate but not decurrent), the basal ones bipartite, 30–35 cm. long, the others simple, 20–30 cm. long, 3.5–5.5 cm. broad, narrowly lance-linear, attenuate at apex, oblique-spreading; segments 35–40 pairs, close, subhorizontal, subfalcate, oblong, slightly narrowed toward the rounded apex, mostly 1–2 cm. long, 7–9 mm. broad at sinus, broadly joined (costal wing 4–5 mm. broad on each side), the upper ones gradually smaller, finally joined to the long-acuminate entire apex (2–3 cm. long); rachis similar to stipe; costae terete beneath and villous-hirsute, densely so above; costules elevated and laxly hirsute on both sides, especially beneath; veins elevated, thick, invariably forming 2 unequal costal arcs between a pair of costules and anastomosing in 2–3 series of pentagonal or hexagonal areoles; leaf tissue light to yellowish green, nearly concolorous, membrano-herbaceous, copiously villosulous beneath, freely but weakly strigillose above; margins lightly cartilaginous, strongly ciliate-hirsute where fertile, the stiff introrse

hairs exceeding the indusium; sori linear, mostly extending from base of sinus nearly to apex, the indusium about 0.3 mm. broad, membranous, entire, hirsute and sparsely ciliate.

Type in the U. S. National Herbarium, no. 1359262, collected at Schunke Hacienda, above San Ramón, Dept. Junín, Peru, alt. 1400–1700 meters, in dense forest, June 8, 1929, by E. P. Killip and A. C. Smith (no. 24697). Two other numbers, also from the Department of Junín, were collected "east of Quimirí Bridge, near La Merced, alt. 800–1300 meters, in dense forest," June 1–3, 1929, by Killip and Smith (nos. 23919, 23962), and there is in the Kew Herbarium an excellent unidentified specimen collected in August, 1856, by Spruce (no. 4063) "in monte Guayrapurima, prope Tarapoto." These are all in close agreement.

The present species belongs to the small group typified by *P. sericea* Fée and need be compared only with *P. Buchtienii* Rosenst., founded on material from Bolivia (*Buchtien* 1068), of which two small teratological fronds are at hand from Dr. Buchtien and a small partially fertile pinna of the actual type from Dr. Rosenstock. Differences are noted in the unicolorous stipes, decurrent upper pinnae, rigidly subcoriaceous leaf tissue, acutish or even pungent segments, and 3–5 costal (intercostular) areoles of *P. Buchtienii*, but these may not all be found to prevail in normal material.

WASHINGTON, D. C.

Fern Field Notes, 1933

EDGAR T. WHERRY[1]

ASPLENIUM MONTANUM.—As its species name implies, this Spleenwort is best developed in the mountains (of the eastern United States), but it occasionally descends to fairly low altitudes. Thus, it has long been known to occur on a cliff rising from the Potomac River 2½ miles east of Deanwood, Fairfax County, Virginia (recorded in the Flora of the District of Columbia and Vicinity as "above Great Falls"). The contour lines on the Seneca quadrangle of the U. S. Geological Survey indicate this to lie 175 feet above sea-level. In August, 1932, it was discovered by a young amateur botanist, Arlton Murray, still nearer to the District of Columbia, namely on a cliff along Northwest Branch, 1½ miles north of Burnt Mills, in Montgomery County, Maryland. This lies so much nearer the Fall Line that it might have been expected to be even lower in altitude; the stream has, however, a rather steep gradient, and a visit to the locality in company with Dr. William R. Maxon and Mr. J. E. Benedict, Jr., on February 22, 1933, enabled it to be located on the topographic map, which showed it to be 250 feet above sea-level. The colony is a very small one, only 7 or 8 plants being in evidence on the rock. The occurrence is worth placing on record, however, both as representing a range-extension of the species into a new county, and as illustrating the remarkable fact that even in a region supposedly well explored there are still discoveries in plant geography to be made.

On July 31, 1933, this fern was collected on slate cliffs along the James River at both ends of the bridge running from Bremo, Fluvanna County, to New Canton, Buck-

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

ingham County, Virginia. The Palmyra topographic sheet shows these colonies also to have an elevation of 250 feet. The record for the growth of the species at low altitudes is thus still held by the stations along the Susquehanna River in the southern parts of York and Lancaster Counties, Pennsylvania, several of which lie little more than 100 feet above mean sea-level.

ASPLENIUM BRADLEYI.—This rare species has apparently been recorded but twice in West Virginia, on Muddy Creek Mountain in Greenbrier County, near the southern boundary of the state (Fred W. Gray), and near Fayetteville, Fayette County (Maurice Brooks). It has now turned up considerably further north, on the southwest-facing cliffs of New Creek Mountain, 2 miles southwest of Corners P. O., in Grant County.

