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A QUARTERLY DEVOTED TO FERNS

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American Fern Journal

VOL. 32 JANUARY–MARCH, 1942 NO. 1

Illustrations of Some Lycopodium Gametophytes

ARTHUR J. EAMES

In a recent number of this JOURNAL[1] Hollis Koster described the hitherto unknown gametophytes of some species of *Lycopodium* and discussed briefly the history of our acquaintance with the sexual generation of the club mosses. He suggests that, since these plants are still unknown for many species, and stations for others are few, field botanists might well give attention to them. He believes that the gametophytes are not so rare as the collections would suggest; that systematic search should uncover much more material. With this opinion the writer agrees. Members of the staff of the Department of Botany at Cornell University have been searching for and collecting club moss gametophytes for the past 15 years with marked success. Information obtained by them, with illustrations from their material, together with illustrations of Koster's plants and his published descriptions, should assist others in obtaining these well-hidden plants.

It has long been known that there are two markedly different types of gametophyte in the genus: the green, surface-living, rapidly developing, short-lived, and minute form and the nongreen, subterranean, slowly developing, long-lived, and much larger form.

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[1] **31**: 53–58. 1941.

[Volume 31, No. 4 of the JOURNAL, pages 121–160, was issued December 29, 1941.]

The first type is well described by Koster and is here illustrated in Plate 1, *Lycopodium alopecuroides.* (The drawings were made from material collected by him and sent to Cornell University.) His paper should be referred to for details of description and for a general discussion of habitat and occurrence. It will suffice here to emphasize the fact that the full-grown plant is only 1 to 2 mm. in diameter, merely a green speck on the humus or decaying vegetation of the swamp, and that most careful search is therefore necessary. The plants can be most readily found, of course, when they have borne young sporophytes (Plate 1, fig. c), which, being larger, are more easily seen.

The Cornell group have no acquaintance with this type in the field, because the species possessing this form are absent or very rare in the regions where field studies are readily made. The second type (Plates 2, 3, 4) has been found by them in considerable abundance at a large number of stations chiefly in and near the Cayuga Lake Basin in west-central New York. The following species have been collected: *L. obscurum, L. clavatum, L. complanatum, L. lucidulum,* and *L. annotinum,* the first species most frequently, the last two rarely. Collections of this type in the northeastern states by other botanists are referred to by Koster. None has yet been found for *L. tristachyum,* but this species is rare in the regions searched.

The gametophytes of this second type, being subterranean, are of course to be located only by the finding of the young sporophytes, which remain for some time—in some cases, at least, up to several years—attached to the gametophytes which bear them. As will be seen in Plates 2 to 4, the young sporophytes when first appearing above ground superficially resemble *Polytrichum,* but differences in aspect as well as in details of structure will

quickly be seen. As the sporophyte increases in size, changes of leaf form and arrangement, stem position, branching, etc., indicate the species represented.[2]

Attempts have been made to learn in what habitats to search for these subterranean plants, but the localities found seem to have little in common. It can be said definitely, however, that, as Koster learned for the swamp species with their surface-living gametophytes, it is useless to search where mature and fruiting plants are abundant; the sexual plants have not been found where mature plants are numerous and only rarely are they discovered even near the borders of colonies. Nearly all have been found where no mature plants exist in the neighborhood, and sometimes none can be found in the same woodland areas.

It is evident, therefore, that the searcher should look everywhere except where, at first thought, he thinks the plants will probably be found. The explanation for this peculiarity of distribution lies perhaps largely in the fact that habitat conditions which are suitable for the growth of mature plants are not suitable for spore germination and the development of the delicate gametophyte. The great abundance of spores formed and the lightness of these spores make certain a broad and general distribution, but only where conditions of ground surface are right do the gametophytes develop.

In considering the conditions favorable to growth of these sexual plants it should be remembered that the gametophytes lie at varying depths below the surface of the soil—usually 3 to 10 cm., but ranging from 1 to 20 cm.; that they have been developing there for 10 to 25 years, during which time humus has increased above them. Most individuals are found in the lower parts of

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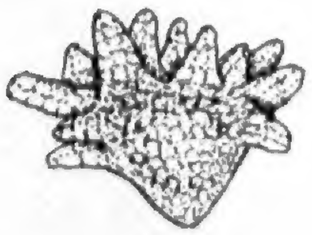
[2] Details of description and consideration of comparative morphology of the gametophytes and young sporophytes of the species listed above will be presented in a later paper.



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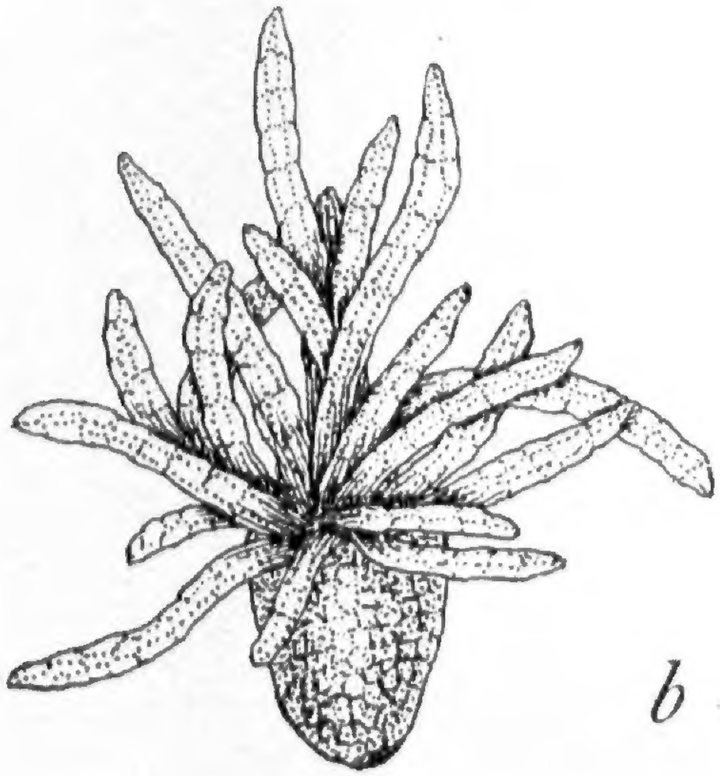

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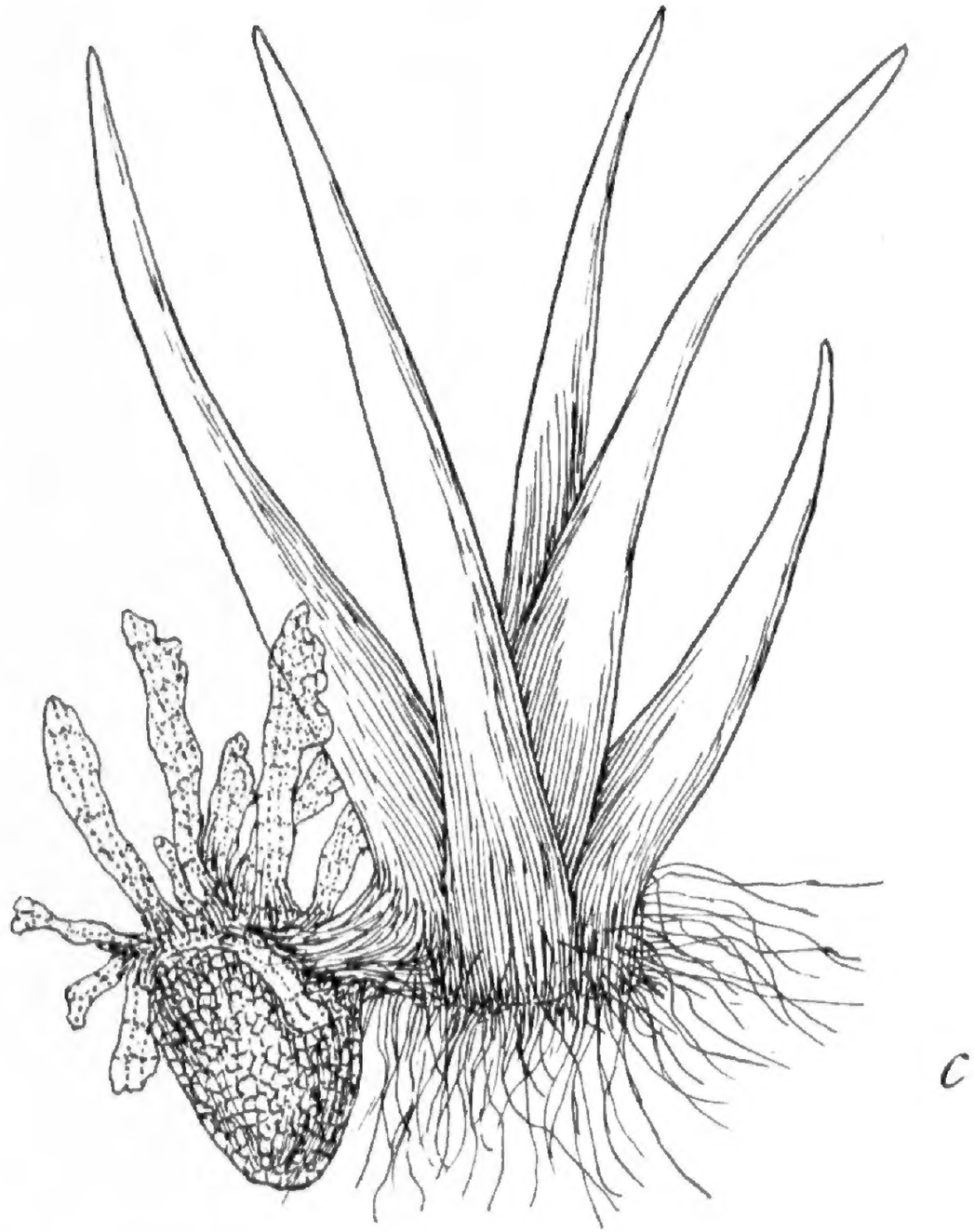

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LYCOPODIUM ALOPECUROIDES

the humus layer, although some have been found 2 or 3 cm. deep in the soil below the humus layer. Where most abundant they occur in small pockets in the forest floor, chiefly on the line between the humus and the soil below. In such areas this line is marked by charcoal from a forest fire. It seems possible that a forest fire, especially one that follows timber-cutting, provides a highly favorable spore-bed and perhaps other favorable conditions.

The spores may reach the level where the gametophytes are found in any number of ways: washing down by rain through the soil crevices; burial by insects or larger animals; any type of disturbance of the soil surface. The fact that so many are found at the base of the humus layer suggests, of course, that the spores are washed down as far as the soil is freely porous. The abundance of gametophytes at this level when a charcoal layer is present suggests also that perhaps the most favorable spore-bed is one where little or no humus is present, that the spores are blown in soon after the fire, and that the gradual building up of humus above the spores as they begin to germinate provides the best growing conditions. This suggestion is supported by the history of development of the plants: The spores do not germinate for 2 or 3 years; a period of 10 to 15 years is required for development of the gametophyte to maturity, time sufficiently long for the accumulation of the humus layer over the plants. In two areas where gametophytes have been found most abundantly the trees and shrubs range in age from 5 to 25 years and obviously had grown after a forest fire following timber-cutting.

The habitats known to the Cornell group are chiefly these: Young upland deciduous forest, apparently cleared in recent years and growing rapidly (for all species of *Lycopodium* listed); white pine forest, dry and usually open (for *L. complanatum* chiefly); open gravelly knolls and abandoned fields with *Hamamelis* and *Rhus*

LYCOPODIUM OBSCURUM

(for *L. complanatum*); low red-maple forest about peat bogs (for *L. obscurum*). These habitats suggest that changes in light, soil type, and temperature as a result of the opening and gradual closing of the forest may directly or indirectly provide favorable growth conditions for these plants. Possibly forest fires make these conditions even more favorable.

Only few out of many apparently perfectly favorable locations will be found to have gametophytes, and some seemingly most unlikely areas may be found to have a few. Doubtless, also, favorable growing seasons must exist for the early stages of development and for later survival. It is, naturally, impossible to determine the age of the gametophytes in a certain area and therefore to ascertain the seasonal conditions at germination time, which may have been 10 to 25 years earlier. Absence of plants from suitable localities may of course be due to absence of spores carried to the region when soil conditions were right; but when these regions are those where fruiting sporophytes are frequent, it is probable that unfavorable growing conditions have exterminated the plants at some period during the years of development. The drought of the summer of 1930 killed great numbers of gametophytes of *L. clavatum* and *L. obscurum* at the first station known in the Cayuga Lake Basin where these plants were abundant; the humus of the forest floor was dry over so long a period that only occasional individuals survived—even the well-established young sporophytes, whether still attached to the gametophytes or living independently, being killed. The dry summer of 1940 destroyed a large part of the plants at the second station known. If such destruction occurs before the sporophytes appear above ground, the existence of a colony of plants can of course never be known.

When one or more young sporophytes have been found, the area should be considered favorable for gametophytes

Lycopodium lucidulum

and the search made intensive, especially for sporophytes just appearing above ground. All sporophytes should be dug carefully from the soil, although usually the gametophyte, if present, is firmly attached and not easily broken off. If several plants occur close together, especially in little hollows or beside rotting stumps or logs, the soil about them should be removed and sifted for gametophytes which as yet have borne no sporophytes. These may be found in varying size and stage of development. It is clear either that germination of spores occurs at different times, perhaps even years apart, or that the growth rate of gametophytes varies greatly, for plants of different sizes and ages can sometimes be found together; the smallest which can be readily found, 2 or 3 mm. in diameter, as yet without sex organs; the oldest up to 1 or 2 cm. in diameter, bearing sporophytes one to several years old. Sex organs are borne years before the gametophyte reaches full size and may continue to be borne for at least a few years after embryos are formed. More than one sporophyte may be borne by a gametophyte in the same year or in different years: two are common; three to five occasional; and even seven well-grown sporophytes have been found on one large gametophyte. This condition is in strong contrast with that in common ferns, where only one embryo is formed and the gametophyte dies soon after the sporophyte is established.

The length of life of the gametophyte after embryo formation varies greatly: It will be found that in favorable habitats nearly all young sporophytes showing above ground are attached to gametophytes; but where soil conditions are poor, or after drought, only a few may have the sexual generation still present. Although the gametophyte apparently does not commonly persist more than two or three years after it bears a sporophyte, a few sporophytes of *L. obscurum* that were at least five years old

Lycopodium complanatum

have been found still attached to healthy gametophytes. These gametophytes were the largest collected and were apparently still growing. Sporophytes that are clearly sporelings should therefore be investigated for possible gametophytes, even if they seem to be so large that the chances of finding sexual plants are small.

The gametophytes of a given locality will continue to form sporophytes over a period of years, limited perhaps to about 10 as a maximum. This distribution of the crop is doubtless partly related to the different rate of development of the gametophytes, and partly to the continued development of sex organs over a period of years, whether embryos are formed or not.

Among the species studied, *L. obscurum* is found most frequently and in most varied habitats. It is apparently the most resistant to unfavorable growing conditions, surviving drought when other species, especially *L. clavatum*, are killed.

In form the gametophytes of the various species differ considerably. In *L. complanatum* the plant is carrot-shaped (Plate 4), with the sex organs in a crown on the larger end. In *L. lucidulum* it is roughly cylindrical (Plate 3), with a "rolled" appearance given by a longitudinal furrow or crease. The sex organs seem always to be borne at one end. The other species (*L. obscurum, L. clavatum, L. annotinum*) have gametophytes which much resemble each other, and probably cannot be distinguished from one another until they reach full size, in some cases not even then unless they have sporophytes that can be named. All of these when very small are club-shaped, but the thicker end soon spreads out, forming a button-like disk which grows at its margin and rolls upward and inward slightly. The sex organs are borne just at the inside of the margin. As the diameter increases, the sides tend to curl upward or downward, the

plant becoming furrowed and saddle-shaped. With continued growth the curling continues and the plant becomes complexly convoluted, somewhat resembling a "walnut meat." Some individuals become lobed and remain nearly flat (Plate 2).

In *L. clavatum* the gametophyte averages smaller than that of either of the other species, and usually does not become convoluted to any extent, remaining disk-shaped. In *L. annotinum* it becomes deeply furrowed; but as it grows larger, it remains simple, retaining the saddle shape, and does not develop lateral convolutions. The sides of the "saddle" spread apart so that the plant has apparent bilateral symmetry and may appear dichotomous.

DEPARTMENT OF BOTANY,
CORNELL UNIVERSITY.

EXPLANATION OF PLATES

PLATE 1. *Lycopodium alopecuroides.* *a*, *b*, young gametophyte; *c*, mature gametophyte with young sporophyte. (×20.)

PLATE 2. *Lycopodium obscurum.* Gametophytes bearing well-grown sporophytes, the oldest beginning to show habit of mature plant. One gametophyte has three sporophytes. (×1.)

PLATE 3. *Lycopodium lucidulum.* Gametophytes and young sporophytes. The specimen at the left is a young sporophyte borne by a gemma, not by a gametophyte; the absence of a primary root and the stouter, less tapering stem distinguish a young plant of this type from one of the same size which has arisen by sexual reproduction—cf. the specimen next to it. (×1.7.)

PLATE 4. *Lycopodium complanatum.* Gametophytes and young sporophytes. The largest sporophyte (specimen at the left) is no longer attached to a gametophyte but shows the knoblike "foot" or haustorial organ by which it was earlier attached. (×1.)

Fragrant Fern about Lake Superior

ALBERT CHANDLER

The Fragrant Fern, *Dryopteris fragrans* var. *remotiuscula,* is rather plentiful from the Iron Range eastward along the north shore of Lake Superior, in a habitat differing from that described for it in the East. There, according to Gray's Manual, it occurs chiefly on limestone cliffs. No limestone cliffs rise north or west of Lake Superior. The characteristic trap rock, though slightly alkaline, is so near to neutral that it bristles with Rusty Woodsia everywhere.

Clute[1] quotes a collector who found the Fragrant Fern "way up on the bare dry face of the cliff"—doubtless true of a New England cliff, which never approaches the aridity of a dry cliff in the West, with its parched breath. The Lake Superior plant shrinks from such sites; it is found close to water, about falls and rocky inland lakes, in river gorges, and where rocky headlands turn one cheek from the weather—always where the night air is damp. Any good collector can get it his first day out, if he looks for Walking Fern; he will find Fragrant Fern instead. Water's statement[2] is nearly accurate for the Fragrant Fern of Minnesota and Ontario: "Although it prefers shaded cliffs, it can adapt itself to sunny situations without suffering much harm," if the western air, we repeat, is mellowed by dews and mists.

Like people, plants are known by the company they keep. The associates of Fragrant Fern about Lake Superior are Bulblet Fern and Polypody. A typical station will wear a broken crown of Rusty Woodsia, with Polypody and Fragrant Fern in a zone below, Bulblet Fern close beneath, and Oak Fern nearby if the crevices

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[1] Our Ferns, 187. 1938.
[2] Ferns, 214. 1903.

are mossy. At the base may be *Dryopteris campyloptera* inland, or *Athyrium angustum* var. *elatius* near the shore, these seldom appearing together. Once only there was *Cryptogramma Stelleri* just around a corner, under conditions so different from its usual haunts in alternate strata of sandstone and limestone that it may be well to record the station, viz., a broken trap-rock shoulder, beside the trail, half a mile up the west side of Cascade River, which gushes into Lake Superior ten miles west of Grand Marais, Cook Co., Minnesota. Here the Fragrant Fern was scattered remotely about the steep slope above, and there was none of the wintergreen and trailing arbutus and *Pyrola* that such retreats harbor on the south shore of Lake Superior.

Along the shore you never see Fragrant Fern on exposed surfaces fronting the big lake. Among inland lakes it may face the water, though veiled somewhat by interposing *Alnus* and *Myrica;* it is quite accessible on the common brown trap-rock, the black slaty shale of Ontario, and a hard gray rock in the Iron Range. Rarely it retreats under an overhanging ledge with Bulblet Fern, quite beyond the scrutiny of the sun. To show the depth of such a pocket I might add that on one occasion, while making a count of the 250 dead fronds of a lush specimen, I heard a rustle and turning my head watched two deer stalk across the little clearing near by, browsing as they went.

For the most part solitary and aloof, the Fragrant Fern is never gregarious about Lake Superior, as its arctic cousins are said by Polunin[3] to be. Four plants make a comparatively large colony. You soon learn where to expect them, and are seldom disappointed. Lighter green than the Polypody, the Fragrant Fern may be recognized at a considerable distance, perched independently on its curled tan cushion.

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[3] Botany of Canadian Eastern Arctic, 32. 1940.

Uses of Hawaiian Ferns

F. R. FOSBERG

The botanical knowledge of the ancient Hawaiians, as with other Polynesians, had reached before the coming of the Europeans a high state of development. Their nomenclature, knowledge of plant relationships, of the sexual nature of plants with the function of pollen and stigma, and their elaborate system of plant uses, both practical and aesthetic, have long been a source of wonder to those who have become interested in the Hawaiians. Certainly the botanical science of this stone age people compared very favorably with that of mediaeval Europeans.

Among the numerous plants for which the Hawaiians had found uses were various ferns, though perhaps their number is small in comparison with the flowering plants and certainly so in proportion to the rich fern flora of the Islands. It is highly probable that there were uses for other ferns, the knowledge of which is not recorded and perhaps has now been forgotten by the sophisticated present generations in the Islands. After all, the diseases which accompany "civilization" are not usually to be cured by the primitive herb remedies of the *kahuna*. The simple crafts and pleasures of what Captain James Cook described as the nearest to paradise of any place he had seen on earth have no place in the bustling fortress at the crossroads of the Pacific which would like to become the forty-ninth State in the Union. Anything from the old days might be mistaken by the visitor for savagery, so now they have imported American and Oriental foods, traffic lights, and shiploads of cheap Japanese manufactured goods. For the interesting and picturesque sides of Hawaiian life one must look more and more into the remotest corners of the Islands, far away from Honolulu.

Still more, he must go back into old books that were written when Hawaii was still an independent nation and when the proud Hawaiians were still enjoying their own indigenous culture.

For the benefit of the members of the American Fern Society I have collected here what could readily be found in the literature, as well as some of my own observations, on the uses of ferns, both past and present, in the Hawaiian Islands. The term "uses" is here adopted in its broadest sense, as will be obvious below. The main general sources of information are Hillebrand's "Flora of the Hawaiian Islands," E. H. Bryan's "Hawaiian Nature Notes," Marie C. Neal's "In Honolulu Gardens," the writings of Otto Degener, and suggestions from E. H. Bryan and from Mrs. Mary K. Pukui, one of the best modern students of old Hawaiian culture. Individual items have been sought in other places.

Doubtless the most important part of any primitive economy is food. The aboriginal colonists of Hawaii, perhaps profiting by the previous experiences of their race in the scattered islands of Polynesia, apparently did not expect to find a land flowing with milk and honey, nor one overgrown with food plants. They brought with them planting material of their main food plants. These formed their basic subsistence, along with fish and their three domesticated animals, the pig, dog, and chicken. The native plants gradually were brought into their economy as their uses and properties became known, probably under the stimulus of famine. They formed supplementary foods, and the list of these includes several ferns.

Most prominent among the ferns used for food were the *hapuu* or tree-ferns (several species of *Cibotium*), which are abundant in the forests of all the larger Islands, reaching magnificent proportions and becoming dominant plants of the forests on the island of Hawaii.

The young stems and starchy pith of this and of the *amau* (*Sadleria Hillebrandii*) were baked in ashes or in the *imu* (underground oven) and eaten in times of famine, and are said by Hillebrand to be by no means unpalatable. A few years ago, before the Kilauea region was made a National Park, tree-fern trunks in that region were cooked in steam crevices and fed to hogs. A business was even established near Hilo for extracting tree-fern starch for cooking and laundry use. Fortunately for those who enjoy the sight of a forest of graceful *lehua* with an understory of tree-ferns, the venture soon failed. The young fronds of the *hapuu* and the *amau* were cooked and eaten, often with meat and taro, by the Hawaiians, as we eat greens or asparagus. The young fronds of the *hoio* or *pohole* (*Athyrium Meyenianum*) and the *kikawaeo* or *pakikawaeo* (*Dryopteris cyatheoides*) were eaten raw, while the rhizome of the latter was grated and salted to taste and also eaten raw. At the present time in the Islands young fern fronds are gathered and used as vegetables by the Japanese, and often are seen on the market.

The *pala* (*Marattia Douglasii*) is today a rare fern in Hawaii. In Hillebrand's time it was rather common, and the fleshy auricles or stipules, characteristic of the Marattiaceae, were baked in hot ashes and eaten, abounding in starch and mucilage. Hillebrand says also that slices of the auricles were soaked in cold water, soaking out their mucilage to form "a pleasant diet drink." Perhaps these uses had something to do with the scarcity of this fern at present, for, as Copeland says of the plant usually called *Pteridium aquilinum* var. *esculentum*, not found in Tahiti since the time of Captain Cook, "it does not behoove a fern to be edible." More likely, however, the wild hogs and other introduced animals are responsible for the destruction of the *pala*.

Ferns entered only slightly into the making of the Hawaiians' clothing. The stipes of the *amaumau* (*Sadleria cyatheoides*) were macerated in water and beaten together with the bark of *mamake* (*Pipturus*) or *wauke* (*Broussonetia*) in making *kapa* or bark cloth. The fern furnished a sizing for the cloth, and perhaps also a reddish color. The cortex of the trunk of the same fern was used to make a red dye. The outer portion of the trunk-like stem was mashed and the red juice squeezed out into a calabash, where it was boiled down by dropping in hot stones to make the dye. The leaves of the *palaa* (*Sphenomeris chinensis*), the commonest of all Hawaiian ferns except *Gleichenia*, also furnished a red dye.

In thatching houses a row of *Sadleria* fronds might be tied lengthwise along the ridge-pole and on the corner ridges to help make these parts waterproof. If *pili* grass (*Heteropogon*) was scarce, *Sadleria* might be used to thatch the whole roof, and even to cover the walls. The fronds of the same fern were also used to construct temporary shelters in the woods.

The fronds of *Sadleria* were employed in drier parts of the Islands as a sort of mulch to cover the ground in the vegetable gardens of the Hawaiians. Degener says that when they saw that it was about to rain, they removed the fronds and planted their vegetables. After the rain they replaced the covering, to hinder evaporation and drying out of the ground.

Recently the tiny water-fern, *Azolla filiculoides*, has in some way been introduced into the Islands, where it has spread with great rapidity and grows with amazing luxuriance in the taro patches which are kept flooded with water. By most taro growers it is considered a pest, but according to Mr. Francis Bowers at least one grower has turned its propensities to use. He finds that a thick

covering of *Azolla* on the surface of the water effectively prevents most other weeds from growing, and that if it gets too abundant it can be checked by temporarily draining the pond. Other growers have considered that *Azolla* encourages some of the taro diseases, but this belief may be merely the result of a coincidence, as taro diseases have increased greatly in recent years. Two other ferns have a negative economic importance as weeds in the pineapple fields in some districts, according to St. John and Hosaka. These are *Dryopteris parasitica* and the *kilau* or bracken (*Pteridium aquilinum* var. *decompositum*), which must be hoed out.

Medicine was a highly developed science among the Hawaiians, though of course the ailments that the *kahuna* or medicine man had to contend with were of little significance in comparison with the scourges that have followed the coming of the European. A large number of plants were used therapeutically in various ways, some native, some apparently brought by the Hawaiians, and, more recently, even some of modern introduction.[1] Whether or not there is any actual basis for the reputed efficacy of these remedies is usually not known. Only by careful investigation and experiment can such facts be ascertained. Some are undoubtedly pure superstition or work by suggestion or other psychological means. Others likely have definite and perhaps valuable drug properties.

At least five ferns and fern allies had a place in native medicine. Infusions or teas made from the *uluhe* (*Gleichenia linearis*) and from the *pipi* or *moa* (*Psilotum nudum*) were drunk as laxatives. The latter tea was also used as a cure for *ea*, or "thrush," a fungus disease in infants. The abundant yellow spores of the *moa* were a favorite remedy for diarrhoea in children and were used

[1] See E. S. C. Handy *et al.*, Hawaiian Physical Therapeutics. Bishop Museum Bull. 126. 1934.

like talcum powder to prevent chafing. An infusion of *laukahi* or *puapuamoa* (*Ophioglossum pendulum* ssp. *falcatum*) was used as a cough remedy, and the spores of this plant, according to Degener, "were given to infants after birth to purge them of meconium." The auricles of the *pala* (*Marattia*) were used, according to Hillebrand, as a remedy for bronchial and intestinal catarrhs. He gives no details of this use. As a remedy for rheumatism, plants of *wawaeiole* (*Lycopodium cernuum*) were boiled for three hours in water. The water was then cooled and the patient bathed in it. The abundant wind-borne spores of this plant have recently been suspected of causing asthma and hay fever, and consequently are used somewhat in testing and immunizing sufferers from these allergies.

In embalming the dead and in dressing wounds the Hawaiians made use of what is known as *pulu*. This is the golden or brownish wool surrounding the growing tip and the stipe bases of the tree-ferns (*Cibotium*) and the *amauman* (*Sadleria cyatheoides*), really soft, hairlike scales, borne in great abundance. When a body was to be embalmed the vital organs, throat, tongue, and brain were removed. The cavities were then stuffed with *pulu* (or sometimes with sugarcane flowers) and sewed up. The body was then wrapped in a sheet of black or gray bark cloth (*kapa*) and later hidden in a cave or buried in the ground, or even thrown into the lava at Kilauea during an eruption, so that the spirits of the dead would dwell with and serve the goddess Pele, to whom they looked as *kupuna* or ancestress, according to Mrs. Pukui.

Later, between 1850 and 1885, *pulu* furnished the basis of a thriving export trade. In one year alone (1869) well over 600,000 pounds of *pulu* were shipped out, mainly to California, to be used as stuffing for pillows and mattresses. The larger trees were cut down, merely to make

easier the gathering of a pound or so of *pulu* each, until the magnificent tree-fern forests were seriously threatened. Fortunately the industry did not last many years, as the fibers were brittle and lacked the resiliency to keep them from wadding up in the pillows. Better fibers were soon substituted for *pulu* and the industry died out. The remains of a stone enclosure used for packing and storing the product may still be seen in the forest near the Chain-of-Craters, below Kilauea.

The trunks of tree-ferns, covered by great mats of densely packed fibrous aerial roots, are used to pave trails across swampy places in the forests. Laid side by side they make a durable and springy corduroy which takes much longer to rot than most plant materials in a rain-forest, especially as they often continue to grow if the terminal bud is not destroyed. Stuck in the ground, erect in rows, they soon form an attractive living fence or hedge around some of the cottages in the Kilauea region.

Ferns also had a place in certain of the ancient religious observances. Miss Neal writes that the priests gathered *palaa* (*Sphenomeris chinensis*) for certain ceremonies, and that it was considered a good omen if they were caught in a rain after the fern was gathered. She also says that the stumps of trees cut for making canoes were covered with fronds of the *ekaha* (*Asplenium nidus*) before the trunks could be adzed. At the dedication of a *heiau* or temple the ground over which the king and his attendants were to pass was covered with the fronds of the *amau* (*Sadleria Hillebrandii*).

Degener tells of a game called "fighting cocks" that was played by using pieces of *moa* (*Psilotum nudum*) from which all the branches but one had been removed. Two contestants held their plants by the tip and, using the branch as a hook, locked them together and pulled. When one branch broke, the holder of the other announced his victory by crowing like a rooster.

The glossy black stipes of the *iwaiwa* (*Adiantum capillus-veneris*) and the *kumuniu* (*Doryopteris decipiens*) were worked by the women into ornamental baskets and, in more modern times, hats, and the black stipes of some ferns were used to decorate mats and other woven work. *Ekaha* (*Asplenium nidus*), *pamoho* (*Doodia Kunthiana*), *amau* (*Sadleria Hillebrandii*), and *mána* (*Hypolepis punctata*) are among the other ferns used for ornamental plaiting. Even now leis are woven of the pinnae of *pala* (*Marattia*) and the fragrant *palapalai* (*Microlepia*). The *pamohu, nianiau,* or *okupukupu* (*Nephrolepis exaltata*) is used as a backing for flower leis, and maidenhair (*Adiantum*) is often combined with flowers to make an attractive lei. Christmas wreaths are now made of *wawaeiole* (*Lycopodium cernuum*).

A subtle fragrance, similar to that of *maile* (*Alyxia*), was imparted to *kapa* by storing it with fronds of *lauae* (*Polypodium scolopendria*) pressed between its folds. Certain other ferns possess a pleasing odor, and may have been used in similar ways. Mrs. Pukui says that it was the commoner and coarser *P. phymatodes* [*P. scolopendria*] which was the more fragrant, despite the efforts of informants to give the honor to *P. spectrum* et al.

By far the most extensive present-day use of ferns is as ornamentals, in the house, garden, or fernery. They are grown and enjoyed by practically everyone. Even the poorer homes often have a fernery of some sort, and hanging baskets of ferns with other plants, such as orchids, are to be seen everywhere. These baskets frequently are carved out of the dense mat of fibrous roots surrounding the tree-fern trunk. They are very satisfactory, especially for growing orchids, and are widely available commercially in the islands. Slabs and plaques, also, of tree-fern trunk are used as hanging substrata for orchids. The commonest ferns in cultivation in the

islands are the birdsnest, *Asplenium nidus*, *Polypodium scolopendria*, *P. aureum*, several species of *Adiantum*, *Cibotium Menziezii*, *C. Chamissoi*, ornamental forms of *Nephrolepis exaltata*, *N. cordata*, *Platycerium alcicorne*, and *P. grande*. It will be noted that most of the commonly cultivated ones are foreign introductions. Many of the native ones are a bit touchy in their cultural requirements, and, anyway, it is easier for most people to get them from the florist or from some other gardener than to climb up into the mountains for the native ones. This is probably very fortunate for the welfare and continued existence of some of the rarer members of the interesting and beautiful Hawaiian fern flora, too.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

Shorter Notes

PROLIFEROUS SCOTT'S SPLEENWORT.—The interesting fern whose portrait accompanies this note was brought to my attention by Mrs. Maude L. Chisholm of Proctor, Vermont. She found the specimen here figured in the herbarium of Mrs. Fred L. Clark of Rutland and supplied the photograph. The original grew in a patch of rocky woods—limestone rocks, of course—in the outskirts of Rutland. It was the object of too enthusiastic collecting; after all its fronds had been removed it died, leaving three other small plants which may or may not be its progeny and may or may not develop its peculiarities.

Exact details of the immediate surroundings of the plant in life are lacking. At any rate, it evidently set out to produce new plants by the Walking Fern method, not only at the tip of the blade but also at the end of two or more elongated lateral lobes. As is well known, in the Walking Fern the basal auricles are occasionally

greatly lengthened and root at the tip. As the experience of Mrs. Griffeth and others shows, proliferation at the apex of the blade can be rather easily effected in Scott's Spleenwort under cultivation. Mr. S. H. Burn-

ham long ago recorded[1] one instance in which a pot-grown individual produced new plants at the tip of the lobes, and Dr. Benedict tells me that the same thing has happened at the Brooklyn Botanic Garden. But among the numerous references to Scott's Spleenwort in litera-

[1] Fern Bull. **16**: 112. 1908.

ture only some half-dozen mention tipping in the wild, and I find but one record of lateral proliferation.[2]

Dr. Maxon has kindly lent me the specimen, collected at Plummer's Island, near Washington, by William Palmer, on which this last record was based. It suggests the conditions under which proliferation may take place. It was collected on April 23. The proliferous fronds are more or less yellowed and obviously must have lasted through the winter from the previous season. Under these circumstances fern stipes usually become weakened, especially if there has been any weight of leaves or snow upon them, and the blades, though still living, are bent down, often so much as to lie flat on the ground. It would seem altogether probable that lateral proliferation would most readily develop under such conditions and that the spring is the time to look for it.—C. A. WEATHERBY, *Gray Herbarium.*

HART'S-TONGUE DIVISION.—The winter of 1940–41 was a severe one for my Hart's-tongues; many died and others were greatly weakened. By midsummer most of the latter had recovered to about one-half normal size and on close inspection I found that nearly all such plants had "divided" crowns. The division had progressed to such an extent that with a little care I was able to separate the parts by hand and pot them satisfactorily; they appear now to be growing nicely.

Some of these ferns are ten years old. Are these side growths due to winter-kill of the fronds, and a subsequent growth from the roots? Or do plants of this age normally put out new crowns from the old one? This is a new experience to me, and I should be glad to have opinions from JOURNAL readers. Mainly the plants in question are our native fern, but even some of English

[2] Maxon, Bot. Gaz. **30**: 413. 1900.

stock acted in a like manner, there being in some cases two offshoots from the main crown.—M. R. SHARPE, *Uxbridge, Mass.*

A FIRST ARIZONA RECORD OF BOTRYCHIUM MULTIFIDUM.—A fourth species of *Botrychium*, *B. multifidum* (Gmel.) Rupr. subsp. *Coulteri* (Underw.) Clausen, can now be added to the known flora of Arizona as a result of a recent collection by Mr. Leslie N. Goodding, who has made many interesting discoveries of southwestern ferns and seed plants. In his monograph of the Ophioglossaceae, Clausen[1] listed only two species of this genus from Arizona, *B. lunaria* (L.) Sw. and *B. virginianum* (L.) Sw. I found *B. lanceolatum* (S. G. Gmel.) Ångstr. in 1938,[2] and Mr. Goodding has kindly given me permission to report his addition. Each of the four species is known within Arizona from only a single locality.

The specimens of *Botrychium multifidum* subsp. *Coulteri* (Underw.) Clausen (*B. Coulteri* Underw.) were collected by Leslie N. Goodding and William Schroeder, No. 340–41, Sept. 17, 1941, at Diamond Creek Beaver Dams in the White Mountains on the Fort Apache Indian Reservation. This locality, elevation about 8,000 ft., is in Apache County, eastern Arizona, between 15 and 20 miles northeast of the town of White River. The vegetation here is a grassy flat or upland meadow near the upper limit of the ponderosa pine zone. Dr. R. T. Clausen has kindly verified my determination. Specimens have been deposited in the United States National Herbarium and the herbaria of Cornell University and the University of Arizona.

According to Clausen's monograph *Botrychium multifidum* subsp. *Coulteri* has been recorded from seven

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[1] Clausen, Robert T. A monograph of the Ophioglossaceae. Mem. Torrey Bot. Club. **19**: 1–177. illus. 1938.

[2] Little, Elbert L., Jr. Botrychium lanceolatum in Arizona. Amer. Fern Journ. **29**: 36–37. 1939.

States: Wyoming, Idaho, Montana, Washington, Oregon, California, and Colorado. It is characteristic of geyser formations and grassy meadows. The Arizona collection represents a considerable extension of range (about 500 miles) from the nearest known stations of this species in Colorado and California, and is also the southernmost record of the species in North America.—ELBERT L. LITTLE, JR., *Tucson, Arizona.*

BRAUN'S HOLLY-FERN IN PENNSYLVANIA.—For over a half-century the only known locality for Braun's Holly-fern (*Polystichum Braunii* var. *Purshii*) in Pennsylvania was in the southern part of Sullivan County and adjacent territory. Eight years ago the writer found two new localities in northern Wayne County. Only about a dozen plants remain in one. In the other the number is gradually diminishing on account of recent lumbering operations, for with the sunlight admitted there has sprung up rank growth that is gradually choking the life out of the 40 to 60 plants.

Something over a year ago there was discovered an extensive growth of this fern in the southern part of Wayne County. There is small probability that this spot will be disturbed for many years, as it is off the main highway and on ground of no value for grazing or tilling. The large number of young plants indicates also that reproduction is taking place here at a good rate.—W. L. DIX, *Morrisville, Pa.*

BIPINNATE CHRISTMAS FERNS.—In a given locality in the Eastern states, you are lucky if you can find as many as 75 distinctive fern forms. This may be the reason why many trivial forms have been described by well-meaning fern lovers who have studied their local ferns so thoroughly that the slightest abnormality seems important. Be that as it may, I have found a colony, 30 strong, of a very distinctive form of the Christmas fern

which is so "incisum" that each pinna looks like a dwarf frond. The fronds are for the most part completely bipinnate, some of the sterile pinnules even having auricles. The fertile pinnae are contracted, and all but the uppermost of these are bipinnate too.

This colony was discovered in November, 1937, and the plants were so odd that one of the band of nature-lovers to whom I showed them thought they were hybrids between the Christmas Fern and the Spinulose Wood-fern growing near by. No such luck! They are merely mutants of the common Christmas Fern, which grows abundantly near the spot—two and one-half miles northwest of Tyson's Crossroads, near Difficult Run, Fairfax Co., Va.—where I found them. The bipinnate plants are confined to an area no more than 15 feet across, among little gulleys at the head of a small stream.