ASPLENIUM RESILIENS.—For many years the northernmost known occurrence of the Black-stem Spleenwort has been in the vicinity of Front Royal, Warren County, Virginia, latitude 38° 55′. In 1930, however, its range was extended to latitude 39° 10′ by its discovery along the North Fork of Patterson Creek, in Grant County, West Virginia (Natalie B. Kimber and Mary F. Wright, specimen in herbarium Academy Natural Sciences Philadelphia.) On July 23, 1933, J. E. Benedict, Jr., and I decided to make an effort to find it still further north, and selected Jefferson County, West Virginia, as a promising region, in view of the extensive outcrops of limestone rock occurring there. At Bloomery, 3 miles southeast of Charles Town, a new bridge has been constructed across the Shenandoah River, and from this bridge limestone cliffs were seen to extend southward along the east bank of the river. At first only the commoner spleenworts could be found there, but we finally came upon one especially moist, sheltered crevice, supporting 6 or 8 plants of the desired species, thus extending its known range north to latitude 39° 15′.

This record was able to stand, however, for but a few weeks. On August 8, 1933, Mr. Walter S. Lapp and I visited a cliff on the north bank of the South Branch of the Potomac River at Grace, two miles southwest of Springfield, Hampshire County, West Virginia. This cliff is interesting in that the upper part is of a fossiliferous sandstone, the soils in crevices tending to become acid there, while the lower part is limestone, and the soils correspondingly circumneutral throughout. *Polypodium virginianum* and *Selaginella rupestris* proved to be limited to the more acid situations, and *Cheilanthes lanosa* to be best developed there. *Pellaea atropurpurea* and *Asplenium cryptolepis* (*ruta-muraria* of old) grew only, and *Woodsia obtusa* and *Asplenium platyneuron* most frequently, in the more limy substrata. In sheltered places at the lower levels a few small plants of *Asplenium trichomanes* were seen. Fortunately, just before leaving, inspection was made of a crevice near the base, where the limestone had weathered back to a depth of about 25 cm. for several meters along the stratum, and this proved to hold in its inner recesses several plants of unmistakable *Asplenium resiliens*. Latitude 39° 25′ thus becomes its present known northern limit.

THELYPTERIS SIMULATA.—While the books give Massachusetts Fern as the common name of this species, that name is apparently without significance in connection with it, and the suggestion is here made that it be called Bog Fern, because it is about as characteristic of sphagnum bogs as its relative, the Marsh Fern, is of marshes. The Bog Fern is very rare southward, and so far as I know the only published records for Maryland have referred to Coastal Plain occurrences. It was therefore interesting to find it, on August 4, in a boggy woods south of the National Highway 3 miles east of Grantsville, Garrett County, at an altitude of 2,575 feet.

OPHIOGLOSSUM ENGELMANNI.—The record of the finding of the Limestone Adders-tongue in Frederick County, Virginia, by Mr. Hunnewell in a recent number of this JOURNAL brings the number of counties of this state in which it is thus far known to five. A sixth may now be added: it was collected on July 26 by J. E. Benedict, Jr., and the writer one mile west of Harrisonburg, Rockingham County. Though not representing a new county, the following report may also be of interest. About 2 miles northeast of Staunton, U. S. Highway No. 11 forks, the left-hand branch avoiding traffic by entering only the outskirts of the town. Southwest from the filling station in the fork there extends a long series of limestone ledges with clayey depressions between, and here this fern is probably as abundant and accessible as anywhere in the northeastern part of its range. It grows in dense clay, mingled with the usual weeds of pastured land, and can best be found after a rainy spell.

WOODSIA IN NORTH CAROLINA.—The manuals give the range of *Woodsia ilvensis* as extending into this state, but no specimens appear to be preserved in any herbarium, so that this report must be considered as lacking adequate foundation. On the other hand, *Woodsia scopulina* (or its southeastern representative) is unquestionably represented by a specimen in the New York Botanical Garden. This had been collected by the late J. A. Ferriss, supposedly on a cliff in the Craggy Mountains, in Buncombe County. Mr. William A. Knight, Mr. J. E. Benedict, Jr., and I recently spent a day in that region, exploring a number of cliffs, but were unable to find any trace of it. As its reported occurrence on White Oak Mountain in Polk County has also never been rediscovered, the presence of any species other than *W. obtusa* in North Carolina remains doubtful.

PHILADELPHIA, PA.

Ferns of the Mammoth Cave National Park Region

WM. BARTON YOUMANS

During the summer and fall of 1932 a study was undertaken of the ferns of the Mammoth Cave National Park region with the purpose of throwing some light on the question of the importance of certain factors which enter into the habitats of ferns, especially soil reaction, moisture, and temperature. The topography and geology of the region make it especially suited to the growth of a number of species, since it has a variety of calcareous and siliceous soils, plateaus, wooded slopes, valleys, cliffs, ravines, ponds, streams, sinks and caves.