Unlike some forms of the Christmas Fern, these plants do not change their cutting after transplanting. The colony hasn't altered for five years. This year, when Carroll E. Wood, Jr., and I visited the stand, we counted at least 30 plants, about 20 of which were of the extremely cut form. Intermediates found were interesting, because the deeply cut pinnae irregularly alternate with almost entire ones.

Such forms of the Christmas Fern have been found before in Fairfax Co., Va. There are specimens in the National Herbarium which Dr. Maxon obtained in July, 1916, in woods near the Potomac River opposite High Island, that are similar in every way to mine. There is also a very remarkable plant collected by William Palmer in July, 1885, at Little Pimmit Run, not far distant, that has three perfectly normal fronds and one completely bipinnate frond. A colony "a short distance above Great Falls" was even suggested by Green[1] to rep-

[1] This JOURNAL 3: 83. 1913.

resent a hybrid of the Christmas Fern with *Dryopteris cristata!*

A similar plant from Connecticut has been named *P. acrostichoides* f. *multifidum* Clute.[2] That was described as having the fronds "bipinnatifid," but the figure shows it to have been really pinnate with pinnatifid pinnae. Our present plant differs in being completely bipinnate. What causes the bipinnate condition is not known, but it must be admitted that these fancy Christmas Ferns are distinctive and that such finds in well-known areas give fern study plenty of added interest.—W. HERBERT WAGNER, JR., *Washington, D. C.*

Recent Fern Literature

Kenneth E. Wright and Dorothy L. Crandall, of the Rhode Island State College, have published a list of the ferns of the state,[1] based on their own collections and the herbaria of Brown University, Prof. J. F. Collins, and Albert Lownes. Except for its treatment of *Onoclea sensibilis* forma *obtusilobata* and *Osmunda cinnamomea* forma *incisa* as varieties coordinate with, for instance, *Dryopteris spinulosa* var. *intermedia*, the list appears to be accurate and up-to-date. It is, however, a bare list, without data on distribution or relative abundance of the species. Much of this information must be available in the herbaria consulted and from the field experience of the authors; we may hope that in the not too distant future it will be used to produce a full-fledged fern flora on the foundation laid in the present article.—C. A. W.

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[2] Fern Bull. **15**: 71. 1907.

[1] Wright, K. E., and Dorothy L. Crandall: Rhode Island Ferns. Torreya **41**: 73–75. 1841.

Dr. E. B. Copeland has published an important paper on the genera of Hymenophyllaceae,[1] the result of studies of this family for many years. Like his monographs of the Old World species of *Hymenophyllum* and *Trichomanes*, it is illustrated with many beautiful drawings. Two early students recognized a large number of genera in the family Hymenophyllaceae, but scarcely any modern authorities have followed their generic treatments. Dr. Copeland, however, now agrees, and takes up 13 of the genera proposed by Presl and four of those of van den Bosch. In addition, he describes 12 as new, recognizing 33 genera in all.

The two traditional genera of the family, *Trichomanes* and *Hymenophyllum*, have been distinguished by the involucre, which is tubular in *Trichomanes*, valvate in *Hymenophyllum*. Dr. Copeland points out that this distinction is not entirely natural, and that *Hymenophyllum Lyallii*, for instance, has an involucre wholly immersed in the leaf tissue, with no free lips, and thus simulates *Trichomanes*, although in other respects it appears to be more closely related to some species of *Hymenophyllum;* on the other hand, also, that some species of *Trichomanes* belonging to the groups *Crepidomanes* and *Didymoglossum* have the mouth of the involucre more deeply divided into two lips than some species of true *Hymenophyllum*. However, his treatment of these anomalous species is no better than the one long accepted, for he puts *H. Lyallii* into *Sphaerocionium*, which is keyed under the heading "involucre valvate," and the species of *Crepidomanes* and *Didymoglossum* are keyed under "involucre tubular or obconic, not valvate."

Dr. Copeland argues that a genus must be both natural and convenient, and that the two traditional genera are too large for convenience; but it may be doubted if con-

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[1] Genera Hymenophyllacearum. Philippine Journ. Sci. 67: 1–110. *pl. 1–11.* 1938.

venience is furthered by recognizing 33 genera, of which 11 are monotypic and three others have only two species each. The characters used to separate these genera are not those ordinarily considered of generic value in other ferns, as witness the following characters used in the key to genera: "Fronds once-pinnate" opposed to "fronds more divided," "fronds remote" opposed to "fronds clustered," "fronds soft in texture" opposed to "fronds harsh," "margin naked" opposed to "margin hairy," "axes of fronds proliferous" opposed to "axes not proliferous," "stipes bristly" opposed to "stipes not bristly," et cetera. All these are good characters separating species or species groups, but they do not seem of sufficient importance to use in separating genera. It is true that the key is labeled artificial, but if more fundamental differences between the genera exist they should have been used in the key. As a matter of fact, these and similar characters are the ones really used in separating the genera, none of greater basic value being brought out in the generic descriptions or in the discussions.

The United States species of the family are not very numerous. *Hymenophyllum tunbridgense* remains the same, since it is the type species of *Hymenophyllum*. *Trichomanes Krausii*, *T. punctatum*, *T. sphenoides*, *T. lineolatum*, and *T. Petersii* all belong in *Didymoglossum*. *Trichomanes Boschianum* belongs in *Vandenboschia*, but this species is not mentioned by name, being presumably included in *V. radicans*.

Dr. Copeland rightly says that the recognition of more than 30 genera in a family where two have been imagined to suffice will not be welcomed by many botanists. However, it is certain that his careful delimitation of species and species groups will be the basis of any future study of the family, especially as to its Old World representatives.—C. V. M.

American Fern Society

Report of the President for 1941

The year 1941 was one of great disturbance and conflict between the peoples of the world. Few populations have been unaffected by the mounting turmoil. Yet, science continues in its endless quest for truth and scientists endeavor so far as possible to cooperate with each other, since only through the free exchange of ideas can the greatest progress be made. Amid the struggles of the world, the humble study of ferns might seem a futile pastime, but there are real arguments against such a point of view. Any wholesome occupation which absorbs our interest and enthusiasm will help to maintain our mental equilibrium and sanity. Fern study offers such a possibility and in addition may contribute towards our bodily health by causing us to venture about outdoors in quest of the objects of our study. Further, practical contributions may arise from our studies. Certain ferns may become items of diet; others may yield substances which can no longer be obtained from other sources. Finally, the fern student, amateur or professional, helps to keep lighted the lamp of knowledge which must never go out if future generations are to profit from the advances of the past. A heavy responsibility rests on us to insure and to pass along the accumulation of information which has been ours.

Attempt has been made to bring the activities of the Society to the attention of a larger number of persons. To accomplish this end, a membership committee has prepared a circular and distributed copies to numerous individuals and institutions. This committee, which is still functioning, includes as members Mr. W. H. Dole, Mrs. Charles Y. Tanger, Mrs. W. D. Diddell, Dr. R. M. Tryon, Jr., and Dr. R. C. Benedict. For their earnest efforts in behalf of the welfare of the Society, I wish to express heartiest thanks to each of the members of this committee.

They have spent much time and effort in the membership project, rendering this service without remuneration except the satisfaction derived from doing the Society a good turn.

Under the editorship of Dr. Maxon, the high standard of the JOURNAL, set by Mr. Weatherby, has been maintained and further interesting numbers are to be anticipated.

A formal agreement regarding the Society's herbarium has been drawn up between the Brooklyn Botanic Garden and the Fern Society. This provides that the herbarium be kept at the Brooklyn Botanic Garden, on terms similar to those relating to the library. Other events of the year have been the reprinting of three back numbers of the JOURNAL and the election of Dr. Douglas Houghton Campbell to Honorary Membership in the Society.

ROBERT T. CLAUSEN, *President*

Report of the Secretary for 1941

Due in large measure to a very active membership committee many new members were added to the Society during the year, bringing to 402 the list of names of those to whom your Secretary sent the annual ballot. This larger than usual gain over the normal losses by resignation and death is very gratifying, since it enables your officers to make enlarged returns to all the members. One interpretation is that it indicates a general increasing interest in natural history, a due portion of which finds an intriguing challenge in the problems of this unspectacular but fundamentally important group of plants.

Two field trips in cooperation with the Torrey Botanical Club were announced for the year, providing expert guidance in areas rich in ferns. Dr. Benedict's report of the September trip into the northern New Jersey area pictures such interesting experiences that some members express regret at living too far away to join such forays.

This fact should stimulate more local groups to organize field trips in their own localities.

The series of "open house" visits to fern gardens established by some of our members has brought enthusiastic responses and the expressed hope that such a delightful method of exchanging enthusiasm and information may be continued each season as long as our rubber tires hold out.

Respectfully submitted,
ELSIE G. WHITNEY, *Secretary*.

Report of the Treasurer for 1941

During my absence in the spring of 1941, Dr. Benedict very kindly took over the duties of the Treasurer. The accompanying statement reveals the financial status of the Society, but a few explanations of these accounts I am sure will be helpful.

Under "Assets" our yearly cash-on-hand varies according to the income from members and subscribers, and outlays for special expenditures. In 1940 such expenditures included the 25-year Index to the Fern Journal. In 1941 (see "Disbursements") $120.36 was appropriated for reprinting three early numbers of the JOURNAL, so that we now have fifty or more numbers of each issue for sale. Through the foresight of Mr. Weatherby and the Science Press, a stock of paper was requisitioned last year, for which we have paid $3.05 in interest and storage charges, to last us for half of 1942. The Membership Committee spent $40.75 and was largely instrumental in securing the 52 new members in 1941, who will offset the losses in these troublous times.

The Bissell and Life Membership Funds have accumulated some interest. Since they practically represent extraneous accounts, they have been entered in the liability column with balanced entries in the asset column. The Reserve Fund, which represents the profit on sales of

back numbers of the JOURNAL, is cumulative from yearly receipts. By council order, $50.00 was transferred from this fund for partial payment of the above-mentioned reprinting of back numbers.

"Accounts Receivable" represent sums due for reprints of articles and for sale of back numbers. "Notes Receivable" are a dubious asset inherited by the present Treasurer. The payment of $1.19 by the bank at Windsor, Vermont, brings to a close the troubled finances of the depression. We have approximated the value of back numbers of the JOURNAL and of library books and have listed them as inventory assets.

Under "Liabilities" is noted the "Capital Account" to balance entries in the asset column. The "Suspense Accounts" represent advance payments. We still pay for the last number of the JOURNAL in the succeeding year.

Turning now to the columns of "Receipts" and "Disbursements," a detailed résumé of dues and subscriptions has been entered. Sometimes payments are made for several years at a time. Mr. Thurston has given us a check for $25.00 to pay for an article to be published in 1942. A member, who wishes to be anonymous, recently enclosed a five-dollar bill in a letter as a gift to the Society. The final item under "Receipts" represents money paid by authors. Under "Disbursements" the item for $9.13 represents the total amount paid to Science Press for reprints (to be paid for by authors). The discount given for purchase of complete sets of the JOURNAL has been entered; also the deductions made by subscription agencies. The expenses of the various officers, except the Librarian, represent almost entirely the cost of postage and stationery.

The Treasurer wishes to thank all the members for their kind cooperation and for the interesting letters he receives from time to time.

	Amount	Sub-Total	Total
Receipts			
Cash on hand Jan. 1, 1941			$ 245.23
Postage Stamps on hand Jan. 1, 1941			4.04
1939 Membership Arrears	$ 3.00	$ 3.00	
1940 Membership Arrears	15.00	15.00	
1941 Membership Renewals	363.00		
1941 New Members	78.00	441.00	
1942 Membership Renewals	29.45		
1942 New Members	10.50	39.95	
1943 Membership Renewals	2.00	2.00	
1938 Subscription Arrears	1.25	1.25	
1939 Subscription Arrears	1.25	1.25	
1940 Subscription Arrears	4.47	4.47	
1941 Subscription Renewals	65.84		
1941 New Subscribers	12.70	78.54	
1942 Subscription Renewals	47.66		
1942 New Subscribers	3.75	51.41	
Sale of back numbers A.F.J.	89.33	89.33	
Sale of Hart's-tongue Fern	.50	.50	
Sale of A.F.J. Index, Vols. 1–25	.50	.50	
Author contribution A.F.J. Vol. 30, No. 4	16.50	16.50	
Author contribution for 1942	25.00	25.00	
Gift for Membership Committee	5.00	5.00	
Gift, not restricted	5.00	5.00	
Gift (books) A.F.J. back numbers	5.29	5.29	
Windsor Nat. Bank (final payment)	1.19	1.19	
1941 Advertising	4.00	4.00	
Reprints	6.90	6.90	797.08
			$1,046.35
Transferred from Reserve Fund			50.00
			$1,096.35
Deduction a/c Gift (books) A.F.J. back numbers[a]	$ 5.29		
Deduction a/c Profit on Sales A.F.J.[b]	29.29		34.58
			$1,061.77

Disbursements			
A.F.J. Vol. 30, No. 4		$141.12	
A.F.J. Vol. 31, No. 1		120.04	
A.F.J. Vol. 31, No. 2		130.00	
A.F.J. Vol. 31, No. 3		135.70	$526.86
Reprints		9.13	9.13
Interest & storage on paper stock		3.05	3.05
Reprinting 3 early numbers & Index		120.36	120.36
Trade Discount		6.20	6.20
Agency Commission		8.00	8.00
Bank Charges		.27	.27
Excise Tax (Canadian)		.35	.35
Refund		.07	.07
Expense Membership Committee		40.75	40.75
Expense President		3.00	3.00
Expense Treasurer		35.81	35.81
Expense Secretary		21.34	21.34
Expense Librarian		24.46	24.46
Expense Editor in Chief		15.00	15.00
Expense Curator		5.00	5.00 $ 819.65
Cash on hand Jan. 1, 1942			$ 242.12

[a] Transferred to Inventory A.F.J.
[b] Transferred to Reserve Fund.

Statement Dec. 31, 1941

Assets			*Liabilities*	
Cash on hand	$242.12		Capital Account	$5,240.90
In Spec. Acct. #1	541.45		1942 Memb. Susp. Acct.	42.95
In Spec. Acct. #2	52.70		1943 Memb. Susp. Acct.	2.00
In Reserve Fund	63.02	$ 899.29	1942 Subscribers Susp. Acct.	51.41
Accts. Receivable		19.25	Distrib. Vol. 31, No. 4	104.00
Notes Receivable		3,200.00	Author contrib. 1942	25.00
Inventory A.F.J.		1,685.71	Bissell Herb Fund	541.45
A.F.S. Library (books)		256.16	Life Memb. Fund	52.70
		$6,060.41		$6,060.41

Respectfully submitted,

HENRY K. SVENSON, *Treasurer*

Report of the Auditing Committee

The undersigned have checked the receipts and expenditures of the American Fern Society for 1941 and find the Treasurer's statement correct.

We also wish to express our appreciation of Dr. Svenson's services in behalf of the Society.

WALTER S. ALLEN
FREDERICK L. FAGLEY
Auditing Committee

Report of the Judge of Elections

The result of balloting for officers of the American Fern Society for 1942 is as follows:

For President	
Robert T. Clausen	133
W. Herbert Dole	4
For Vice-President	
Joseph Ewan	131
C. A. Weatherby	3
Mrs. Carlotta Hall	2
Mrs. W. D. Diddell	1
Aaron Sharp	1
For Secretary	
Mrs. Elsie G. Whitney	133
E. T. Wherry	2
For Treasurer	
Henry K. Svenson	133
H. L. Blomquist	1

I therefore declare the regular nominees elected: Robert T. Clausen, President; Joseph Ewan, Vice-President; Mrs. Elsie G. Whitney, Secretary; Henry K. Svenson, Treasurer.

A wholly affirmative vote resulted in the election of Dr. Douglas Houghton Campbell to Honorary Membership.

Respectfully submitted,

MABEL H. OTIS, *Judge of Elections*

FERN LANTERN SLIDES TO LEND.—To the many services now rendered the Fern Society, the Brooklyn Botanic

Garden is prepared to add another, the lending of sets of fern lantern slides. A suggestion by Mrs. Tanger, of the Membership Committee, that many members might be glad to make use of such lecture sets for local talks, was made concrete by a post-card addressed to "The American Fern Society, Brooklyn Botanic Garden" during the summer. This request was honored through the cooperation of members of the Botanic Garden staff. Later, Dr. C. Stuart Gager, Director, was asked whether such a loan service could be made available to Fern Society members generally. His answer was in the affirmative, and this announcement is the result. Any interested member may write to Mr. Frank Stoll, Brooklyn Botanic Garden, for particulars as to borrowing, and for lists of fern slides available.

At present the Botanic Garden collection includes a fair representation of slides for such topics as the following: "Hardy Eastern ferns," "Ferns for the hardy garden," "Ferns as house plants," "Tropical or greenhouse ferns," "Fern variation." None of these possible lecture sets has been pulled out for loan, but if there proves to be a demand for such a service it is planned eventually to prepare selected slide sets with appropriate lecture notes, together with selections of reading matter from the back files of the Fern Bulletin and the JOURNAL and other relevant literature. Fern Society members interested in aiding the Botanic Garden in the development of this slide service can contribute in a number of ways, for example, by the gift or loan of fern negatives of special merit and by the preparation of lecture outlines on fern topics. Although the Botanic Garden will in any event gradually augment its fern negative and slide collections, any considerable enrichment for this special group will naturally depend upon the interest which our members display.—R.C.B.

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NEW MEMBERSHIP LIST.—A new list of members of the Society is being prepared for distribution. As an economy measure, to insure continued publication of the Journal at about its usual size, the list will be mimeographed, instead of printed as in the past, and will be sent only to members who desire it. Requests should be addressed to Dr. Robert T. Clausen, Cornell University, Ithaca, New York.

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American Fern Journal

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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. 32 APRIL–JUNE, 1942 NO. 2

An Amateur's Fern Garden

EDWARD D. THURSTON, JR.

During the fall and winter of 1938, at the request of the Millbrook Garden Club, Mrs. Thurston and I collected and forced 60 species of ferns native to the Middle Atlantic States and New England and exhibited them at the International Flower Show at New York the following March. This so aroused our interest in ferns that we decided that we must have a fern garden. Since we had only a level, treeless, sunny meadow available for such a garden, this seemed like a bold decision.

On examining the ferns upon our return home the prospect seemed even less propitious, as the week at the Grand Central Palace and the journey back to Sharon had played havoc with them. Then, too, we had no space in which to store our ferns pending the completion of a proper setting, except a small workroom in which light, temperature, and humidity were so unfavorable that the condition of the plants became worse every day. It was obvious, therefore, that some place must be speedily prepared, even if it did not entirely coincide with plans for the permanent setting.

We had for some years made use of slatted covers for our cold frames as a protection from the strong summer sun, and we believed that an adaptation of these could be made to provide the shade necessary for the ferns.

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Accordingly, screens 6 by 4 feet were made, consisting of a frame of 1 by 4-inch boards, to which 1¼-inch slats were nailed with a half-inch space between them. To support the screens 2 by 4-inch posts were erected, spaced 6 feet apart in one direction and 8 feet in the other, and the tops joined by a double row of the 1 by 4-inch boards, upon which the screens rested. The posts were set 3 feet in the ground, after this much of them had been thoroughly creosoted, and 7 feet of head room was provided. A space 40 feet long and 20 feet wide, giving an area of 800 square feet, was decided upon as sufficient for the ferns then on hand.

To increase the degree of shade, slats were nailed to the posts on the south and west sides of the garden with the same spacing as on the roof screens. When completed, the woodwork was stained a nut brown, as this color was found to be least conspicuous and to harmonize with the ferns and their surroundings.

To convert the rather heavy loam and sod ground into a suitable soil, the area was first thoroughly spaded to a depth of 10 inches and the grass roots were shaken out. A 2-inch layer of sharp sand was then spread over the entire space, with a liberal layer of coarse but well decomposed leaf mold on top. Then the whole was thoroughly mixed by more spading and raking. When the soil had thus been prepared the ferns were set out, a generous quantity of finely sifted leaf mold being worked in around each plant as it was put in place. The primary object that spring having been to get the ferns into congenial surroundings as quickly as possible, little attention was given to arrangement or naturalistic effect. Some hemlock trees ranging in height from 3 to 12 feet were set out to the north and west of the slat house, however, to supply additional shade and to break the bareness of the house itself.

The response of the ferns to the new environment was very satisfactory. Nearly all put out luxuriant new growth, and by August looked as if they had always grown where they were. In many cases this was quite remarkable, as it meant putting forth three sets of fronds in a little over a year.

The success of this small planting was in fact so encouraging that plans for a much larger garden, one which would give the impression of a bit of actual woodland rather than a mere collection of ferns, were carefully made over the winter. There appeared to be no better way of providing shade than by the type of slat house originally constructed. A house 60 feet long and 40 feet wide giving an area of 2,400 square feet was judged to be adequate, and construction of this was begun in the late autumn, so that work on the soil, pools, and planting could start early in the spring. At the same time we brought together a collection of water-worn, moss-covered limestone rocks, ranging in size from some easily lifted in one hand to others weighing several hundred pounds. They were all very carefully selected, those which were well eroded and well covered with moss being the type chosen. The time thus spent and the pains taken to transport the rocks, many from a distance of a dozen miles, without damaging either the stones or the moss, proved well worth while, as they added immensely to the setting of the garden and gave it an immediate impression of age.

As soon as the soil could be worked in the spring, it was prepared as in the small original plot, except that about a ton of commercial leaf mold was added to a liberal quantity from our own pile. The next task was the construction of two pools and of the little stream that was to join them. The pools were about 5 feet in diameter and irregular in shape. They were excavated a foot

THE UPPER POOL

deeper and 2 feet broader than the finished pools were to be, and were lined with a rich concrete mixture. The sides and bottom were poured at one time, and the junction of the side walls and bottom was made with a liberally rounded corner as an insurance against cracking at this point. This involved the construction of rather complicated forms, but was a most important feature. The depth of water in the upper pool was fixed at 3 feet, and that in the lower at 2 feet. Although the site chosen for the garden was practically level, by grading and by making the lower pool a foot shallower than the other a drop of 2 feet between them was obtained. This enabled us to make a series of small falls in the brook joining the pools, as well as a placid stretch between them. The course of the brook was an easy reverse curve. The first step in its construction was to excavate along the proposed bed to a depth of 2 feet, and then to lay a heavy concrete bottom and sides as a sluice-way. The side walls were hidden by moss-covered limestone rocks laid upon them, and the same procedure was followed for the borders of the pools. The selection and placing of these rocks was one of the most difficult portions of the entire enterprise.

The little waterfalls in the brook were made by laying flattish stones in its bed, using just sufficient cement to prevent the water from passing under or between them; so with little or no cement visible they appear to be a natural rock formation. The concrete bottom of the still-water portion was spread with limestone pebbles and pulverized limestone, which very shortly took on a natural appearance.

To form a cliff at the head of the upper pool four limestone rocks were used, beautifully covered with moss and deeply indented with pockets and clefts. The two largest ones were placed together in such a way that a shelf

and tiny pool were formed a little below the top of the cliff. When these had been flanked by the two smaller ones, the impression was that of a single mass of moss-covered, water-worn rock about 6 feet long and 3 feet high, such as might be seen along a woodland stream or on a springy bank.

It was possible to lead in through the narrow spaces between the rocks lengths of $\frac{3}{8}$-inch copper tubing in such a way that it was entirely hidden. To prevent the water from issuing in jets, as would have happened had the ends of the tubes been left open, each was fitted with a T-shaped piece a couple of inches long. The ends of these were closed, and slots cut in the bottom where the T's rested on the rocks. The small sheets of water issuing from these slots at a low velocity spread quietly over the rock surface and trickled and dripped from ledge to ledge and from the little pool in the face of the cliff in a most natural and attractive way. The T's were for the most part completely hidden in the crevices, but where this was not possible they were painted the gray-green color of the rock and so were quite unnoticeable.

We were fortunate in having an unlimited supply of water from a deep artesian well, and in its being so cold—about 45 degrees—that mosquito larvae could not thrive in the pools. The quantity of flow was controlled by valves hidden beneath a rock near the edge of the upper pool, these of course enabling the water to be turned on or shut off at will. After spilling over the edge of the lower pool into a small catch-basin hidden by planting, the water was piped away a short distance and then allowed to run to waste in the meadow. Because of its slightly bluish tinge, we found it unnecessary to tint the inside of the pools, the water itself giving them a very satisfactory color.

Behind the rocks at the head of the upper pool several small feathery hemlocks 4 to 5 feet high were planted. Their tops appear above the rocks, so that as one looks from the lower pool along the brook the impression gained is that of a moss-covered rocky bank with a spring flowing from the midst of the rocks, shaded by a growth of hemlock.

With the completion of the pools and the brook we were now ready to begin planting. On the far side of the upper pool we placed a long bank of *Adiantum pedatum* and on the other a mass of *Cystopteris bulbifera*, whose long fronds stretched out over the water. The Maidenhair planting was continued along the brook on one side, with *Phegopteris polypodioides* on the other. Thus low ferns bordered the brook and pool on the edge nearest the entrance to the garden, so that, as one approached, this low green bank on one side, the crystal pool, and the flowing brook beyond—framed with taller ferns, which were reflected in the pool—presented a charming picture, to which the dripping mossy cliff added greatly.

It was amazing how quickly the moss increased on all the rocks in the damp and shady atmosphere, and what numbers of young ferns, especially *Adiantum, Cystopteris bulbifera*, and *C. fragilis*, established themselves between the rocks. Within a few weeks this entire section of the garden appeared as if established for years.

Larger ferns were planted around the lower and more distant pool, with *Cystopteris bulbifera* again close to the water's edge. On one side the bank was covered with Maidenhair backed by a large mass of *Athyrium pycnocarpon, Dryopteris cristata, D. Clintoniana,* and *D. Boottii,* with tall groups of Ostrich Fern (*Pteretis nodulosa*) on either side giving contrast and character to the picture. Behind the *Cystopteris* on the opposite side

Walking Fern and Woodsia obtusa

Royal Ferns (*Osmunda regalis*) were massed; these developed quickly into luxuriant plants over 4 feet high. Marsh Ferns (*Thelypteris palustris*) and *T. simulata* were also included on the outer edge of the brookside planting. Beyond the lower pool and around the little overflow basin, and reaching out into masses of dogwood (*Cornus florida*), spicebush, and witch-hazel taken from our woods, with hemlocks closing in on either side of the garden, we placed drifts of *Osmunda cinnamomea* and *O. Claytoniana*.

With the plantings around the pools completed, the placing of the smaller ferns was undertaken. For these, groups of eroded limestone as well as igneous rocks were built up at several points in the garden in such a way as to give the appearance of single units, yet to provide ample soil space in the crevices and in the pockets between the rocks. Whether or not a crevice was to prove congenial to a fern seemed impossible to predict. In some which appeared ideal, plants simply would not thrive; in other, apparently very unsuitable, cracks they grew apace. The smaller ferns that prefer rocks other than limestone were planted among the igneous groups. These were *Cheilanthes lanosa*, *Woodsia ilvensis*, *W. obtusa*, *W. scopulina*, *Asplenium platyneuron*, *A. montanum*, and *Dryopteris fragrans*.

We were presented with two very large limestone boulders, so large in fact that moving them into the fern garden presented quite a problem. One of these was of irregular shape with numerous crannies, in some of which ferns were already growing. *Camptosorus rhizophyllus* and *Asplenium Trichomanes* were planted on this rock, and in a well protected crevice *Asplenium Ruta-muraria* was successfully established. In its position a little back from the upper pool and not far from the entrance, this boulder is one of the focal points of the garden. The second rock, rectangular in shape and with relatively

unbroken surfaces was not suitable to plant ferns upon. It was, however, beautifully covered with mosses and lichens. Placed at the end of one of the paths where a ray of sunlight fell upon it, with a background of *Dryopteris spinulosa*, *Athyrium angustum* (one specimen of which grew to the height of 53 inches), and *Osmunda Claytoniana* reaching out into the masses of native shrubbery beyond the garden and appearing over the top and to one side of the rock, and with *Cystopteris fragilis* at one side of the base, it was most effective.

In one far corner of the fernery a dry ledge of igneous rocks was built up, in whose crevices *Asplenium montanum*, *Dryopteris fragrans*, and *Woodsia ilvensis* were set out. The *Woodsia* was placed in one of the upper crevices, where at certain times of the day a ray of sunlight reached it; the *Dryopteris* and *Asplenium* were placed in lower, deeper crevices well shaded by overhanging rocks. In the other far corner a similar cliff was constructed, with water dripping down its face from mossy rock to mossy rock into a shallow pool at its base. Here *Polypodium virginianum* was planted in some of the rock spaces and tucked in around the base and the pool.

Two small slopes of limestone rocks were placed at the north and south sides of the garden, on which Hart's-tongue (*Phyllitis Scolopendrium*) was planted in profusion. Some of those in the north planting were supplied by Dr. Benedict and others were propagated by us from spores brought by a friend from plants growing on the wall of an old cemetery in France. On the south slope the plants were of our American variety. Here beside the Hart's-tongues we added a number of plants of *Cryptogramma Stelleri*, placing them under a projecting limestone rock which gave additional cool shade. Quite frequently we sprayed water on the top of this small ledge, so that it might drip down upon the cliff-

brake and not only give additional moisture but serve to cool the rocks and the soil around the plants.

Besides these two slopes, several other limestone arrangements were prepared at different points in the fernery. Among the rocks of one of these Parsley Fern (*Cryptogramma acrostichoides*) and *Pellaea densa* were successfully established. In a nearby spot little plants of *Asplenium viride*, *Woodsia alpina*, and *W. glabella* were placed in deep cool pockets, almost completely shaded and protected by overhanging rocks.

Two fairly large rocks, which had become cracked in moving and had several deep natural crevices besides, were selected for *Pellaea atropurpurea*. A number of well-developed plants of this fern were placed in the larger openings. In the smaller crevices we introduced little plants of the same fern which we had raised from spores and which we believed would establish themselves better in the narrow spaces than the fully grown ones—an experiment which has, apparently, been quite successful.

At three other points in the fernery smaller limestone rocks were so adjoined as to form pockets, crevices, and slopes in and upon which quantities of *Camptosorus rhizophyllus* and *Asplenium Trichomanes* were established as nearly as possible as we had seen them in nature.

For the soil in which ferns were planted in the pockets between the rocks and in most of the crevices we used a mixture of equal parts of good garden soil, sharp sand, and sifted maple leaf mold. For those crevices in which *Pellaea atropurpurea* and *Asplenium Ruta-muraria* were introduced we used a mixture of powdered limestone and about one-sixth soil with no leaf mold, as we had found the most luxuriant plants of these in our vicinity growing in the cracks of limestone cliffs in what appeared to be almost pure disintegrated limestone.

The problem of laying out paths through the fernery had given us a good deal of concern, but by the time the pools and rockeries were complete and the ferns planted in and about them we found that in going from place to place as we worked and planted we had unconsciously laid out a perfect system of winding paths. The problem had solved itself. The accidental paths became the permanent ones, and as one passed along them there was always an interesting group of ferns at hand or an attractive view in the distance.

There now remained merely the placing of additional plants of the larger ferns in the open spaces between the plantings of the smaller ones. At two points large groups of *Dryopteris Goldiana* were put in and at another a tall luxuriant group of Ostrich Fern. Between them we placed masses of *Dryopteris marginalis*, *D. spinulosa*, *D. intermedia*, *D. campyloptera*, and *Polystichum Braunii*, with *Dryopteris Filix-mas* and *Polystichum acrostichoides* toward the edges of these groups. A large mass of *Athyrium thelypteroides* was placed behind one of the rockeries near the entrance, and beyond it one of *Phegopteris hexagonoptera*. At the back of a boulder at the easterly edge, where a ray of sun was striking through, a group of *Dennstaedtia punctilobula* was so planted as to nestle close to the boulder and, stretching above it, point toward the denser shade; the plants grew luxuriantly, to an unusual height. In addition to the masses of Maidenhair about the pools we placed smaller groupings of this lovely fern in various other situations, and tiny sporelings are already appearing along the edges of the paths and in out-of-the-way corners. Small plants of *Cystopteris fragilis* also have appeared in many protected places, as well as many other little sporophytes which as yet we have been unable to identify.

At various spots where the taller ferns provided plenty of shade, but where their growth was not too dense, plants of *Botrychium virginianum* were introduced, and at others *Phegopteris Dryopteris*. The latter soon spread over wide areas in the congenial conditions of soil, shade, and moisture, and made a lovely carpet under the larger ferns. *Polystichum munitum*, *P. Lonchitis*, and *Blechnum spicant* were also established in small open spaces among the larger ferns, as well as *Ophioglossum vulgatum*, two small Botrychiums (*B. lanceolatum* and *B. matricariaefolium*), and the tiny *Botrychium simplex*.

In the vicinity of the lower pool a space of about one square yard was excavated to the depth of 2 feet and the soil replaced with a mixture of equal parts of loam, sand, peat moss, and sifted leaf mold, with a bushel of sawdust incorporated to increase the acidity. This area was then planted thickly with *Lygodium palmatum*, which thrived on the soil provided, climbing to a height of 5 feet on stalks of goldenrod and fruiting freely.

With the planting of the Climbing Fern the task of placing the ferns themselves was completed. To add variety, and to fill in the open spaces which appeared between the ferns in early spring before their growth was complete, numerous little woodland plants and ground covers were introduced. These included *Mitchella repens*, *Clintonia borealis*, *Sanguinaria canadensis*, *Trillium grandiflorum*, *Hepatica triloba*, *Goodyera pubescens*, *Viola blanda*, and *Uvularia sessilifolia*. A few groups of *Cypripedium spectabile*, *C. pubescens*, and *C. parviflorum* gave a touch of color during their blooming period, as also *Orchis spectabilis*.

The final effect produced was most satisfying. The ferns, rocks, brook, and pools settled into place almost at once, the moss spreading rapidly over the rocks, especially around the brook and pools, the whole taking on

Asplenium viride in Center; Woodsia glabella at Left;
W. alpina at Bottom

the appearance of a most unusual bit of woodland that had been undisturbed for years—one far richer in fern species than could be found naturally in so limited an area. The slatted roof and sides produced just the right degree of shade within the fernery, and the little rays of sunlight coming through the narrow openings gave much the same effect as sunlight flickering through the foliage of forest trees.

To maintain uniform moisture conditions a limited amount of watering is done at frequent intervals. For this purpose a length of small rubber tubing ($\frac{5}{16}$ inch, inside diameter) long enough to reach all parts of the garden is attached to a water supply in the middle of the fernery. A piece of $\frac{3}{8}$-inch copper tubing flattened at one end to make a narrow slit serves as a nozzle and provides a spray so gentle that it can be used without damage to any of the ferns and yet furnishes enough water to moisten thoroughly the entire area in a short time. This small hose is very easy to handle. Wire hooks are suspended from the roof at various points from which it may be hung and thus can be led around the entire fernery without damage to the ferns. Except for watering and the occasional removal of such few weeds as may have been able to start, the fernery requires little or no attention throughout the summer.

The ferns receive no covering during the winter and the slatted sections forming the roof are left in place. We find that the snow filters through the spaces between the slats and does not impose too great an additional load upon the supports. The shade provided by the roof is also beneficial, as due to this the snow remains longer after each snow-fall and covers the ferns within the enclosure late into the spring. Before freezing weather occurs we drain, clean, and refill the pools and place some floating logs in them to lessen the strain set up by

the ice when the pools freeze over. Owing to the wide fluctuations in temperature experienced in our locality, with resultant alternate freezing and thawing of the ground, we have found it advisable to place certain species in cold storage for the winter. These are *Cheilanthes lanosa*, *Pellaea glabella*, *P. densa*, and *Phyllitis Scolopendrium*. Our pump-house has proved to be an ideal storage place for them, as it is kept just above freezing and is dark and damp.

During the first winter mice caused a good deal of damage to those ferns that were planted among the rocks by burrowing under them, and by actually eating off the fronds of the Walking Fern. Late each autumn we now enclose these rock plantings with $\frac{1}{4}$-inch mesh wire cloth supported on wooden frames, with the wire extended an inch or two below the level of the ground around the edge of the rockeries, to prevent the mice from entering. Since this has been done, no trouble has been experienced.

Early in the spring, after the frost is out of the ground but before the ferns have started their growth, a very generous layer of well-decomposed leaf mold that has been finely sifted is carefully spread over the ground between the crowns. No other fertilizing or cultivation is attempted.

Beyond the space protected by the slatted roof, groups of hemlocks have been planted to give partial shade to this area, and ferns of those species less dependent upon complete shade and moisture have been established among rocks beneath the hemlocks. These include *Polypodium virginianum*, *Woodsia ilvensis*, and *Asplenium platyneuron*, as well as groups of the larger wood-ferns stretching out among the trees. At the very entrance to the fernery a long mass of feathery New York Fern (*Thelypteris noveboracensis*) appears in front of a group of hemlock. In a less shaded spot groups of *Botrychium*

obliquum and *B. dissectum* are growing well and find conditions in their new location quite as congenial as in their natural habitat. To a spot at the edge of the hemlocks in full sun we moved several large boulders and among and around them have planted masses of *Dennstaedtia punctilobula,* which are now growing in profusion.

Although the fernery is only a short distance across the lawn from our house, we felt that it would be utterly out of place to approach it except by a woodland path. Accordingly this was provided by planting white birch, flowering dogwood, witch-hazel, and hemlocks, all protected on the northeast by a windbreak of groups of Black Hills spruce. *Cimicifuga racemosa* and *Polygonatum commutatum* have been established along the path and we are planning to introduce other woodland flowering plants to give added interest, for the path is still unfinished.

At some distance from the fernery and entirely separated from it we have planted *Onoclea sensibilis, Anchistea virginica, Lorinseria areolata,* and *Pteridium latiusculum.* Although these members of the fern family are utterly unsuited to a small fern garden such as ours, we felt that they should be included in our collection.

Mrs. Thurston and I have been gardening for very many years, but we have never made any garden that has given us the complete satisfaction and pleasure that this fernery has. This beautiful spot, with its masses of green ferns, the sound of trickling water in its pools and brook, the whispering of the wind in the hemlocks, and the changing lights and shadows, give a sense of indescribable peace and remoteness.

SHARON, CONNECTICUT

New Tropical American Ferns—XIII[1]

WILLIAM R. MAXON

The two species described herewith are from the headwaters of the Amazon and from northern Mexico respectively. The first, a tree-fern, is apparently not uncommon over a considerable area, as shown by recent exploration. The new *Bommeria* adds a fifth member to an interesting genus.

Alsophila Killipii Maxon, sp. nov.

Caudex 1–2 m. altus, ca. 5 cm. diam., apice dense paleaceus, paleis basi solum stipitis persistentibus, fusco-brunneis, lanceolatis, attenuatis, 1–1.5 cm. longis, margine pallido angusto laxe denticulato-ciliolatis. Folia 1.8–2.5 m. longa, stipitibus usque ad 60 cm. longis, 1–2 cm. diam., pallide brunneis, minute furfuraceis, paleis carentibus, hinc inde aculeis rectis anguste conicis 2–3 mm. longis armatis; lamina ovata, abrupte acuminata, 1.5–2 m. longa, 60–85 cm. lata, bipinnato-pinnatifida, rhachi fere inermi, sursum hirsutula; pinnae patentes, basales anguste ovatae, petiolatae (2–4 cm.), ceterae oblongae, vix basi angustatae, subsessiles, 30–45 cm. longae, 12–18 cm. latae, rhachi paleis angustis laxis pallidis perpaucis praedita, hirsutula, pilis basi turgida rigidis, ochroleucis, curvato-patentibus, costas costulas venasque utrinque adeuntibus; pinnulae 20–23-jugae, patentes, non contiguae, anguste oblongae, supra medium latiores, subabrupte acuminato-caudatae, 6–9 cm. longae, 1–1.8 cm, latae, subsessiles, pinnatifidae, costis paleis castaneis lanceolatis attenuatis subbullatis minutis paucis praeditis; laciniae 16–18-jugae, paululum obliquae, medio 2.5–3.5 mm. latae, obtusae, basi dilatata anguste conjunctae (ala utrinque 0.5–1 mm. lata), oblique et valde crenatae, lobis vel crenaturis 6–8-jugis, planis, textura membranaceis; sori medii inter costulam et marginem, utrinque 3–7, mediocres; receptaculum globosum; paraphyses numerosae, flaccidae, plerumque ramosae.

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

Type in the U. S. National Herbarium, nos. 1,480,024–6, collected in dense forest between Yurimaguas and Balsapuerto (lower Río Huallaga basin), Dept. Loreto, Peru, altitude 135 to 150 meters, April 26–31, 1929, by E. P. Killip and A. C. Smith (no. 28133). Duplicates at Field Museum and New York Botanical Garden.

Alsophila Killipii is apparently a common lowland forest species of the headwaters region of the Amazon in the montaña of eastern Peru. The following additional material from Peru all comes from the Department of Loreto, and the two Brazilian localities are not far distant.