Occasional observations have been made of the ferns of this region for at least sixty years. In 1878 the book by John Williamson on "Ferns of Kentucky" was published. This book, which has the distinction of being one of the first important works on ferns published in the United States, includes descriptions, original drawings, and some recorded habitats for all of the species found in the state previous to that date. About thirty-eight or forty species are discussed in it which were considered indigenous to the state. Among those who supplied Williamson with information concerning the localities where certain species were to be found was Professor John Hussey, of Purdue University, who was appointed botanical assistant in 1874 of a party sent by the Kentucky Geological Survey into the district of Edmonson. Butler, and Grayson Counties. Hussey was interested primarily in the timber but was continually on the watch for a new or rare species of fern. Several of his vivid descriptions of the habitats of rare species which he observed in the Mammoth Cave region or in other parts of Edmonson and adjacent counties are quoted in Williamson's book.

A more recent contributor to the literature on Kentucky ferns was Sadie F. Price, of Bowling Green, in Warren County, which is adjacent to Edmonson. Her "Flora of Warren County, Kentucky," includes a list of twenty-seven species of ferns. Miss Price also made occasional excursions into Edmonson County and the Mammoth Cave region in search of rare species of ferns which had been mentioned by Hussey. In her "Contributions toward the Fern Flora of Kentucky," she lists, with one exception, the same species described by Williamson.

The following species were found in the region. The nomenclature used is that of Britton and Brown, ed. 2.

1. ADIANTUM PEDATUM. Maiden-hair Fern. Best growth on medium-wooded slopes. Not found in any of the numerous sinks and rarely in the damp cool ravines.

2. ASPLENIUM PYCNOCARPON. Narrow-leaved Spleenwort. Restricted to the bottoms of sinks, bases of cliffs, and well-shaded ravines.

3. ASPLENIUM PLATYNEURON. Ebony Spleenwort. Found chiefly on the white soil of the sandstone plateaus, frequently in dry, open places. Not found in the sinks and ravines.

4. ATHYRIUM FILIX-FOEMINA. Lady-fern. Confined almost entirely to sandstone cliffs.

5. ATHYRIUM THELYPTEROIDES. Silvery Spleenwort. About five plants observed. Either at the bottom of sinks or in damp ravines.

6. DRYOPTERIS GOLDIANA. Goldie's Fern. Found only at the bottoms of three sinks.

7. DRYOPTERIS MARGINALIS. Evergreen Wood-fern. Especially numerous on north hillsides or in sinks.

8. DRYOPTERIS HEXAGONOPTERA. Broad Beech-fern. On medium-wooded slopes where the undergrowth was sparse.

9. DRYOPTERIS INTERMEDIA. American Shield-fern. Found only at the bases of sandstone cliffs.

10. FILIX BULBIFERA. Bulblet Cystopteris. The most common species at the bottom of Cedar Sink. Only one or two plants were found at other points in the region. Always on limestone.

11. FILIX FRAGILIS. Brittle Fern. Large clumps found at the bottom of one sink. The temperature at the bottom of this sink was 26 degrees F. lower than at the top of the ridge.

12. ONOCLEA SENSIBILIS. Sensitive Fern. Found only along Green River shortly above the average water level. Fronds gave evidence of having been submerged.

13. OSMUNDA CLAYTONIANA. Clayton's Fern. Not definitely identified since no fertile fronds were present. At base of a cliff. Only one plant observed.

14. PELLAEA ATROPURPUREA. Purple-stemmed Cliff-brake. Found on the limestone cliffs surrounding Cedar Sink. Only one or two specimens at other points in the region.

15. POLYPODIUM POLYPODIOIDES. Gray- or Tree-Polypody. Found on the branch of a sycamore tree on the bank of Green River. About twenty-five feet above the average water level.

16. POLYPODIUM VULGARE. Common Polypody. Chiefly on moss-covered sandstone rocks.

17. POLYSTICHUM ACROSTICHOIDES. Christmas-fern. Most common fern on all of the wooded slopes. Superseded by other species in the more specialized habitats.

18. PTERIDIUM AQUILINUM. Bracken. On siliceous soils along the edges of ridges.

19. TRICHOMANES BOSCHIANUM. Filmy-fern. Bristle-fern. Found on the roof of a typical "rock-house" formation where it was protected from the sun and received an unfailing supply of moisture.

20. WOODSIA SCOPULINA. Rocky Mountain Woodsia. Shortly after this species was identified as the above it was noticed in a recent issue of the AMER. FERN JOUR. (Vol. 23, No. 1, pp. 27–28) that a specimen found in Unicoi County in Tennessee had just been identified as *Woodsia scopulina*. It was stated that this extends the recorded range for the fern. Apparently, this species has not been reported as far south in non-mountainous areas as this locality where it is found in the Mammoth Cave region.