PERU: Iquitos, alt. 100 meters, *Killip & Smith* 26944, 26989; *Klug* 177. Santa Rosa, lower Río Huallaga below Yurimaguas, alt. 135 meters, *Killip & Smith* 28781. La Victoria, *L. Williams* 2918. Lower Río Huallaga, alt. 155–210 meters, *L. Williams* 4848.

BRAZIL: Near mouth of Río Embira, a tributary of Río Tarauacá, basin of Río Jurua, State of Amazonas, *Krukoff* 4937. Municipality São Paulo de Olivença, near Esperança, basin of Río Javary, State of Amazonas, *Krukoff* 7527 in part.

In its hirsutulous covering *A. Killipii* is similar to the diminutive *A. aterrima* Hook.,[2] founded on *Spruce* 4713, from the vicinity of Tarapoto, eastern Peru, of which two specimens are at hand; but the resemblance goes no further. In *A. aterrima* the stipe and the rachises throughout are conspicuously shaggy with long close-set, flexuous, linear, ferruginous scales, the leaf tissue is rigidly thick-herbaceous, and the segments are entire, in sharp contrast to the delicately membranous, crenate segments of *A. Killipii* and its nearly scaleless condition.

Bommeria Knoblochii Maxon, sp. nov.

Rhizoma funiforme, 4–6 cm. longum, 1.5 mm. diam., paleis 1.5–2 mm. longis lanceolatis adpresso-imbricatis

[2] In Hook. & Baker, Syn. Fil. 38. 1866.

late fusco-carinatis praeditum. Folia pauca, disticha, propinqua, 11–16 cm. longa, stipitibus longis, primum furfuraceis et basi tenuiter paleaceis, fusco-castaneis, demum glabratis, sublucidis; lamina pentagona, 5–6 cm. longa et lata, pedatipartita; pinnae basales deltoideae, inaequilaterales, basiscopicae, 3.5–4 cm. longae, basi 2–2.5 cm. latae, segmentis basalibus proximis elongatis, proxime lobatis; media laminae pars subaequalis, aequilateralis, oblique pinnatifida, segmentis primariis 3- vel 4-jugis, anguste oblongis, subintegris, vel maximis proxime crenato-lobatis; venatio semiareolata, areolis costalibus et costularibus elongatis, 4–8 mm. longis, plerumque uniseriatis, basi pinnarum et segmentorum majorum incomplete biseriatis, areolis obliquis et brevioribus; venatio alioqui libera, venulis laxis marginem ciliatum non attingentibus; sporangia in venulis liberis, limbo submarginali lato disposita. Laminae superficies ventralis parce strigillosa, superficies dorsalis hirtella, praecipue in costis, his paleis linearibus subflexuosis pallidis paucis onustis.

Type in the U. S. National Herbarium, no. 1,791,245, collected near Majarachic, Chihuahua, Mexico, Sept. 20, 1939, by Irving Knobloch (no. 6044).

Four species of *Bommeria* have previously been known: *B. hispida* (Mett.) Underw., of the southwestern United States and Mexico; *B. pedata* (Sw.) Fourn., of Mexico and Guatemala; *B. Ehrenbergiana* (Kl.) Underw., of Mexico; and *B. subpaleacea* Maxon, known only from a single collection in the State of Puebla, Mexico. The first two of these have the veins wholly free and differ widely in other respects from *B. Knoblochii*. The two last have the venation almost wholly areolate, and of these *B. Ehrenbergiana* is well marked also by its greater size, coarse divisions, and mainly visible atropurpureous rachises beneath. The relationship of *B. Knoblochii* is rather with *B. subpaleacea*, which it resembles in general appearance; but *B. subpaleacea* differs conspicuously in its almost wholly areolate venation (fertile nearly

throughout), its ovate and more numerous scales upon the costae beneath, and its much more pronounced hairy covering.

The Ostrich Fern as an Edible Plant

S. F. BLAKE

It is not often that one of our ferns finds mention as an article of diet on the front page of a newspaper, even if it be one of our so-called local newspapers (What other kind have we?); and when, in addition, the same fern evokes the enthusiasm of a *New York Times* food columnist and a writer for the *Saturday Evening Post*, the circumstances deserve to be chronicled for the benefit of pteridological posterity.

For many years the inhabitants of Aroostook County, Maine, up against the Canadian border, have looked forward to spring as the season when they might satisfy to the full their yearning for "fiddlehead greens"—the very young fronds of the Ostrich Fern [*Pteretis nodulosa* (Michx.) Nieuwl.], still tightly coiled into thick, green, brown-scaly watch-springs an inch or so in diameter. The outer world knew not of this delectable vegetable, and the native sons of Aroostook who wandered far from its borders grew thin and hollow-cheeked for want of their favorite provender, until in despair they abandoned lucrative positions elsewhere and returned to the potato fields of Aroostook and the there obtainable fiddleheads. But the supply of fiddleheads, after all, was limited, so why waste them on an unappreciative outside world?

As usual, it required the enthusiasm of an outsider, a new convert, to spread the gospel abroad. In 1936 Elliot N. Spear, of Hartland, didn't know a fiddlehead

from a skunk cabbage. We have his word for it, reported by Clementine Paddleford in the *New York Herald Tribune* of May 8, 1941. Tramping the woods as a war veteran guest in a government hospital, he was made acquainted with the luscious qualities of the fiddlehead through the introduction of a comrade who must have been an expatriated native of Aroostook, although history is silent on this matter. Therewith a new industry was born. To Mr. Spear, a thrifty New Englander, it occurred that others might enjoy the delicious herbage as much as he did, and might be willing to back up their appreciation with coin of the realm. The first year Mr. Spear made a deal with a chain store in Waterville, 30 miles away. The ferns were gathered in baskets, rowed four miles across the lake, and sent to town daily by express. Next year a store in Bangor was glad to take fiddleheads from him. By the third year merchants in Massachusetts were handling them, and first shipments had been arranged to some of the best New York hotels. In 1941 the Maine Fiddlehead Green Company of Hartland was organized, with Mr. Spear as president, and the H. C. Baxter and Bro. Company of Brunswick undertook to pack 100 cases of canned fiddleheads as a commercial venture. From a letter written by Mr. Spear to Dr. Ralph C. Benedict on June 23, 1941, however, it appears that this undertaking was not carried out, as "acute shortage of labor, with frosts, forced a closing of the season this year, with only about five per cent of the crop harvested and none canned." Mr. Spear added: "We plan to resume operations as soon as labor is available, but the outlook is not promising with continuation of National defense activities." Later (April 17, 1942) Mr. Spear wrote that it had become necessary to suspend operations until the close of the war.

Although the use of Ostrich Fern as a food plant in northern Maine is evidently long-established, references to the subject are scarce in fern literature. The earliest mention I have found is by J. H. Schaffner and Rachel L. Lowe in two independent notes in this JOURNAL in 1933 (**23**: 63), and the latest by the editor (W. N. Clute) in the American Botanist in 1941 (**47**: 115). Curiously enough, a hurried but fairly extensive search through the available general works on European ferns has brought forth no evidence that the very closely related European form of *Pteretis* is eaten.

In 1935 George Rector published in the *Saturday Evening Post* (number for Nov. 2, pp. 19, 79–82), under the title "Rhapsody in Greens," an article setting forth the epicurean delights afforded by the spring greens of different countries, a subject on which, as a member of the famous house of Rector of New York, he might be assumed to be an expert. His account of the fiddlehead or, as he calls it, "fiddle-neck," verges on the poetical: "Fiddle-neck ferns, by the way, show that this country of ours, in spite of all fads, fancies and foreign aspersions, manages to retain a fundamentally sound attitude toward eating. The fiddle-neck fern is the young shoot of the ferns that grow in the Maine woods, cut by the astute native while still light green and tender, and cooked like greens; the name deriving from the fact that a young fern shoot is all curled up at the end like one of those rolled-up paper tubes they blow in your face on New Year's Eve. They taste, simply and beautifully, like the soul of spring. Spring, of course, is the queen season of the year for dyed-in-the-wool greens lovers as well as for poets and the manufacturers of tonics, and a man who has acquired a real taste in the subtle bitternesses of wild greens is well on the way to being a genuine and home-grown epicure."

On May 8, 1941, the pages of the *New York Times* and the *New York Herald Tribune* contained accounts, by Jane Holt and Clementine Paddleford respectively, of the arrival of shipments of Ostrich Fern in the New York market. Miss Holt's interest seems to have been chiefly gastronomic—her contribution appeared under the heading "News of Food"—but Miss Paddleford, without

Fiddleheads purchased in New York City. (Photograph by R. C. Benedict.)

neglecting this aspect, entered so thoroughly into the local history of the plant, evidently on the basis of information furnished by Mr. Spear, that her article deserves to be copied in its entirety. Lack of space makes this impossible, however, and the readers of the JOURNAL will have to be content with the quotations that follow. Her story, by the way, is headed by a photograph of Mr. Spear spooning out the contents of a can of the first tinned pack of fiddleheads.

"The young fiddleheads of Maine are in the markets this morning; 520 pounds arrived yesterday, the first

shipment this year. More will be coming daily now until the season ends around June 15. This week, fiddleheads will be on the bill of fare at the Plaza, the St. Regis, at the Ritz-Carlton, at the Waldorf-Astoria. The University Club in Pittsburgh has an order for dozens of boxes daily. New York markets have the fronds at 40 to 50 cents the quart box.

"Fiddlehead, a pot herb known to Indians on the Tobeque and to the early Colonists as the first green taste of spring, was introduced here two seasons ago, a vegetable 'revival.' Fiddleheads are strange to New Yorkers, but not to the country folk of north Maine. In Aroostook County each May, fiddleheading is a common sport as eagerly awaited as the trout season. In late April, back-country people begin to watch the low banks of forest rivers for the first sign of these ferns. After the snow melts and the water recedes from the root crowns, the fronds spring up in brown sheaths, their tips coiled tightly, held snugly inside. Growth gives pressure and eventually (it seems an eternity to fiddlehead lovers), the fern shoots break through the brown cover. The fern is released, its tender top still a tight coil—a disk about one and one-half inches in diameter and resembling the scroll work on the neck of a violin, thus the name 'fiddlehead.' Now the fiddlehead is ready to eat, before the sun unfurls the coil into a lacy leaf of fibrous stem.

"Maine pickers sell fiddleheads by the basket to local stores. Housewives 'put them down' (technical term for putting them up), for use in the winter and to exhibit at local fairs. Everybody in north Maine eats fiddleheads, all they can hold, during the brief season. But the suggestion that fiddleheads might eventually become a leading industry of the state would have given a Down Easter a big horse laugh a few years ago. The reasons 'why not' would stretch from here to Maine and back. The season is too short—only a few weeks. The patches are scattered and usually inaccessible—deep in the woods along streams and swampy lowlands. The ferns are perishable. They should be eaten within a few hours after they are plucked or they lose their delicate flavor."

Then follows a description of Mr. Spear's initiation into the brotherhood of fiddlehead eaters, which I have

used in the preparation of the third paragraph of this paper, and of his introduction of the plant into the Boston and New York markets. The article continues:

"The fish and game commissioner, an old friend of Mr. Spear's, directed all wardens to inspect their regions and report on fiddlehead acreage. These reports are now in Mr. Spear's hands and he knows the exact location of half a million pounds of the ferns. One patch follows a stream for eight miles through the woods, the fiddleheads growing back a solid mass, four rods on either side. There are three types of the fern, all known as fiddleheads because their tops curl, but most popular is the Ostrich Fern found growing in clumps in lowlands that flood in early spring. These are the fresh ferns you will find in the markets this morning.

"If the weather is good this season (there is always a gamble with frost) 75,000 pounds of the fronds will be gathered by local workers, who have been organized by communities throughout a 150-mile stretch along the edge of the forest. This year a thirty-five-day picking period is expected, as the territory includes three weather zones. Now only the southernly section is ready. Fiddleheads that grow on the shores of the Allagash River, deep into northern Maine, still lie covered by a two-foot blanket of snow. A refrigerated truck is routed through this area to haul the daily pick, about 5,000 pounds, to the Brunswick factory, where the greens go into the rotary washers which clean away the brown bitter pollen [scales are meant]. This year the bracken comes to market clean enough to cook after only one or two dousings of water.

"Maine cooks break off the top of the fern and use only the head and about two inches of stalk. They favor the fiddlehead boiled in lightly salted water until just tender enough to pierce with a fork (twelve to fifteen minutes of boiling), then drained and butter dressed. We like a little freshly ground pepper dusted over, and a dash of wine vinegar to add to the zest. Mr. Spear likes the cooked fiddleheads chilled for a salad, with thinly sliced Bermuda onions and a sharp dressing, preferably one made with vinegar. Hotel chefs are

arranging the boiled fiddleheads on toast and covering with melted butter, to which is added a little of the water in which the greens have cooked, or they may be served with a Hollandaise like asparagus. What do they taste like, everyone asks, and the answer is complicated. They have the delicate qualities of asparagus and the artichoke, with an overtone of broccoli's brute strength.''

My only personal experience with the Ostrich Fern as an article of diet took place seven years ago. In 1935 Wallace R. Gerow, of Houlton, Maine, after some correspondence, sent me two jars of Ostrich Fern put up in the usual fashion by a local housewife. My family and I ate of them freely one day and found them good, suggestive of asparagus, as I recall the flavor, but with an agreeable crispness totally lacking in that somewhat supine vegetable. Part of the contents of the jars, not eaten the first day, was placed in the refrigerator and eaten by me alone the second day after, presumably after having been heated to a boil, although I cannot affirm this. Within a few hours, after a preliminary violent headache, my eyelids and lips puffed up, welts appeared on my neck and shoulders and a rash on my body, but the other members of my family, who had not eaten the fiddlehead, showed no such symptoms. The doctor who was called diagnosed the case as one of food-poisoning, and it seemed clear, in view of all the circumstances, that the fiddleheads were responsible. Another doctor whom I have since consulted, however, suggested that it may have been a case of anaphylaxis (sensitivity to a specific protein), rather than of true food-poisoning. In either case the effects were clear enough, whatever the proper diagnosis. I mention this, not to discourage the eating of fiddleheads, but to suggest that some care be exercised by those who have not had previous experience with them.

From various sources it appears that although the Ostrich Fern is par excellence the ''fiddlehead'' for

culinary use, the Cinnamon Fern (*Osmunda cinnamomea* L.), the Interrupted Fern (*O. Claytoniana* L.), and perhaps some other large species are sometimes eaten under this name. The Ostrich Fern, of course, is readily distinguished by its complete lack of wool, its covering of brown scales, and its fronds tapering from the middle to both ends. The Cinnamon and Interrupted ferns are both more or less densely covered with wool in the fiddlehead stage, have no scales, and do not taper noticeably toward the base.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

Shorter Notes

FÉE ISOTYPES AT COLORADO COLLEGE.—Early in January I had occasion to visit Colorado Springs and through the courtesy of the authorities was permitted to look through the small, but excellent and well-cared-for, herbarium belonging to Colorado College there. It contains a good local collection, a considerable number of Pringle's Mexican plants, the first set of Prof. Penland's recent collections in Ecuador, and the herbarium of the late Edward Tatnall of Delaware (1818–1898), comprising some representation of the work of many of the best American collectors of his time and of some foreign ones. Nevertheless, it was a real surprise to run across isotypes of seven species of West Indian ferns described by Fée. The actual types, if they still exist, are presumably in Brazil; there is little authentic material of Fée in this country. The specimens at Colorado College may well be the only original representatives of their species in North America.

The species concerned are as follows: *Diplazium grammatoides*, *Goniopteris tenera*, *Phegopteris villosa*, *Polypodium inaequale*, *P. mollissimum*, *P. serricula*, and *P. tenuiculum*. All the specimens were collected in

Guadeloupe by l'Herminier and were given by Fée to one Miciol, from whose herbarium Tatnall obtained them. They are rather fragmentary, but are otherwise in good condition. For the benefit of anyone who may consult them it may be added that though the labels bear numbers, these are not the collector's numbers but apparently reflect some herbarium arrangement of Miciol.—C. A. WEATHERBY.

WALL RUE ON WALLS.—Back in 1936, when I first became "hepped" on ferns, I was thrilled to find a colony of the Wall Rue. This colony of one of the rarest ferns in our Washington-Baltimore region is about 20 miles from the nearest other one at Point of Rocks, Frederick Co., Maryland, which has now been ruined by "civilization." My locality is one-third of a mile above Seneca Creek, just north of the now unused Chesapeake and Ohio Canal in Montgomery Co., Maryland. The plants grow in the mortar of an old wall.

A difference in habitat between our Wall Rue and the common European plant, to which the name was originally given, has been stressed,[1] but our American plant is by no means unknown on walls. I have seen it so growing in West Virginia and Pennsylvania, as well as here in Maryland, and a fine colony is reported at Lynchburg, Virginia. Considering its scarcity, this is pretty often. One should not forget the relative ages of walls in the Old and New Worlds. The Seneca Creek wall was built to underpass a stream in connection with the Chesapeake and Ohio Canal project begun by George Washington, but the entire length—as far as Cumberland, Maryland—was not finished until 1850. The century-old wall has been revisited for six years, and the fern seems perfectly happy. Evidently, given time and sufficient antique

[1] "The plant of North America is rarely if ever found on brick or stone-walls." M. L. Fernald, Rhodora 30: 37. 1928.

masonry, Wall Rue will live up to its common name here as in the Old World.—W. HERBERT WAGNER, JR., *Washington, D. C.*

FERN CENSUS OF A CITY BLOCK.—Marietta, Ohio, is a small city of about 15,000, situated on the Ohio River, in Washington County. Its streets are lined with tall trees; its lawns are green and lush. Such an environment might favor the growth of a considerable variety of ferns.

Out of curiosity, a fern census was taken of a thickly built-up residential block, bounded by Fifth, Sixth, Cutler, and Putnam streets, on May 12, 1941. This disclosed the presence of 21 species and one form, numbering in all nearly 700 plants. An attempt was made to distinguish ferns planted from those apparently of spontaneous growth; questions were asked wherever possible, not only to ascertain this, but also to discover the origins of plants.

In the following list, (s) means "of spontaneous growth" and (p) means "planted"; the numbers after these letters indicate the approximate number of plants in each category.

1. *Adiantum pedatum* L. (s)1, (p)35
2. *Asplenium platyneuron* (L.) Oakes (s)35, (p)2
3. *Athyrium angustum* (Willd.) Presl (s)26, (p)150
4. *Athyrium pycnocarpon* (Spreng.) Tidestrom (s)2, (p)40
5. *Athyrium thelypteroides* (Michx.) Desv. (p)45
6. *Camptosorus rhizophyllus* (L.) Link (p)1
7. *Cystopteris bulbifera* (L.) Bernh. (p)31
8. *Cystopteris fragilis* (L.) Bernh. var. *protrusa* Weatherby (p)27
9. *Dryopteris Goldiana* (Hook.) A. Gray (p)2 (Origin, West Virginia)
10. *Dryopteris marginalis* (L.) A. Gray (s)3, (p) 23
11. *Dryopteris spinulosa* (O. F. Müll.) Watt (s)4, (p)2
12. *Onoclea sensibilis* L. (p)15
13. *Osmunda cinnamomea* L. (p)2
14. *Osmunda Claytoniana* L. (p)2
15. *Phegopteris hexagonoptera* (Michx.) Fée (p)6

16. *Polypodium virginianum* L. (p)1
17. *Polystichum acrostichoides* (Michx.) Schott (s)18, (p)68
17a. *Polystichum acrostichoides* f. *crispum* Clute (p)1
18. *Pteretis nodulosa* (Michx.) Nieuwl. (p)115
19. *Pteridium latiusculum* (Desv.) Hieron. (p)28
20. *Selaginella apoda* (L.) Spring (s)occasional in grass
21. *Woodsia obtusa* (Spreng.) Torr. (p)3

Thus, of the 688 individual plants observed 89 were of spontaneous occurrence, 599 planted.

Cystopteris bulbifera, Osmunda cinnamomea, and *Pteretis nodulosa* have not yet been reported growing wild in Washington County, and the presence of the last-named in such large quantities is provocative. All attempts to discover where they came from have so far been futile; most of these plants have been cultivated in Marietta gardens beyond the memory of the present residents. —GEORGE R. PROCTOR, *Los Angeles, California.*

ASPLENIUM PALMERI IN TEXAS.—On August 22, 1941, while driving down Limpia Canyon, over Highway 17, north of Fort Davis, Jeff Davis Co., in southwestern Texas, my wife and I observed some rather jagged cliffs skirting Limpia Creek. Their rough broken faces combined with their proximity to water suggested a good locality for ferns, and we decided to spend a little time exploring. Small Aspleniums were found growing in dense mats in granite soil at the bottom of many of the narrow crevices in the cliffs and between massive boulders. Some of these, sent to Dr. Maxon, were identified by him as *Asplenium Palmeri* Maxon, making this the first station reported in Texas. Growing with *A. Palmeri* were a few plants of *A. resiliens.* Other species found during the short time spent at this locality were *Cheilanthes Eatoni, Notholaena aurea* (*N. bonariensis*), and a *Woodsia,* none plentifully.

Asplenium Palmeri was described originally from Mexico, where it is not uncommon. The new station is

75 miles northeast of the nearest point on the Mexican border and about 200 miles southeast of the Organ Mountains locality, New Mexico.[1] In Arizona this species has been collected in the Mule Mountains (Cochise County), Baboquivari Canyon (Pima County), and Sycamore Canyon (Santa Cruz County).—G. M. SOXMAN, *Dallas, Texas.*

Recent Fern Literature

A key to the pteridophytes of Marin County, California, has recently appeared,[2] which should be valuable to fern students not only of the region covered but also of the entire North Coast Range of California. Thirty-one species are treated, some of which are rare. *Botrychium* is reported from Marin County for the first time.

There are a few inaccuracies in the key, notably in the first division, in which the true ferns are distinguished from the fern allies by having "the sporangia borne on the lower surface of leaves." Some of the true ferns treated (e.g., *Pteridium*) have the sporangia marginal, however, and not on the lower leaf surface. Another slight error is the statement that in *Azolla* the sporangia are borne in sporocarps on the lower side of stems, whereas actually they are borne on modified leaf lobes. It is also not quite accurate to say that *Botrychium* bears two leaves, one sterile and one fertile. In this genus the "fertile leaf" is morphologically a pair of modified basal pinnae of the "sterile leaf." However, these slight lapses do not detract appreciably from the usefulness of the work as a whole.

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[1] Amer. Fern Journ. 11: 105. 1921.

[2] Howell, John Thomas. A Key to the Pteridophytes of Marin County, California. The Wasmann Collector 4: 139–144. 1941.

The journal in which this article appears is little known. It is the official organ of the Wasmann Biological Society, and prints original research in the field of biological science.—C. V. M.

Mr. Roland[1] has given us an excellent and usable account of the ferns of Nova Scotia; the "fern-allies" are not included. There are detailed notes on habitat preferences and distribution under each of the 43 species, a short history of the name,[2] and a statement of general range. The distribution of 11 of the species is illustrated by maps. Many interesting notes are included, such as the observation that Cinnamon Fern is "often a weed in poorly drained areas" and that the Fragrant Fern is associated with Rusty Woodsia, Common Polypody and Fragile Fern—a characteristic association from the reviewer's experience in northern Wisconsin. The 19 varieties and forms are also treated in some detail. For example, we learn that a form of *Cystopteris bulbifera* closely approaching f. *horizontalis* grows only on dry, gypsum cliffs.

There is an ample bibliography and references to special groups are included in the text. The introduction contains a short history of fern-collecting in Nova Scotia and a summary of the soils, topography, and principal types of fern-distribution in the province.

The southern and southwestern parts of the province are relatively low and flat, poorly drained and with a

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[1] Roland, A. E. The ferns of Nova Scotia. Proc. N.S. Inst. Sci. **20**: 64–120. *f. 1–28.* 1941.

[2] It may be worthwhile to point out a minor error in nomenclature, probably arising from one of the very few in Broun's Index to North American Ferns—the statement that under *Diplazium* the correct name of *Athyrium thelypterioides* (not *thelypteroides*) is *D. thelypterioides.* Actually *Diplazium acrostichoides* (Sw.) Butters is the correct combination. The specific epithet *acrostichoides* is the earliest for the species and must be used under *Diplazium;* it cannot be used under *Athyrium* because a different species was described earlier under the same name.

thin soil—a region of lakes and bogs. This area is covered generally by predominantly coniferous forests. The wide-spread species make up most of the fern flora here, such as the Lady-fern, Bracken, Crested Fern, and Christmas Fern. But to relieve the monotony there is a small, but interesting and very significant group of Coastal Plain species: *Woodwardia areolata*, *W. virginica*, and the famous Curlygrass, *Schizaea pusilla*.

In contrast, the northern part of the province has more relief and better soils—a region of limestone and gypsum outcrops, damp ravines, and rich intervales. This area was originally covered by hardwood forests. Here species of rich woods and calcareous cliffs occur: Rattlesnake Fern, Maidenhair, Braun's Holly-fern, and Green Spleenwort. Two Cordilleran species, *Dryopteris Filix-mas* and *Polystichum Lonchitis*, very rare and local in the upper Great Lakes and Gulf of St. Lawrence region, grow on Cape Breton Island.

There is an illustrated key to the genera and many of the species; the rest of the species are keyed out under the respective genera. The keys are workable, on the whole, but a few misleading statements have slipped in. For example, *Pteridium* is keyed out under "fronds smooth," though actually it is commonly pubescent on the margin and on the midnerves beneath; and *Ophioglossum* and *Botrychium* have short, stout, erect stems, not "soft, delicate rhizomes." The blade of *Polypodium virginianum* (deeply pinnatifid) is described as "once-divided" and that of *Osmunda cinnamomea* (pinnate-pinnatifid) as "twice-divided." This is a departure from conventional usage.—R. M. TRYON, JR.

Dr. Eric Hultén has recently published the first part of his "Flora of Alaska and Yukon,"[1] of which pages 12–77 are devoted to the pteridophyta. The work is the

[1] Lunds Univ. Arsskr. II. 37: 1–108. 1941.

result of many years of study and will fill a long-felt need.

The fern student of eastern Canada and northeastern United States would feel quite at home among the ferns of Alaska. All but eight (*Dryopteris oreopteris, Polystichum aleuticum, P. Andersonii, P. munitum, Blechnum spicant, Botrychium boreale, Equisetum hiemale* var. *californicum*, and *Selaginella sibirica*) of the 53 Alaskan species are found also in this area, although sometimes in a different varietal form.

The most recent list of Alaskan pteridophyta was that of William Trelease (The Ferns and Fern Allies of Alaska, Harriman Alaska Exped., 1904). Trelease recognized 58 species, but 10 of these are now excluded. Four of the records were based on misidentifications: Plants referred to *Woodsia obtusa* are *Cystopteris fragilis*, those to *Dryopteris Filix-mas* are *Athyrium Filix-femina* subsp. *cyclosorum*, those to *Polypodium falcatum* are *P. vulgare* subsp. *occidentale*, and those to *Botrychium neglectum* are *B. lanceolatum*. Two others are no longer recognized as species: *Isoetes Macounii* is referred to *I. Braunii*, and *Dryopteris aquilonaris* now becomes *D. fragrans* var. *aquilonaris*. The four remaining species are excluded because their occurrence is not verified by specimens: *Cystopteris bulbifera, Dryopteris rigida arguta, Polystichum Lemmonii*, and *Selaginella struthioloides* [*S. oregana*].

On the other hand Hultén records three species not known to occur in Alaska at the time of Trelease's paper, viz., *Dryopteris Robertiana, Asplenium Trichomanes*, and *Struthiopteris filicastrum* [*Pteretis nodulosa*]; also two others which had not then been described, *Polystichum Andersonii* and *P. aleuticum*.

Ferns are found scattered throughout the greater part of Alaska, but naturally they are most abundant in the

warmer coastal districts of the south and southeast. Twenty-one of the species occur only in this region, including the only two Alaskan endemic ferns, *Polystichum aleuticum* and *Dryopteris fragrans* var. *aquilonaris*, both rare and little-known plants. The genera *Polystichum*, *Blechnum*, *Pteridium*, and *Adiantum* are confined to this area. Broun says that *Blechnum spicant* is reported to occur farther north along the coast than any other Alaskan fern, but this is most surely not true. That honor belongs to *Cystopteris fragilis* among the true ferns. However, other pteridophytes go even farther north, and *Equisetum arvense*, *E. variegatum*, and *Lycopodium Selago* are found at the most northern point in Alaska along the Arctic Ocean.

Although there are excellent keys to the species under each genus, there is no key to families and genera. This lack is not a serious drawback to the professional botanist, but it does detract from the value of the work to others, especially since there are no generic or specific descriptions. The citations of specimens examined is full, in some cases occupying more than a page. It seems that some of this space might more profitably have been devoted to descriptions. These would be especially useful for the flowering plants, which are in general less known than the pteridophytes.

The method of citation of synonymy is of a type very irritating to the bibliographer. Usages and misidentifications are cited in exactly the same way as new species and combinations. Thus, under *Cystopteris fragilis* we find the synonym *Woodsia obtusa* Trelease. This might better be cited: *Woodsia obtusa* sensu Trelease. Some inconsistency is obvious in the uses of the categories subspecies and varieties. In the introduction Dr. Hultén says that he considers geographically limited variations as subspecies. He does not define his use of the term variety. We find both terms used under *Athyrium*. *Athyrium*

Filix-femina is restricted to Eurasia and the Alaskan plant referred to subsp. *cyclosorum,* which is assigned a range from Alaska to Washington and Idaho. On the other hand, *Athyrium alpestre* is similarly restricted to Eurasia, but the Alaskan plant is called var. *americanum* and is assigned a range from Alaska to California.

The treatment of *Adiantum pedatum* is somewhat confused. The main entry reads only *A. pedatum* var. *aleuticum,* thus inferentially excluding the typical form; but under the statement of geographical range we find the typical form reported to occur from the southern coast of Alaska across the continent to Newfoundland and south to California, and the var. *aleuticum* said to occur along the Pacific coast from Japan to California and along the Atlantic from Newfoundland to Vermont.

A praiseworthy feature is the publication of maps showing the distribution of each species within Alaska. These will be most useful, especially since this is not done in general terms by means of shaded areas, but by black dots at each definitely known locality and circles at each reported locality. Dr. Hultén's book will undoubtedly be the standard work on the Alaskan flora for many years to come.—C.V.M.

American Fern Society

FIELD TRIPS TO FERN GARDENS.—Listed below are a number of fern gardens that will be open to visitors this summer. If definite dates are not given, prospective visitors should enquire in advance as to a convenient time for visiting.

Bowman's Hill State Wild Flower Preserve, Washington Crossing Park (2.5 miles below New Hope), Bucks Co., Pennsylvania. Of the 80 species of pteridophytes native to the state 70 have here been established along the Edgar T. Wherry Trail. (All summer.)

Mr. Maurice Broun, Long Trail Lodge, Sherburn Pass, near Rutland, Vermont. Some 60 species, an almost complete representation of the fern flora of Vermont, have been successfully established in this small area. Included are *Woodsia glabella*, *W. alpina*, *Asplenium viride*, *Dryopteris Filix-mas*, *D. fragrans*, and *Cryptogramma Stelleri*. (June 1 to September 15.)

Mr. W. C. Curtis, South Sudbury, Massachusetts. "Garden of the Woods," a wild flower sanctuary and botanical garden. About 85 species and varieties of ferns are included in this collection of hardy native plants. (Week-ends throughout the summer.)

Mr. and Mrs. W. Herbert Dole, 23 Overlook Ave., West Orange, New Jersey (one block below Gregory Ave., near Luddington Road). Eighty ferns or more, many of them planted 20 to 30 years ago. (June 1 to September 30. Telephone: OR–4–8324.)

Dr. Edmund LeRoy Dow, Arcadia, Watch Hill, Rhode Island. A large collection of New England ferns. (June 1 to September 30.)

Mrs. Caroline A. Dunham, 450 Beverly Road, Ridgewood, New Jersey. Forty species of ferns and 10 fern allies growing in her wild garden about two miles distant in East Saddle River Road, Hohokus, New Jersey.

Mr. and Mrs. R. Harcombe, "Twin Brooks," New Jersey. (Take Route 28 to Lebanon; at Lebanon take Stanton Road, on left 3.2 miles to road on left marked "Camp Brett"; from this point 0.8 mile to "Twin Brooks"). Fifty or more species of ferns, including Hart's-tongue, *Asplenium Bradleyi*, and *A. montanum*. (Any Saturday or Sunday during the summer.)

Mr. and Mrs. Richard C. Harlow, La Anna, Pennsylvania (in the Poconos, near Buck Hill Falls). A large collection, including many of the rarer rock-ferns, in a natural setting; also gentians and many other flowering plants.

Mr. and Mrs. William A. Knight, Biltmore Forest, Biltmore, North Carolina. Four acres devoted to native ferns and wild flowers. (Visitors always welcome.)

Mr. and Mrs. M. D. Mann, Jr., 625 Locust St., Roselle, New Jersey. A recent but rapidly expanding garden. (At any time after June 20, by arrangement. Telephone: RO–4–6355.)

Mr. Harold G. Rugg, Hanover, New Hampshire. "Not a real fern garden, but a large variety of ferns scattered about." (Visitors welcome. For appointment write Box 241, Dartmouth College.)

Mrs. Charles Y. Tanger, 318 North President Ave., Lancaster, Pennsylvania. Visitors welcome "during the season."

Mr. and Mrs. Edward D. Thurston, Jr., Sharon, Connecticut, on road toward West Cornwall. (Visitors are welcome at any time, but advance notice should be given by writing or telephoning. Telephone: Sharon 145.)

W. HERBERT DOLE

Frederick Gillan Floyd, a member of the Society since 1897 and twice its treasurer, died at Sierra Madre, California, January 10, 1941. He was born at South Boston, Massachusetts, the son of Fred C. and Anna (Luce) Floyd. He attended the English High School in Boston and would have liked to go to college, but the family finances were limited and, as the eldest son, he felt it his duty to become self-supporting as soon as possible. He accordingly went to work for his father, who was owner and editor of a small newspaper; but he disliked journalism, studied surveying, and soon found employment with the Massachusetts Highway Commission. They became so impressed with his ability that they sent him to Nantucket to build the first stone road across the moors of that quaint island. After this work was com-

pleted, he entered the employ of the Engineering Department of the City of Boston and was put in charge of street engineering in South Boston, a position which he held until his retirement on a pension in 1929. In 1898, he married Edith Mackay of Boston, who survives him. After his retirement, he and his wife (there were no children) moved to California.

Floyd was for many years an enthusiastic botanist. He was one of the early members of the New England Botanical Club. In our own Society, he was one of the group who founded the FERN JOURNAL, contributed to the first experimental numbers and occasionally to later ones. He did a good deal of collecting, amassing a considerable herbarium, particularly of ferns, and also an excellent library. Indeed, he became expert in botanical books and sometimes dealt in them. After his retirement, however, he felt himself unequal to the physical work of collecting; he sold his herbarium and devoted himself to philately, especially postmarks. He published an historical account of postal markings and cancellations in the United States.—C. A. W.

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American Fern Journal

VOL. 32 JULY–SEPTEMBER, 1942 NO. 3

A New Dryopteris Hybrid

R. M. TRYON, JR.

On a collecting trip through northern Wisconsin in the early summer of 1940, my brother, P. F. Tryon, and I noticed in the field a single plant of a narrow-leafed woodfern that obviously was not a typical phase of any species known in the area. At the time we suspected that it might be a hybrid, and later study has substantiated our first impression.

Dryopteris fragrans (L.) Schott var. **remotiuscula** Komarov × **spinulosa** (Muell.) Watt var. **intermedia** (Muhl.) Underw., n. hybr. Lamina $2\frac{2}{3}$–3-plo longior quam lata, non odorata, modice glandulosa; pinnae aequaliter et subabrupte in apicem brevem acutum angustatae; dentes acuti; glandulae eis *D. spinulosa* var. *intermedia* simillimae; indusium margine modice glandulosum, supra glabrum vel leviter glandulosum, cellulis plerumque longioribus quam latis, leviter tortuosis.—In a damp shady situation on wooded talus at the base of a north-facing diabase (copper-bearing series) cliff; associated with *D. spinulosa* var. *intermedia* and *D. fragrans* var. *remotiuscula* on the cliff above; 2 miles west of Rockmont, about 10 miles southeast of Superior, Douglas Co., Wisconsin, July 4, 1940, *Tryon & Tryon* 4621 (TYPE in the author's herbarium; COTYPES (i.e. fronds from the same plant) deposited in the Gray Herbarium, Herbarium of the New York Botanical Garden, U. S. National Herbarium, Herbarium of the Field Museum of Natural History, and the Herbarium of the University of Wisconsin).

[Volume 32, No. 2 of the JOURNAL, pages 41–80, plates 5–7, was issued June 29, 1942.]

The plant is intermediate between the parent species in several characters. It has a few of *D. spinulosa* var. *intermedia* and no undiluted ones of *D. fragrans* var. *remotiuscula*, being definitely more closely related to the former than to the latter. The critical characters of the hybrid and its parents are compared in the following table.

D. FRAGRANS VAR. REMOTIUSCULA (PLATE 9, FIG. 1.)	HYBRID (A SINGLE PLANT: PLATE 8; PLATE 9, FIG. 2.)	D. SPINULOSA VAR. INTERMEDIA (PLATE 9, FIG. 3.)
Stipe with 3 vascular bundles.	Stipe with 5 vascular bundles (one with 6).	Stipe with 5 vascular bundles.
Blade usually 4 times as long as broad.	Blade about 3 times as long as broad (one twice as long as broad).	Blade usually twice as long as broad.
Upper part of blade tapering rather evenly to a short tip.	Upper part of blade tapering evenly but rather abruptly to a rather short tip.	Upper part of blade tapering abruptly to an elongate tip.
Blade bipinnate.	Blade tripinnate-pinnatifid at base, bipinnate-pinnatifid above.	Blade bipinnate-pinnatifid or tripinnate at base, bipinnate-pinnatifid above.
Blade fragrant.	Blade not fragrant (field observation).	Blade not fragrant.
Pinnae tapering, with the sides convex, to a short blunt tip.	Pinnae mostly tapering rather abruptly but usually evenly to a short pointed tip.	Pinnae usually tapering rather abruptly, sometimes evenly, to an elongate pointed tip.
Larger pinnules mostly oblong to oblong-ovate, not overlapping at base.	Larger pinnules mostly deltoid, overlapping at base (a unique state, not found in either parent).	Larger pinnules mostly oblong-lanceolate to ovate-lanceolate, not overlapping at base.

Inner lower pinnules of basal pinnae usually longer than the adjacent ones.	Inner lower pinnules of basal pinnae approximately as long as the adjacent ones.	Inner lower pinnules of basal pinnae shorter than the adjacent ones.
Teeth blunt and rounded.	Teeth mostly acute, but not spine-tipped.	Teeth spine-tipped.
Scales toothed.	Scales mostly entire, a few slightly toothed.	Scales entire.
Glands with a short stout stalk and a large yellowish to reddish brown head.[1]	Glands with a long slender stalk and a small whitish or brown head.	Glands with a long slender stalk and a small whitish or brown head.
Indusium sparsely glandular on the margin, nearly always glabrous on the surface.	Indusium usually rather densely glandular on the margin, glabrous or only sparsely glandular on the surface.	Indusium densely glandular on the margin, sparsely to densely glandular on the surface.
Larger indusia at their widest dimensions (1.0–) 1.2–1.3 (–1.5) mm. wide.	Larger indusia at their widest dimensions 0.7–0.8 (–0.9) mm. wide.	Larger indusia at their widest dimensions 0.6–0.7 (–0.8) mm. wide.
Cells of indusium not much longer than broad, the walls lightly sinuate to nearly straight.	Cells of indusium a little longer than broad, the walls slightly tortuous or tending to be straight (6 fronds), or much longer than broad, the walls tortuous (2 fronds).	Cells of indusium much longer than broad, the walls strongly tortuous.

[1] The margin and the upper and lower surfaces of the blade of the hybrid are moderately glandular, within the limits of variation of both parent species.

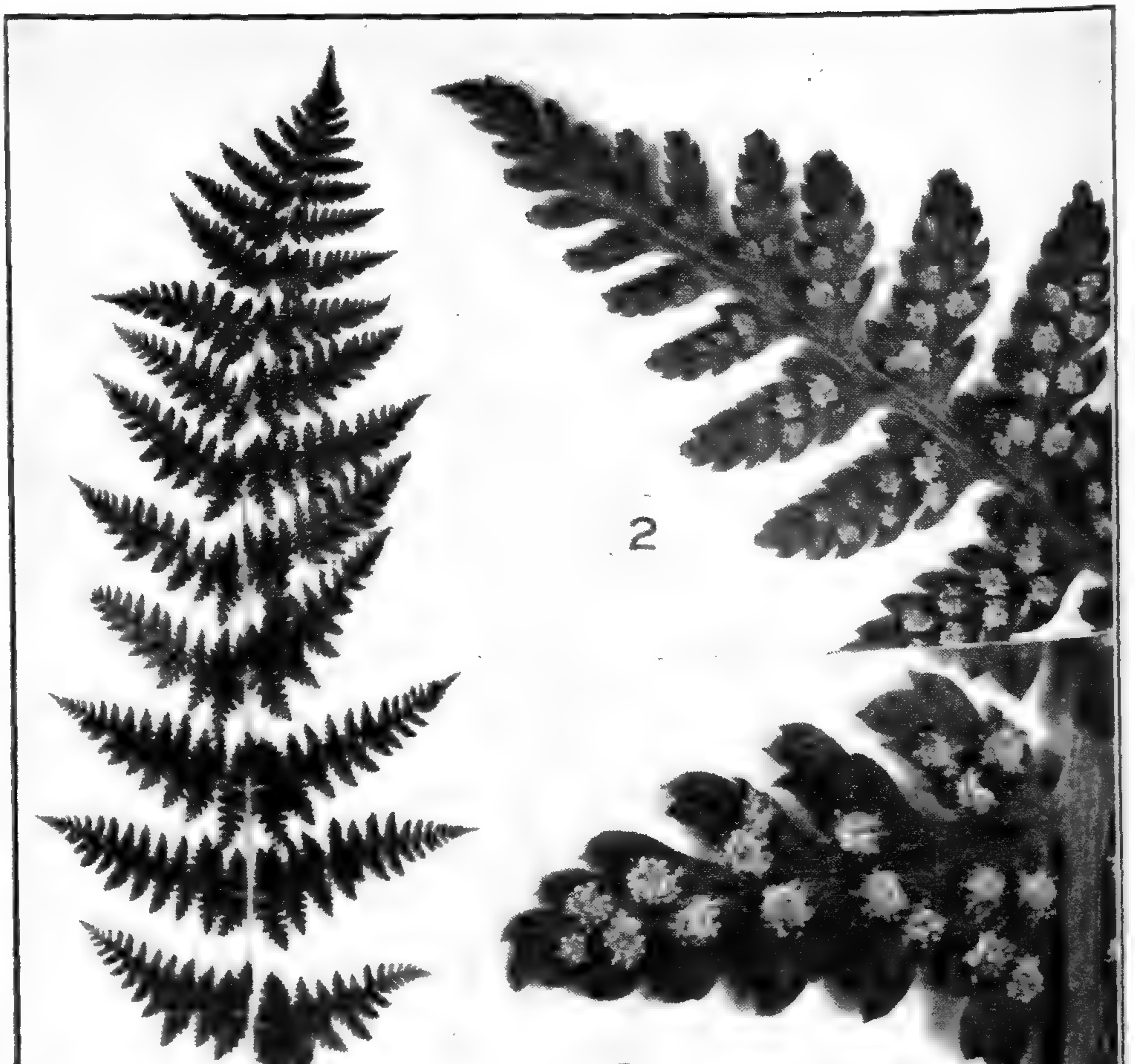
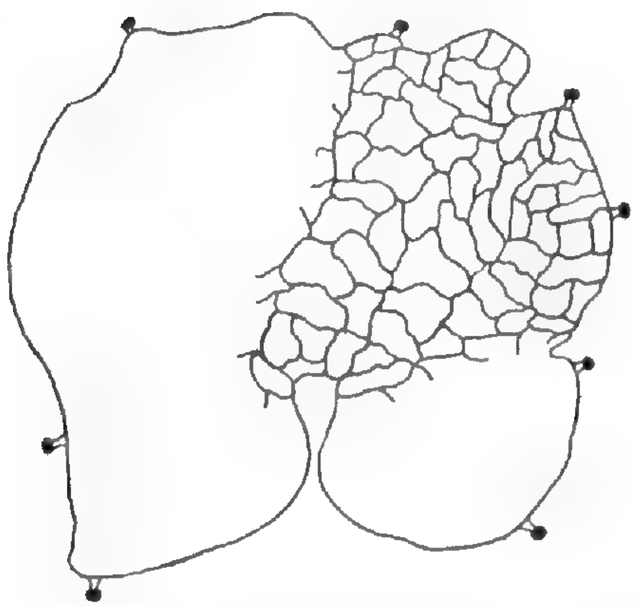


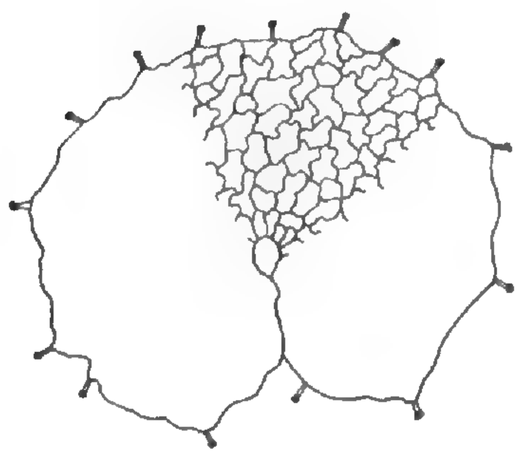
Plate 8.—Dryopteris fragrans var. remotiuscula × spinulosa var. intermedia: Fig. 1, frond, × ⅓; fig. 2, tip of a pinna, × 3; fig. 3, pinnules, × 6. All from the type specimen.

1

2

3





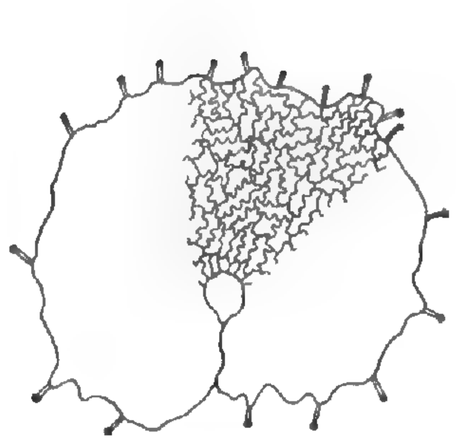


PLATE 9.—FIG. 1, DRYOPTERIS FRAGRANS var. REMOTIUSCULA: pinnule, × 12, and indusium, × 35; FIG. 2, D. FRAGRANS var. REMOTIUSCULA × SPINULOSA var. INTERMEDIA: pinnule, × 6, and indusium, × 35 (both from the type specimen); FIG. 3, DRYOPTERIS SPINULOSA var. INTERMEDIA: pinnule, × 6, and indusium (glands on the upper surface not included), × 35.

A Rare Selaginella from Northeastern Nevada

A. H. HOLMGREN

An interesting and rare *Selaginella* was collected in the Ruby Mountains of northeastern Nevada last summer. Mr. C. V. Morton has studied the plant and verified the identification as *Selaginella selaginoides* (L.) Link.

The plants form a mat with slender, branching, prostrate-creeping sterile branches and slightly thicker, unbranched, erect fertile branches. Leaves in six ranks, lanceolate, acute, spreading, spinulose-ciliate on each side of leaf. Spikes erect with lanceolate or ovate-lanceolate oblique sporophylls having 4–5 spinulose cilia on each side, 3.0–4.0 mm. long. Microsporangia few, confined to tip of the spike; microspores yellow with ca. 25 spines averaging 7μ in length, the spores (including spines) 45μ in diameter. Megasporangia more numerous; megaspores pale yellow to nearly white, subglobose, 0.5–0.6 mm. in diameter; exine mostly smooth with minute reticulations on apical and basal portions.

The nearly smooth megaspores are of considerable interest as typical European material has strongly tuberculate-papillose megaspores, at least on the commissural faces.

The distribution of this species, as given by Broun in his "Index to North American Ferns," is as follows: "Newfoundland to Alaska, south to New Hampshire, New York, the Great Lakes region, and Idaho; reported from Colorado." Dr. William R. Maxon has reported to me that there were only three specimens of *S. selaginoides* from the western United States in the U. S. National Herbarium: Grand Marais, Minn., *F. F. Wood*, June 26, 1891; Yellowstone National Park, *E. A. Mearns*, No. 3704, September 4, 1902; Fork Lake, Sublette County, Wyoming, *E. B. & L. B. Payson*, No. 4403, July 21, 1925; and now a duplicate of the northeastern Nevada collec-

tion, which bears the following data: Rare in wet boggy soil along stream-bank, ¾ mile above the Thomas Canyon Camp, ¼ mile above old fence crossing creek, Thomas Canyon, Ruby Mountains, Elko County, Nevada, *A. H. Holmgren*, No. 1858, alt. about 8,500 ft., August 21, 1941. This collection is also on deposit at the Intermountain Herbarium. These records add Wyoming and Nevada to the distribution as outlined by Broun.

INTERMOUNTAIN HERBARIUM,
UTAH STATE AGRICULTURAL COLLEGE,
LOGAN, UTAH.

An Unusual Botrychium

M. A. CHRYSLER

During August 1941 the writer visited a station for *Botrychium Lunaria* (L.) Sw. near the summit of Mt. Ste. Anne (alt. about 1000 feet), Gaspé Sud, Quebec. On a grassy tract, gently sloping toward the south and overlying calcareous rocks, protected from north winds by a spruce forest, grew a colony of the Moonwort. Among the plants one strikingly atypical individual was found. This is illustrated in the accompanying figure. The usual fertile spike is present and in addition, inserted about 10 mm. higher, a pair of somewhat smaller spikes, followed by the sterile pinnae.

That specimens of this kind are not common in American herbaria is indicated by the writer's failure to find a single example in the U. S. National Herbarium and in the Britton Herbarium at the New York Botanical Garden. A photograph of the Gaspé plant was referred to Dr. R. T. Clausen, who furnished the interesting report that, as a sheet in his herbarium shows, in 1937 he collected an almost identical specimen from the same station (personal letter, January 26, 1941). Such specimens do

not appear to have been figured, although Goebel[1] reports having seen examples, and Luerssen[2] lists this condition in his series of 22 monstrous forms of *B. Lunaria*.

Botrychium Lunaria, showing three fertile spikes. Above-ground portion of plant measures 7.5 inches.

To the writer the Gaspé specimen appears to be of greater interest than the ones previously illustrated because it affords confirmation from an additional subgenus (most of the cases occur in subgenus *Sceptridium*)

[1] Schenk, Handbuch 3: 112.
[2] Rabenhorst's Kryptogamen Flora 3: 560.

for the widely adopted explanation of the origin of the fertile spike, namely from the fusion of the basal pair of (fertile) pinnae. For in the present specimen the second pair of pinnae are fertile although not fused, thus appearing to represent one of the evolutionary stages.

In *B. dissectum* and closely related forms the strongest evidence for the double nature of the normal fertile spike is the presence of two vascular strands, each arising from the C-shaped petiolar bundle in a position corresponding to that of the single strands which supply each sterile pinna.[3] The normal *B. Lunaria* likewise shows a double vascular strand in the fertile spike, whereas a single strand supplies each green pinna. With these observations in mind the Gaspé specimen has been examined and shows plainly a pair of bundles in the normal spike, but a single bundle in each of the paired spikes. This is obviously what was to be expected in case each of the extra spikes is the equivalent of a pinna.

It would be desirable to determine the cause for appearance of such abnormalities. Variations in nutrition are suggested by certain observations. Judging from the occurrence of reversionary features in conifers, following wounding, it is suggested that trampling by grazing animals may be a stimulus in the case of *Botrychium*. Is it possible that the numerous tourists who have climbed Mt. Ste. Anne during recent years have anything to do with the matter?

The writer would be glad to hear from members of the Fern Society concerning other cases of additional spikes in *Botrychium*.

RUTGERS UNIVERSITY,
NEW BRUNSWICK, NEW JERSEY.

[3] Chrysler, Ann. Bot. 24: 1–18. 1910.

Annotations on West American Ferns—II

JOSEPH EWAN

The present paper treats of the systematic status of the xerophytic endemic Californian *Notholaena californica* and the mesophytic widespread Pacific Coast *Polystichum munitum*.

It is a pleasure to acknowledge the excellent workmanship of the Berkeley photographer, W. C. Matthews, and his able assistant, Victor Duran, in the preparation of the accompanying plate, and of the Graduate Council of this University for making possible its publication. Miss Ruth Sanderson of the Gray Herbarium and Miss Edith M. Vincent of Field Museum have generously assisted in providing descriptions of ferns from books not available locally.

NOTHOLAENA CALIFORNICA

NOTHOLAENA CALIFORNICA D. C. Eaton, Bull. Torr. Bot. Club **10**: 27. 1883. Based on a collection by (Miss) Annie L. Burbeck in 1876, from Spring Valley, San Diego Co., Calif. Type in Eaton Herb., Yale Univ. As noted by Maxon[1] this binomial included two entities, the southern California fern here described and a chiefly Mexican species, *N. neglecta* Maxon. It seems wholly justified to consider *N. californica* a valid name for the reasons advanced by Maxon, rather than reject it as a *nomen confusum*.

Notholaena candida sensu D. C. Eaton, Ferns N. Am. **2**: 22. 1879, in part, as to the "smaller form with minute rounded segments, and yellow or yellowish-white powder." The Burbeck collection is the basis of this characterization. Not *N. candida* Hook.

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[1] Contr. U. S. Nat. Herb. 17.: 603. 1916.

Notholaena sulphurea var. *californica* (D. C. Eaton) Farwell, Am. Midl. Nat. **12**: 283. 1931. Based on *N. californica* D. C. Eaton.

Ferns suggestive of diminutive *Pityrogramma triangularis*, but low, 8–12 cm. high, more or less tufted upon a chaffy short subglobose rhizome, the scales abundant, acerose-acicular, dark brown or blackish, the stipes dark red-brown, shining, rather *Adiantum*-like, 6–10 cm. long, a little paleaceous near the base, the scales dark brown but white-margined; fronds numerous, the blades deltoid or, more precisely, broadly pentagonal, 3–4 cm. wide, 2–5 cm. long, bipinnatifid, all the pinnae approximate, the ultimate segments closely but irregularly lobed to form an intricate mosaic pattern, pruinose-puberulent and olivaceous above, the sterile fronds sulphur-yellow beneath with a powdery epidermal wax, the soriferous ones dark-brown, little if at all glandular; sori more or less incompletely confluent.

Local, but rather easily passed over for the Gold-fern; usually in semi-shaded crevices of decomposed granite rocks, under boulders and rock ledges of the Upper and Lower Sonoran Life Zones. Western arm of Colorado Desert and on coastal slope of Peninsular Range from Riverside Co., Calif., southward into Baja California, Mexico. Isolated stations (suggesting geographic relicts) on Santa Catalina, Santa Margarita, and Cedros islands, Slover Mt. near Colton, Victorville on Mohave Desert, and three localities in Arizona.

CALIFORNIA. Slover Mt. near Colton (a mecca for collectors in the 1880's and 1890's as shown by May, 1882, *M. E. Jones;* Sept. 1882, *Lemmon;* Mar. 1886, *Parish Bros.;* May 1894, *Parish;* and May 1901, *Parish;* but probably now extinct here due to activity of the Portland Cement Co.). Colorado Desert: Murray, Andreas, and Palm canyons, near Palm Springs (several collections);

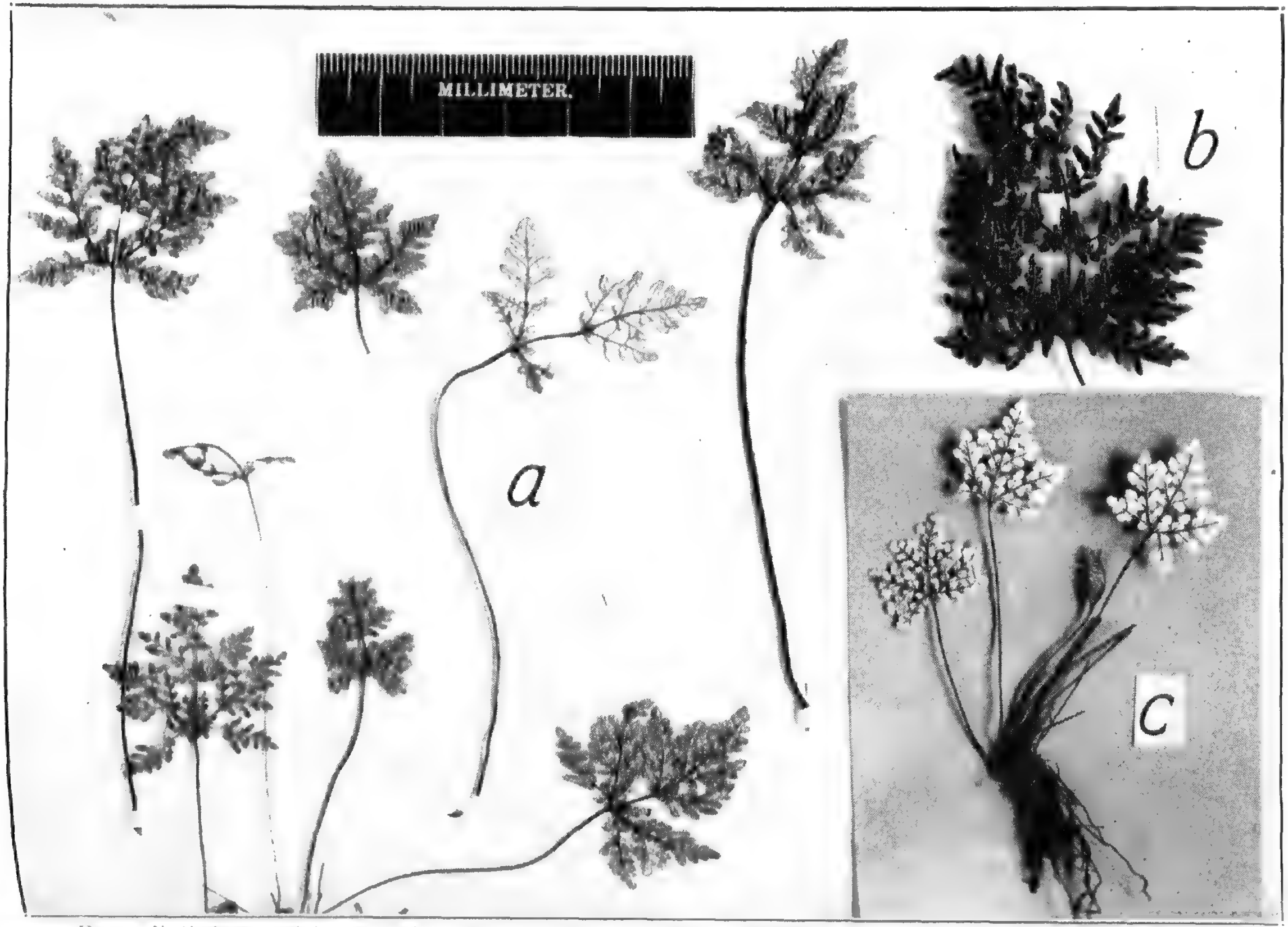

Fig. a, *Notholaena californica californica*, topotype; fig. b, *N. californica nigrescens*, paratype; fig. c, *N. californica*

Borego Valley, alt. 2600 ft., 1931, *F. M. Cota* 139 (Ewan Herb.); Mountain Springs.[2] Mohave Desert: Victorville.[3] Peninsular Range: Near San Jacinto;[4] Temescal Canyon;[5] Spring Valley, San Diego Co., *Laura Kimball* (U. Cal. Herb., topotype, Pl. 10, fig. a); Sweetwater Valley.[6]

ARIZONA. Hills 4 mi. n. w. of Congress Jct., about 3000 ft. alt., Yavapai Co. (Maxon, l.c.); Tule Tank and Tinajas Altas, Yuma Co.[7]

BAJA CALIFORNIA. Ensenada; San Telmo; Los Angeles Bay on Gulf of California.[8]

Maxon has discussed[8] the relationships of this xerophytic Southwestern fern. Its affinities are with the Mexican *Notholaena cretacea* Liebm. of the Mesa Central, and with *N. neglecta* Maxon, of the Sierra Madre Occidental and its biologic northern extensions, the Huachuca and Mule Mts. of southern Arizona. Lemmon's Slover Mt. specimens (in Ewan Herb.) are a mixture of true *N. californica* and of *N. neglecta*. This mixture was intimated by Lemmon when he added to the printed label in his own hand "& Arizona. Sept. 1882."

NOTHOLAENA CALIFORNICA subsp. **nigrescens** Ewan, subsp. nov. Based on *Wheeler* 878; sunny rock crevices with *Stylophyllum densiflorum*, San Gabriel Canyon, 6 mi. from mouth, alt. 1000 ft., Los Angeles Co., Calif. Type in Ewan Herb. at Univ. Colo.; isotype in L. C. Wheeler Herb. at La Verne, California. Paratype: Rog-

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[2] Maxon, l.c.
[3] Munz and Johnston. This JOURNAL 12: 108. 1923.
[4] Munz and Johnston, l.c.
[5] Johnston, Bull. So. Calif. Acad. Sci. 17: 64. 1918.
[6] Kimball, Fern Bull. 19: 43. 1911.
[7] Maxon in Kearney & Peebles, Flowering Plants and Ferns of Arizona 41. 1942.
[8] Maxon, Contr. U. S. Nat. Herb. 17: 603. 1916. [Occurs also in Sonora.—Ed.]

ers Canyon, alt. 1000 ft., San Gabriel Mts., *Wheeler* 955 (Plate 10, fig. b).

Filix robustior et altior, 10–15 cm. alta, stipitibus robustioribus, 6–10 cm. longis, paleis paucis lanceolatis acuminatisque, concoloribus, lucidis, fusco-castaneis; foliis 5–8, laminis ovato-deltoideis, 3.5–4.5 cm. latis et 4–6 cm. longis, basi tripinnatis, supra bipinnatisectis, utrinque pinnatisectis; pinnis discretis, segmentis ultimis lobulatis vel subintegerrimis sed variabilibus, supra atro-olivaceis atque pruinoso-puberulentis, subtus fusco- vel cinereo-olivaceis atque glandulosis; soris confluentibus.

Ferns stouter, taller, 10–15 cm. high, the stipes stouter, 6–10 cm. long, sparingly paleaceous at the base, the scales dark brown uniformly; leaves 5–8, the blades ovate-deltoid, larger, 3.5–4.5 cm. wide, 4–6 cm. long, bipinnatifid, the pinnae more distant, the ultimate segments lobulate or subentire, now closely set, now more openly disposed, dark olivaceous or ferrous, pruinose-puberulent above, yellow when young and sterile, darkening when soriferous to rusty black or ashy-olivaceous, sparingly rusty-glandular beneath.

In rock crevices in full sun, sometimes of hot canyon walls. Known only from the Upper Sonoran Life Zone of San Gabriel Mts. of southern California where it is locally plentiful.

This fern was first collected by George L. Moxley on a cliff between Fish and San Gabriel canyons, alt. 850 ft., May 30, 1923 (*Moxley* 1126) and reported by me in 1931.[9] In 1934 I reported Wheeler's collections and commented upon the convergent evolution, the parallel form or simulism (of Jepson), exhibited by this fern.[10] The

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[9] Am. Fern Journ. 21: 108.

[10] Am. Fern Journ. 24: 4.

Wright collection mentioned therein is properly *N. californica californica*. In 1937 the author collected *N. californica nigrescens* at the junction of West Fork with North Fork of San Gabriel River, alt. 1700 ft., *Ewan* 10965, thus establishing its occurrence in a slightly different area of the San Gabriel Mts. There is no collection of this subspecies among those listed by Maxon, the fern in any of its phases being unknown at that time (1916) in the San Gabriels. I have yet to see a collection of this dark-fronded subspecies outside the San Gabriels, and it seems that *Notholaena californica nigrescens* constitutes another instance of the minor endemism already detected for this interesting montane region.

NOTHOLAENA CALIFORNICA forma **accessita** (Jepson) Ewan, comb. nov. Based on *Notholaena candida* var. *accessita* Jeps., Man. Fl. Pl. Calif. 27. 1925, which in turn was based on *Jepson* 8031, from upper Vallecito, San Diego Co., Calif. Type (in Jepson Herb.) studied, illustrated by Pl. 10, fig. e.

? *Notholaena albida* Prantl, Engler Bot. Jahrb. **3**: 405. 1882, *nomen nudum*.

Differs from *N. californica californica* only in the plants possibly averaging smaller and in the nearly milk-white fronds, the nerves dark.

Known only from the type collection. Immaturity of the plant is at once suggested by the type, but the delicate little plants appear to be fully developed. Maxon, who has discussed the variability of *Notholaena californica* (l.c., 603), suggests that such variations in the amount of ceraceous covering of the blades "may be correlated with local or seasonal conditions." In any case this pallid form has no geographic significance. Although no specimens of *N. californica californica* have been seen of a whiteness comparable to Jepson's type of forma *accessita*, plants nearly as pallid are included in the topotype col-

lection here illustrated (cf. Pl. 10, fig. a). The plants from the vicinity of Palm Springs, along the western margin of the Colorado Desert, which might be thought to correspond in their characters with Vallecito specimens, do not show any such pallor, but contrariwise are dark olivaceous. More collections from the vicinity of Vallecito and Montezuma Valley are desirable.

POLYSTICHUM MUNITUM

POLYSTICHUM MUNITUM (Kaulf.) Presl, Tent. Pterid. 83. 1836. Based on *Aspidium munitum* Kaulf. Enum. Fil. 236. 1824, in turn based on a Chamisso collection from "California," probably taken in the vicinity of Presidio, San Francisco, 1816, upon disembarking from *Rurik*. Type not located, but tracing of isotype (Herb. Berlin-Dahlem) kindly furnished by Dr. L. Diels shows Kaulfuss's material to be the well-known central and northern California form of the species.

Nephrodium plumula Presl, Pl. Reliq. Haenk. **1**: 33. 1825. Based on a Thaddeus Haenke collection from Nootka Sound, Vancouver Island, 1791. Type not seen. Presl compared his species with *Aspidium acrostichoides*, not with *Aspidium munitum*.

Polystichum plumula (Presl) Presl, Tent. Pterid. 83. 1836. Based on the last.

Dryopteris munita (Kaulf.) Kuntze, Rev. Gen. Pl. **2**: 813. 1891. Based on *Aspidium munitum* Kaulf.

Coarse but often princely evergreen fern arising from strong, woody, suberect, very chaffy rhizomes crowded into heavy stool-like tufts or clumps; fronds numerous, sometimes 75–100, rather strictly ascending, mostly 60–140 cm. long, the stipes stout, mostly 8–30 (or even 60) cm. long, these and the rachises conspicuously paleaceous with large lanceolate chestnut-brown scales intermixed with shorter linear-lanceolate ciliate scales; blades of

fronds pinnate, lanceolate, rather shortly acuminate to a slender subcaudate tip, dark lustrous green above, paler beneath, 30–45 or even 100 cm. long, 9–16 or even 25 cm. wide; pinnae evenly and closely set, very numerous, sometimes over 70 pairs, alternate, narrowly lanceolate, auriculate, now nearly straight, now falcate, pungently toothed or incised, the teeth short, firm, bristle-tipped; sori 1–1.5 mm. wide, submarginal or confluent (especially in sun forms), usually in 2 rows, sometimes in several rows, the indusia subrotund, fringed, irregularly and tardily deciduous.

Common in damp woods of *Sequoia sempervirens*, *Picea*, *Thuja*, *Pseudotsuga*, etc., chiefly of the coastal Humid Transition Life Zone. Here it is an "indicator species." Alaska, south to northern Idaho, northwestern Montana, and along the Coast Ranges to Monterey Bay, California.

BRITISH COLUMBIA. Renfrew, V. I., *Rosendahl & Brand* 103; 1 mi. above Cameron Lake, V. I., *Ewan* 10545; Nanaimo, *Ewan* 10534.

WASHINGTON. Grays Harbor Co.: w. of Quinault Lake, *Ewan* 10504. Whatcom Co.: Mt. Baker trail, *Eggleston* 21706. Columbia Co.: Blue Mts.[11]

IDAHO. Lake Coeur d'Alene, June 1892, *G. B. Aiton;* no. fork Clearwater River, *Epling & Houck* 9424; Moose Creek trail, alt. 3500 ft., *Kirkwood & Severy* 1695.

OREGON. Tillamook Co.: Neskowin, *Ewan* 10491. Multonomah Co.: Council Crest, Portland, July 1926, *M. N. Ackley.*

CALIFORNIA. Mendocino Co.: Navarro River, *Ewan* 9339. Marin Co.: Alpine Lake, *Ewan* 9415; Tomales Bay, *Ewan* 8103; 3 mi. w. Inverness, *Ewan* 9374; Pt. Reyes, cold bog, *Ewan* 8050. Contra Costa Co.: Wildcat Creek, *Ewan* 8628 (in part). Alameda Co.: Straw-

[11] Piper, Fl. Wash. 81.

berry Canyon, *Ewan* 7984, 9279. San Mateo Co.: bet. Santa Cruz and Pescadero, 1929, *Viola N. Poole*. Santa Cruz Co.: Big Basin, Aug. 22, 1926, *Ewan*. Placer Co.: Dutch Flat, American River, Sept. 1929, *Eliz. Flint*.

Though the fern ranges north to Alaska according to several authors, I have not seen an Alaskan collection. The Vancouver Island specimens seen are very typical, and upon the basis of other species demonstrating a similar Pacific Coast range there is good likelihood that the Alaskan plants are similar. Eaton writes that the fern was first collected at Nootka Sound by Menzies, but Haenke took it there the preceding year, that is, 1791, during the Malaspina Expedition. Of the Pacific Coast ferns, *Polystichum munitum* is the most familiar to the layman, aside only from the Maidenhair. To those persons frequenting the popular Redwood Highway of California it is a familiar sight in a world of lush verdure. For there the Pacific Sword-fern stands in magnificent stools three to five feet high, not infrequently growing from the tops of rotting Redwood stumps of long-cutover groves. And to those persons who notice funereal designs in florists' windows, it is again a familiar background greenery there. Bales of this fern are brought into the metropolitan cities for the florist trade.

The small roundish spots on the fronds of Oregon collections of *Polystichum munitum* have been determined by A. J. Mix as due to the fungus *Taphrina Faulliana*.[12]

Of *Aspidium munitum* it may be said that the likelihood of Chamisso's having taken the type collection at the Presidio, San Francisco, is very good. Chamisso himself has described the original place of collection of the several ferns and flowering plants taken at San Francisco in the following words: "The presidio and mission of San Francisco lie on this tongue of land [i.e., San

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[12] Mycologia 30: 573. 1938.

Francisco peninsula], which, with its hills and downs, was the narrow field which lay immediately open to our researches."[13]

The *Aspidium munitum* of Sadler[14] represents *Polystichum aculeatum* var. β of Moore, Index Fil. 97. 1858 or *Polystichum lobatum* (Huds.) Presl according to C. Luerssen (Farnpflz. in Rabenhorst, Kryptogamen-Flora **3**: 332. 1889).

POLYSTICHUM MUNITUM subsp. **curtum** Ewan, subsp. nov. Based on *Ewan* 5159 from Sawpit Canyon, alt. 4200 ft., San Bernardino Mts., Calif., growing beneath *Quercus chrysolepis* in a shaded glen. Type in Ewan Herb. at Univ. Colo.; isotypes in Dudley Herb. and U. S. Nat. Herb.

Rhizoma gracilius, foliis paucioribus, stipitibus 20–30 cm. longis, tenuioribus, supra stramineis et subepaleaceis, basi manifeste paleaceis, paleis brunneis; laminis anguste lanceolatis, regulariter acuminatis, 25–38 (raro 50) cm. longis, rhachibus ubique stramineis et subepaleaceis; pinnis 30–40-jugis, infimis oblongo-lanceolatis, pinnis sterilibus apice breve rotundo-apiculatis, manifeste auriculatis, fertilibus lanceolatis acuminatis subauriculatisque.

Rhizomes less robust, shorter, very chaffy; fronds fewer, usually 15–30, weakly ascending, 40–80 cm. long, the stipes more slender, 20–30 cm. long, densely paleaceous at base but sparingly so above, the rachises finely and inconspicuously paleaceous, the scales of stipe attenuate-lanceolate chestnut-brown, the supplementary subfiliform ciliate scales few; blades of fronds characteristically tapering gradually to tip, 25–38 (rarely 50) cm. long, 6–9 cm. wide, the pinnae fewer, usually 30–40 pairs, oblong-lanceolate, the sterile pinnae shortly apiculate, falcate, the fertile ones long-acuminate, often straight.

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[13] Chamisso in Kotzebue, A Voyage of Discovery **3**: 38. 1820.
[14] De Filicibus veris Hungariae 34. 1830.

In well-drained decomposed granite soils of canyon slopes in dappled shade of *Quercus chrysolepis* and *Pseudotsuga*, in Upper Sonoran Life Zone. Santa Lucia Mts., Monterey Co., Calif., to the San Bernardino and Cuyamaca mountains, from 1500 to 8600 ft. (fide Munz and Johnston), mostly below 4500 ft.

CALIFORNIA. Monterey Co.: Arroyo Seco, Santa Lucia Mts., *Ewan* 9022. Los Angeles Co.: Pasadena, *Jones* 3032; near Opids Camp, San Gabriel Mts., *Ewan* 1240; Little Santa Anita Canyon, alt. 2700 ft., *Ewan* 1279; San Antonio Canyon, *C. F. Baker* 3674. San Bernardino Co.: Mill Creek, alt. 5400 ft., beneath *Quercus Kelloggii*, *Ewan* 56; Dobbs Cabin, alt. 6200 ft., June 30, 1929, *E. L. Peterson*. Riverside Co.: Lower Strawberry Valley, San Jacinto Mts., alt. 5100 ft., Aug. 24, 1930, *E. L. Peterson*; Box Sprs. Mts., below 1500 ft., *Reed*.[15] San Diego Co.: Cuyamaca Mt., 1888, *Ida Teed* (UCLA Herb.).

I have not seen a Santa Cruz Island collection.[16] Indeed, *P. munitum munitum* rather than *P. munitum curtum*, may be expected to occur there. Thus *Polypodium Scouleri*, characteristic of the mainland from Monterey Bay northward, occurs on Santa Cruz Island, though not known from the adjacent mainland.[17] Typical *Polystichum munitum* follows this mainland distribution pattern.

POLYSTICHUM MUNITUM subsp. **nudatum** (D. C. Eaton) Ewan, comb. nov. Based on *Aspidium munitum* var. *nudatum* D. C. Eaton, Ferns N. Am. **1**: 188. 1878, this in turn based on a collection of Alphonso Wood, Nevada Falls, Yosemite Valley, Calif., in 1866. Type in Eaton Herb., Yale Univ.

Polystichum munitum var. *nudatum* Gilbert, List N. Am. Pterid. 20. 1901.

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[15] Muhlenbergia **5**: 94. 1909.
[16] Cf. Greene, Bull. Calif. Acad. Sci. 2: 415. 1887.
[17] Ewan. This JOURNAL **21**: 6. 1934.

Polystichum munitum forma *nudatum* (D. C. Eaton) Broun, Index N. Am. Ferns 148. 1938. Based on *A. munitum* var. *nudatum* D. C. Eaton.

Rhizome slender; fronds few, practically wholly scaleless, 30–40 cm. long, the stipes very slender, 10–20 cm. long, these and the rachises straw-colored; blades of fronds ovate-lanceolate, evenly acuminate, 23–30 cm. long, 7–9 cm. wide, the pinnae few, rather remote especially below, short, 3.5–4.0 cm. long, deltoid-lanceolate, rather indistinctly auriculate, the teeth closely appressed; sori scant, scattered or in 2 interrupted rows.

Shaded rock crevices; usually highly local, in coniferous woods of Transition Life Zone. Sierra Nevada from Mariposa Co. to Tulare Co., Calif., from 4500 to 6700 feet altitude.

CALIFORNIA. Mariposa Co.: Yosemite, alt. 6000 ft., *Lemmon;* Ledge Trail and along Wawona Road, *Hall.*[18] Tulare Co.: Moro Rock, Sequoia Nat. Park, July 21, 1927, *H. A. Anderson* (rachis finely paleaceous at middle and some imbrication of pinnae, therefore atypical but approaching this scaleless phase).

Polystichum munitum nudatum is well marked morphologically. In fact, Eaton wrote (l.c., 191) that it is "so unlike the type of the species, that, if it had been sent from some other country than California, it would not have been referred to this species." This fern is treated as a subspecies here because it has a natural geographic range and does not seem to be a mere sporadic form appearing over the whole range of *Polystichum munitum.*

POLYSTICHUM MUNITUM forma IMBRICANS (D. C. Eaton) Clute, Fern Bull. **15**: 124. 1907. Based on *Aspidium munitum* var. *imbricans* D. C. Eaton, Ferns N. Am. **1**: 188. 1878, in turn based on a collection by

[18] Yosemite Flora 38. 1912.

Mrs. R. M. Austin from Plumas Co., California, in 1877 (?), and a collection by Albert Kellogg from Red Mt., Mendocino Co., Calif., the latter illustrated by Eaton (l.c., pl. 25, right hand fig.). Published by Eaton, same year, in Wheeler Surv. Rep. **6**: 335. 1878.

Polystichum munitum var. *imbricans* (D. C. Eaton) Maxon, Fern Bull. **8**: 30. 1900. Based on *A. munitum* var. *imbricans* D. C. Eaton.

Rhizome slender; fronds few, smaller, the stipes densely chaffy at the base, the blades with elongated cuspidate tips, the rachises usually scaleless, the pinnae all more or less closely imbricated, ascending.

Occasional over the whole range of the species, being apparently a response to increased insolation, and growing in sunny rock crevices of exposed slopes. Vancouver Island (fide Maxon) south to southern California. The following are representative collections:

WASHINGTON. Chelan Co.: Lake Wenatchee, *J. W. Thompson* 6798.

OREGON. Wasco Co.: Mosier, *J. W. Thompson* 5152.

CALIFORNIA. Siskiyou Co.: Mt. Shasta, 7000 ft., *Lemmon*. Tulare Co.: Sequoia Nat. Park, July 1908, *A. Davidson* 2091 (L. A. Mus. Herb.). Los Angeles Co.: Deer Canyon, San Gabriel Mts., alt. 3200 ft., *Wheeler* 1444. San Diego Co.: Palomar Mts., alt. 5000 ft., *Munz* 8212.

"Gradations" were noted for forma *imbricans* when it was proposed by Eaton and continue to be observed and collected. Both typical shade plants of this fern and the "sun form" occur often in the same region. Thus in the San Gabriels *Polystichum munitum curtum* grows on lightly shaded slopes, and forma *imbricans* in exposed places, with intermediate states (e.g. *Ewan* 4751, Big Tujunga Canyon, San Gabriel Mts.) interspersed. It would be a misuse of the term "subspecies" to refer to this phase, an ecologic state, by that term.

POLYSTICHUM MUNITUM forma INCISO-SERRATUM (D. C. Eaton) Clute, Fern Bull. **15**: 124. 1907. Based on *Aspidium munitum* var. *inciso-serratum* D. C. Eaton, Ferns N. Am. **1**: 188. 1878, in turn based on a Lyall collection in 1860 and a collection of *J. Macoun*, both from British Columbia.

Polystichum munitum var. *inciso-serratum* (D. C. Eaton) Underw., Our Native Ferns ed. 6, 116. 1900. Based on foregoing.

Like *P. munitum munitum* except the pinnae often strongly auriculate, variously incised or serrate, the teeth sharp, prominently bristle-tipped.

Occasional and sporadic over the range of the species, sometimes growing with typical clumps, but not known from the range of *P. munitum curtum* or *P. munitum nudatum*. Commonly the rachis is fuscous-paleaceous with abundant dark, lance-acuminate, lacerate and ciliate scales, the stipes similarly thinly chaffy with large deltoid-lanceolate scales. Representative collections:

WASHINGTON. Beacon Hill, Seattle, *J. W. Thompson* 5180.

CALIFORNIA. Humboldt Co.: Prairie Creek n. of Orick, *Ewan* 10768 (fronds to 150 cm. long). Contra Costa Co.: Wildcat Creek, *Ewan* 8628 (in part). San Luis Obispo Co.: San Luis Obispo, July 1911, *Thekla Mohr* (L. A. Mus. Herb.)—somewhat atypical and intermediate with *P. munitum curtum*.

POLYSTICHUM LOBATUM × P. MUNITUM (*Aspidium Arendsii* F. Wirtg. mss.) reported by Christ (Allg. Bot. Zeitschr. **12**: 4. 1906).