21. WOODSIA OBTUSA. Blunt-lobed Woodsia. Found at the east end of Indian Hill.

Miss Price listed seven species for Warren County which were not found in the Mammoth Cave region during this survey. Since the physical features of the two counties are somewhat similar it may be presumed that some of these species may also be found in Edmonson County and, more specifically, in the Mammoth Cave region. The species are, as she listed them, *Cheilanthes vestita*, *Asplenium pinnatifidum*, *Asplenium Trichomanes*, *Camptosorus rhizophyllus*, *Aspidium Thelypteris*, *Asplenium Bradleyi*, and *Osmunda cinnamomea*. Three of these, *Asplenium Bradleyi*, *Asplenium Trichomanes*, and *Cheilanthes vestita*, were found in Edmonson County by Prof. Hussey, but only the location which he gives for *Asplenium Trichomanes* is within the boundaries of the National Park region.

The Fern Exhibit at "A Century of Progress"

Kathryn E. Boydston

The exhibit came about in rather an unexpected way. At the Chicago Flower Show in April, I had been chairman of the exhibit for the Glen Ellyn Garden Clubs—a reproduction of a bit of our Bird Sanctuary during or immediately following a sleet storm. Due to the unusual and quite realistic result it attracted a surprising amount of attention, and Mr. Servas wished it repeated on a larger scale at the Horticultural Building. After several weeks of considering the difficulties and possibilities, it was finally decided that this was impractical, as the material used for the "ice" did not stay in good condition more than a week or two. In the meantime, I had suggested to Mr. Servas that a collection of ferns might be interesting, and it was finally decided to substitute ferns for ice, the exchange being much more fun for me, though perhaps not so attractive to the average visitor.

I wrote Dr. Maxon to ask his opinion. His prompt reply was so cordial and enthusiastic that I decided in spite of the rather limited expense money allowed by the management and the *very* limited amount of time, I would swallow my fears and plunge in.

It was then well past May first, and the Fair was to open June 1st. There followed a frantic amount of correspondence with dealers and fern enthusiasts, friends and strangers alike. The response was most gratifying. In almost every case the reply contained not only the information I had asked but also several names of people to whom I might write for other species. Six months would have been a better amount of time for this endless chain of letters.

The space allotted was a diorama about 25 x 20 feet in an excellent location in the Main Hall. The general plan was this: To provide a cliff for the rock ferns, a swamp for the marsh ferns, and a hill for the wood ferns. The rock used for the cliff was southern Wisconsin limestone (more than seven tons of it!). Interest *and work* was concentrated on a "dripping ledge" about five feet wide and four feet high. After several attempts, six large rocks beautifully stratified, were fitted together to look very much like one sheer little cliff. The day Mr. Boydston and I started to the Horticultural Building to work on that part of the cliff, we decided that our memory of a beautiful dripping ledge near Starved Rock had been somewhat blurred by the three year interval since we had seen it, so we traveled one hundred miles to spend fifteen minutes looking at it! After this detour of a mere 200 miles, we felt it almost wrong to try to duplicate anything so beautiful and perfect, but we did have a better idea of what we wanted. And it is a good thing, for no one else working with us or looking on could imagine what we were striving for. There were all sorts and degrees of waterfalls, brooks, lakes, and pools in other exhibits, but no dripping ledge. Across the top of the ledge near the front, we put a pipe with tiny perforations at one inch intervals. Until later covered with moss and Cystopteris, this pipe was much in evidence and caused a good deal of conjecture. The water dripped through the moss and over the rocks in a very realistic way, falling into a little irregular-shaped shallow pool at the base of the ledge. The overflow was piped to the bottom of a cement-lined "swamp" which was adjacent to the pool and curved around behind the hill. From the coarse gravel a foot deep at the bottom of the swamp the water seeped up to keep the roots of the marsh ferns continually damp. A cement wall di-

vided the swamp in two parts so that one half could be an acid soil bed for the Royal Ferns (*Osmunda regalis*), Cinnamon Ferns (*Osmunda cinnamomea*) and others requiring acid soils, and the other half prepared for the ferns preferring circumneutral soils. Of course a cement wall could not be used for the acid swamp in a permanent location, but in our case we thought the ill effects of the cement could not be worse than the lime in the Chicago water which would be used all summer—and in any case, seepage of water had to be kept from the Italian restaurant immediately behind our blue sky!

Sometime about the middle of May the opening date of the Fair was advanced one week. This necessitated another letter to every one who had promised to send ferns, and doubled the difficulties of every exhibitor working in the unfinished building. But with the aid of four men and a block and tackle, the "mountain" finally took shape, the plumbing was made to work, and planting began. Because of the many differing parts of the country from which the ferns came, and because of the small space in which they would be planted, it seemed impossible to include the shrubs, vines and flowers which would in nature be found with the ferns and which would have made it more of a "scene." Except for a few tree trunks and bushes, the planting was exclusively ferns.

The thrill of arriving boxes of ferns, many of which I had not seen before, will not soon be forgotten, though I confess to a few qualms at the great number which arrived merely roots. Others kept growing in the cramped quarters of their boxes and developed fantastic shaped fronds. But Mr. Toole had taken the great trouble to force a great many into premature leaf, so although these did not last, they helped greatly to make a green showing at first. It was disconcerting too to see

a whole dozen expensive rock ferns go into one small rock crevice and look like nothing. Just as we were finding that our supply of ferns for the hillside (though in the hundreds) was going to be quite inadequate for a good showing, one of the painters working in the building came along at the crucial time and told us he could say the magic word which would let us dig some very large ferns in an otherwise forbidden spot near South Chicago. So, alternating between hope and despair, excitement and discouragement, we worked through two days and nights planting and labeling, and could scarcely believe it possible that the contents of so many boxes and boxes could have gone into that comparatively small space and leave so much room to spare. Another last minute trip to the privately owned farm near Starved Rock gave us a car full of Maidenhair, Marginal and Interrupted ferns, and plenty of the luscious moss and fresh cool Cystopteris to transform our ledge and the margins of the pool below into a thing of real beauty. The general and usual comment of the visitors those first hot days as they paused beside the dripping water was "how refreshing," or "how lovely and cool." A few of course, looked beyond to enjoy the rarer species hidden here and there, which had been sent by many of the kind and friendly members of the American Fern Society.

In the meantime I had asked Dr. Maxon and the members of the committee appointed to cooperate, Dr. Standley, Dr. Benedict and Dr. Wherry, to contribute short articles for a pamphlet on Ferns to be sold at the exhibit, and *intended* to help pay expenses. Every one of these men responded most helpfully, and I feel strongly that the material they sent has made the booklet by far the most valuable part of the enterprise. However, we as "fern fans" will have to admit that ferns are a very

specialized interest, and the book has not had the distribution it deserves. Unexpected circumstances made it impossible for me to spend time there, and the sale of the book did not warrant some one being there all of the time. A young man was at the exhibit during the busy hours of the good days, and other times there was a small sign in evidence listing the contents and the contributors and stating that books could be obtained at the Information Desk which happened to be very close by.

It will not be surprising to members of the American Fern Society that those who were interested were very greatly interested. A great many letters have been received.

However, there are between five and six hundred booklets left which must be disposed of in order to come even on remaining expenses. If every member of the Society would send for from two to four, as several did following the brief announcement in the June Fern Journal, all bills could be paid and the books would be in the hands of interested people rather than on my closet shelf.

During the summer, some replacements were made at different times. But contrary to the hope held out by several people, the ferns which disappear early out of doors also withered in the building. A good many large Marginal ferns were brought in, and saved the day as to appearance, though of course the list could no longer be studied and all species found.

In spite of a few disappointments (due mostly to promises of the management not kept), the contacts made and the pleasure of seeing so many species long read about but not known have more than repaid me for the work. The friendly cooperation of the Society members and their prompt help was one of the pleasantest experiences I have ever had.

I should like nothing better than to do the same thing

again sometime under more favorable cirmumstances, with some more expense money and a lot more time for preparation. If it has spread some fern interest and found some new members for the Society, I feel it has been worth while.

559 CLINTON PLACE, RIVER FOREST, ILLINOIS

Shorter Notes

SCOTT'S SPLEENWORT IN DUTCHESS COUNTY, NEW YORK.—As all botanists collecting afield can testify, anticipation of the unexpected is a compelling motive. This did not start as a fern foray. It began on the morning of September 22nd as a hunt for goldenrods and several other species reported by Hoysradt from near Pine Plains, northern Dutchess county. Mr. Rogers McVaugh, of Kinderhook, N. Y., had volunteered to guide me to a locality in Columbia County where he had found *Solidago rigida*, and on the same trip we decided to look for *Solidago speciosa* and certain other species, rare for this region, which Hoysradt had reported from Riesdorf hill near Pine Plains. But where was Riesdorf hill? Along with several other local names in Hoysradt's list, it was not to be found on any map. The garage man at Pine Plains referred us to his father, the postmaster and a long time resident of the region.

At the post office the bench full of elderly residents on the benches along the front walk proclaimed the fact that the morning mail was in the process of being distributed so to fill in the time we explored the near-by base of Stissing Mountain, finding *Polypodium virginianum*, *Dryopteris marginalis*, *Adiantum pedatum*, *Cystopteris fragilis* and *C. bulbifera*, *Woodsia ilvensis* and *W. obtusa*, *Pteridium latiusculum*, *Dryopteris noveboracensis*, *Dennstaedtia punctilobula*, *Pteretis nodulosa* and *Polystichum acrostichoides*, as well as several

ASPLENIUM EBENOIDES R. R. SCOTT, FROM RIESDORF HILL NEAR PINE PLAINS, DUTCHESS COUNTY, NEW YORK; SEPT. 22, 1933.
PHOTO BY E. J. STEIN.

interesting flowering plants. Returning to the post-office we were guided to a place about a mile distant where once had lived a family named Riesdorf. The hill adjacent to the highway was small compared with some of the surrounding hills but we decided to have a closer look at it.