DISCUSSION

The coastal populations of the Pacific Sword-fern represent two recognizable subspecies, *Polystichum munitum munitum*, ranging north from the Monterey Bay of California to Alaska, and *Polystichum munitum curtum* of

southern California from Monterey southward. These two subspecies have a tension zone at Monterey Bay. Some species which similarly have their northern limit in the Santa Lucia Mountains of Monterey County are *Equisetum Funstonii, Bloomeria crocea, Calochortus in-venustus, Cycladenia venusta,* and *Monardella macrantha.* The significant fact, then, that has again come to the attention of the author is that there exists a clear floristic pattern in the Coast Range flora of California. That is, the part played by the geographic break in the outer more moist Coast Range at Monterey Bay must be taken into account with the floras taking on a different content north and south of this embayment.

A second fact in floristics is the occurrence of a Coast Range species-group in the Sierra Nevada at a point about opposite the Golden Gate and extending southward irregularly as far as Tulare County (e.g., *Chlorogalum pomeridianum*). It is significant, I believe, that not only angiosperms follow this floristic pattern but vascular cryptogams as well. This suggests even greater significance for this interesting distributional effect. The geologic history of the central Sierra Nevada must hold the answer to this entertaining problem. More collections of this Sierran subspecies *Polystichum munitum nudatum* are most desirable, with full field notes. The two subspecies *curtum* and *nudatum* have phytogeographic distinctness. Two forms, representing sporadic conceivably mutant states appearing over nearly the whole range of the species without geographic pattern, are forma *imbricans* and forma *inciso-serratum.* Application of the transplant method with these two forms, and with the subspecies as well, should bring to light further points of interest relative to the systematics of the Pacific Sword-fern.

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Ophioglossum vulgatum on the Inner Coastal Plain of Alabama

ROBERT T. CLAUSEN

A considerable colony of *Ophioglossum vulgatum* was found on April 1, 1942, in a swampy woods about 5 kilometers east of Eutaw, at an elevation of 30 meters on the inner Coastal Plain of Greene County, Alabama. The plants were growing under *Ulmus* and *Quercus* and were in various stages of development,—some just coming up, others having the sterile blade fully expanded and the fertile segment well developed, but the sporangia still green. Twenty plants were collected by my wife and me (*R.T. & E.R.C.* 5719); others were taken by R. V. Moran and R. F. Thorne, who accompanied us. Specimens are deposited in the herbaria of Cornell University and the University of Alabama. This seems to be the first record of the species in Alabama, although I have previously reported it from such nearby states as Mississippi, Louisiana and Florida (Clausen, 1938).

Of twenty-four specimens of the Alabama plants, twenty-one have a basal sheath (remains of a previous leaf or leaves) about the base of the leafstalk, and three are broken off at the base and cannot be definitely checked for this character. The sterile blades are various: lanceolate-elliptical, ovate-elliptical, elliptical, and broadly oblong. The sporangia are not mature, but they appear as broad as long, not crowded and transversely oblong as Fernald (1939) described the sporangia of his variety *pycnostichum*, typified by plants from the Coastal Plain of Virginia. The Alabama plants are similar to certain specimens from Virginia in the shape of the sterile blade, the persistence of the basal sheath, and their development early in the season, but they also resemble (in presence of basal sheath, shape of blade, and sporangia) plants

from such diverse localities as Wethersfield, Hartford Co., Conn., Chenango, Cortland, Tompkins, and Wayne counties, N. Y., various localities in Europe, and other places. For that reason no subspecific name is indicated.

The characters available for the segregation of subspecies in *Ophioglossum vulgatum* seem unsatisfactory. This statement is made after studying over 555 lots of specimens (that is, about 2000 herbarium sheets) of this species from most parts of its range. The variations appear only weakly correlated with geography and are mostly distributed throughout the entire area occupied by the species. They seem to lack the geographical, ecological, or genetical isolation which would render them significant as subspecies. Instead, they often occur together in the same region and in the same habitats and because of their proximity, probably, are constantly arising and disappearing. Perhaps they are incipient races and, as such, deserving varietal designation, but certainly they are not yet of the status of subspecies.

The shape and size of the sporangia are not satisfactory for separating subspecies, since they vary with the age of the fertile segment. The sporangia become more nearly globose as they approach maturity.

The presence or absence of a basal sheath depends on the degree of weathering (rotting) of the leafstalk of the previous season. This weathering is presumably influenced by climate, moisture, and the nature of the soil. In herbarium specimens the presence or absence of such sheaths is possibly determined by the degree of washing to which the plants have been subjected before pressing. In discussing *Ophioglossum vulgatum*, Fernald (1939) indicated that one of the characteristics of the plant of the northeastern United States is its lack of a basal sheath. In a random sample of 305 northeastern North American specimens examined by me, 45 had a basal

sheath, 72 lacked it, and 188 plants lacked basal parts. In a similar survey of 158 European specimens, 44 had a sheath, 19 did not, and the rest were without basal portions. These figures indicate a definite tendency, yet it seems reasonable to be cautious in using this character for separating populations because of the factors which may be responsible for the presence or absence of the sheath. In both *Botrychium* and *Ophioglossum* basal sheaths are present in varying degrees in many species; but they seem of slight systematic value, since plants in the same colony may vary widely in this respect. Occasionally, as in *Ophioglossum Aitchisonii*, the basal portions of many leaves persist and form a conspicuous involucre which may be of greater taxonomic value.

Translucence of the sterile blade depends on age. In early stages blades are usually opaque. Later they become quite translucent, with the venation evident. The var. *alaskanum* seems to have as its best character the translucent blade, but in this and other characters it can be matched by plants from as far away as Syria, Ontario, Scotland, and Scandinavia.

Shape of sterile blade is not sufficient for subspecific segregation, since various leaf forms frequently occur in the same habitat and the different types are rather widely distributed over the whole range of the species. The Alabama plants demonstrate the truth of this statement. They tend to vary in the direction of Fernald's var. *pycnostichum*, but many plants from central New York do likewise. Probably all the varieties of *Ophioglossum vulgatum* (described from North America) occur in central New York. There is not yet enough material from Alabama to warrant a similar statement for there, but the small suite of specimens available already indicates that the population should be treated in the same species

(and subspecies) with plants from the northern part of the country.

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LITERATURE CITED

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Shorter Notes

GO SLOW ON EATING FERN FIDDLEHEADS.—Dr. Blake's article on the Ostrich Fern as an edible plant[1] could not fail to remind me of the situation in respect to the Western Bracken. Some years ago the scientists working at one of the northwestern range experiment stations thought they would try dried Bracken as a winter feed for sheep. During the long winter these animals, kept in well-closed pens, increased in weight on this diet, and a bulletin was prepared, in which the data were presented and this plant was recommended to western stock raisers. The bulletin did not reach the stage of publication before spring; fortunately so, for when the animals which had been fed on the fern were turned out into the sunlight, they developed severe hemorrhages and died.

So, when inquiries come in as to the use of this or that fern as food, my advice is always, to go slow. Bracken—at least some subspecies—contains light-sensitive toxins. The rhizomes of several species of *Dryopteris* (*Eudryopteris*) are in the Pharmacopeia as a source of powerful drugs. The fronds of *Cystopteris fragilis* and several other ferns are well known to chem-

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[1] This JOURNAL **32**: 61. 1942.

ists as containing glucosides which produce deadly hydrogen cyanide on boiling. Recently Dr. A. R. Hodgdon, of the University of New Hampshire, wrote me of a case of cattle poisoning seemingly due to *Onoclea sensibilis*.

If you must eat fiddleheads, be sure they are picked by someone who knows one species from another, and that no species that are generally poisonous, or to which you have individual allergy, are included.—EDGAR T. WHERRY, *University of Pennsylvania*.

PROLIFEROUS SCOTT'S SPLEENWORT.—The recent note by C. A. Weatherby[1] struck my fancy because of the remark in the last paragraph that lateral proliferation might be most likely to occur in the spring. The reason given is that the stipes become weakened during the winter and lie flat on the ground. They may be partly covered with a mulch of leaves and then, if in no other season, they are in contact with continuously moist soil.

The weakening of the stipes is easy to see in *Dryopteris marginalis* and *Polystichum acrostichoides*, in which the tissues are light green and pulpy. Late in the fall the tissues a short distance from the rhizome turn brown and become more or less disintegrated. Only the fibrovascular bundles remain entire and apparently functioning. Probably similar changes take place in the dark, wiry stipes of *Asplenium platyneuron* and *A. ebenoides*. If the changes do occur, this suggests an analogy between the proliferation of *A. ebenoides* in the spring and the gardener's method of "layering" for rooting woody shoots. The shoot is cut part-way through, the cut surfaces are twisted slightly apart, or else earth is put between them, so they will not grow together again, and the cut is covered with earth. With the stipe as with the

[1] This JOURNAL **32**: 23–25. 1942.

shoot there is maintained a partial connection with the main part of the plant.

Asplenium platyneuron, one of the parents of *A. ebenoides*, proliferates fairly often. Early in 1904 I happened to turn up a prostrate frond on which was a small plant springing from the rachis. Further search brought to light perhaps a dozen more specimens. Each of the small plants was growing in the axil of a pinna, just as a lateral shoot of a flowering plant grows from the axil of a leaf. Most of the specimens were found during the first week of July, when there was an unusually good opportunity to examine a large number of plants.

Finding the first specimen was sufficiently exciting, because no reference to it could at first be found. However, D. C. Eaton had not overlooked it, but described it as var. *proliferum*.[2] The name may be a convenience, but the fern hardly deserves to be considered as a valid variety, unless it is shown by extensive observations for a number of years that some plants regularly and consistently proliferate, while other plants growing under the same conditions do not. It seems safe to predict, or merely to suggest, that proliferation would be found to be more or less accidental, and not a character possessed by some plants and not by others.

Within the past few years a number of chemicals that stimulate the rooting of cuttings of flowering plants have been discovered, and some of them can be bought of seedsmen. According to the literature that comes with one of these chemicals it will almost grow roots on a dead stick. but in my hands it has given no clear evidence of any ability to root various kinds of cuttings. In spite of this. it was given a chance to show whether it would cause proliferation of the rachises of *A. platyneuron*, *Dryopteris marginalis*, and *D. cristata*, while duplicate rachises not

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[2] Bull. Torrey Club **6**: 307. 1879.

treated with it did not proliferate. The rachises were pinned down on the surface of a mixture of fine peat and sand in equal volumes. Those in one of the two fern pans filled with this mixture were liberally sprinkled with the chemical, while those in the other pan were not so treated. To avoid accidental contamination, the untreated rachises were planted first, and their pan was kept several feet from the other pan. To lessen evaporation from the pinnae, which had been cut off to a length of one-half inch or less, each pan was covered with a pane of glass supported an eighth of an inch above the rim by small sticks. The pans stood in saucers kept filled with water, and were put where they got sunlight only part of the day.

The cuttings of the two species of *Dryopteris* did not stay green longer than two or three weeks, and by that time those of the *Asplenium* were turning brown. It was realized at the start that the experiment was faulty because there were too few rachises, and they were handicapped by having been cut from the parent plants and by being kept under unnatural conditions. Perhaps some member who is interested and has the opportunity will experiment with a large number of undisturbed plants outdoors, making sure that whatever chemical is used cannot be washed by rain to the untreated plants under observation.—C. E. WATERS, *Washington, D. C.*

LYCOPODIUM SABINAEFOLIUM IN PENNSYLVANIA.—Early in July, 1941, Mr. Richard C. Harlow observed on his property a mile south of South Sterling, in Wayne County, Pennsylvania, a *Lycopodium* which he could not identify; and a specimen he sent me at that time remained unnamed. On August 3rd, 1942, an opportunity came to search for fruiting material, and its identity was then established as the boreal *Lycopodium sabinae-*

folium, occurring far south of its previously known range. The plant forms a patch several meters in diameter, intermingled with *L. clavatum* and *L. tristachyum*. Its rootstocks are shallowly seated in mediacid humus, from which they locally emerge, as in *L. flabelliforme*. Its foliage is deep green and not glaucous.

Several varieties have been segregated from *L. sabinaefolium*, but the original plant of Willdenow[1] has not received a varietal name. To have a means of referring to it without circumlocution I hereby propose that it be known as var. **typicum**, nomen novum.

This entity is characterized by having a bushy habit with ascending branches, the sterile 10 to 15 cm. long, and the fertile more or less exserted; its ascending leaves are mostly 4-ranked, with those of the lower rank shortened; its peduncles are usually well-developed, ranging from 1 to 5 cm. long, simple or sparingly furcate and in groups of 3 to 9 per primary branch. Segregates comprise var. *patens* Vict., with the branches and lateral leaves spreading; var. *sharonense* Blake, with likewise spreading branches but peduncles 6 to 8 cm. long; and var. *superfertile* Vict., compact-tufted, with furcate peduncles in groups of 10 or more per primary branch. The Pennsylvania plant proves to belong to var. *typicum*.

A related clubmoss, *L. sitchense* Rupr., has been classed by Fernald as still another variety of *L. sabinaefolium* on the ground that its supposed diagnostic characters of five-ranked leaves of uniform length and short peduncles are not correlated. In the field, however, the two have a dissimilar aspect, *L. sitchense* being much more glaucous and dwarfed, with the fertile branches little exserted. If, instead of peduncle-length alone, the combined length of peduncle and exserted supporting branch is considered, the two are usually separable.

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[1] Sp. Pl. 5: 20. 1810.

Lycopodium sabinaefolium is generally recognized to range in eastern North America south to Michigan, New York, and Maine. In the 7th edition of Gray's Manual it is reported from Staten Island, but was presumably misidentified there. House in the Annotated List of New York plants records var. *sitchense* from Mt. Marcy in the Adirondacks and var. *sharonense* from Hinkley, Herkimer County. The latter place lies nearly 150 miles north of the Pennsylvania locality, which thus represents a considerable range-extension southward. It is interesting to note that the north slope of the Poconos carries other disjunct limiting colonies of northern plants, such as *Botrychium multifidum* var. *typicum* and *Lycopodium complanatum.*

The find here announced came too late for inclusion in my recent list of the ferns of Pennsylvania or in the second edition of "Guide to Eastern Ferns."—EDGAR T. WHERRY, *University of Pennsylvania.*

Recent Fern Literature

Dr. R. M. Tryon, Jr., has published[1] a revision of the genus *Pteridium,* Bracken. The last previous monographic treatment of the group was by Agardh in 1839; he recognized eight species. Contemporary and later authors did not accept his views and bracken was regularly cited as an example of a cosmopolitan species. Recent authors, however, though no one until Dr. Tryon had given it comprehensive study, have been inclined to break it up again. Christensen lists seven specific combinations under *Pteridium,* and Ching, in his recent rearrangement of the Polypodiaceae, allows the genus five or six species.

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[1] Tryon, R. M., Jr. Revision of the Genus Pteridium. Rhodora 43: 1–31, 37–67. *pl. 650–653.* 1941.

It is therefore as interesting as it is unexpected to find Dr. Tryon, after thorough and detailed study, reverting fully to the conservative view and treating all the brackens of the world as members of one species, *Pteridium aquilinum*. His conclusions are, however, well documented and work out rather prettily. He finds the species far from uniform; it consists of a series of twelve varieties in different parts of the world. Four occur in the United States—var. *latiusculum* in the northeast, var. *pseudocaudatum* and var. *caudatum* in the southeast, and var. *pubescens* in the west. Two give us geographic surprises. Var. *latiusculum* is found not only in the familiar eastern-America-eastern-Asia range, but through Eurasia to eastern Europe; and typical *Pt. aquilinum* occurs only in western Europe (except for an area on the northeastern shore of the Black Sea) and south through Africa to the Cape (Dr. Tryon is unable to separate *Pt. capense*). It thus takes its place with that element of the European flora which presumably survived the glacial epoch at a few points in western and southwestern Europe (or in this case, Africa) and has spread north and east since.

Dr. Tryon's paper is also interesting in its relation to the current difference of opinion among American taxonomists as to the use of the terms subspecies and variety. His twelve varieties are all strictly geographic, each having a distinctive range which does not greatly overlap that of any other. In all but one case, to be noted later, they cross and produce intermediates where their ranges touch. They also fall into two larger groups, likewise geographic, one mainly in the northern, the other in the southern hemisphere. These major groups do not intergrade where their extreme members meet in Central America and Florida; but they are connected by var. *yarrabense*, ranging from southeastern Asia to northern

Australia, intermediate in characters and intergrading with both. It occupies a considerable area and cannot be dismissed as a "hybrid swarm"; it truly connects the major groups.

The term subspecies is at present being used in three ways. The first is the traditional European system. Under it, Tryon's major groups would be treated as subspecies, the minor ones as varieties on morphological grounds and more or less regardless of the fact that both grades are geographic. The second is that of du Rietz, which uses geography alone as a criterion of subspecies and variety—if a group has a distinctive range, it is a subspecies; if it is "local" within the range of the species proper, it is a variety. Under this system the lesser groups in *Pteridium* would have to be called subspecies and since the major ones do not have the discontinuity required of species, no place would be left for them. The third is taken from vertebrate zoology and uses only a single category, subspecies, below the species. Under it no distinction of major and minor infraspecific groups is possible. Tryon, wisely I think, chose the first as the only one under which the scheme of classifiation can be made to fit at all closely to the degrees of relationship in nature.—C. A. WEATHERBY.

Dr. William R. Maxon has recently published[1] an account of the ferns and fern allies of Arizona, which have not previously been treated as a unit. Seven families, 24 genera, and 78 species are treated. There are no specific descriptions, but short generic diagnoses are given, as well as excellent keys to the genera and species.

There are no endemic Arizona species, but the following species are found in the United States only in Ari-

[1] In Kearney & Peebles, Flowering Plants and Ferns of Arizona. U. S. Dept. Agric. Misc. Publ. **423**: 24–45. 1942.

zona: *Dryopteris patula* var. *Rossii*, *Ceterach Dalhousiae*, *Asplenium exiguum*, *Cheilanthes pyramidalis* var. *arizonica*, *C. Pringlei*, *Notholaena Lemmonii*, and *N. neglecta*. Of these the *Ceterach* and *Asplenium* are especially interesting as examples of an extremely disjunct distribution. These were both described from the Himalaya Mountains of Asia, and the plants from these two widely separated regions are indistinguishable. The *Ceterach* occurs also in a third area, Abyssinia, far distant from the other two. Among the rare ferns of Arizona are *Ophioglossum vulgatum*, *Botrychium virginianum*, *B. Lunaria*, *Dryopteris Linnaeana*, *Cystopteris bulbifera*, *Asplenium Adiantum-nigrum*, *Polystichum Lonchitis*, *Cheilanthes alabamensis*, *Pellaea Suksdorfiana*, *P. ternifolia*, *Azolla caroliniana*, and *Selaginella neomexicana*, all of which are known in Arizona from a single locality only.—C. V. M.

Bro. Daniel of the Colegio de San José, Medellín, Colombia, has published a list of the Colombian specimens of *Dryopteris*, *Blechnum*, and *Asplenium* in the two principal herbaria at Bogotá which will be useful to such as can read Spanish and wish data as to the distribution of South American ferns. It is of especial interest as recording the whereabouts and identity of some of the historical collections of Triana, under whose supervision Mettenius issued his list of the ferns of that country in 1864–65, as part of a projected Flora of Colombia.

Bro. Daniel's list[1] is accompanied by nomenclatural notes and bits of general information. We learn from it, for instance, that the widespread tropical species *Dryopteris paleacea* is used, like its close relative, our northern Male-fern, as a vermifuge. The author has,

[1] Daniel, Hermano. Los generos Dryopteris, Blechnum y Asplenium en algunas colecciones Colombianas. Caldasia, no. 3, 33–40. 1941.

unfortunately, not had access to Maxon and Morton's recent revision of *Dryopteris*, subgenus *Meniscum*, and his data as to that group cannot therefore be accepted as accurate. And *Doryopteris* and *Dryopteris* are confused to the extent of including a member of the former (*D. palmata*) among the species of the latter.—C.A.W.

Dr. E. T. Wherry, a former president of the American Fern Society, has published an annotated list of the pteridophytes of Pennsylvania.[1] The paper contains many distributional data and some taxonomic discussion. The list includes 81 species, 48 varieties, 36 forms, and 13 hybrids occurring within Pennsylvania. Nomenclatural innovations are *Botrychium obliquum* f. *confusum* Wherry (for a phase of *B. dissectum* var. *obliquum* with the "margins more or less distinctly dentate"), *Athyrium asplenioides* var. *subtripinnatum* (Butt.) Wherry, *Asplenium platyneuron* var. *Hortonae* (Dav.) Wherry, *A. Ruta-muraria* var. *ohionis* (Fern.) Wherry, ×*Dryopteris Slossonae* (Hahne) Wherry for the hybrid between *D. cristata* and *D. marginalis*, *Currania Dryopteris* (L.) Wherry for *Dryopteris disjuncta* (Rupr.) Morton, and *C. Robertiana* (Hoffm.) Wherry for *D. Robertiana* (Hoffm.) C. Chr. The combination *Asplenium Ruta-muraria* var. *cryptolepis*, made previously by Massey without bibliographical citation, was later validated by Christensen and again by Broun in his Index. The International Rules of Botanical Nomenclature, edition 3, seem to require only the citation of some previous description of a group to validate the publication of a new combination. Articles 37 and 44 deal particularly with this detail.

Under eight species Wherry has given nomenclatural

[1] Wherry, E. T. The ferns and lycosphens of Pennsylvania. Bartonia 21: 11–37. 1940–1941 [1942].

standing to epithets designating the typical element of the species. To the reviewer, this practice, increasingly frequent among current writers, seems contrary to the wording of the rules, Article 30, Recommendation XVIII. Under *Botrychium multifidum,* Wherry designates the typical element of the species as "var. *typicum* (Clausen) Wherry." Yet when I originally used "ssp. *typicum*" under *B. multifidum,* I employed it in a parenthetical sense and by no means intended to have my own name written after the *typicum.* There is no type designated by me and the fate of *typicum* (whether as ssp., var., or form) depends on the type or description of Gmelin's *Osmunda multifida,* not on the interpretations of Wherry or myself. The "*typicum*" is a bibliographical device, rather than a taxonomic one. The Rules need clarification on this detail. The above remarks are not intended as criticism, but are made to draw attention to a troublesome point.

Wherry proposes the term "lycosphen" for the primitive groups known previously as fern allies. These include the Psilotales, Equisetales, Lycopodiales, Selaginelales, and Isoetales. This term may serve a useful purpose, but it should not be forgotten that the old popular term, pteridophytes, may still be used to designate both the ferns and the lower groups.

In the introduction to the paper, the categories subspecies, variety, and form are defined. In the treatment, however, subspecies is not employed. The variations of the Spinulose Shield-fern, which might be regarded as good subspecies, are treated as full species. On the other hand, the strongly geographical eastern American phase of *Polypodium vulgare* is treated as a variety, as are the American representative of the Wall-rue and the strong geographical races of *Botrychium multifidum* and *B. virginianum.* These and other examples indicate the

kind of difference of opinion which prevails regarding the nomenclature of our eastern North American ferns.

In the distributional accounts, county records are particularly stressed. The details of distribution are carefully worked out and are evidently the result of much diligent work. The whole paper is a major contribution to fern literature and will be a classic on the pteridophytes of Pennsylvania.—ROBERT T. CLAUSEN.

Sister Teresita Kittell has published[1] an account of the ferns and fern allies of Arizona and New Mexico. A total of 8 families, 26 genera, and 96 species are recognized from the area. Brief descriptions of the families are given, but no generic or specific descriptions. Keys are provided for the genera and species.

Perhaps the most serious fault is the lack of definite statements as to range and abundance within the area treated. Ten species are reported from Arizona which are not given in the recent treatment of the ferns of Arizona by Maxon. These are *Polystichum mohrioides* var. *scopulinum*, *Cheilanthes horridula*, *C. microphylla*, *Asplenium vespertinum*, *Pellaea microphylla*, *Notholaena Fendleri*, *Adiantum Jordanii*, *Selaginella lepidophylla*, *Azolla filiculoides*, and *Equisetum Funstonii*. The first eight of these are perhaps reported on the authority of Broun,[2] who includes Arizona within the ranges of these species. They were excluded by Dr. Maxon in the absence of specimens. *Notholaena Fendleri* is apparently included on the basis of an old specimen collected by Edward Palmer and labeled Arizona or New Mexico. Since this species is well known in New Mexico and has never since been found in Arizona, it seems reasonable that this

[1] In Tidestrom and Kittell, A Flora of Arizona and New Mexico. Catholic Univ. Press, Washington, D. C. 1941.
[2] Index to No. Amer. Ferns. 1938.

specimen was collected in New Mexico. *Asplenium vespertinum, Equisetum Funstonii,* and *Adiantum Jordanii* are Californian, occurring principally in the coast ranges. Their occurrence in Arizona must be considered doubtful. There is nothing inherently improbable in the occurrence of *Polystichum mohrioides* var. *scopulinum, Cheilanthes horridula, C. microphylla,* and *Pellaea microphylla* in Arizona, but the reports should be substantiated by specimens. Two species known to occur in Arizona are omitted: *Woodsia scopulina* and *Dryopteris Feei.*—C. V. M.

Mr. Frank P. Mathews has published[1] an account of the disease known among stock raisers as "jimmies," which is characterized by sudden seizures of severe trembling which may be followed by death from respiratory paralysis, both of which are induced by exertion. The disease is becoming a serious one, especially for sheep growers. The animals are apparently unaffected until forced to walk for some distance, either to water or corrals, when the mortality may be as high as 25 per cent.

Experiments have shown that the disease is due to grazing on a fern, *Notholaena sinuata* var. *crenata.* This fern appears to be not unpalatable to sheep, at least in the absence of more succulent vegetation. The toxic substance is at present unknown. The most interesting feature to botanists is that typical *Notholaena sinuata* does not seem to be poisonous. This suggests the possibility that the variety *crenata* may represent a distinct species, as some field botanists have claimed.—C. V. M.

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[1] Mathews, Frank P. Fern poisoning in sheep, goats and cattle—the so-called "jimmies" of the Trans-Pecos. Texas Agric. Exper. Station Bulletin 611 (1942).

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American Fern Journal

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Edible Ferns

E. B. COPELAND

The following information was published several years ago, by Tomas Collado and myself, in the Philippine Journal of Agriculture;[1] but as this Journal probably reaches no American especially interested in ferns its republication is invited. It is the only report of the testing of any ferns as crop plants.

The most important edible fern is *Athyrium esculentum*,[2] used as greens throughout the Malayan and adjacent regions, collected from wild plants, often marketed, but never in quantity to satisfy the demand. When the Philippines Economic Garden was established, in 1932, we began at once a study of the domestication of this plant. It forms large clumps, the fronds up to a meter tall. The lower part of each frond matures completely while the apex is still curled up, and the tip up to a decimeter (4 inches) long is still juicy and tender. These tips are picked, cooked, and eaten. Grown from spores, a plant must be two or three years old before it produces enough and big enough leaves to be worth collecting. However, it gives rise to runners, which in turn produce plants of some value after about six months.

The native name of this fern is almost everywhere *pacó*. Because this is the one of importance, its name

[1] 7: 367. 1936.

[2] Commonly known also as *Diplazium esculentum*.

[Volume 32, No. 3 of the JOURNAL, pages 81–120, plates 8–10, was issued September 30, 1942.]

applies in a loose way to ferns in general, at least to terrestrial ferns.

Our work on this species was never well finished. From plot cultures it appeared that it could produce a gross yield worth 2000 pesos a hectare,—say $400 an acre. Its culture is easy and cheap, but the harvest is expensive. At a wage of fifty cents a day—a high wage in the rural Philippines—harvesting might cost half of the gross return. Obviously, it is work for women and children in spare time. Even so, it is incomparably cheaper than collecting from wild plants. And the market is never satisfied, anywhere in the Malay region. In our cultures, the plant was attacked by three insects, all controllable by hand-picking, and by no fungus.

We turned aside from the *Athyrium* because *Ceratopteris* seemed more promising, and we did not feel able to devote much attention to more than one fern. The advantage of the *Ceratopteris* is that, unlike almost all ferns, it is an annual and can therefore be propagated and brought rapidly to maturity. In the Philippines it seems to be eaten only in the Cagayan Valley in northern Luzon, where it is gathered wild and sold in the markets at one centavo for five young fronds. It was our practice to sell by weight, at an approximately equivalent price. The plant is common in open, wet places, throughout the Malay region and to Madagascar, Japan, and New Guinea. It is eaten only here and there, as in Japan. Rumphius, who first described it, said it was eaten by the Buginese and Macassarese (in Celebes), but not by the Amboinese. We call our plant *C. siliquosa* (L.), and are not perfectly sure that this is correct.

It presented itself to us, a single spontaneous plant in a nursery, the parent of all our cultures. We sowed the spores on a seed-bed of mud, and in two months could prick out sporelings for experimental plots. This transplanting, from mud to mud, should yield a perfect stand.

without the removal of any leaves. Easy as this technique is, we abandoned it, as soon as our first cultures were mature, in favor of vegetative reproduction.

A dormant bud is borne in the axil of each pinna of every frond of an adult plant. On occasional plants these buds develop into little plants, even as the fronds mature. If such little plants be used for propagation, all the progeny behave in the same way. This fact having been established, and such activity seeming to be wasteful of the plants' energy, we eliminated plants of this sort from our cultures, as they appeared. Their recurrence was interesting, because we believed our cultures to be pure, in the sense that they had a single ancestor in the generation of our one original plant.

After the fronds of normal plants pass maturity they die in the air, or they fall backward. If they fall into mud, some of the buds begin to grow, and produce new plants. To provide small plants in abundance we prepared beds of almost liquid mud, perfectly flat, and placed side by side in them fronds just about mature, their rachises half immersed, and presently had an effectively unlimited supply of material for new beds. From such beds the first plants are ready to be transplanted in about a month. From beds sown with spores the corresponding period is about 100 days. Thus, we saved two months by the use of vegetative reproduction. Plants produced in either way can be moved when 5 cm. tall, but the total attention to them is cheaper if they are held in the first beds until 10 cm. tall. A square meter of seed-bed would yield 100 perfectly uniform plants at any time, and would do this twice a week over a long period.

Experience showed 30 by 30 centimeters to be a proper spacing in the field. We then planted in long beds of four rows, with a space of 50 cm. between the beds. This spacing provides about 95,000 plants to the hectare. We

A PHILIPPINE SPECIMEN OF CERATOPTERIS.
(One-third natural size.)

set out that many plants, but never had much more than an acre in production at one time. Although germination occurs only on mud, established plants in the field grow equally vigorously in mud and in shallow water. In water, however, the erect stem is more disposed to elongate, and this may be associated with shorter life.

Harvesting consists in cutting the young tender fronds, a centimeter above the base of the stipe. For home use harvest may begin six weeks after transplanting; but for the market it is better to wait a little longer, until each plant bears a number of fronds at least 30 cm. tall in the dry season, 40 cm. during the rains. In the latter season fronds are not rarely 70 or 80 cm. tall. At first we harvested nearly a week after the rapid elongation of the frond began, the length being 20 to 25 cm. The base is then more tender than ordinary fresh asparagus, but cannot be cut with a fork. As it developed that our produce was used largely for salad, rather than for greens, we advanced the harvest two or three days, cutting about 12 cm. The frond is then perfectly succulent throughout; the diameter at the base is about 1 cm.

In preliminary experiments we had kept plants alive for a full year. To keep the plants strong for a long harvest, we tried removing one frond in three, alternate fronds, and two out of three. The conclusion was that under any conditions full vigor cannot be maintained for much more than two months of harvest. As soon as any considerable number of plants lose their vigor, the cost of harvest increases rapidly. It is not unlikely that the best procedure would be the removal of every young frond, letting the harvest last as long as the old fronds can keep the plant active.

While our figure for publication was that each plant will produce five fronds, our real belief is that eight may be expected with confidence,—in the absence of disease. Using the figure five, the gross yield per hectare should

be worth 950 pesos. The corresponding cost is about 400 pesos, mostly for the harvest. We used old rice land, and our gross and net returns were about three times those usual with rice.

From the time that our first field cultures came into bearing, we satisfied a steadily growing local demand. Samples sent to Manila brought orders, and we were shipping 10 or 20 kilos a day. Then we were gratified by an order for 50 kilos. We did not fill it, and never sent another frond to Manila. Just that suddenly, our whole field was laid waste by a fungus disease. The ensuing pathological study is not of interest to fern lovers.

Ceratopteris siliquosa and *C. pteridoides* have recently come into use in California aquaria. I have made preliminary tests of both in a rice paddy near Chico. The American species, *C. pteridoides*, is equally edible, and offers promise because it is more succulent. It may not be equally luxuriant on mud.

A really large number of ferns are eaten here and there over the world. *Helminthostachys*, a relative of *Botrychium*, comes onto Philippine markets for a brief period every year. In the Garden, it produced seven fronds in a year; but it offers no promise as a cultivated plant. *Dryopteris prolifera* (*pacong calabao*) is sometimes marketed; it has no advantage over *pacó*, and is less palatable. All species of *Athyrium* seem to be edible, but no other has the other advantages of *A. esculentum*. A *Pteridium* was named *Pteris esculenta*, and said to be an important source of food of Polynesians. Our own bracken fills its rhizomes with starch by the end of each season; but whoever tries to use it as his food will get rid of a weed before he gets fat. Rector's rhapsody on the "fiddle-neck" fern (*Pteretis nodulosa*) a few years ago, in the Saturday Evening Post, has recently been quoted in part by Dr. Blake.

A Fern Collection from Chihuahua

IRVING W. KNOBLOCH

The pteridophytes discussed in this paper were collected in the west-central part of the State of Chihuahua, Mexico, during 1938–40. It appears that few fern collectors have stopped long in Chihuahua, repelled perhaps by the arid nature of the terrain as seen from car or train. However, in the western part of the State rises the lofty and beautiful Sierra Madre, pierced by innumerable deep barrancas, and it is in this region that we find many habitats suitable for ferns and their allies.

Collections were made at Mojarachic, Maguarichic, and Recuvichic, in the District of Rayon, and also at San Juanito, District of Benito Juarez. A few ferns were collected in the remarkable Barranca de Cobre, in Andres del Río District, a canyon well over 5000 ft. deep in one spot. The base camp was at Mojarachic, a town not far south of Uriachic, at an altitude of 6900 ft.

Cyrus Guernsey Pringle penetrated Chihuahua as far as San Antonio, and other collectors to San Juanito and Creel. I have not seen any plant records from Mojarachic, Recuvichic, Maguarichic, or the Barranca de Cobre, and several of my records are extensions of range. These are marked in the following list by asterisks. To the late Arthur N. Leeds, to Dr. Wherry, Dr. Maxon, and Mr. Morton thanks are due for determining many of the specimens and checking the range of the species. Specimens representing most of the collections here recorded have been placed in the U. S. National Herbarium and in the herbarium of the Academy of Natural Sciences of Philadelphia. The numbers following the localities in this paper are those on the author's specimens.

SCHIZAEACEAE

ANEMIA ANTHRISCIFOLIA Schrad.

A stunted, sterile specimen collected on a dry talus slope; doubtfully referred to this species.—Barranca de Cobre, no. 7022.

POLYPODIACEAE

ELAPHOGLOSSUM PILOSUM (H. & B.) Moore

The distribution of this species in Mexico is uncertain. In western Chihuahua it grew on shaded, moist, north-facing cliffs, with a soil reaction of 5.0.—Recuvichic, no. 5944; Mojarachic, nos. 5545, 5963.

*POLYPODIUM GUTTATUM Maxon

Known previously from the states of Zacatecas, Nuevo Leon, Coahuila, Hidalgo, and San Luis Potosí. In our region it grew in pine woods among rocks, with the soil neutral (pH 7.0).—Mojarachic, nos. 5060, 5476, 5550, 5955.

POLYPODIUM HARTWEGIANUM Hook.?

Delicate, immature material, identified tentatively as this species.—Mojarachic, nos. 5549, 5957.

POLYPODIUM SUBPETIOLATUM Hook.

Two collections are tentatively referred to this widespread Mexican species, although they differ in minor details from typical material.—Mojarachic, nos. 5542, 5930.

*POLYPODIUM POLYPODIOIDES (L.) Watt. var. ACICULARE Weatherby

This variety is much commoner and more widely distributed in Mexico than the two other varieties known from Mexico. It has not previously been recorded north of Durango. In our region it grew in shaded arroyos with a soil reaction of 4.0.—Mojarachic, nos. 5543, 5977.

POLYPODIUM THYSSANOLEPIS A. Br.

This species extends from Texas to Arizona, throughout Mexico, and well into South America, besides occurring in

the West Indies. I found it in shaded rock crevices with a pH of 6.0–7.0.—Recuvichic, no. 5945; Maguarichic, no. 5966.

*POLYPODIUM POLYLEPIS Roem.

Common in southern Mexico, but not previously known north of San Luis Potosí and Guanajuato. I found it on rocks in pine woods with a neutral soil reaction (pH 7.0).—Mojarachic, nos. 5475, 5544, 5951.

POLYPODIUM AUREUM L. var. AREOLATUM (H. B. K.) Eaton

Local, in shaded rock-crevices.—Mojarachic, nos. 5043, 5568.

ADIANTUM CAPILLUS-VENERIS L.

A common pantropic species, collected previously in Chihuahua by Pringle and by Edw. Palmer. I found it on moist, perpendicular cliffs, where the soil had a pH value of 8.0.—Recuvichic, nos. 5064, 5943; Mojarachic, no. 5553; Barranca de Cobre, nos. 7012, 7013, 7016.

ADIANTUM POIRETII Wikstr.

This species also is widely distributed in Mexico and extends southward throughout South America. The roots are tucked well under rocks in the beds of arroyos.—Recuvichic, nos. 5065, 5571, 5942; Mojarachic, nos. 5939, 5964; Barranca de Cobre, no. 7017.

BOMMERIA HISPIDA (Mett.) Underw.

A common rock fern of Mexico and the southwestern United States. I found it in rather dry shade, often associated with *Selaginella rupincola.* The soil reaction ranged from 7.0 to 8.0.—Mojarachic, nos. 5458, 5581, 6009.

BOMMERIA KNOBLOCHII Maxon

This recently described species is based on no. 6044, from Mojarachic, which is the only known collection.

CHEILANTHES ANGUSTIFOLIA H. B. K.

This species, listed as *Pellaea angustifolia* by Conzatti, is widespread in Mexico. In our region it grew profusely

on half-shaded, rocky slopes, with a soil reaction ranging from very acid (pH 4.0) to neutral.—Mojarachic, nos. 5045, 5059, 5405, 5948, 5976.

*CHEILANTHES CUCULLANS Fée

This rather rare species has previously been known only from southern Mexico, in Morelos, Puebla, and Michoacán. Its favorite habitat is in half-shaded rock crevices.—Maguarichic, no. 5933.

CHEILANTHES EATONII Baker

Wiggins (1939) does not record this species from Mexico, but Pringle collected it in Chihuahua, and Maxon (1919a) knew it as ranging into Mexico as far south as Puebla. It grows at Mojarachic in the same situations as *C. tomentosa* and, in fact, was most often associated with the latter. It grew in neutral soil.—Mojarachic, no. 7069.

CHEILANTHES FARINOSA (Forsk.) Kaulf.

A widespread species found from Mexico to Peru, and also in the Old World. Pringle collected it in Chihuahua at Arroyo Ancho. It grew sparingly in the region here studied, in moist, shaded arroyos, with a neutral soil reaction.—Mojarachic, nos. 5046, 5547, 6026.

CHEILANTHES KAULFUSSII Kunze

An abundant species, ranging from Texas south to Colombia. It prefers half-shaded rock crevices with a neutral soil reaction.—Mojarachic, nos. 5404, 5975, 8001; Barranca de Cobre, no. 7009.

CHEILANTHES LENDIGERA (Cav.) Swartz

This species ranges from southern Arizona to the Andes of South America. It is not uncommon in Mexico according to Maxon (1939). It has been collected in Chihuahua by Pringle. I found it on moist, shaded talus slopes with a neutral soil reaction.—Mojarachic, nos. 5068, 5069, 5469, 5931, 5970, 6007.

CHEILANTHES LEUCOPODA Link

A rather common species occurring from Texas to southern Mexico. Several collectors have found it in

Chihuahua.—Mojarachic, no. 5950.

CHEILANTHES LINDHEIMERI (J. Smith) Hook.

Found from Texas to Arizona and south to San Luis Potosí and Durango. Pennell has collected it in Chihuahua. In our region it grew in half-shaded rock crevices with a neutral soil reaction.—Mojarachic, no. 6030.

CHEILANTHES PYRAMIDALIS Fée

Pringle collected this fern in Mapula Canyon, Chihuahua. It is a common species in Mexico. I found it in shady rock crevices and on rocky slopes with a soil reaction varying from pH 5.0 to 7.0.—Mojarachic, nos. 5470, 5580, 5953.

*CHEILANTHES TOMENTOSA Link

West Virginia to Texas, extending into Mexico as far south as San Luis Potosí. In our region it grew on shady slopes with a decided acid soil reaction of 5.0. Broun notes that in the United States this species grows in non-calcareous soil eastward, but toward the southwest it withstands alkaline conditions.—Recuvichic, nos. 5066, 5552, 5946; Mojarachic, nos. 5471, 5972, 8004.