The appearance of large patches of *Camptosorus rhizophyllus* awakened anew our interest in the ferns of the region and soon on the small ledges near the top of the wooded summit Mr. McVaugh located fine clumps of *Pellaëa atropurpurea* and *Asplenium Trichomanes.* This was followed by the finding of numerous plants of *Asplenium Ruta-muraria* and almost immediately Mr. McVaugh asked if I might be interested in seeing Scott's Spleenwort (*Asplenium ebenoides* R. R. Scott). Needless to say I was soon beside him and we were gazing at a single plant of this rare fern hybrid. Above it and less than four feet away were patches of Camptosorus and close beside it two or three plants of *Asplenium platyneuron.*

A few additional ferns, all common in this region, were noted on this hill, *Dryopteris spinulosa, Athyrium angustum,* and in wet places below the hill *Dryopteris Thelypteris. Dryopteris marginalis* occurs in all of these rocky woods in the greatest abundance. Later on we found the two species of goldenrod and several other rare flowering plants which we had originally set out for, but they were submerged in the pleasure of the one rare fern find.—H. D. HOUSE, *New York State Museum, Albany, N. Y.*

A SECOND STATION FOR LYGODIUM PALMATUM IN NEW HAMPSHIRE.—For several years I have heard rather vague rumors of the presence of the Climbing Fern in the southern part of Rockingham County, New Hamp-

shire, but have been unable to obtain any very definite directions as to where the station was located. On October 7, 1933, Mr. C. A. Weatherby and I started in search of the plant. In Haverhill, Massachusetts, we called on Mrs. D. C. Hunt and were pleased to find that she had visited the station only two weeks before. Following her directions we found, after searching a small patch of woods for more than two hours, a few plants growing in South Hampton, New Hampshire.

The station apparently consists of only about a dozen plants and these are very small, the largest found being only about six inches long and the majority consisting of only two frondlets. In the past the fern was much more abundant, but the addition of gravel to fill in a wood road, the piles of brush along the sides of the road, and the growing up of the woods itself have resulted in almost exterminating the Lygodium.

The Powow River flows through a broad, rather low sand plain extending through Newton, East Kingston, and South Hampton, which is an ideal habitat for the fern. Further botanizing in clearings along this river may well bring to light new stations in this region.

A survey of the collections of the Gray Herbarium and the New England Botanical Club and a review of the literature reveals that this is the second station for Lygodium in New Hampshire and the first for the eastern portion of the state. It has been recorded from Winchester, in the southwestern part of the state by R. H. Metcalf in the *Fern Bulletin* for April, 1902. The nearest station to South Hampton is in Saugus, Massachusetts, about thirty miles distant; this station is now probably extinct but specimens have been placed in the Gray Herbarium. Mr. E. H. Clarkson in the AMERICAN FERN JOURNAL for July–September, 1929, reported the fern as growing in the vicinity of Newburyport, Massa-

chusetts. Mr. Clarkson informs me that he was referring to the South Hampton station. The same is true of the reference in Miss Mira Bartlett's list of the ferns of Haverhill, Massachusetts, which was published as a Bulletin of the Haverhill Public Library in 1924.—STUART K. HARRIS, *Boston University.*

American Fern Society

A meeting of the American Fern Society was held in connection with the annual gathering of the American Association for the Advancement of Science in Boston and Cambridge during the Christmas holidays. The meeting was held in a room of the Mallinckrodt Chemical Laboratory in Cambridge at 2 p. m., Friday, Dec. 29th, and was well attended in spite of the unprecedentedly severe weather which undoubtedly cut down to some extent the attendance at all of the Science meetings.

In the absence of the president, the meeting was called to order by Mr. C. H. Knowlton with a brief address of welcome and timely remarks on fern interests and fern growths, especially in New England.

An exhibition of New England ferns carefully selected and mounted by Mr. James J. Quinn, of Winchester, Mass., which was on display, attracted a good deal of interest and comment.

The following papers were presented on the programme prepared by the local committee:

Mr. Ernest J. Palmer spoke on Ferns of the Ozark region, giving a brief account of the location, topography and geology of the region, in which it was stated a number of northeastern ferns reach the western limit of their range and are met by a smaller percentage of western species, such as the Lip Ferns and Cloak Fern. The discovery of *Woodsia scopulina* on Magazine Moun-

tain in west-central Arkansas, and more than five hundred miles from any other known station, was particularly mentioned. The paper was illustrated with lantern slides showing a map of the region and its subdivisions, some of the typical habitats of Ozark ferns and examples of fern growth.

Mr. Quinn, who was to have spoken on hunting ferns in New England, was unable to attend on account of sickness in his family, but his beautiful collection of herbarium specimens, mentioned above, was a welcome contribution.