CHEILANTHES WRIGHTII Hook.

Pringle collected this species in Chihuahua, and Wiggins records it for the Sonoran desert. It grows only as far south as Durango. At Mojarachic it occurs in exposed rock crevices with a soil reaction of 7.0 to 8.0.—San Juanito, no. 5420; Mojarachic, nos. 5048, 5579, 5980.

NOTHOLAENA AUREA (Poir.) Desv.

This very common xerophyte has usually been known under the names *N. bonariensis* or *N. ferruginea*. It is the most common of our ferns, growing abundantly on dry, exposed slopes. The soil reaction was 4.0.—Mojarachic, nos. 5054, 6006.

NOTHOLAENA CANDIDA (Mart. & Gal.) Hook.

A wide-ranging Mexican species, extending north into Texas and New Mexico. It grows locally in dry, exposed

situations, and can be collected only in the rainy season. —Maguarichic, nos. 5929, 6028; Barranca de Cobre, no. 7021.

NOTHOLAENA GRAYI Davenp.

I was able to find but two plants of this species, which is listed by Conzatti from Jalisco, Chihuahua, San Luis Potosí, and Coahuila. It is found also in Sonora, and extends across the Mexican border into the United States. —Maguarichic, no. 7071.

NOTHOLAENA INCANA Presl

A common species in Mexico, which has usually been known as *N. nivea*. It grew in dry, exposed rock crevices with a neutral soil reaction.—Maguarichic, no. 6027; Mojarachic, nos. 5960, 5961, 6032, 8026.

NOTHOLAENA LIMITANEA Maxon

This grows in dry, exposed rock crevices with a neutral to slightly alkaline reaction (8.0). The first two numbers cited belong to subsp. *mexicana* Maxon, which was based on a Pringle collection from the Santa Eulalia Mountains, Chihuahua.—Mojarachic, nos. 5401, 5582, 8027.

NOTHOLAENA SINUATA (Lag.) Kaulf.

This wide-ranging species is known from Oklahoma to Chile. It is very common over much of its range. I found it growing mostly in half-shaded rock crevices with a neutral soil reaction.—Maguarichic, nos. 5402. 5935; Mojarachic, nos. 5941, 9007.

NOTHOLAENA STANDLEYI Maxon

In assigning this name to the species described under the preoccupied name *N. Hookeri*, Maxon (1915) noted the range as from the southwestern United States to southern Mexico.—Maguarichic, no. 8300.

PELLAEA ALLOSUROIDES (Mett.) Hieron.

This endemic Mexican species grew in exposed situations above arroyos. The soil reaction varied from 5.0 to 7.0.—Mojarachic, nos. 5579, 5981.

PELLAEA SAGITTATA (Cav.) Link

A widespread species in Mexico, a synonym being *P. cordata* (Cav.) J. Smith, not Fée. It grew sparingly in our region and always in shaded oak woods in neutral soil.—Mojarachic, nos. 5052, 5455, 5940, 5983.

PELLAEA TERNIFOLIA (Cav.) Link

Common throughout Mexico. It grows in our region in rather exposed, dry places, usually at the base of rocks.—Mojarachic, nos. 5042, 5058, 5489, 5567, 5570, 6002.

PTERIDIUM AQUILINUM (L.) Kuhn var. PUBESCENS Underw.

This United States fern is not common in Mexico, being known there only from Baja California, Chihuahua, and Durango. In Chihuahua it grew on open slopes, under pines, or along streams. It is an acid-loving fern, growing in soils with a reaction of 4.0.—Mojarachic, nos. 5548, 8019.

ASPLENIUM EXIGUUM Bedd.

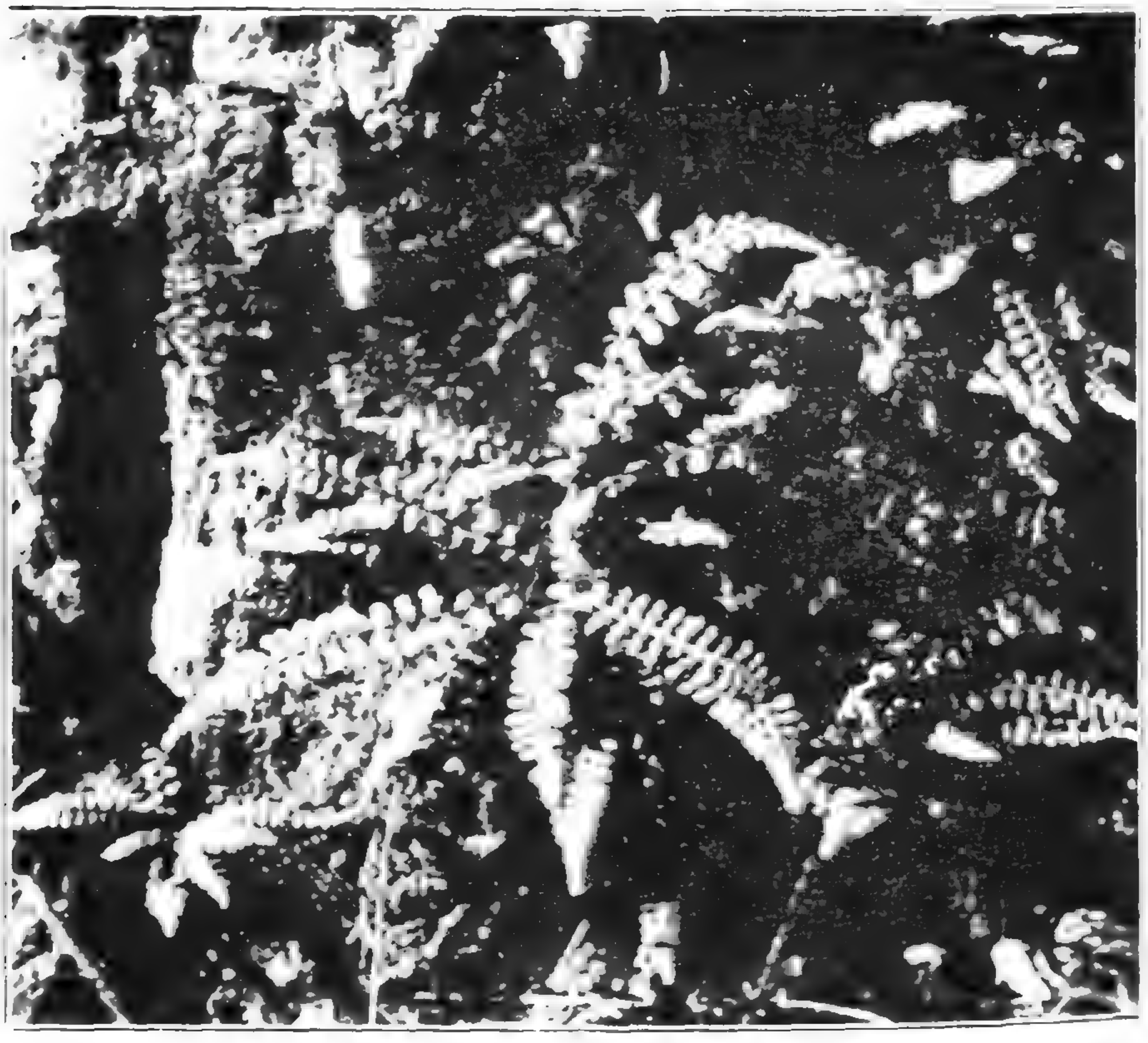
This Asiatic fern was recorded for Mexico by Hooker as early as 1868; a synonym is *A. Glenniei* Baker, founded on Mexican material. It grows from Arizona south to San Luis Potosí. It is rare in our region, growing best on shaded, moist banks. The pH of the soil was 5.0.—Mojarachic, nos. 5540, 5932, 5962.

ASPLENIUM MONANTHES L.

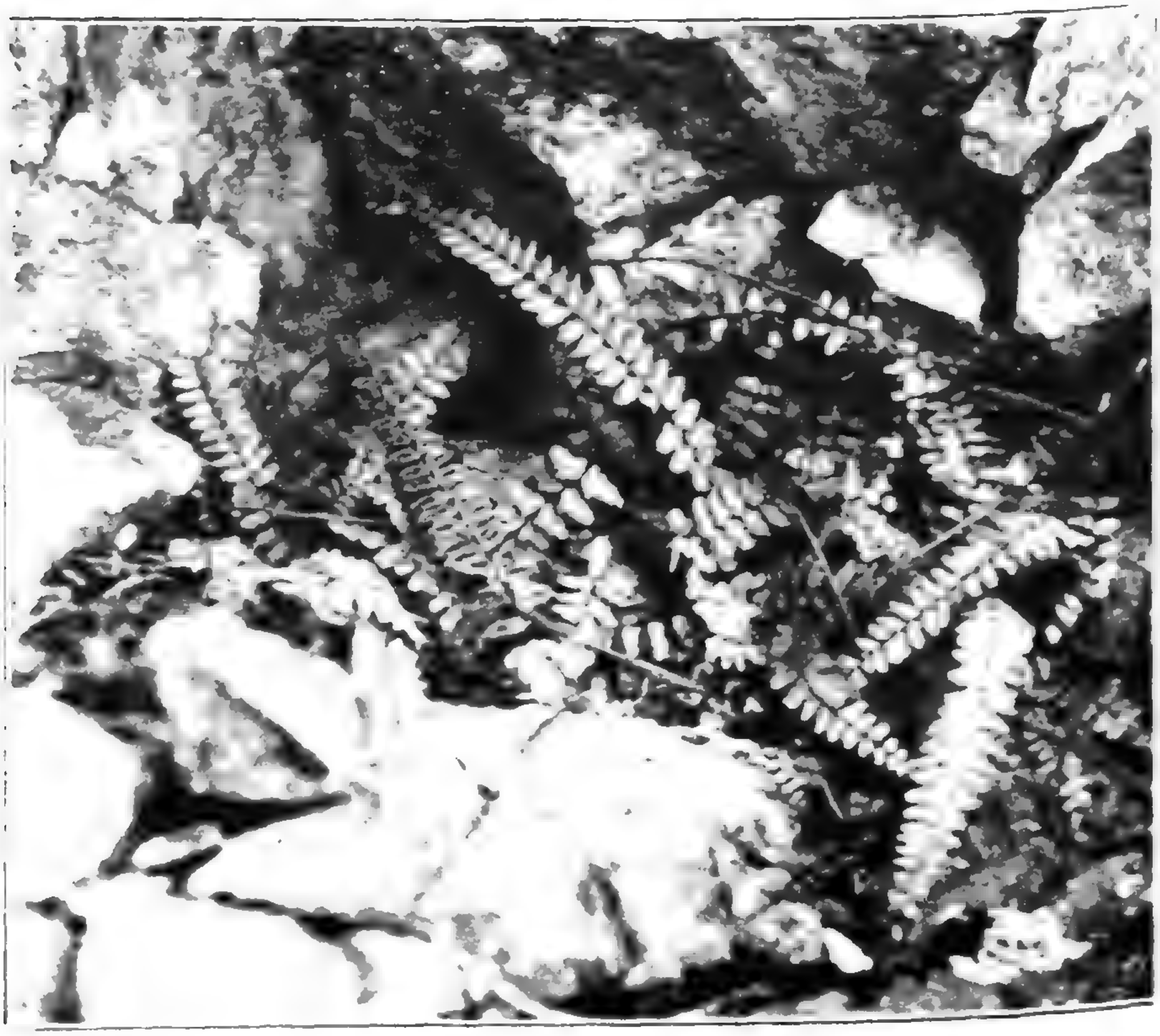
This highly variable, widespread spleenwort has been found nearly throughout Mexico. In our region it grew on thinly covered shaded rocks with a neutral soil reaction.—Mojarachic, nos. 5468, 5956, 6025, 8018.

ASPLENIUM PALMERI Maxon

This species is well known in Chihuahua and many other parts of Mexico (Maxon, 1921). In our region it grows in shaded rock crevices with a neutral soil reaction.—Maguarichic, no. 5967; Mojarachic, no. 8002; Barranca de Cobre, no. 7008.



Asplenium [illegible] at Mojarachic.



Asplenium Palmeri at Maguarichic.

ASPLENIUM RESILIENS Kunze

A widespread fern ranging from Pennsylvania to Peru. At Mojarachic it grew in shaded crevices with a pH of 6.0. Broun (1938) gives its habitat as cliffs of limestone and other calcareous rocks, which holds for the United States (Wherry, 1920). It is evidently tolerant to slight acidity in the climate of Chihuahua.—Mojarachic, nos. 5055, 6010.

*ATHYRIUM ASPLENIOIDES (Michx.) Desv.

This Lady-fern has been known heretofore chiefly in the United States, from Massachusetts to Texas. It does grow also sparingly in Mexico, and has been collected in Durango. At Mojarachic its favorite habitat is under overhanging rocks in arroyo beds where even in the dry season there may be some moisture. As with most of the local species, however, it dies down during the latter part of the dry season. The pH value is neutral. In the United States, Wherry (1921) found it tolerant of a wide range of soil reaction.—Mojarachic, nos. 8007, 8017.

*PLAGIOGYRIA SEMICORDATA (Presl) Christ

Not common, and not previously known north of Durango. The specimens probably belong to the form described as *P. arguta* (Fée) Copel. It grows here in full sun in arroyos with a soil reaction of 5.0.—Mojarachic, nos. 5051, 5947.

DRYOPTERIS PATULA (Sw.) Underw.

The small representative of the species found here resembles some material which has been identified by Christensen with his variety *Rossii*, although it does not agree with his description very well. I found this on sunny banks along arroyos and in neutral soil.—Mojarachic, nos. 5569, 5959, 5968, 6004, 6005.

DRYOPTERIS FEEI C. Chr.

A well-known fern of Mexico, reaching Arizona and California. Locally it grows in moist shade, with its roots

always under rocks. The soil is neutral.—Mojarachic, nos. 5551, 5973, 6003; Barranca de Cobre, no. 7037.

DRYOPTERIS PILOSA (Mart. & Gal.) C. Chr.

This species is not very common, but is found over a wide area from Sonora and Chihuahua to Puebla and Morelos. It is quite uncommon here with us. At Mojarachic it grows small and dwarf on dry rocks. At Creel it was larger and more typical, growing under overhanging, shaded rocks along a little stream.—Mojarachic, no. 5047; Creel, no. 7042.

PHANEROPHLEBIA AURICULATA Underw.

The minute, yellowish glands occasionally found on other specimens of this species are particularly abundant on this collection, which was found in moist soil in a deep shaded canyon.—Barranca de Cobre, no. 7011.

WOODSIA MEXICANA Fée

Pringle collected this species in Chihuahua, and it has been found a good many times elsewhere in Mexico and the southwestern United States. It grew best in shaded arroyos with a soil reaction of 7.0 to 8.0.—Mojarachic, nos. 5472, 5546, 5954, 5971, 8003.

*WOODSIA MOLLIS (Kaulf.) J. Sm.

This common species has not previously been collected in Chihuahua, although it is known from the adjoining states to the south, Sinaloa and Durango. In Chihuahua it grew very sparingly, with its roots well tucked under rocks and boulders. The soil was slightly acid (6.0).—Mojarachic, no. 5958.

CYSTOPTERIS FRAGILIS (L.) Bernh.

This cosmopolitan fern is quite common in Mexico, occurring in several forms. In our region it grew on moist banks in an alkaline soil (pH 8.0). Wherry has noted that this species prefers alkaline soil, but that it is tolerant of acidity.—Mojarachic, nos. 5538, 5546, 5952.

DENNSTAEDTIA SP.

A moderate-sized representative of this genus was collected in the Barranca de Cobre, growing in moist soil, where it was quite common. It is obviously related to *D. rubiginosa* and *D. mexicana*, but can not be definitely assigned to either.—Barranca de Cobre, no. 7025.

MARSILEACEAE

MARSILEA VESTITA Hook. & Grev.

This Pepperwort is not common in Mexico, but its exact range is uncertain. I found it growing in rather quiet water.—San Juanito, no. 5417.

EQUISETACEAE

*EQUISETUM FUNSTONII A. A. Eaton

On the map published by Schaffner (1939), dots representing collections of this species are shown both to the north and south of Chihuahua, but none in that state. I found it in moist soil alongside an arroyo.—Mojarachic, no. 7077.

EQUISETUM LAEVIGATUM A. Br.

On Schaffner's map for this species there is a locality-dot in Chihuahua near the Rio Grande, but none elsewhere in the state.—Mojarachic, no. 5691.

PSILOTACEAE

*PSILOTUM NUDUM (L.) Griseb.

This primitive fern-ally has a wide distribution in Mexico, but is not common and has not previously been known from Chihuahua. It grew here in moist, shaded, rock crevices.—Barranca de Cobre, no. 7035.

SELAGINELLACEAE

SELAGINELLA CHRISMARI Hieron.

Only one collection of this little-known species was made. It was found growing in a dry rock crevice.—Maguarichic, no. 5928.

SELAGINELLA PALLESCENS (Link) Spring

A very common Mexican species, usually known as *S.*

cuspidata Link. I found it in shady, moist canyons with the soil neutral.—Mojarachic, nos. 5050, 5539, 5974, 6001.

*SELAGINELLA RUPINCOLA Underw.

Exposed, dry rock crevices were the favorite habitat of this species, which is known to occur in Mexico south to Jalisco, but which has not previously been found in Chihuahua. *Bommeria hispida* was frequently associated with it. The soil reaction varied from 7.0 to 8.0.—Maguarichic, no. 5936; Mojarachic, nos. 5573, 6000.

*SELAGINELLA WRIGHTII Hieron.

Uncommon in Mexico, and not previously found in Chihuahua. This and the preceding species belong to a section of *Selaginella* as yet little known in Mexico. It grows only in exposed rock crevices and prefers a neutral soil.—Maguarichic, no. 5938; Mojarachic, no. 5969.

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Observations on Florida Ferns

EDGAR T. WHERRY

Late in December, 1941, an opportunity came to renew acquaintance with the ferns of northwest peninsular Florida, guidance and transportation being generously furnished by Messrs. Edward and Robert St. John, whose studies there are widely known and appreciated.[1] In view of the fact that differences of opinion as to the taxonomic and geographic relations of some of the species growing there appear to have arisen, a few notes on the trip may be placed on record here.

OPHIOGLOSSUM.—Five species were seen, and the differences between the smaller ones proved to be more striking than had been anticipated. One of these, *O. pumilio* E. St. John,[2] is now realized to have been founded on a mixture, and its author advises me that he desires to withdraw it; but the other species described in the work cited are real entities. Some may have to be changed in status, as has been done by Clausen[3] for *O. tenerum* Mett., but apparently all are endemic forms, regardless of category.

TRICHOMANES.—In the course of my studies on the soil-reaction preferences of ferns, *T. Petersii* was tested at several points from Mississippi to South Carolina, and found to grow exclusively in soil of distinct acidity (act. ac. 30, pH 5.5). This species has also been collected at Constanza, Dominican Republic, and the geologic map shows this place to lie in an area of crystalline rocks, which may well give rise to soil of similar reaction. Then came the unexpected discovery[4] of its occurrence in northwestern Florida, where only limestone was sup-

[1] This JOURNAL 25: 33. 1935; 26: 41. 1936; 31: 143. 1941.
[2] Small, Ferns SE. States 361. 1938.
[3] Mem. Torr. Club 19²: 146. 1938.
[4] Small, Ferns SE. States 46. 1938.

posed to outcrop and acid soils would be correspondingly unlikely to occur.

Naturally, one of the first localities I asked to be shown in Florida was that of this species, and a point 6 miles northwest of Brooksville was visited. Although the outcrops on which the fern grows proved to be fossiliferous, the lime had been largely leached out, resulting in a porous siliceous rock; and the soil had attained as high an acidity as in the upland colonies.

There seems to be a feeling among plant geographers that plants in general can only migrate over short distances, and that when disjunctions of range with spacings of hundreds or thousands of miles exist, there must have been intermediate colonies of the species at some time, which were exterminated by geologic, climatic, or other changes. The situation in respect to this fern shows, however, that such is not necessarily the case; for there surely never has been a continuous line of outcrops of siliceous rock connecting its stations.

ASPLENIUM.—In a recent article[5] a writer who claims to have "found every fern species in northern peninsular Florida" considers that "the list of endemic fern species is not very impressive." Actually, however, northern botanists keep making trips to that region just because more endemics grow there than in any other part of the state. He further states, without citation of authorities, that "the specific status of the three Aspleniums collected at Lecanto has been questioned; in any event they are of seemingly recent origin." After visiting the Lecanto station and studying specimens of the plants in question, I could see nothing to suggest recent origin (not subscribing to the Willis view that endemics in general are "young"). *Asplenium plenum* and *A. subtile* are strikingly different from anything else, indicating a long

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[5] This JOURNAL 31: 95. 1941.

period of isolation; and although *A. scalifolium* may be only a subspecies of *A. biscaynianum,* changing its status does not render it less endemic or less interesting. (It should be noted here that *A. suave,* listed on page 169 of Small's work, had been recognized by its proposer as merely immature *A. scalifolium.* His request that it be deleted got overlooked, however.)

In his elaborate list of Florida fern records, Correll[6] included *Asplenium Adiantum-nigrum* as having been collected by Miss Reynolds in Marion County. A plant resembling that, but more nearly related to *A. pumilum,* had been found by Dr. St. John in association with another of her discoveries—*Thelypteris tetragona* at its apparent northern limit. A visit to the locality, a wooded ridge north of Shady Hill road and west of Olivet Church, about 5 miles south of Ocala, confirmed the correctness of his view as to the spleenwort. Though heretofore classified and filed in herbaria with *A. pumilum,* it surely deserves some taxonomic recognition. However, before this variable species can be adequately subdivided, examination will have to be made of the type specimens of the varieties already proposed, along with measurements of specimens from Mexico, Central America, and the West Indies. This being at the moment impracticable, I wish merely to place on record my agreement with Dr. St. John that there are two distinct entities passing as *A. pumilum* Sw.[7] in Florida, as well as in tropical America: The original form (the one figured by Small[8]), which grows in rock-crevices and has a relatively short stipe and deltoid-ovate, 3- to 5-lobed blade rarely more than 4 cm. long; and a tall variety (*A. anthriscifolium* Jacq.), which grows in woodland

[6] This JOURNAL 28: 49. 1938.
[7] Prodr. 129. 1788.
[8] Small, Ferns SE. States 176. 1938.

soil and has a relatively long stipe and a narrowly ovate, pinnate blade 5 to 12 cm. long, with several pairs of pinnae, the lowest deeply lobed.

THELYPTERIS.—In the use of this genus name I am following the most recent view of C. Christensen, foremost authority on this group of ferns.[9] The group allied to *T. normalis* was split up by Robert P. St. John[10] into 8 species and 2 varieties, but Correll in the tabulation of localities above cited recognized only 4 (under *Dryopteris*). In minimizing the endemicity of northwest Florida ferns Spurr[11] pointed out that one of these which Correll accepted "is known from only one collection,"—which would lead most plant geographers to consider it an excellent example of an endemic! One of the objects of my Florida trip was to see these plants in the field, and Mr. Robert St. John kindly showed me the majority of them and pointed out their distinctive characters. The key in Small proved too highly simplified to work, so another has been constructed which is here presented in the hope that it may aid others who desire to identify the plants concerned. This is so arranged as to bring related species as close together as practicable, and to allow for existing intermediates.

KEY TO THE THELYPTERIS NORMALIS GROUP[12]

Mature fronds relatively large, often over 50 cm. long; pinnae mostly elongate, linear-undulate, their segments acutish, with numerous veins (6–10 pairs). Rootstock horizontal or oblique, elongate, with evident internodes.

Texture thick-coriaceous; blade oblong, abruptly tipped by a long pinnatifid segment; pinnae narrow, spaced, the inferior basal segments of the upper ones conspicuously decurrent. Southern Florida ..... *T. serra* (Fla. var.).

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[9] In Verdoorn, Man. Pterid. 544. 1938.

[10] In Small, Ferns SE. States 219. 1938.

[11] This JOURNAL 31: 95. 1941.

[12] *Thelypteris patens*, found but once in Florida, in 1905, differs from all the above in its erect rootstock, bearing large eciliate scales, and prominent basal pinna-segments parallel to the rachis.

Grading into the next.
Texture thin-coriaceous to membranous; basal pinna-segments barely or not decurrent.
Blade ovate-lanceolate, abruptly tipped by a long pinnatifid segment; pinnae moderately narrow and spaced, sessile, the upper adnate to rachis; costae scaly beneath. Peninsular Florida and tropical America ..... *T. augescens.*
Grading into the next (through "var. *Lindheimeri.*")
Blade ovate to elliptic; pinnae subsessile, only the uppermost adnate to rachis; costae hairy beneath.
Tip of blade subabruptly narrowed to a long pinnatifid segment; pinnae close, the lower short and deflexed, their basal segments slightly enlarged. Fronds scattered on a branched rootstock. Florida, Alabama, and Georgia. *T. ovata.*
Grading into the next (through forms of "*T. unca.*")
Tip of blade gradually narrowed to a short pinnatifid segment; pinnae spaced, the lower little shortened or deflexed, their basal segments strikingly enlarged. Fronds crowded in two ranks on a simple rootstock. Gulf States to South Carolina; West Indies ..... *T. normalis.*
Grading into the next.
Mature fronds relatively small, rarely over 50 cm. long; pinnae rather short, linear-lanceolate to elliptic, their segments few-veined (3–6 pairs). Rootstock oblique, short, the internodes obscured by crowded roots and frond-bases.
Terminal frond-segment elongate; pinna-segments acutish, the basal ones more or less enlarged; sori submarginal. Wide-ranging through Florida ..... *T. saxatilis.*
Grading into the next.
Terminal frond-segment short; pinna-segments obtusish, the basal ones little or not enlarged; sori medial.
Pinnae elliptic to lanceolate; basal veins of adjacent segments running together. Upper Florida ..... *T. versicolor.*
Pinnae all elliptic; basal veins of adjacent segments not running together; Citrus Co., Florida ..... *T. macilenta.*

Although these marsh-ferns have been fully discussed by Robert P. St. John,[13] a few additional notes seem worth while. The West Indian *T. serra* is represented in southern Florida by a plant so gradational toward *T. augescens* that it should be segregated as a variety. The latter species in turn intergrades with others, the name var. *Lindheimeri* (originally under *T. normalis*) having been applied to certain intermediates. In the field *T. ovata* certainly looks distinct in having scattered fronds, with broad roundish blades and close-set pinnae. Of the

[13] In Small, Ferns SE. States 219. 1938.

plants listed in Small, only *T. unca* seemed to me insufficiently distinctive to deserve species status, being apparently in large part a mere sun-form of *T. ovata* or *T. normalis*. The last varies enough to be divisible into several varieties, but this will not be undertaken here.

The illustration of *T. saxatilis* in Small represents an immature plant, and fails to bring out the auricle-like basal pinna-segments; this species differs from *T. normalis* in the much longer frond-tip but shorter pinna-tips. Although *T. versicolor* was placed by St. John in the group of *T. dentata*, in which the basal veins of adjacent segments unite to form an erect compound vein extending toward the sinus-base (genus *Cyclosorus* Link), specimens seen showed incomplete coalescence of adjacent basal veins, so it is here inserted among the related species of *Thelypteris*. The remarkable endemic *T. macilenta* is now preserved only in cultivation, its single known colony, consisting originally of but three plants, having disappeared.

Many taxonomists hold that when entities show extensive intergradation they should not be classed as independent species, but be given some infra-specific status under the one which chanced to be named first (in this case *T. serra*, proposed as *Polypodium serra* by Swartz in 1788). In cases like the present, however, where there is transition from one end of a long series to another very dissimilar end, such a plan would lead to a system of names too complex for practical use. It seems preferable to admit the existence of several species in the group, and to place the intermediates in some infra-specific category under their apparent ancestor,—subspecies, variety, form, or perhaps a novel category. Until general agreement is reached in respect to the latter, the intermediates in the group under discussion may merely be designated as such without formal naming.

Although this is not the place to enter into any controversy as to the significance of the occurrence of subtropical and endemic ferns in northwestern peninsular Florida, it is desired to urge the importance of recording what is really there. It makes no difference what category a given entity is placed in, for opinions as to content of special categories vary from one school of thought to another, and also change with time. What should be avoided is reducing to complete synonymy names based on different type specimens collected in different places and habitats, lest interesting geologic, geographic, and ecologic relationships be thereby obscured.

University of Pennsylvania

A New Thelypteris from Florida

Edward P. St. John

In a great bend of the Withlacoochee River, in Citrus Co., Florida, lies a wild region of low hammocks, cypress swamps, marshes and ponds some 15,000 acres in extent. This area, known as "The Cove," is uncultivated and is little visited save by trappers and turkey hunters and by the owners of cattle and hogs which roam the drier parts. Scattered through it are many islands from three or four to over 100 acres in extent, which except in especially dry seasons can be reached only on horseback or by wading waist-deep through the black and moccasin-infested waters. Occasionally the islands bear ledges and boulders of rock. These are habitats of some of the rarest relicts of the ancient tropical flora.

Here, in December 1938, the writer discovered an unknown fern which is now described as *Thelypteris macrorhizoma*. The colony, which comprises about 300 plants and is included within a circle having a diameter of 100

feet, occupies the sandy leaf mold of a hammock floor. On rocks near by is a colony of *Asplenium cristatum*, found in the United States only in this immediate region. Growing in the sluggish water which one must ford to reach the island is a floating fern, *Ceratopteris pteridoides*, and a night-blooming water lily which until its recent discovery here was unreported from the United States. The new fern seems to be one of the remnants of the old Pleistocene or possibly Pliocene flora, now endemic in this region.

Since its discovery the fern has been observed in its habitat at all seasons of the year, and has been continuously in cultivation in the writer's fernery. Its most obvious distinctive characters are the short triangular blade with long caudate tip, and the very long rootstock bearing many persistent bases of former stipes. It seems to be a primitive species of the *T. normalis* group. There are suggestive resemblances to *T. submarginalis* and *T. tetragona*, while the form of the blade is extremely like that of juvenile plants of *T. normalis*. Detailed study seems to indicate that it is an early and more generalized species of the group, rather than a recent hybrid. In any case it is clearly entitled to specific rank. The rarity of fertile leaves in the natural habitat at first suggested hybridity, but this seems to be due to the unfavorable conditions under which it now survives, since in the fernery almost every plant is fertile, one producing seven fertile leaves within three months. The technical description follows:

Thelypteris macrorhizoma E. St. John, sp. nov.

Rhizoma gracile, 3–6 dm. longum, paleis lanceolatis, acuminatis, setosis ciliatisque; folia 4–7, 2–4 dm. longa, lamina pinnato-pinnatifida, triangulari, apice pinnatifida, caudata; pinnae 6–8-jugae, lanceolatae vel lineares, basales non reductae, ascendentes, subtus praecipue in

venis minute hirtellae, segmentis paullo obliquis, basalibus vix elongatis; venae 4–8-jugae, basales saepe conniventes; sori parvi, mediales; indusia minuta, setosa.

Plants closely aggregated. Rootstock horizontal, dark, slender, rarely branched, ligneous, 3–6 dm. long, not far below the surface of the ground, bearing many slender rootlets and in maturity from 25 to 50 stipe-bases, these produced irregularly in obscurely indicated periods of growth, the apex nearly horizontal, moderately scaly, the scales (found also sparingly on croziers and bases of stipes) light brown, lanceolate from a wide base, with long-acuminate tips, the margins ciliate with long simple hairs, the surface sparsely setose, the cells translucent, commonly rectangular, four or five times as long as broad, the septa straight and slender. Leaves 4–7, approximate, arching, 2–4 dm. long; stipes of the sterile leaves shorter than the blades, those of the fertile leaves longer, slender, light stramineous, irregularly sulcate below, glabrous except near apex and base; blades triangular, narrowing to a caudate tip, very thin, without glands, nearly glabrous above and below except rachis, costa, veins and margins, these thickly beset with simple single-celled hairs; pinnae 6–8 pairs (the basal not reduced), horizontal or ascending, distant, subsessile, lanceolate or linear, the larger about 10 cm. long and 1.7–1.9 cm. wide, broadest at the base, with entire tips, cut rather more than halfway to the costa, the sinus acute, without keel or cartilaginous membrane, the segments oblong, oblique, approximate, the basal segments very slightly enlarged, the basal proximal segments of the lowest pinnae wanting and the adjacent segments reduced; veins simple or rarely forking, distant, 4–8 pairs to a segment, the basal veins meeting at apex of sinus or frequently the distal one entering the sinus slightly above the apex. Sori small, few, medial or nearer the margin; indusia minute, setose; sporangia few.

Type specimen in the herbarium of the University of Florida, collected at Sheep Island, The Cove, six miles from Floral City, Citrus Co., Florida, Dec. 13, 1938, by Edward P. St. John (no. 1273). Cotypes in National Museum and Gray Herbarium. Known only from this locality.

Floral City, Florida.

Shorter Notes

THE DISCOVERERS OF NEW PENNSYLVANIA FERNS.—In reporting some additions to the known fern-flora of Pennsylvania in an article[1] recently reviewed in this JOURNAL[2] I failed to give full credit to the discoverers in several cases. The following supplementary notes are accordingly placed on record.

Botrychium multifidum var. *intermedium* was first noted to occur in Pennsylvania by Graves[3] in 1935.

Botrychium simplex var. *laxifolium* was listed for this state by Clausen[4] on the basis of specimens collected by C. L. Gruber.

Osmunda cinnamomea forma *glandulosa* was collected here by the late Rodney H. True, June 23, 1937; the specimen is preserved in the herbarium of the University of Pennsylvania.

Pellaea glabella was recognized to occur in Pennsylvania by Butters[5] in 1917.

Asplenium platyneuron var. *Hortonae* was first recorded for this state by Mrs. Tanger.[6]

Asplenium ruta-muraria var. *ohionis* was collected here in typical development by O. E. Jennings, July 21, 1908. His specimens are in the Carnegie Museum and University of Pennsylvania herbaria.

Currania Robertiana (*Dryopteris* or *Phegopteris Robertiana*). The statement given on page 32 of the article under discussion needs amplification. This fern was first observed in 1935 by Miss Katherine Schneider, an amateur botanist of Altoona, Pennsylvania. She took two members of the American Fern Society, Mrs. G. W.

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1 Bartonia 21: 11. 1942.
2 32: 117–119. 1942.
3 This JOURNAL 25: 113. 1935.
4 Mem. Torr. Club 19²: 77. 1938.
5 This JOURNAL 7: 79. 1917.
6 This JOURNAL 23: 16. 1933.

Strattan and Miss Elsie D. Canan, to see it. They agreed with her identification, but in the interest of conservation did not make the occurrence public. Then in September, 1941, a somewhat larger colony was found by Miss Schneider and Miss Canan at a nearby point, and a small frond was sent me. A visit to the locality was promptly arranged and their identification was confirmed.

The hybrid of *Polystichum acrostichoides* with *P. Braunii*, known heretofore only from Vermont,[7] was found in the midst of a large colony of the parent species in southern Wayne County by Richard C. Harlow in 1941.

Lycopodium Selago var. *patens* was first collected in Pennsylvania by G. V. Nash, July 12, 1909; the specimen is in the Britton Herbarium.

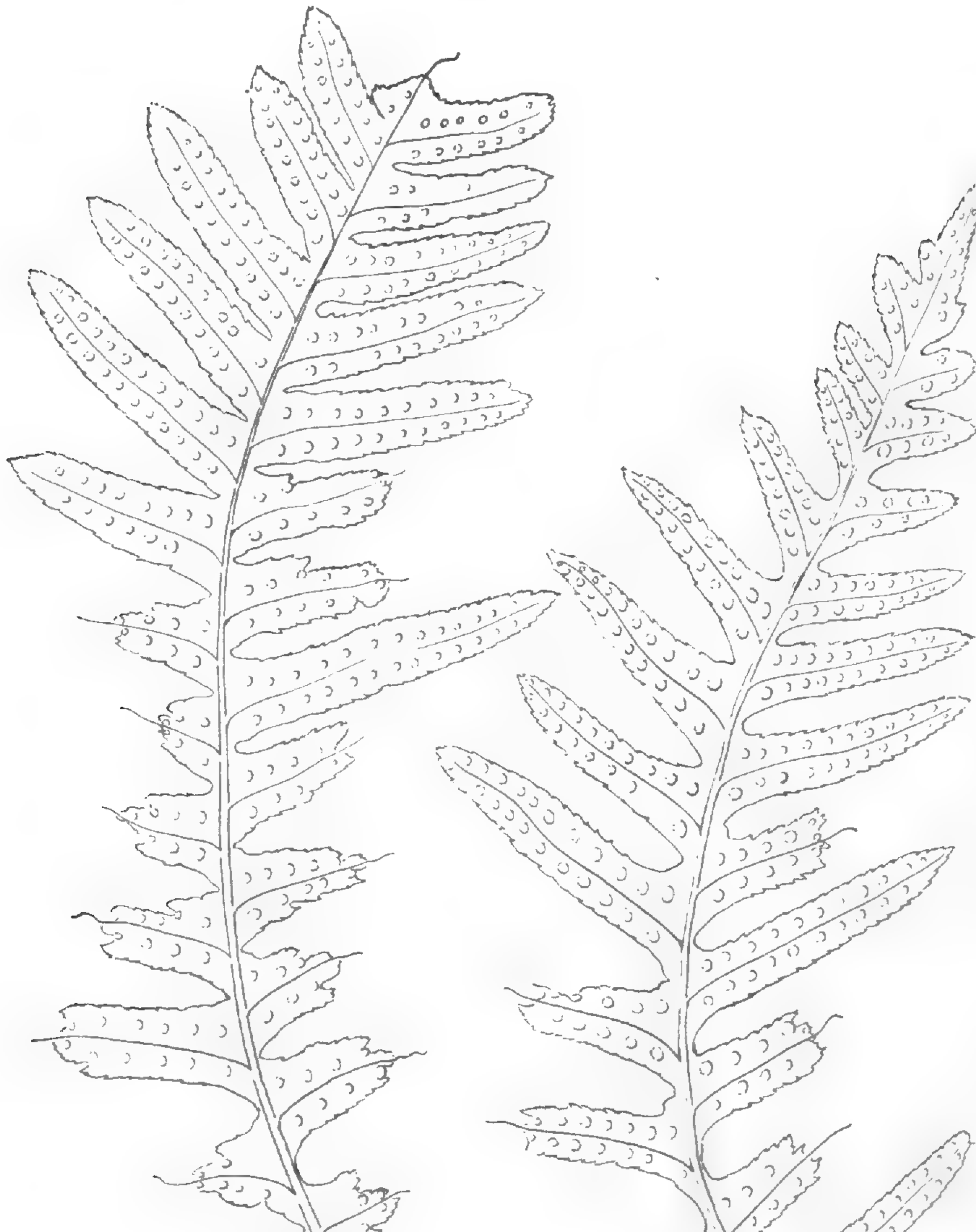
Lycopodium annotinum var. *pungens* was recognized to occur in our northeastern counties by the late Arthur N. Leeds, but he never got around to publishing upon it.

Lycopodium complanatum was first collected here by Jennings and Gress, August 22, 1920; specimen in Carnegie Museum.

Equisetum arvense forma *campestre* is represented by a collection by Shafer, June, 1900, in Carnegie Museum. —EDGAR T. WHERRY, *University of Pennsylvania.*

NEW LOCALITY FOR A CURIOUS CALIFORNIA POLYPODY.—A few years ago Professor Fernald applied the name *Polypodium vulgare* var. *intermedium* forma *projectum*[1] to a specimen from Butte County, California, which had some of the basal pinnae reduced to truncated stubs with projecting midveins. In the fall of 1939 a plant bearing between 25 and 30 fronds, mostly of the *projectum* type, was found growing on a decaying log about three feet above the normal level of the water on the bank of Corte

[7] Thompson and Coffin. This JOURNAL 30: 81. 1940.
[1] Rhodora 24: 140. 1922.



POLYPODIUM VULGARE VAR. INTERMEDIUM F. PROJECTUM

Madera Creek, in southern San Mateo County. All except three fronds in the clump had at least one reduced pinna, and on most of the fronds a half dozen or more pinnae exhibited this peculiar development. There was no evidence of injury, either from insects or browsing herbivores. One young frond, only partially uncoiled, had truncate pinnae with projecting midviens toward its base. In a few fronds the tips of the blade itself were truncately shortened also, the central rachis projecting just like the midveins of the lower pinnae.

On the "abnormal" pinnae there was a tendency for the sori to occur at the bases of shallow sinuses extending inward from the margins and along the apical truncated margin. Variation in the size, distribution, and number of sori on the "abnormal" pinnae was just about the same as shown by nearby "normal" plants.

The projecting midveins of the affected pinnae were not completely attached to the leaf tissue at the tips of the latter, but were separated at a point from 1 to 6 millimeters back from the truncate, irregularly toothed apices, as the detailed sketch indicates. The tracings are typical of average fronds from the plant.

During the fall of 1940 this plant again produced the *projectum* type of pinnae. Unfortunately, however, excessively heavy rains during January, 1941, caused Corte Madera Creek to rise a foot or more above the level at which the plant grew, so neither log nor Polypody is there now. A hurried search for other plants of forma *projectum* in the immediate vicinity has revealed only those having normal fronds.—IRA L. WIGGINS, *Stanford University.*

ADDITIONAL FERNS IN THE KUTZTOWN-FLEETWOOD AREA, PA.—Since my latest report (this JOURNAL **31**: 73), the following additional ferns have been found:

CYSTOPTERIS FRAGILIS var. GENUINA Bernouilli,—the typical phase of *C. fragilis*. Near the top of a rocky bluff off the right bank of the Maidencreek, a short distance beyond and a little below the bridge crossing the Maidencreek at Moselem Station, Berks Co., Pa., *E. T. Wherry & C. L. Gruber*, June 7, 1941.

CYSTOPTERIS FRAGILIS var. PROTRUSA Weatherby. Near the base of the bluff, same locality as above, *E. T. Wherry & C. L. Gruber*, June 7, 1941.

Dr. Wherry informed me later that among the specimens collected as var. *genuina* he found some with glandular indusia. These were tentatively referred to *C. fragilis* var. *laurentiana* Weatherby. On May 30, 1942, Dr. Wherry again visited the station and wrote me that many of the specimens are of the glandular variety. These are now being studied with a view to definite identification. At the same station we found also specimens of *C. fragilis* var. *Mackayii* Lawson. At least three, quite probably four, varieties of *C. fragilis* have thus been collected on the same rocky bluff,—a red letter experience.—C. L. GRUBER, *Fleetwood, Pa.*

POSTSCRIPT ON LYCOPODIUM SABINAEFOLIUM.—In reporting a range-extension of this species recently[1] I gave the nearest New York locality as 150 miles away, the records published by House[2] having been overlooked. The southernmost of these is Labrador Pond; it was given as in Onondaga County, but Dr. Clausen has relocated the station and finds it to be in Cortland County. A specimen from this new collection proves to be variety *typicum*. The extension represented by the Pennsylvania find is therefore about 100 miles.—EDGAR T. WHERRY, *University of Pennsylvania.*

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[1] This JOURNAL 32: 111. 1942.
[2] This JOURNAL 23: 6. 1933.

Recent Fern Literature

A splendid addition to the growing list of state and local fern floras has appeared, dealing with Louisiana, a state to which heretofore little attention has been paid by fern students.[1] It is an octavo volume of 186 pages, illustrated with photographs of many of the 66 species and other entities known to grow in the state, some only in cultivation.

The work includes an 8-page account of previous studies on Louisiana ferns, a discussion of distribution in relation to geology, with a generalized geological map of the state, and brief treatments of the cultivation, propagation, structure, and economic significance of ferns. These are followed by a key to the 13 families represented, which are then taken up individually, with keys to their genera and species, and descriptive accounts of each of these entities. Under each species there is a full account of its features, a historical treatment, a statement of its habitat and geographic relationships, and a list of Louisiana collections, arranged alphabetically by counties, including reference to the 13 herbaria in which they are to be found.

Among the species included there are several that have not heretofore been generally recognized to occur in Louisiana: *Trichomanes Petersii, Woodsia obtusa, Cystopteris fragilis* var. *protrusa, Dryopteris cristata, D. versicolor, Asplenium resiliens, A. Trichomanes, Pellaea atropurpurea, Cheilanthes alabamensis, C. lanosa, Diplazium lonchophyllum, Blechnum occidentale, Equisetum laevigatum,* and *Isoetes melanopoda.*

The compilation of the material has been done with the utmost care, and there are no major errors such as

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[1] Clair A. Brown and Donovan S. Correll. Ferns and Fern Allies of Louisiana. Louisiana State University Press, Baton Rouge, 1942. $3.00.

mar the pages of not a few other local fern lists. The following minor criticisms in part apply to current views expressed in works upon which the authors have drawn. For example, they state that "The southward movement of the early Wisconsin ice sheet caused many northern plants to migrate southward. It is possible that many northern plants came into Louisiana at that time, as Louisiana was less than 800 miles from the southern edge of this ice sheet." This corresponds to a traditional viewpoint; but no one has yet shown how the mere advance of an ice sheet could cause any migration whatever in plants situated hundreds (or even scores) of miles away.

From the standpoint of taxonomy, the work exhibits a tendency toward lumping, which is perhaps undesirable in a local flora, in that interesting geographic relations may be obscured thereby. Under each genus the species are arranged alphabetically. The failure to split up the comprehensive genus *Dryopteris* results in having the closely related *D. cristata* and *D. ludoviciana* separated by the decidedly dissimilar *D. dentata* and *D. hexagonoptera.* Making the entity known as *australis* a variety of *D. cristata* will certainly not contribute toward straightening out the complex relations in this group (referred to on page 46). Nor does classing entity *versicolor* as a hybrid of *D. dentata* and *D. normalis,* without definite evidence, adequately account for the relationships here.

Placing all the brackens of the state under the single heading *Pteridium aquilinum* var. *pseudocaudatum* hides the probable extensions into this region of both the northern entity *latiusculum* and the southern one *caudatum.* Similarly classing all the autumnal Botrychiums as *B. dissectum* var. *obliquum* obscures the not inconsiderable distinctions between entity *obliquum typicum* and entity *tenuifolium,* which latter is beautifully shown in

the illustration on page 128. In the genus *Lycopodium*, entity *pinnatum* is accepted as a variety of *L. alopecuroides*, whereas the features of slender peduncle and prostrate stem well brought out in the photograph relate it rather to *L. adpressum*.

In the key on page 25, Family 3, Parkeriaceae (otherwise known as Ceratopteridaceae) is incorrectly inset under first No. 3, "Plants . . . not succulent." The genus *Woodsia* commemorates one Joseph Woods, not Wood as stated on page 33. Compositors' errors are extremely few and negligible.

A few additional items might well have been included. In a local flora it is desirable to emphasize entities first described from the area. Correspondingly, a photograph of the striking entity *Asplenium ebeneum* var. *Bacculum-Rubrum*, named after the place where the present work was published, might well have been introduced. A view of the entity ×*Dryopteris versicolor* would also have been desirable. And it would have been well to include in the bibliography a reference to the place of publication of the entity named after one of the important Louisiana fern students, *Selaginella Riddellii*.

Finally it may be remarked that the definitions in current glossaries are not all that could be desired, and exception can certainly be taken to such items as these on page 171: "*Paniculate*. Resembling a panicle." and "*Peduncle*. The stem supporting the sporocarp . . ." (when the term is more commonly used for the stalk bearing the strobile in *Lycopodium*).

An account of the American Fern Society and its activities is printed on the paper jacket of the book, and, we may hope, will bring in some new members; but it might have been more effective if it could have been placed on blank page 187.—EDGAR T. WHERRY.

American Fern Society

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The annual winter meeting of the American Association for the Advancement of Science having been canceled, the meeting of the American Fern Society scheduled for December 28 at the Brooklyn Botanic Garden has been indefinitely postponed.

Index to Volume 32

ERRATA

Page 13, line 22: for Water's read Waters'.
Page 117, line 2: for Meniscum read Meniscium.

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Published by the

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American Fern Journal

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Early Days of the American Fern Society

WILLARD N. CLUTE

The roots of the American Fern Society run back to 1875, when Harlan H. Ballard established a society for the study of nature in connection with classes which he was then teaching in Lenox, Massachusetts. This was so well received locally that he decided to extend an invitation to the young folks in other communities to join the new movement, and a note to this effect was published in *St. Nicholas*, at the time the leading nature magazine for young people. A large number of replies were received, and as a result the Agassiz Association for the study of nature by correspondence was formed in 1880 and named for the distinguished naturalist, Louis Agassiz.

In a day when movies, autos, radios, bicycles, telephones, and interurbans were rare or absent, people had more time for a study of their surroundings and the chance of being helped over the hard places in a new study was not to be neglected. Not only did the idea appeal to the children for whom it was originally intended, but many grown-ups, interested in a study of the out-door world, were attracted. Local groups, known as Chapters, were formed in many places, and three years later there were more than 650 Chapters in existence, with a total of some 15,000 members. Soon other Chapters, known as Corresponding Chapters, were formed for

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the study of a single branch of nature. Thus originated The Gray Memorial Botanical Chapter, The Wilson Ornithological Chapter, The Sullivant Moss Chapter, and The Linnaean Fern Chapter, this last the forerunner of the American Fern Society. Several of these Chapters, with slight changes in name, have continued existence for more than fifty years.

The founder of the Fern Chapter had earlier founded a Local Chapter for the study of plants at Binghamton, N. Y. When he became interested in ferns and began to look about for help in identifying them, a Corresponding Chapter for their study was the natural result. Although this was some fifteen years after the Agassiz Association was founded, information about ferns was still decidedly meager. All the popular books on ferns came later. There were, to be sure, John Williamson's "Ferns of Kentucky," the first real fern book, issued in 1878, but already too rare to be available, and D. C. Eaton's two monumental volumes with colored plates that appeared in 1877–80 but were too expensive for the ordinary student. The first thin copies of Underwood's somewhat technical "Our Native Ferns," destined to run through six editions, appeared in 1881, and John Robinson's "Ferns in Their Homes and Ours" came out in 1883; but there still lingered an idea that the naming of ferns without help was too difficult for the novice, a view that was somewhat justified by such unfamiliar terms as prothallia, gametophytes, sporophylls, sporangia, and indusia, with which the new study bristled.

Having decided on a Chapter, it took the greater part of a year to find enough fern students to fill the offices; but early in 1893, with four officers and two other members, the Linnaean Fern Chapter of the Agassiz Association was duly established. For the first year, officers were agreed upon without an election as follows: Willard

N. Clute, President; H. C. Cowles, Vice President; Mrs. T. D. Dershimer, Secretary; Reuben M. Strong, Treasurer. It is interesting to note that three of the officers, then scarcely past their teens, later became college professors. The charter was held open for new members until the end of the year, and at the November election there were 18 members, representing 15 States, voting. At the next election there were twice as many members. The first President was elected for four years in succession; but in 1896 he resigned in order that the Vice President, who declined to be a candidate for President, would be President for at least part of a term. At the end of the fourth year it was tacitly agreed that the President should not hold office for more than two successive years and there followed in this office C. E. Waters, Alvah A. Eaton, William R. Maxon, B. D. Gilbert, James A. Graves, and J. H. Ferriss. In a corresponding society, such as ours, the Treasurer's office was regarded as semi-permanent, and the second Treasurer, James A. Graves, was re-elected for ten successive terms.

The objectives of the Chapter, as stated in the Constitution, were "to promote the study of ferns by correspondence, the exchange of specimens, and the publication of the knowledge thus obtained." In view of subsequent events, there might have been added "the promotion of field trips for ferns," for from the very first such trips became one of our chief activities. At that time the distribution of even the commonest ferns was unknown, and every expedition to the woods and fields was a voyage of discovery. Not only were the haunts of the known species discovered, but there was always the chance that one might find varieties and forms new to science, or occasionally even a distinct new species. Extensive collections were made and the exchange of specimens was an important occupation during the

winter months. In the first ten years specimens of 30 rare ferns were distributed free to members by the Chapter.

Extended trips for ferns often became part of the summer vacation. The writer recalls with much pleasure several trips of this kind, among them the exploration of the haunts of the Hart's-tongue at Chittenango Falls with Maxon in 1895, a trip on foot across southern New Jersey with C. F. Saunders in which we discovered many new localities for *Schizaea*, a similar trip through eastern Pennsylvania with Graves in search of *Isoetes* and *Botrychium*, a trip with Ferriss on foot and horse-back across the Painted Desert to Navajo Mountain in Arizona for desert ferns, and an exploration of the Gulf Coast of Louisiana with Cocks. Many lesser trips of this kind were made by nearly every member of the Chapter. Occasionally they extended into foreign lands and Gilbert, Clute, and Maxon, each made fern-collecting trips to Jamaica.

In keeping with its purpose to make new information about ferns available to its members, the Chapter early published a "List of the Pteridophyta of the United States" and distributed various books and pamphlets free to members. Included in the distribution were Dodge's "Ferns and Fern Allies of New England," Gilbert's "North American Pteridophytes," Clute's "Ferns and Fern Allies of the Upper Susquehanna," and Waters' "Analytical Key to the Ferns, based on their Stipes." The Chapter also published the papers presented at its first meeting, held in Boston in August, 1898, and those presented at the meeting in New York City, in June, 1900.

In the beginning, reports on ferns were circulated from member to member through the Chapter, but as the membership increased this proved to be a time-consuming

process and an official organ was proposed to take care of the more important notices and reports. The new publication, financed by the dues of members, was "The Linnaean Fern Bulletin of the Agassiz Association," to give it its full name. This was a quarterly, begun in 1893, with pages only $3\frac{1}{2}$ by $5\frac{1}{2}$ inches, this size having been adopted in order that copies might be slipped into an envelope of ordinary size, with other matter. Four volumes of this size were issued, and these have facetiously been dubbed "the prothallium stage" of the *Bulletin.* In 1897 the page size was increased to $5\frac{1}{2}$ by 8 inches and the title shortened to *The Fern Bulletin.* The name of the Chapter, however, was not changed to the name the Society now bears until eight years later. Incidentally, the size of the magazine page was popular enough to be adopted for the *American Fern Journal* and the *British Fern Gazette.* When the first numbers of the *Fern Bulletin* were issued, it was discovered that the Chapter lacked sufficient funds to print as many pages as were thought desirable, so the writer took it over, agreeing to make up any deficiency. Fortunately there were many persons, not members of the Chapter, who nevertheless were interested in ferns, and enough of them subscribed to the enlarged publication to more than cover expenses; in fact, the magazine at one time had more than 700 subscribers.

It is interesting to note that during the first years of the Fern Chapter's existence, every prominent fern student in America was on its list of members. There were more than a hundred different contributors to the first ten volumes. In addition to those mentioned elsewhere in this article, some of the more prominent students included George F. Atkinson, Raynal Dodge, L. M. Underwood, George E. Davenport, Sadie F. Price, W. A. Murrill, F. Peyton Rous, Mrs. E. G. Britton, S. F. Burnham,

A. T. Beals, J. A. Bates, A. A. Eaton, Margaret Slosson, J. B. Flett, E. J. Hill, and Thomas Meehan.

Among the more important contributions to the *Bulletin*, was a series of fern floras of the States, each written by an authority, which greatly aided in making clear the distribution of our native ferns. There were also a series of biographical sketches (with portraits) of the more prominent fern students, a series of papers on the genus *Equisetum* by Eaton, illustrated with authentic specimens sent to such members as desired them, and a series entitled "Rare Forms of Fernworts," by the editor, which ran through five volumes. Probably more important than any other feature that aided in maintaining the magazine's popularity was the great number of short articles by many observers, reporting new things about ferns. In fact, the magazine was, in a very real sense, the Fern Chapter.

Looking back over the years, it is interesting to note the strong influence exerted by the Chapter on the literature of American ferns. Practically all the early books on the subject were written by members, and the interest created by the Chapter itself provided an ever-increasing audience for them. Among the more important are Parsons' "How to Know the Ferns," Price's "Fern Collector's Handbook," Beecroft's "Who's Who Among the Ferns," Waters' "Ferns," Eastman's "New England Ferns and Their Common Allies," Woolson's "Ferns and How to Grow Them," Slosson's "How Ferns Grow," and Clute's "Fern Collector's Guide," "Fern Allies," and "Our Ferns in Their Haunts."

Another distinction, due in large measure to the Chapter, was the establishment of the Sullivant Moss Chapter, now the Sullivant Moss Society. To fern students, the mosses seemed fernlike enough to warrant notes about them in the *Fern Bulletin*. In the sixth volume A. J. Grout was induced to edit a 4-page "Moss Department"

in each issue. In the second number the title was changed to "The Bryologist, A Department of the Fern Bulletin." Separates of this feature were sent to an increasing number of moss students, and in 1899 the department was continued as Volume 2 of *The Bryologist*. During this year the Sullivant Moss Chapter of the Agassiz Association was formed and the following year *The Bryologist*, as the official organ of this Chapter, became an independent publication.

Ten years after the Fern Society was founded, the *Fern Bulletin* moved to a part of the Midwest where ferns were practically absent and first-hand information about them was increasingly difficult to get. A decided change had also come over the Society. It might be said to have grown up. The Agassiz Association had ceased to function, while a large number of new books on the popular side of fern study had appeared, making the identification of these plants easy. New forms of ferns were no longer easy to find and new interests were claiming the attention of students. It was also quite evident that future fern study would be concerned with more technical matters. In addition, the so-called American Code of Nomenclature was much in the mind of the botanist and more or less persistent effort was being made to induce the *Fern Bulletin* to adopt it, or at least to publish articles couched in the new jargon. There was also a decided push by some members for the Society to have its own official organ again, and it was finally decided to suspend publication of the *Fern Bulletin* at the end of its twentieth volume. The magazine was offered to the Society at cost; but certain members with a flair for amateur journalism preferred to begin at the beginning, and so before the *Fern Bulletin* had ceased they produced the first numbers of the *American Fern Journal*. Members of the Society subscribed for both

publications. Two years before the end, notice was given of the impending merger of *The Fern Bulletin* with *The American Botanist*, and it may be added that the *Botanist* has continued to print articles on ferns. It is now in its 48th volume.

The occurrences of the next thirty years have presented many contrasts to those of the first twenty. All these must be left for others more intimately connected with the Society to record. Let it suffice to say, that the founder of the Fern Society and the editor of its official organ for twenty years never found a dull moment in carrying the movement for fern study to a successful conclusion, and he now derives much pleasure in reflecting that "It could never happen again."

Fern Notes, IV: Supplementary Remarks on the Ferns of the Keweenaw Peninsula, Michigan

OLIVER A. FARWELL

Special attention was given to the common Bracken during the summer of 1939 and many specimens were collected. Specimens of *Pteris aquilina* var. *lanuginosa* from Oregon and California were in my possession for comparison with Michigan plants, but none of *P. aquilina* subvar. *latiuscula* from the eastern states. A request for such specimens to Dr. Wherry, of the University of Pennsylvania, and to Mr. Maurice Broun, of the Hawk Mountain Sanctuary, was graciously complied with and my sincerest thanks are herewith tendered to them for their generous action in supplying the same. The subvariety *latiuscula* is supposed to be separated from the var. *lanuginosa* by a less dense pubescence, often being glabrous, and a non-ciliate indusium, that of var. *lanuginosa* being ciliate and the pinnules being tomentose underneath.

On the Keweenaw Peninsula, the subvar. *latiuscula* is much the more frequent plant; but there are plenty of intermediates and the placing of these is often an arbitrary matter. A careful examination and comparison of the Michigan plants with those of the Atlantic and Pacific states mentioned above have shown no differences except that of density of pubescence. The indusium is entire with no trace of ciliation in any specimen I have seen from any of the regions mentioned above. These two so-called varieties are but the extreme conditions of one and the same variety and their true relationship may best be expressed by calling one a subvariety of the other. I have also come to the conclusion that there is no real generic difference between *Pteris* and *Pteridium*. My collections are as follows:

PTERIS AQUILINA L. var. LANUGINOSA Bong.

Keweenaw Co.: Cliff Mine, no. 539, Aug. 20, 1887; Old Phoenix, no. 12163, Sept. 5, 1939; Lake Glazon woods, no. 12224, Sept. 25, 1939. Houghton Co.: Lake Linden, nos. 10195, 10195a, 10198, Aug. 9, 1934; Rice Lake woods, no. 12135, Aug. 30, 1939, and no. 12178½, Sept. 19, 1939; Gregoryville, no. 11446, July 29, 1936.

PTERIS AQUILINA L. var. LANUGINOSA Bong. subvar. **latiuscula** (Desv.) Farwell, comb. nov.

Pteris latiuscula Desv. Mém. Soc. Linn. Paris **6**: 303. 1827.

Keweenaw Co.: Lac La Belle, no. 12094, Aug. 16, 1939. Houghton Co.: Little Traverse Bay region, no. 12027, July 28, 1939; Rabbit Bay woods, nos. 12191 and 12192, Sept. 19, 1939. Baraga Co.: L'Anse, no. 10878, July 7, 1935.

Numbers 12027 and 12191 have reddish-brown stems and rachises; the others have straw-colored.

WOODSIA CATHCARTIANA B. L. Robinson

Some plants of this fern were found in crevices on the very edge of cliffs; but as the top of the bluff was sloping

downward to the edge of the cliff with nothing but some dead stumps to cling to, it was a risky matter to get any of the plants and avoid a sheer fall of some 150 feet more or less to the rocks below. However, some specimens were obtained.

Keweenaw Co.: West Bluff, no. 12153, Sept. 5, 1939.

WOODSIA ALPINA (Bolton) S. F. Gray

New stations in Keweenaw County for this fern are as follows: Lac La Belle, no. 12097, Aug. 16, 1939, and Esrey Park, no. 12222½, Sept. 25, 1939.

WOODSIA OREGANA D. C. Eaton

In crevices of rocks forming the face of bluffs, Keweenaw Co.: Lac La Belle, nos. 12096 and 12097½, Aug. 16. 1939.

PELLAEA ATROPURPUREA (L.) Link

Specimens of this species were found on the edge of the cliffs close to *Woodsia Cathcartiana*, probably at Dr. Fernald's station, as that was on West Bluff, no. 12152. Sept. 5, 1939.

HIPPOCHAETE PREALTA (Raf.) Farwell, var. INTERMEDIA (A. A. Eaton) Farwell

This scouring rush is frequent in wet depressions of shore sand. Keweenaw Co.: Bete Grise Bay. No. 12112. Aug. 16, 1939.

LAKE LINDEN, MICHIGAN.

Studies in the Ophioglossaceae: Botrychium, subgenus Sceptridium

ROBERT T. CLAUSEN

These notes are supplementary to the Monograph of the Ophioglossaceae (Clausen, 1938). The arrangement of species follows the system set forth in that paper; also, the abbreviations for herbaria are the same. Herbaria additional to those previously consulted are: Ark, Herbarium of the University of Arkansas, Fayetteville, Ark.; Bz, Herbarium en Museum voor systematische Botanie van's Lands Plantentuin, Buitzenzorg, Java; Cinc, Herbarium of the University of Cincinnati, Cincinnati, Ohio; Cok, Herbarium of Coker College, Hartsville, S. C.; Fur, Herbarium of Furman University, Greenville, S. C.; Hnh, Herbarium of Dartmouth College, Hanover, N. H.; K, Herbarium of the Royal Botanic Gardens, Kew, England; Mich, Herbarium of the University of Michigan, Ann Arbor, Mich.; Ore, Herbarium of the University of Oregon, Eugene, Ore.; Otb, Herbarium of the Division of Botany, Central Experimental Farm, Ottawa, Canada; Roch, Herbarium of the University of Rochester, Rochester, N. Y.

Synonymy and distributional data are included only when they are supplementary to those already listed in the Monograph.

1. BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr.

This is the type species of the section Multifidae. As now interpreted, it comprises four subspecies. Field study in California and examination of further herbarium specimens from that state seem to confirm the opinion that ssp. *californicum* is merely a large shade phase of ssp. *silaifolium*. Accordingly it is here reduced to synonymy under that subspecies. Plants observed in Tuolumne County, California, had blades as large as 21

cm. wide and 16 cm. long; others were smaller and closely similar to certain specimens of ssp. *silaifolium* from New York. These were growing under *Pteridium* and *Lilium* in a moist swampy place northwest of Lake Vernon, Yosemite National Park. On July 6, 1940, the blades were still not fully expanded, nor were the sporangia mature.

In the key to the subspecies of *B. multifidum* on page 27 of the Monograph, under the first C, the measurements for ssp. *silaifolium* should now be changed to include ssp. *californicum*.

Weatherby (1942) and Wherry (1942) have both questioned the advisability of treating as subspecies the strongly geographically correlated variations of *Botrychium multifidum*. Wherry treats the two subspecies occurring in northeastern Pennsylvania as varieties on the basis that the differences seem too unimportant to constitute subspecies. Weatherby likewise points to the slight morphological differences between the subspecies. Both authors seem to disregard or overlook two very important considerations: First, that the Ophioglossaceae are among the most primitive of living ferns, that the number of characters available for systematic purposes is few, and that these are often of a trivial sort; second, that the formation of geographical races is probably one of the most important methods of speciation and that a geographical subspecies begins to develop when one or more genes become somewhat different in one part of the range of a species from that in another. The general change in the genic constitution of large parts of a population is probably most significant, far surpassing in evolutionary importance the genic changes which occur sporadically throughout a population. In *Botrychium*, the characters available for classification are so few that the geographical subspecies may be only slightly different morphologically, yet they should be recognized since they

indicate a condition of genic unbalance in different parts of the range which is important in phylogenetic taxonomy. The ssp. *typicum* of *B. multifidum* is the only race of the species which occurs in Europe, the ssp. *Coulteri* is the only one which occurs in the Middle Rocky Mts., and the ssp. *silaifolium* is the only one which occurs in certain areas of the Pacific Coast of North America. In other areas, these or the other subspecies occur or intermediate populations occur connecting the extreme types. All of the northeastern United States is in an area where ssp. *typicum* and ssp. *silaifolium* overlap. Remove this big area and a small portion of Canada, and there are left (considering now only the two subspecies just mentioned) populations which would probably be treated as species by most taxonomists (using morphological data), even as they have in the past by Presl, Underwood, Jepson, and others. Experimental studies to test these subspecies are difficult, because it is at present almost impossible to breed these plants in cultivation and to carry them through the first and second generations. Simple transplants have demonstrated that an individual plant retains its distinctive characters in a new locality, but first and second generation plants must be studied before the evidence is complete. Meanwhile, we can only homologize with the conditions prevailing in groups like *Sedum* and *Gentiana* which I am studying in the experimental garden, and in other genera of higher plants which are already understood cytologically and genetically.

Ia. BOTRYCHIUM MULTIFIDUM ssp. SILAIFOLIUM (Presl) Clausen. *B. multifidum* ssp. *californicum* (Underw.) Clausen, Mem. Torr. Club **19**: 37(1938), plus synonymy; *B. obliquum* var. *Habereri* Gilbert, Fern Bull. **11**: 88–89(1903).

I have now seen the type of Gilbert's var. *Habereri* at the New York State Museum. The specimen is typical

B. multifidum ssp. *silaifolium.* It is the collection of J. V. Haberer, no. 1901, from Whitesboro, Oneida Co., N. Y. The combination, *B. ternatum* var. *intermedium* first appeared in Gray's Manual, ed. 6, p. 694(1890).

Several specimens have come to hand which are intermediate between ssp. *silaifolium* and var. *oneidense* of *B. dissectum.* Yet, there usually seems to be discontinuity between the two species, even though the differences are not great. Two plants from near London, Middlesex Co., Ontario, *J. A. Balkwill* in part (Mich.) have the blades much divided, with the ultimate divisions small, resembling forms of *B. Schaffneri* and *B. australe.* Such plants suggest the possibility that these two species are only races of *B. multifidum.* When abundant material is available from the mountains of northern Mexico and from the Andes of South America, further revision may be necessary in this group.

No drastic extensions of range have come to my attention, but there are many records to fill some of the gaps in the previously known distribution of the subspecies.

Additional collections from the New England Geographical Province are from Belknap Co., N. H., New London Co., Conn., and north of Petersburg Pass, Rensselaer Co., N. Y.; the ssp. *silaifolium* is also reported from Rhode Island as var. *intermedium* by Wright and Crandall (1941).

The only Coastal Plain record known to me is the collection from near Keyport, N. J. There are specimens of this subspecies in the herbarium of Dartmouth College, mounted with others of *B. dissectum* var. *obliquum,* collected by J. H. Redfield and labeled "copses in sand hills. Atlantic City." Probably the collection is a mixed one, since the occurrence of *B. multifidum* at or near Atlantic City seems unlikely. Moore (1940) has reported specimens from low woods along the St. Francis River and in Hempstead Co., Arkansas (Hempstead County is on

the inner Coastal Plain of Arkansas). The Palmer specimens, on which the report from there is based, are *B. dissectum* var. *obliquum*. I have not seen the specimens from the St. Francis River, but suspect that they too may be referable to *B. dissectum*, since *B. multifidum* occurs no nearer to Arkansas than Iowa.

Several more records from the Appalachian Plateau indicate that this subspecies, although infrequent, is rather widely distributed in the northern part of that region. Further specimens are from Albany and Madison Counties, N. Y., and from Erie, Pike, Susquehanna, and Wayne Counties, Pennsylvania; also it is reported by House (1933) from Chenango Co., N. Y. Additional collections on the Central Lowland are from Carleton, Clinton, and Middlesex Counties, Ontario, and from Wayne Co., N. Y.; also Tryon (1940) has reported it from several counties in Wisconsin. Further records from the Superior Upland include specimens from Hull Co., Quebec, and a report by Graves (1933) from Gogebic Co., Mich., and by Tryon (1940) from several counties in Wisconsin.

The collection by E. T. Wherry (Penn) from open pine woods, Clearwater Co., Idaho, in the Northern Rocky Mts., is the first from Idaho. Lewis Co., Wash., is a further locality in the Cascades.

I have not seen the specimens on which are based the reports by Fraser and Russell (1937) from McKague, Saskatoon, and Big River, Saskatchewan, all localities in the western part of the Central Lowland.

1b. BOTRYCHIUM MULTIFIDUM (Gmel.) Rupr., ssp. TYPICUM. *B. ternatum* A) *europaeum* α *campestris* and β *montana*, Milde, Verh. zool.-bot. Ges. Wien. **19**: 150(1869); *B. multifidum* f. *dentatum* Tryon, Amer. Fern Journ. **29**: 6, *fig. 2*(1939).

Tryon's forma *dentatum*, described from Douglas Co.,

Wisconsin, differs from the typical condition of the subspecies in having the margins of the segments more prominently toothed, with the teeth of a dentate rather than a crenate type. Ssp. *silaifolium* seems to vary similarly in the serrature of the segments.

For the New England area, there are further records from Windsor Co., Vt., and Essex Co. and Mt. Washington, Berkshire Co., Mass. A previous collection from Berkshire County was questionable. From the Adirondack Mountains there are specimens from Hamilton Co., N. Y. From the Appalachian Plateau, specimens are available from Delaware, Lewis, and Oneida Cos., N. Y., and from Wayne Co., Pa. These localities represent the southern limits of ssp. *typicum* in eastern North America. In Wayne Co., Pa., which is physiographically related to the Catskill Mts. of New York, the plants occur at an elevation of about 490 meters. The subspecies was discovered there by W. L. Dix and later seen by E. T. Wherry and the writer. Small specimens collected by Wherry in Susquehanna Co., Pa., on the Glaciated Allegheny Plateau, are transitional towards ssp. *silaifolium*.

Additional records for the Central Lowland are from Middlesex Co., Ontario, and Douglas and Sheboygan Counties, Wisconsin. From the Superior Upland of Wisconsin, it is reported by Tryon (1940) from Bayfield, Iron, Lincoln, Polk, and Vilas Counties.

From the northern Great Plains there is a collection by J. Macoun (Roch) simply labeled "Plains," Saskatchewan. From the northern Pacific Coast there is a collection from Heart Lake near (?) Sitka, Alaska, *Luella G. Smith 238* (Ore). This is somewhat intermediate between ssp. *typicum* and ssp. *silaifolium*.

Additional European records are from Mt. Congo, Hungary, *17021* (Bz) and Bienhof near Riga, Latvia, *M. S. Baxter* (Roch).

1d. BOTRYCHIUM MULTIFIDUM ssp. COULTERI (Rydb.) Clausen.

I have now observed this subspecies in grassy meadows in Yellowstone Park, the region of the type locality. In the fresh condition the blades appear yellow-green and crisped. In the Wallowa Mountains of Oregon I have seen ssp. *Coulteri* in a grassy place in open woods along the Lostine River. There the plants were growing in association with *B. boreale* ssp. *obtusilobum* and *B. lanceolatum* ssp. *typicum.* The largest specimen was 27 cm. high and the longest fertile spike 8 cm.

The range of ssp. *Coulteri* has been extended considerably southward. The southernmost locality previously known was in Sequoia National Park, California, in the Sierra Nevada at Lat. 36° 30′ N. Specimens have now been collected by Leslie N. Goodding and William Schroeder, no. 340–41, Sept. 17, 1941, in a grassy flat in the White Mountains of Arizona, at an elevation of about 2838 meters, at about 34° N. This collection is the first from the Colorado Plateau. Specimens were sent me for confirmation by Dr. E. L. Little, Jr., and he (Little, 1942) has published a note on this occurrence.

4. BOTRYCHIUM TERNATUM (Thunb.) Sw. *B. daucifolium* f. *subbasilis* van Alderwerelt van Rosenburgh, Bull. Jard. Bot. Buit., II, **1**: 3(1911).

Thirteen specimens of f. *subbasilis* in the Buitenzorg Herbarium, all from Java and Sumatra, are so similar to plants from China and Japan that I treat them as *B. ternatum.* Minimum measurements of the blade are 2.5 cm. long and 2.7 cm. wide.

CHINA: Yunnan Province; also Su-tchuen oriental, District Tchen-kéou-tin. Two collections of R. P. Farges from the latter locality, previously cited as *B. multifidum* ssp. *typicum*, should be referred here on a basis of the membranous blades with small ultimate segments. This

conclusion is the result of study of further specimens of those collections in the Buitenzorg Herbarium.

JAPAN: Sekido, Province of Musashi and Mt. Amagi, Province of Izu; also Yokohama.

JAVA: From 1800 to 2250 meters; Ardjoena Beroeki, Helling van Merbaboe, and Priangan P. Papandijag. Fruiting time extends from October to March.

SUMATRA: From 1225 to 1350 meters; Karohoogolakhe. Fruiting time seems to extend from January to May.

5. BOTRYCHIUM BITERNATUM (Sav.) Underw.

This is the type species of the Section Biternatae; also probably the rarest *Botrychium* in eastern North America. Auburn in Lee County, Alabama, a locality approximately on the fall line, is a station for the species not previously reported by me.

6. BOTRYCHIUM ALABAMENSE Maxon.

This species is now known north to Davie County, North Carolina, and from three localities in South Carolina. The center of distribution seems to be the Piedmont Upland, with extensions into the Southern Blue Ridge and Coastal Plain.

Records from the Piedmont include: Buncombe Co., N. C., reported by Blomquist and Correll (1940); Davie County, N. C., 3 km. northwest of Mocksville, Sept. 17, 1934, *J. E. Benedict, Jr. 2970* (Herb. J. E. Benedict, Jr.), also *R. T. C. & H. Trapido 3837* (C, Claus); Greenville Co., S. C., along Jamison Mill Creek, elev. about 380 m., 6.5 km. northwest of Gowansville, Aug. 24, 1938, *H. W. Trudell & E. T. Wherry* (Ph); Pickens Co., S. C., 6.5 km. from Easely, March 27, 1937, *Miriam Fullbright* (Fur); also along Eastatoe Creek, alt. 426 m., Sept. 11, 1941, *R. T. C. et al. 5640* (Claus); Habersham County, Ga., in woods along small stream, alt. 365 m., 10 km.

north of Cornelia, Nov. 16, 1939, *Mary G. Henry 1906* (Ph).

A further collection on the Coastal Plain is from the eastern side of Appalachicola River, Aspalaga, Liberty Co., Florida, Nov. 28, 1936, *E. P. St. John et al.* (Herb. E. P. St. John).

8. BOTRYCHIUM UNDERWOODIANUM Maxon.

A series of specimens collected by M. A. Chrysler, no. 5494, south of Escuela de Porrosati, Costa Rica, exhibits two interesting variations. The sterile blade of one plant approaches *B. australe* var. *erosum* in cutting and size, but not in texture. The sterile blade of another plant has the ultimate divisions much smaller than usual and prominently incised.

9. BOTRYCHIUM DISSECTUM Sprengel.

This is the type species of the section *Elongatae*. Despite the complete intergradation between the several varieties of ssp. *typicum*, some authors continue to designate as full species such variations as the dissected and undissected leaf-phases. Among others, Blomquist and Correll (1940) follow this practice, recognizing *B. dissectum* and *B. obliquum*, although they state that the vars. *tenuifolium* and *oneidense* "should be considered only as leaf forms of *B. obliquum*." Yet the var. *tenuifolium*, besides differing in leaf form and texture, also is somewhat geographically separated, for it is the common phase of the species on the southern Coastal Plain, whereas the other three varieties are rarely found there. From this, there would seem to be justification for regarding var. *tenuifolium* as a subspecies. No such geographical correlation supports the separation of the dissected leaf-phase from the undissected. Further, the sole difference seems to be in the cutting of the leaf. If var. *oneidense*, in which leaf form is supported by a

physiological character, is not worth recognizing in any category, then the two variations based on dissection of the blade not only should be suppressed as species, but they also should be dropped as varieties. The character of the laciniations, stressed again by Gruber (1940) as a means for separating the dissected from the undissected phase of ssp. *typicum*, is not satisfactory as an absolute basis for differentiation, since this, like the depth of the lacerations, is very variable.

This is one of the commonest Grape-ferns. Probably because of its abundance, abnormalities which occur in many of the species are more frequently observed in this. These abnormalities include plants with several fertile panicles. The extra panicles usually occur in pairs and are arranged as opposite or subopposite branches from the base of the main fertile segment.

9a. BOTRYCHIUM DISSECTUM var. ONEIDENSE (Gilbert) Farwell.

I have now seen the type specimen in the Gilbert Fern Herbarium at Hamilton College, also a cotype in the herbarium of the New York State Museum. Locality is given as wet woods on Mohawk Flats near Utica.

New England Province: Cited by Dole (1937) from Proctor, Rutland County, Vt.; Hampshire Co., Mass.

Blue Ridge Mts.: Roan Mt., Mitchell Co., N. C.

Ridge and Valley Province: Schuylkill Co., Pa.

Appalachian Plateau: Chautauqua, Chemung and Schoharie Counties, N. Y.; Allegheny, Beaver, Cameron, Elk, Lackawanna, Lycoming, Monroe, and Potter Counties, Pa.; Rowan Co., Ky.

Central Lowland: Genesee, Monroe, and Orleans Counties, N. Y.; Lucas Co., Ohio; Ottawa, St. Clair, and Washtenaw Counties, Mich.; also reported by Tryon (1940) from Dane and Waukesma Counties, Wisconsin.

9b. BOTRYCHIUM DISSECTUM var. OBLIQUUM (Muhl.) Clute. *B. dissectum* f. *pennsylvanicum* (E. W. Graves) C. L. Gruber, Amer. Fern Journ. **30**: 44. (1940). *B. obliquum* f. *confusum* Wherry, Bartonia **21**: 12(1942); based on a form of var. *obliquum* with the ultimate sterile segments with more or less dentate teeth. I have seen many specimens which belong in this category.

New England Province: Reported by Roland (1941) from Colchester, Cumberland and Kings Counties, Nova Scotia; Somerset Co., Me.; Grafton Co., N. H.; Windham Co., Vt.; Putnam Co., N. Y.

Adirondack Mts.: Franklin, Fulton, and Lewis Counties, N. Y.

Coastal Plain: Anne Arundel, Calvert, and Caroline Counties, Md.; Northampton and Surry Counties, Va. I have seen no specimens of var. *obliquum* from the Coastal Plain south of Virginia. Reports by Blomquist and Correll (1940) from Brunswick, Franklin, Moore, and Pender Counties, N. C., by Matthews (1940) from Florence Co., S. C., and by Correll (1939) from Alcorn and Tishomingo Counties, Miss., probably are based on plants of var. *tenuifolium*.

Piedmont Plateau: Carroll and Frederick Counties, Md.; Henry Co., Va., also reported by Lewis and Massey (1940) from Amelia Co., Va.; Surry Co., N. C., also reported by Blomquist and Correll (1940) from Caldwell, Durham, Granville, Guilford, Johnston, Lincoln, Montgomery, and Yadkin Counties, N. C.; Greenville, Oconee and Pickens Co., S. C. Reported from Lee Co., Ala., by Correll (1939).

Blue Ridge: Alleghany Co., N. C.; also reported by Blomquist and Correll (1940) from Ashe, Graham, Macon, Madison, and Mitchell Counties, N. C.; Pickens Co., S. C.

Ridge and Valley Province—Hudson Valley: Columbia and Rensselaer Counties, N. Y. Middle Section: Northumberland, Schuylkill, and Snyder Counties, Pa.; Washington Co., Md. Southern Section: Reported from Loudon Co., Va., by Correll (1939). Some specimens from Schuylkill Co., Pa., are intermediate between vars. *obliquum* and *oneidense*.