Mr. L. R. Wilson, who has been engaged in a study of spore characters in Lycopodium, and who was on the programme for a paper on this subject, was also unable to be present, but his carefully prepared slides showing clear distinctions in the spores of different species of this genus, were shown and explained by Professor N. C. Fassett, under whose directions the investigation has been carried on, and the evidence was so convincing as to leave no doubt as to the value of this method of approach to the study of this group of fernworts.

Some extremely interesting unusual forms of Equisetum were exhibited and discussed by Professor John H. Schaffner. The specimens showed examples of spiral, flexuous and dichotomous shoots, proliferated cones and other sporadic forms, the physiological and historical significance of which in the development of the group were considered.

Dr. Wherry, under the title Recent Fern Finds in the Appalachian region, showed a series of slides of certain ferns of both northern and southern distribution, with maps on which the marginal colonies as at present known were indicated. He described his experiences in searching out these marginal colonies and in some cases of extending previously known ranges. Northern species

thus discussed included *Woodsia scopulina*, *Woodsia ilvensis*, and *Cryptogramma Stelleri*, and southern ones *Ophioglossum Engelmannii*, *Asplenium resiliens* and *Cheilanthes tomentosa*. Some of the colored slides, including views of *Woodsia scopulina* taken at its newly discovered station near Erwin, Tennessee, and one of *Cryptogramma Stelleri* at its southernmost known locality, near Proctor, Lycoming County, Pennsylvania, were most unusual and beautiful.

The programme was concluded with a series of colored slides and an account of a collecting trip to the Galapagos and Cocos Islands, by Dr. H. K. Svenson. The views of the luxuriant tropical growth of ferns and other plant life along the shores and in the ravines of these islands made a striking contrast to the previously shown illustrations of the North American fern flora. Some slides of a more general nature, showing scenes in the islands and some of its interesting forms of animal life, served to fill in the picture.

Although called on short notice, the meeting proved to be a decided success, judging by the expressions of those in attendance. Besides the interest in the papers and discussions, some of which served to amplify and make more graphic facts and questions that have been treated in the FERN JOURNAL, it is recognized that perhaps the greatest value of such meetings lies in the opportunity they afford the members who are fortunate enough to attend them to make personal contacts and new acquaintances, and the stimulus they impart should result in renewed interest in all the activities of the society.—E. J. PALMER.

"In memory of Eugen Bela Kümmerle."

Under the title above quoted, Eugene Kümmerle's life and activities are attractively set forth in the Hungarian

or Magyar periodical, "Botanikai Közlemenyek" 30: 1933. The account is published in duplicate, in Magyar and in German.

Dr. Kümmerle's activities in botany were largely devoted to ferns, including a number of collecting trips in parts of Southeastern Europe together with reference visits to the larger European herbaria for consultation. While his work was predominantly with Old World species he did give special attention to a number of fern problems relating to American ferns. As an indication of the breadth and scope of his earlier studies may be noted the fact that he had undertaken a synopsis of the ferns of the whole earth, a task which was rendered unnecessary by the appearance of the "Index Filicum" by our honored member, Carl Christensen. Dr. Kümmerle, however, continued work on an index of the fern allies, the one group of vascular plants now without that convenience. Unfortunately, it was not yet ready for publication at the time of his death; it is greatly to be hoped that some one may finish and publish it.

BOOKS PURCHASED FOR THE LIBRARY

From Henry George Fiedler, 89 Chambers St., New York City—Mar. 2, 1933

Clute. W. N. The Fern-Collector's Guide. N. Y., Stokes, 1901–2.

Pratt, Anne. Ferns of Great Britain and their Allies. Lond. Fred. Warne & Co. n. d.

Schaffner, J. H. The Pteridophytes of Ohio. (Ohio State Acad. of Sc., Proceedings. . . . Spec. Paper No. 16, 1910).

Smith, John. Historia Filicum; an exposition of the nature, number, and organography of ferns. Lond. Macmillan, 1875.

From the Gray Herbarium—Mar. 2, 1933.

Catalogue of the "Davenport Herbarium" of North

American Ferns. Mass. Horticultural Society, Boston, Mass. 1879.

INFORMAL AMERICAN FERN SOCIETY TRIPS.—On July 3 to 5, 1933, an informal field meeting was held at Woodstock, Vermont. Through the kindness of Miss Billings we were able to visit the remarkable fern localities on Mt. Tom. Members of the Society in attendance were Miss Elsie M. Kittredge (guide), Mr. Arthur N. Leeds, Mr. and Mrs. C. A. Weatherby, and the writer. *Botrychium minganense* was seen and photographed. Other notable species seen here and elsewhere in the vicinity were *Botrychium simplex* in a large series of forms. *Dryopteris Filix-mas* and hybrids of it with *D. marginalis*, and *Woodsia alpina*.

On September 9th to 11th a similar visit was made to Williamsport, Pennsylvania, the region where several northern ferns reach their southern limits. Members participating were Mr. Arthur N. Leeds, Dr. Everett G. Logue (guide), Miss Ruth Sener, Mrs. C. Y. Tanger, and the writer. The southernmost known station for *Cryptogramma stelleri* at Proctor, Lycoming County, Pa., was photographed. The famous station for *Polystichum braunii* var. *purshii* in Ganoga Glen, Luzerne County, was also visited; although this is not quite the limiting occurrence of the species, it is one that is likely to survive, for the area is now a wild life preserve, and wardens are employed to see that the plants are not destroyed.—EDGAR T. WHERRY, *Philadelphia, Pa.*

REPORT OF JUDGE OF ELECTIONS

"Philippi, W. Va.
December 22, 1933

"Seventy-seven (77) ballots have been returned. Three were unmarked. The tabulation is as follows:

For *President:*

Dr. Edgar T. Wherry	73
Paul Standley	1

For *Vice-President:*
Mrs. Carlotta C. Hall 74
For *Secretary:*
Mrs. Elsie G. Whitney 73
For *Treasurer:*
H. K. Svenson 73

I hereby declare the regular ballot elected—Dr. Wherry, Pres., Mrs. Hall, Vice-Pres., Mrs. Whitney, Sec'y., and Dr. Svenson, Treas.

(Signed) FRED W. GRAY,
Judge of Elections.''

I hereby certify that the above is a faithful and correct copy of the report of the Judge of Elections and that therefore the persons named have been duly elected to their several offices.

Attest: CHARLES S. LEWIS,
Secretary.

Albany, N. Y., December 26, 1933.

Can any members of the Fern Society help Prof. H. L. Blomquist, of Duke University, in his study of North Carolina pteridophytes? He would be much interested to receive reports regarding collections of any North Carolina ferns, especially, of course, the less common types. His address is Department of Botany, Duke University, Durham, North Carolina.—R. C. BENEDICT.

Prof. Dr. Georges Poirault, Villa Thuret, Cap Antibes, Alpes Maritimes, France, wishes to obtain spores of the following American species of ferns. Any members of the Society who can supply him will be aiding an interesting project in the growing of ferns.

Pellaea atropurpurea
" *gracilis*
" *densa*
Woodsia ilvensis
" *glabella*
Polystichum acrostichoides
Dryopteris noveboracensis
" *simulata*
" *marginalis*
" *Boottii*
Asplenium montanum
Asplenium pinnatifidum
" *ebenoides*
Athyrium thelypteroides
Asplenium angustifolium
Dryopteris hexagonoptera
Woodwardia virginica
" *angustifolia*
Dicksonia pilosiuscula
Onoclea sensibilis
Camptosorus rhizophyllus
Lygodium palmatum
Cryptogramma acrostichoides

New members:

Prof. H. L. Blomquist, Dept. Botany, Duke University, Durham, N. C.
Maurice Brown, North Eastham, Mass.
Miss Bernice L. Carleton, Lisbon, N. H.
Charles Chapman, 533 Virginia St., Keyser, W. Va.
Robert T. Clausen, Dept. Botany, Cornell University, Ithaca, N. Y.
Mrs. Forrest F. Collier, Billerica, Mass.
Mrs. Grace Cole Fleischmann, Seed Laboratory, Corvallis, Oregon.
Oren T. Ford, 2516 6th Ave., Sacramento, Calif.
Homer M. Northrup, 210 East Union Ave., Bound Brook, N. J.
Dr. Mabel H. Otis, 815 Fifth Ave. Building, Moline, Ill.
William A. Slater, Port Authur, Tex.
Oliver W. Storey, 55 Ash St., Madison, Wis.
Lucien B. Taylor, Farm St., Dover, Mass.
Russell West, 115 Edgewood St., Wheeling, W. Va.
J. Elling Zieman, 505 Watchung Road, Bound Brook, N. J.

Changes of address:

Mrs. John J. Bell, to Nyack, N. Y.
Mrs. David C. Boyce, to 102 Lakeview Ave, Cambridge, Mass.
Dr. Philip Dowell, to Glenwood, Fla.
Max A. Elwert, to Red Hook, Dutchess Co., N. Y.
Anna B. Freedley, New Hope, Bucks Co., Pa.
E. H. Hazen, to 212 College St., Middletown, Conn.
Mrs. D. S. Hartline, to 605 East Fourth St., Bloomsburg, Pa.
Charles Hudson, 540 South Lewis St., Lombard, Ill.
Mrs. E. H. James, to 1423 Northwest 22nd Ave., Portland, Oregon.
Elbert L. Little, Jr., Weatherford, Okla., to Box 384, Tahlequah, Okla.
Prof. S. Fred Prince, Notch, Stone Co., Mo.

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ERRATA

Page 43, line 3 from bottom. For *P.*, read *Pellaea.*
" 60, " 25, for spleenworth read spleenwort.
" 61, " 23, for break, read brake; for *Pellea*, read *Pellaea.*
" 99, " 1, for *Dryopteris*, read *Thelypteris*; for C. Chr., read Slosson.