Appalachian Plateau: Cattaraugus Co., N. Y.; Armstrong, Beaver, Bedford, Butler, Cameron, Clarion, Clearfield, Crawford, Elk, Greene, Lycoming, Mercer, Potter, and Somerset Counties, Pa.; Trumbull Co., Ohio; Greenbrier and Jefferson Counties, W. Va.; Morgan Co., Tenn. Some specimens from Warren Co., Pa., are intermediate between vars. *obliquum* and *oneidense*.

Central Lowland: Delaware Co., Ohio; also reported from Henry Co., Ohio, by C. H. Jones (1940); Allegan, Berrien, Cass, Kalamazoo, and Oakland Counties, Mich. There are specimens intermediate between var. *obliquum* and var. *oneidense* from Porter Co., Ind.

Ozark Plateau: Newton, Van Buren, and Washington Counties, Ark.

Ouachita Province: Mentioned from Montgomery Co., Ark., by D. M. Moore in letter.

A doubtful specimen from Duluth, St. Louis Co., Minn., is my only record from the western part of the Superior Upland.

9c. BOTRYCHIUM DISSECTUM var. TENUIFOLIUM (Underw.) Farwell.

The northernmost locality on the Coastal Plain was Salisbury, Maryland (Clausen, 1938). A collection by E. T. Wherry (Ph), Sept. 18, 1938, from Farmington, Hartford Co., Conn., so closely resembles specimens from the southern Coastal Plain that it seems necessary to refer it here. This record extends the range of the var.

tenuifolium to the New England Upland. From the Coastal Plain or its inner fringe in Maryland, three additional records are available. Northernmost of these, from the data on the herbarium label, is: Wet woods, Woodbrook, Baltimore Co., Oct., 1891, herb. C. E. Waters (Mich). From the Coastal Plain of southeastern Virginia, there are specimens from three more counties. Although there is only one record of var. *tenuifolium* from the Coastal Plain of North Carolina, there are several from South Carolina, indicating that var. *tenuifolium* is the common phase of the species on the Coastal Plain of that state. This is confirmed by my own experience in the field there. It is likely that reports of var. *obliquum* from the Coastal Plain of North Carolina are based on plants referable to var. *tenuifolium*. From farther south and west there are additional records from the Coastal Plain of Alabama and Louisiana.

On the Piedmont the northernmost collection known to me is from a stream bank in Durham County, N. C., Oct. 5, 1933, *Mildred G. Stites 37* (Hnh). From South Carolina I have seen specimens from five counties on the Piedmont Upland, also intermediates between vars. *obliquum* and *tenuifolium* from several localities, both on the Piedmont and Coastal Plain. An additional record from the Piedmont of Georgia is afforded by a collection from a swamp near Stone Mt. (Fur).

Although the var. *tenuifolium* is predominantly a population of the Coastal Plain, it also occurs in other provinces to a limited extent. Already I (Clausen, 1938) have reported it from two localities in the Southern Blue Ridge in North Carolina and from the Tennessee Mountains. To these records may now be added the collection of *W. E. Merrill* (Fur), Aug. 23, 1928, from low moist woods at about 300 meters elev., near Cedar Mt., Transylvania Co., N. C., and a collection by D. S. Correll, no.

4045 (NY) from moist woods along the New River near Scottsville, Ashe Co., N. C.

From the Ohio Valley, there is a collection from farther upstream than previously reported and the first from Ohio. This is from woods at Madiera, Hamilton Co., *Mrs. Walter Callahan* (Cinc).

9d. BOTRYCHIUM DISSECTUM Spreng. var. TYPICUM.

The northern limit of the distribution of this variety in the east seems to be the St. Lawrence Valley. An additional locality in this region is the Co. de St. Iberville in Quebec. From the New England Province, Windham Co., Vt., and Rensselaer Co., N. Y., should be added to the list of counties from which specimens are available.

The var. *typicum* occurs on the northern Coastal Plain, but seems to be rare in the pine barrens of New Jersey. From the pine barrens, it has been collected by Hollis Koster, no. A 2–3–1 (Claus), in a damp thicket at Burlington Co., N. J. There are records from nine counties on the Coastal Plain of Maryland, but from only two counties on the Coastal Plain of Virginia, whereas there are records for var. *tenuifolium* from five counties of the same region of Virginia. I have seen no specimens of var. *typicum* from the Coastal Plain south of Virginia, but there are reports of its occurrence in Florida and southern Arkansas.

On the Piedmont var. *typicum* ranges south to North Carolina, Tennessee, and South Carolina. Blomquist and Correll (1940) gave the range as south to Georgia, but they did not mention the part of the state where it occurs. Southernmost Piedmont collections known to me are 6.5 km. from Easley, Pickens Co., S. C., Mar. 26, 1937, *Miriam Fullbright* (Fur), also *R. T. C. & H. Trapido* (Claus, Corn, BH); wooded slope along Jamison Mill Creek, elev. about 375 meters, Greenville Co., S. C., *H. W. Trudell & E. T. Wherry* (Ph); woods along stream at

Forty-Acre Rock, Lancaster Co., S. C., *Velma Matthews & Elizabeth Boland* (Cok). There are many additional specimens and records from the Piedmont of New Jersey, Pennsylvania, Maryland, Virginia, and North Carolina, indicating that this variety is frequent in the northern part of that province. Records from the Blue Ridge are few. From the Valley and Ridge area west of the Blue Ridge, specimens are available from Roanoke County, Virginia, to Washington Co., N. Y.

The var. *typicum* is common on the northern part of the Appalachian Plateau and there completely intergrades with var. *obliquum*. South and west of Pennsylvania, I know it from that province only from Tucker Co., W. Va., and Ashtabula, Portage, and Trumbull Counties, Ohio. On the Central Lowland the var. *typicum* ranges from Oswego Co., N. Y., west to Iowa. Specimens or records are available from additional counties in New York, Ohio, and Michigan.

Graves (1933) has cited a collection from the Superior Upland, from the Black River, Gogebic Co., Mich., but I have not seen specimens.

Previously known from the northeastern limits of the Ozark Plateau, the var. *typicum* is now also known from the southwestern part of that province, from low open woods, Farmington, Washington Co., Ark., *D. M. Moore 330309* (Ark).

12. BOTRYCHIUM DAUCIFOLIUM Wall. in Hook. & Grev. *B. subcarnosum* Wall., Hooker's Bot. Misc. **3**: 222. 1832(1833). *B. formosanum* Tagawa, Act. Phyt. Geobot. **9**: 87–88(1940).

Authentic specimens, kindly sent to me by Dr. Tagawa, so closely resemble *B. daucifolium* that I am inclined to place *B. formosanum* in the synonymy of that species, not even according it subspecific status. In separating his species from *B. daucifolium*, Tagawa has used particularly

the venation and the color of the sporangia. As a result of field experience with other species of *Botrychium*, sporangial color impresses me as of slight taxonomic importance. The venation character is more satisfactory, but there is overlapping in this. In *B. formosanum* the basal posterior vein of the penultimate segment arises either at or above the point of insertion of the costa. In thirty-five collections of *B. daucifolium* from the East Indies, the same basal posterior vein arose either at or below the point of insertion of the costa. Perhaps this tendency, if maintained through a large series of specimens, is of sufficient importance to warrant the recognition of the Formosan population as a distinct subspecies, but in the absence of further evidence and more specimens from there, I am not now making the new combination.

In the Botanical Miscellany, Greville and Hooker (*ibid.*) listed both *B. subcarnosum* and *B. daucifolium*, but it is not clear to me how they were to be distinguished.

The East Indian specimens mentioned above include collections from Bali, British North Borneo, Java, Sumatra, and Timor. From data with these specimens, the altitudinal distribution in Java seems to be from 900 to 1600 meters and the fruiting time from late May to the end of July. From Flores Island, specimens are available from an elevation of 1850 meters.

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Shorter Notes

THE RANGE OF NOTHOLAENA DELICATULA—A CORRECTION.—When we described *Notholaena delicatula*,[1] Dr. Maxon and I recorded collections from the southeastern part of the state of Coahuila, Mexico, and adjacent Nuevo León, and one from "Jalisco: limestone ledges, mountains near Monterrey, June, 1889. *Pringle* 2581. . . ." The quoted phrases were copied verbatim from Pringle's label.

At the time, we accepted the data on the label without misgiving. Reference, however, to Pringle's diary, as published by Mrs. Davis,[2] shows that he was in and near Monterrey, Nuevo León (not Jalisco), for most of the month of June, 1889. He specifically refers to the particular fern in question, as *Notholaena nivea* var. *flava* (the name under which it was distributed), and notes

[1] Contrib. Gray Herb. **127**: 7, 8. 1939.
[2] Davis, Helen Burns. Life and Work of Cyrus Guernsey Pringle, p. 62. 1936.

that it was collected June 18th on the rocky slope of the Sierra Madre "two hours' walk south of the old Bishop's Palace." Jalisco, then, on the label, is a clerical error; and *N. delicatula* becomes one of the local species of northeastern Mexico, known, so far, only from Coahuila and Nuevo León. This is a more natural, or at least more usual, geographic condition.

Two other species, *Canavalia villosa* and *Cnicus Pringlei,* recorded in the diary as collected at the same place and on the same or the preceding day, are correctly labelled in the Gray Herbarium. Only the fern seems to have suffered a mischance. Indeed, in the course of a good many years familiarity with Pringle's specimens, this is the only error I have detected in the data given on his labels.—C. A. WEATHERBY, *Gray Herbarium.*

PTERIS VITTATA HARDY IN WASHINGTON, D. C.—In passing the corner of Maryland Ave. and 2d St., S. W., in Washington, D. C., on November 20, 1942, I happened to notice several groups of ferns growing on the brick foundation of a Government greenhouse. Investigation disclosed the species to be *Pteris vittata* L. Several of the larger plants are 15 to 18 inches tall, which may be taken to indicate the age as approximately five years. The venation, sori, scaly petioles, non-articulate pinnae, and other diagnostic characters check perfectly with specimens I have collected in southern Florida.

This find may extend the range of *Pteris vittata* some 500 miles north of previous records, but in any event it is interesting to find that this species has been able to endure the winter temperatures of this latitude for so many years. In Dade County, Florida, it is found sparingly, growing on the walls of limestone road-material pits and occasionally about the bases of limestone boulders, often in association with grasses and weeds, usually in full sunlight.—F. N. IRVING, *Washington, D. C.*

ASPLENIUM SEPTENTRIONALE IN CALIFORNIA.—A record of the discovery of this rare spleenwort in California has recently appeared in a mimeographed publication[1] of the Sierra Club of California, by John Thomas Howell, but apparently has not been formally published. It thus seems decidedly worth while to bring this find to the attention of botanists, and especially fern students. Perhaps no missing link in the distribution of North American ferns is so critical as the discovery of this Carex-like spleenwort in the Sierra Nevada, "in crevices of granite rocks above Columbine Lake," below Sawtooth Pass, east of Mineral King, Tulare Co. (*J. T. Howell 17803*). Because this spleenwort was long ago detected in the San Pedro Martir of Baja California, and in the region of San Francisco Peaks and Flagstaff, Arizona, but *absent* from California proper, this collection is truly historic. Inasmuch as other holarctic plant species occur in the San Pedro Martir Sierra, along with the spleenwort, as extreme southernmost stations in every case, it is now clear that what appeared to be an incongruous distribution pattern for *Asplenium septentrionale* falls easily into the familiar mapping known for dozens of holarctic species. My field experience with this fern in Colorado leads me to conclude that wherever it grows, this spleenwort eludes the eye of many keen collectors. In its unusual growth habit it looks more like a *Carex* out of season, less like the expected fern form, than any other fern I have met in the field.—J. EWAN, *University of Colorado.*

POLYPODIUM PECTINATUM AS AN EPIPHYTE.—In early May of last year I went on a collecting trip to the southern end of the county, on the old St. Augustine Road. This is a wonderful spot, with more species of orchids to

[1] Base Camp Botany, 1942. 29 pp. Sept. 10, 1942 (received as reprint item Nov. 30, 1942).

the square yard than any other place I know, besides a host of other interesting flowering plants. It is also my nearest station for *Selaginella apoda*. Back in the swamp, where the *Selaginella* grows, I came on a large live oak which I had never noticed before and, struck by its ancient and picturesque appearance, I went close to it and was greatly astonished to see a number of plants of *Polypodium pectinatum* growing as epiphytes upon the trunk. The weather had been extremely dry all spring, and most of the fronds were curled and brown, some of the largest being dead.

Six months later I went back to the place with another member of the Fern Society, Lieut. Commander Shields, now stationed here. We collected three nice plants, leaving plenty more on the tree, and these are now growing in my fern garden. The summer rains had brought the plants into good condition and some of them were especially fine. This is the first record of this fern in Duval County and, I believe, the most northern station known.—MARY W. DIDDELL, *Jacksonville, Fla.*

HART'S-TONGUES IN A LIMESTONE GROTTO.—Several years ago I constructed in my garden an enclosure of weathered rocks taken from limestone ledges in Sussex Co., New Jersey. It is roughly oval, about 4 feet long, 3 feet wide, and 2 feet deep, and is surrounded by tall ferns, having thus the effect of a small grotto. In it I set out several Hart's-tongues, probably all of the European type. These have grown very well, and last year many sporelings appeared, some an inch or two in height and others just emerging from the prothallial stage. If they continue to grow well and to increase in number, a good supply of young plants will shortly be available to members of the Society.—W. HERBERT DOLE, *West Orange, New Jersey.*

Recent Fern Literature

With the prefatory remark, "Whatever *Cheilanthes* Sw. may stand for, the generic sense of which is far too broad according to current usage, the conclusion of my study in the years past is that that group of ferns, as typified by *Pteris argentea* Gmel. and *Pteris farinosa* Forskål and referred to *Cheilanthes* by later authors, is especially distinct from that genus," Dr. Ching has revived *Aleuritopteris* Fée (1852). He recognizes 19 Asiatic species, divided into three sections on characters of habit and spores, and adds, in notes, the American *Ch. aurea* Baker and *Ch. aurantiaca* (Cav.) Moore. Geographic data, some discussion and informal description of species, and full synonymy are given.[1]

Even though he provides no more than the skeleton of a key, Ching's carefully documented treatment can hardly fail to aid in an understanding of the Asiatic species concerned. And, as he limits it, *Aleuritopteris* is no doubt a natural group. It has been recognized as such by most pteridologists in the 90 years since Fée's publication. Hooker and Mettenius placed together the same species, so far as known to them, without giving them a name; John Smith,[2] Fournier, Trevisan, Diels, and Christensen used Fée's name, all except Fournier (who followed Fée in taking it as a genus) for an identical group as a section or subgenus of *Cheilanthes*. The trouble with such work as Ching's is, first, that it is too mechanical; it merely raises to generic rank, without adducing significant new evidence, groups already accepted and defined by other authors in a subordinate rank. Ching follows very closely the outline sketched

[1] Ching, R. C. The studies of Chinese ferns—XXXI. Hong Kong Naturalist, **10**: 194–204. 1941.

[2] Ching's statement that John Smith referred these species to *Cassebeera* is correct only for Smith's very early synopsis of the genera of ferns published in the Journal of Botany in 1841. It is not correct for his more mature "Historia Filicum" (1875).

by his predecessors; in substance he merely asserts that his opinion differs from theirs.

A second and more serious weakness of such work is that it rests on too narrow a basis. It is almost wholly regional. The Asiatic species of *Cheilanthes*, section *Aleuritopteris*, are distinct enough from other species of *Cheilanthes* inhabiting that area. It is in America that the real difficulties of classification are found. Even the American species which Ching assigns to *Aleuritopteris* are habitally aberrant, *Ch. aurea* in its finely dissected blade and *Ch. aurantiaca* in its reduced lower pinnae. Other American species, conventionally placed in *Nothoalaena*—*N. sulphurea*, *N. candida*, and particularly *N. galapagensis*—differ from *Aleuritopteris*, at least so far as has yet been pointed out, only in the absence of a modified hyaline leaf-margin serving as an indusium. *N. Standleyi* is like them except for a more pedate type of leaf-architecture, in this respect resembling *Ch. grevilleoides* Christ, the type of the genus *Sinopteris* C. Chr. & Ching. Farther afield, but still within range, is *Pityrogramma triangularis*, again strikingly like *Aleuritopteris*, but without indusium and bearing sporangia along the whole length of the veins instead of at the tip only. In this last case, soral structure may well be phylogenetically important enough to counterbalance everything else, as has usually been supposed; nevertheless, in the tribe Cheilantheae any particular type of sorus is likely to be associated, in different species, with a rather miscellaneous lot of other characters. Ching does not mention any of the species enumerated above, though Fée assigned two of them to his *Aleuritopteris*. But until they are disposed of, one must either assume that an extension of the epidermis beyond the edge of the leaf-tissue is by itself a generic character, though it is found in all degrees of development in the Cheilantheae, or must leave *Aleuri-*

topteris, as a genus, distinctly ragged about the edges. Ching, I think, does just that.

There are many difficult questions of classification in the Cheilantheae and they center about just such marginal species as *N. sulphurea* and the others discussed above. They can probably be settled only by patient and minute comparison of the characteristics of all the species of the tribe. The final solution may lie in such broad generic lines as those laid down by Prantl in his study of *Pellaea* and *Cryptogramma*, or in the recognition of relatively numerous small genera. But the premature setting up of insufficiently studied microgenera gets us nowhere.

There is another way. Christensen, once Ching's teacher, has shown it to us. When he published the second part of his monograph of the American species of *Dryopteris*, he believed that the subgenera he there recognized were in reality good genera. But he would not set them up as such and continued to treat them under *Dryopteris* until he had studied the Old World species also and tested his concepts by them. Not until 18 years later did he finally accept them as genera. It is to be hoped that serious students of the Cheilantheae will follow his example.—C. A. WEATHERBY.

A recent note in Ecology[1] discusses the rôle of Bracken (*Pteridium*) in the regeneration of Douglas fir forests. The Bracken is abundant in one of the regions where Douglas fir grows. After lumbering, the slash is usually burned and then the fern becomes dominant. In areas that are subjected to repeated burning, the effect of a Bracken cover is detrimental to the Douglas fir seedlings. The dead fronds produce such a continuous and inflammable cover that most of the seedlings are killed by a fire. On the other hand, in undisturbed areas the protective Bracken cover is beneficial. The seedlings grow better

[1] McCulloch, W. F. The Rôle of Bracken Fern in Douglas-fir Regeneration. Ecology 23: 484, 485. 1942.

and there are more of them under the Bracken than in exposed areas.—R. M. TRYON, JR., *Dartmouth College.*

Dr. Jesse M. Shaver[1] has produced a veritable *vade mecum* for amateurs in ferns, at least if they happen to live in or visit Tennessee. It contains, within the limits of a 25-page article, sections on the folk-lore of ferns, their life-history, the making of blue-prints and other such "nature prints" of fern leaves, the names of ferns (with an interesting little essay on the pronunciation of the Latin ones), photographing ferns, fern gardens, and growing ferns from spores. There are instructions at once concise, clear and in considerable detail for all of these activities which require them. In addition there is a good account, with map, of the chief floristic areas of Tennessee, lists of the species of ferns most characteristic of each, and a bibliography. It is hard to think of anything a beginner in the study of Tennessee ferns would need to know about, including the Fern Society, which is not touched upon.—C. A. WEATHERBY.

American Fern Society

Report of the President for 1942

Conditions of war made necessary the postponement of the American Fern Society's usual annual meeting. Yet the Journal has appeared in all four numbers and there is good reason to expect its continued publication in this new year on which we are now embarked.

A membership list, in mimeographed form, was issued in 1942. Some question arose regarding the desirability of printing or mimeographing the list. By adopting the latter method of preparation, a considerable economy was effected. Members might assist the officers in deciding whether or not to mimeograph such a list in the future

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[1] Shaver, Jesse W. Some general notes on ferns. Journ. Tennessee Acad. Sci. **17**: 311–336. 9 figs., 1 map. Oct. 1942.

by letting them know whether they approve or disapprove such procedure. Expressions of opinion on all sorts of topics will help the Council better to administer the affairs of the Society. Also the editors will appreciate suggestions about the Journal and will be particularly glad to receive for publication brief notes about the distribution or culture of ferns or other details of fern study.

As retiring president, I desire to express the hope that the Society will continue to prosper, even in these years of strife. Also, I hope that the Journal will continue to appear as frequently and with as many pages as the recent volumes have contained. Finally, I hope that enthusiastic interest in ferns may not only continue among us all, but may spread to still others who will join in our association and enjoy the pleasures of our study and hobby.

ROBERT T. CLAUSEN, *President*

Report of the Secretary for 1942

During this first year of active participation by our country in the war effort of the Allied Nations the basic routine of the Society has gone on as unspectacularly as usual. But as in all other activities of life, the war has made itself felt in the more public aspects of our existence. Largely because of gasoline rationing, no attempt was made to hold a Field Meeting during the year. Our annual winter meeting, scheduled to be held December 28 at the Brooklyn Botanic Garden, was canceled also, in compliance with the Government's request that meetings of the American Association for the Advancement of Science and affiliated societies, ordinarily held during Convocation Week, be dispensed with in order to reduce civilian travel during the holidays.

The Society was officially represented at the 75th Anniversary celebration of the Torrey Botanical Club in June by Dr. Edgar T. Wherry.

Information has reached the Secretary of the active participation of some of our members in the war: Richard C. Harlow and Edward M. Shields have been commissioned Lieut. Commanders in the U. S. Navy; and Harold Trapido is stationed at Paine Field, in Washington. This may be only a partial list, and the Secretary would be glad to have information of other members who are in war service.

The names of four of our members have been removed during 1942 through death: Rev. Charles S. Lewis, who from 1923 through 1933 was Secretary of the Society; William B. Rossberg, one of our Life Members; Miss Anna L. Hall and A. H. Marchant. In addition to these, some 40 others were lost through resignations and the non-payment of dues. This heavy loss has been compensated in part by the relatively large addition of 27 new members. This brings the balance back to a membership of 387 with which to start the new year.

For 1943 one of our goals may well be the interesting of friends to become members, so that we may regain the high mark of 1941, when our "fern fellowship" included 402 members.

Respectfully submitted,

ELSIE G. WHITNEY, *Secretary*

Report of the Treasurer for 1942

In a year which has brought serious difficulties to many scientific organizations the American Fern Society may still be said to be in a fairly good financial condition, but the cooperation of all members will be needed during the coming year to maintain the present level. Cash on hand, it may be noted, is only $10 less than on January 1, 1942, a good sign of present stability.

There is a rise of 10 per cent in the cost of printing for 1943.

Some members of long standing, upon whom we have

counted to pay dues for several years back, have done so, as may be seen from the accompanying detailed report.

During the year we received a gift of $5 from a member of long standing who wishes to remain anonymous, and as contributions toward the membership committee we received gifts of $5 from Mrs. D. C. Boyce and $9.75 from Dr. R. C. Benedict.

The treasurer wishes to thank all members for their kind cooperation throughout the year.

Receipts	*Amount*	*Sub-Total*	*Total*
Cash on hand Jan. 1, 1942			$ 242.12
1938 Membership Arrears	$ 6.00	$ 6.00	
1939 Membership Arrears	9.00	9.00	
1940 Membership Arrears	13.50	13.50	
1941 Membership Arrears	40.50	40.50	
1942 Membership Renewals	401.88		
1942 New Members	21.00	422.88	
1943 Membership Renewals	14.25		
1943 New Members	12.00	26.25	
1944 Membership Renewals	.50	.50	
1941 Subscription Arrears	2.50	2.50	
1942 Subscription Renewals	59.57		
1942 New Subscribers	8.85	68.42	
1943 Subscription Renewals	39.58	39.58	
Sale of back numbers A.F.J.	72.00	72.00	
Sale of A.F.J. Index	.50	.50	
Sale of "State and Local Fern Floras"	10.25	10.25	
Sale of "Var. and Forms of Ferns of E. N. Am."	1.50	1.50	
Author contribution for 1943	10.00	10.00	
Gift, not restricted	5.00	5.00	
Gifts for Membership Committee	14.75	14.75	
Gifts (books) A.F.S. Library	4.34	4.34	
Gift (books) A.F.J. back numbers	6.27	6.27	
1942 Advertising	4.00	4.00	
Reprints	15.97	15.97	
Transferred from Bissell Herbarium Fund	41.45	41.45	$ 815.16
			$1,057.28
Deduction a/c Gift (books) A.F.S. Library[a]		$ 4.34	
Deduction a/c Gift (books) A.F.J. back numbers[b]		6.27	
Deduction a/c Profit on Sales[c]		28.40	$ 39.01
			$1,018.27

Disbursements

Science Press			
A.F.J. Vol. 31, No. 4	$154.30		
A.F.J. Vol. 32, No. 1	155.71		
A.F.J. Vol. 32, No. 2	150.44		
A.F.J. Vol. 32, No. 3	147.66	$608.11	
Reprints	45.21	45.21	
1000 printed clasp envelopes	8.00	8.00	
Trade Discount	4.12	4.12	
Agency Commission	7.40	7.40	
Bank Charges	1.54	1.54	
Expense President	3.00	3.00	
Expense Treasurer	27.90	27.90	
Expense Secretary	19.12	19.12	
Expense Librarian	10.00	10.00	
Expense Curator	51.45	51.45	$ 785.85
Cash on hand Jan. 1, 1943			$ 232.42

[a] Transferred to A.F.S. Library Acct. (books).
[b] Transferred to Inventory A.F.J.
[c] Transferred to Reserve Fund.

Statement December 31, 1942

Assets			*Liabilities*	
Cash on hand	$232.42		Capital Account	$5,437.78
In Spec. Acct. #1	510.05		1943 Memb. Susp. Acct.	28.15
In Spec. Acct. #2	53.75			
In Reserve Fund	92.68	$ 888.90	1944 Memb. Susp. Acct.	.50
Accts. Receivable		19.25		
Notes Receivable		3,200.00	1943 Subscribers Susp. Acct.	35.87
Inventory A.F.J.		1,818.21	Memb. Comm. Susp. Acct.	.76
A.F.S. Library (books)		260.50	Distrib. Vol. 32, No. 4	110.00
		$6,186.86	Author contrib. 1943	10.00
			Bissell Herb. Fund	510.05
			Life Memb. Fund	53.75
				$6,186.86

Respectfully submitted,
HENRY K. SVENSON, *Treasurer.*

Report of the Auditing Committee

The undersigned have checked all the receipts and expenditures of the American Fern Society for 1942 and find the Treasurer's statement correct.

We recommend that the item Notes Receivable listed in the Assets column in the sum of $3,200.00 be reappraised and entered with an Inventory value of $1.00, and that the Liability Capital Account be reduced accordingly.

We wish to express our sincere appreciation of the services of Dr. Svenson and his staff in behalf of the Society.

WALTER S. ALLEN
FREDERICK L. FAGLEY
Auditing Committee

Report of the Judge of Elections

A tabulation of the votes for officers of the American Fern Society for 1943 follows:

For President	
C. A. Weatherby	83
E. T. Wherry	1
Robert T. Clausen	1
For Vice-President	
Joseph Ewan	80
Herbert Dole	2
For Secretary	
Mrs. Elsie G. Whitney	84
H. L. Blomquist	1
For Treasurer	
Henry K. Svenson	83
W. S. Allen	1

I therefore declare the following nominees elected: C. A. Weatherby, President; Joseph Ewan, Vice-President; Mrs. Elsie G. Whitney, Secretary; Henry K. Svenson, Treasurer.

Respectfully submitted,

W. L. DIX, *Judge of Elections*

From Sweden word has very recently been received of the death of Dr. Carl Christensen, foremost taxonomic authority upon ferns, which occurred in Copenhagen, November 24, 1942. He had been, since 1915, a member of the American Fern Society, and it is hoped soon to publish a biographical sketch in the JOURNAL.

NEW MEMBERS

Mr. F. M. Cota, 2611 33d St., San Diego, California.
Mr. Marlin A. Espenshade, 435 Littleton St., West LaFayette, Indiana.
Miss E. Irene Graves, 237 Sumner St., Bridgewater, Massachusetts.
Mrs. Annie T. Hale, Hopkinton Rd., Concord, New Hampshire.
Mrs. Weld Morgan, 5 Burgess Road, Worcester, Massachusetts.
Mrs. Josephine Reddy Wilde, 156 Clarkson Ave., Brooklyn, N. Y.

CHANGES OF ADDRESS

Mr. Maurice Broun, The Northfield, East Northfield, Massachusetts.
Miss Elsie D. Canan, 1023 Millcreek Road, Johnstown, Pennsylvania.
Dr. Edmund LeRoy Dow, 8 Golf View Road, Palm Beach, Florida.
Mr. F. C. Greene, Biltmore Arms Apt., 900 East 9th St., Kansas City, Missouri.
Lieut. Comdr. Richard C. Harlow, U. S. Naval Rest Center, Asheville, No. Carolina.
Miss Barbara Howlett, R. D. 2, Presque Isle, Maine.
Dr. Irving W. Knobloch, 699 East Utica St., Buffalo, New York.
Mrs. Arthur Luhr, 555 Kellogg Ave., Palo Alto, California.
Mr. Ian McCallum, c/o Mr. James Marshall, R.R. 1, Sarnia, Ontario, Canada.
Dr. Alice P. Ottley, Seneca Castle, New York.
Mr. J. A. Schuurman, Consulate General of the Netherlands, Box 1606, New Orleans, Louisiana.
Mrs. James M. Stifler, 326 15th St. Court, Bradenton, Florida.
Dr. Edward P. St. John, Floral City, Citrus Co., Florida.
Mr. Willman Spawn, P. O. Box 4098, Washington, D. C.
Mr. Robert P. St. John, Floral City, Citrus Co., Florida.
Mrs. G. W. Strattan, 1004 20th Ave., Altoona, Pennsylvania.
Mr. J. W. Thompson, 5245 20th Ave. South, Seattle, Washington.
Mr. Hans Wilkens, 424 So. 15th St., Reading, Pennsylvania.

Vol. 33 April-June, 1943 No. 2

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

CONTENTS

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The American Fern Society

Council for 1943

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Joseph Ewan, Boulder, Colorado ..... *Vice-President*

Mrs. Elsie Gibson Whitney, 274 South Main Ave., Albany, N. Y.
Secretary

Henry K. Svenson, Brooklyn Botanic Garden, Brooklyn, N. Y.
Treasurer

William R. Maxon, Smithsonian Institution, Washington, D. C.
Editor-in-Chief

OFFICIAL ORGAN

American Fern Journal

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C. V. Morton ..... Smithsonian Institution, Washington, D. C.
Ira L. Wiggins ..... Dudley Herbarium, Stanford University, Calif.

An illustrated quarterly devoted to the general study of ferns.

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

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

Matter for publication should be addressed to William R. Maxon, Smithsonian Institution, Washington, D. C.

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

LIBRARIAN

Miss Hester M. Rusk, Brooklyn Botanic Garden, Brooklyn, N. Y.

CURATOR OF THE HERBARIUM

Miss Hester M. Rusk, Brooklyn Botanic Garden, Brooklyn, N. Y.

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. 33 April–June, 1943 No. 2

New Names for Ferns and Fern Allies Proposed by C. S. Rafinesque, 1806-1838

E. D. Merrill

In connection with a preliminary examination of all of Rafinesque's known botanical publications it was noted that a very large number of his new generic and specific names have been entirely overlooked by the compilers of our standard indices. This situation will not be discussed in detail here, as I have in hand the preparation of a comprehensive index to Rafinesque's numerous botanical papers in which it is proposed to list all his new names in all groups of plants. The necessary data have been compiled on large index sheets, to which normally all that Rafinesque published regarding each entity has been transferred. When these sheets were sorted there was noted an extraordinarily high percentage of names appertaining to the vascular cryptogams that have remained in the category of overlooked ones for more than a century. It is suspected that the total number of unlisted Rafinesque names in all groups of plants will be between 1200 and 1500. With the acceptance of the homonym rule by the International Botanical Congress, if for no other reason, it is clearly high time that Rafinesque's validly published names be listed at least.

There are various reasons why Rafinesque's work has been so generally overlooked or ignored, but the three chief

[Volume 33, No. 1 of the Journal, pages 1–40, was issued March 30, 1943.]

ones are: First, the non-availability of many of his publications, even in some of our larger botanical libraries; second, the low esteem in which Rafinesque's botanical work was held by his contemporaries and successors; and, third, because the majority of his types were destroyed after his death. However, our botanical rules are impersonal, and no really valid reason exists for continuing to ignore the work of this admittedly most erratic botanist, for most of his new names were validly published under all rules of botanical nomenclature. As his new names for the ferns and fern allies, mosses, lichens, fungi, and algae do not come within the field of Index Kewensis, it has been thought desirable to list these in a series of special papers independent of their probable inclusion in the proposed comprehensive Index Rafinesquianus now under way.

In the preparation of this list I have compared the entries with those in Christensen's Index Filicum and its Supplements, and where a Rafinesque name was omitted, or was entered with a reference to other than the original place of publication, it is indicated by an asterisk. It will be noted that nearly all of the 63 Rafinesque names considered below are in the nature of additions to previously published lists or indices. For those groups covered by Christensen's Index Filicum and its three supplements only eight Rafinesque names are included, and of these only four are correct in that the references are to the original places of publication.

The total number of Rafinesque entries, including minor orthographic variants, is 62, but most of his proposed names fall as synonyms. Certain *nomina nuda* cannot be placed. Under our accepted rules of nomenclature *Pteretis* Raf. is the proper generic name for that group of ferns previously called *Struthiopteris* Willd. and more recently known as *Matteuccia* Todaro. Among

the species that Rafinesque actually described as new, only one, *Equisetum praealtum* Raf., appears to be valid, and this name has been rather generally accepted for a widely distributed North American species.

In general, most of Rafinesque's reasons for changing generic and specific names proposed by earlier authors have never been accepted by other botanists. The changes were made by him in accordance with his own code of nomenclature as published by him in 1814, and again in 1837.[1] In making changes he did not always remember what he had proposed at an earlier date. Thus he actually published no less than three different generic names for the group now called *Phyllitis* Ludwig (*Filinguis* Raf., *Glossopteris* Raf., and *Phyllitis* Raf.), five new ones for *Pteris* Linn. (*Lemapteris* Raf., *Peripteris* Raf., *Phyllitis* Raf., *Pteridium* Raf., and *Pterilis* Raf.), and two for *Lycopodium* (*Clopodium* Raf. and *Copodium* Raf.). He actually described *de novo* only one new genus, *Nesoris* (1838), and this is clearly a synonym of *Pityrogramma* Link (1833); but he published about 20 new generic names (including minor variants), all but a single *nomen nudum* being readily reducible to synonymy. *Glossopteris* Raf. (1815) invalidates *Glossopteris* Brongn. (1828), the latter a widely used name for a characteristic group of fossil plants. The palaeobotanists will doubtless wish to take proper action with a view to conserving *Glossopteris* Brongn. over *Glossopteris* Raf. at some future International Botanical Congress. Because of his confidence in his own rules he used such forms as *Adiantum capilveneris* (*A. Capillus-Veneris* Linn.), *Asplenium ruta* (*A. Ruta-muraria* Linn.), and *Marsiglia* (*Marsilea* Linn.). Minor variants such as *Driopteris* for *Dryopteris*, *Thelipteris* for *Thelypteris*,

[1] Rafinesque, C. S. Principes fondamentaux de somiologie ou les loix de la nomenclature et de la classification de l'empire organique ou des animaux of des végétaux, 1–52. 1814; Flora Telluriana 1: 81–90. 1836 [1837].

Sciphofilix for *Scyphofilix*, and *Pillularia* for *Pilularia* may have been due to inadvertence, although throughout his work he seems very generally to have changed the letter "y" to "i" in certain types of generic and specific names. It will be noted that the percentage of accepted Rafinesque names for this group of plants is very low, but there is no reason to believe that the acceptable percentage for the several thousand new names that he proposed for the phanerogams will be higher, and this without invoking the principle of *nomina conservanda*.

In some of his later publications Rafinesque records the fact that he had in preparation additional works, some of these apparently planned to be more or less like his Flora Telluriana (1837–38), Sylva Telluriana (1838), Alsographia Americana (1838), and Autikon Botanikon (1840). Thus, in his Autikon Botanikon (p. 2), he lists such titles as his proposed Pterikon, Agrostikon, Lirikon, Ericon, Dendrikon, Autikon Formosum, and Pomona, in which he proposed to treat the ferns, grasses, lilies, ericaceous plants, trees, ornamental plants, and fruit trees. It is clear that he had scarcely developed plans for publishing all of these, for most of the titles were selected to represent sets of duplicate botanical specimens that he could supply. In discussing his new fern genus, *Nesoris*,[2] he says: "It shall be fully described and figured in my Pterikon, a work now preparing. I announce it meantime as a great discovery. . . ." Those interested in ferns and at all familiar with Rafinesque's erratic work can only be thankful that he never completed and published this proposed work. His last published volume was the Autikon Botanikon, which appeared in the year of his death; Raflnesque died Sept. 18, 1840. Of the Autikon Botanikon only about a dozen copies are known to be in existence, but fortunately it is now available to

[2] New Fl. No. Amer. 4: 104. 1836 [1838].

those who must or should use it, a modern facsimile lithoprint edition having been issued under the auspices of the Arnold Arboretum in 1942. In 1943 Rafinesque's Sylva Telluriana was similarly reproduced.

Because Rafinesque's names for ferns and fern allies have for the most part been entirely overlooked for more than a century, and because some of his original papers are exceedingly rare, I have in this paper, in general, repeated what he published about each entity. I have added at the end of the paper a complete bibliography of the Rafinesque papers that contain new names for vascular cryptogams, for the reason that these items were not included in the several bibliographies of fern literature prepared by Christensen for his Index Filicum and its Supplements.

FILICALES

*ACROSTICHUM ACUMINATUM Raf. New Fl. No. Amer. **4**: 104. 1836 [1838], non Willd., nec Juss. = *Acrostichum daneaefolium* Langsd. & Fisch. 1810 (*A. lomarioides* Jenm. 1898, non Bory 1833; *A. excelsum* Maxon, 1905; *A. aureum* sensu Kunth, Syn. Pl. Aequin. Orb. Nov. **1**: 67. 1822, non Linn.).

This binomial appears in Rafinesque's discussion of *Acrostichum aureum* Linn. He says regarding that species that the form described under that name by Kunth is quite unlike it or his *A. maritimum:* "I will call it *Acrostichum acuminatum* Raf. pinnules lanceolate acuminate base rounded petiolate entire thin costate, smooth above like stipes, beneath quite fructiferous all over. In Venezuela, ten feet high." This was based entirely on Kunth's description of *Acrostichum aureum,* cited above, the latter's specimen being from Venezuela and described as "frondes 10 pedales."

*ACROSTICHUM LACINIATUM Raf. Med. Repos. II. **5**: 353. 1808, *nom. nud.*; Journ. Bot. (Paris) **2**: 173. 1809, *nom. nud.*, non Gilib. 1792.

Rafinesque's specimen was undoubtedly from the Central Atlantic States.

*ACROSTICHUM MARITIMUM Raf. New Fl. No. Amer. **1**: 60. 1836 = *Acrostichum aureum* Linn.

Rafinesque's description is: "*Acrostichum maritimum* Raf. *A. aureum* Mx. Pursh. Pinnate, smooth, pinnules stipitate oblong entire obtuse or acute.—Sea shore of Florida, large fern, unfigured as yet, compare with next [*A. aureum* Linn.] again."

*ADIANTUM CAPILVENERIS Raf. Med. Fl. **1**: 31. 1828; Man. Med. Bot. 31. 1841 = *Adiantum Capillus-Veneris* Linn.

*ASPLENIUM FALCATUM Raf. Western Minerva 42. 1821, *nom. nud.*; Fox, Science II. **12**: 213. 1900, *nom. nud.*, non Thunb., nec Swartz.

Rafinesque's specimen was from Missouri (Dr. L. Beck, of St. Louis), or from Mississippi (Dr. J. Hart, of Natchez).

*ASPLENIUM GLAUCUM Raf. Western Minerva 42. 1821, *nom. nud.*; Fox, Science II. **12**: 213. 1900, *nom. nud.*

Rafinesque's specimen was from Missouri (Dr. L. Beck, of St. Louis), or from Mississippi (Dr. J. Hart, of Natchez).

*ASPLENIUM RUTA Raf. Med. Fl. **2**: 198. 1830 = *Asplenium Ruta-muraria* Linn.

*CARPANTHE AXILLARIS Raf. Med. Repos. II. **3**: 422. 1806, *nom. nud.* = *Carpanthus axillaris* Raf. op. cit. II. **5**: 357. 1808, *descr.* = *Gratiola virginiana* Linn. var. *aestuariorum* Pennell (prob.).

CARPANTHUS Raf. Med. Repos. II. **5**: 357. 1808; Journ. Bot. (Paris) **1**: 221. 1808, prob. = *Gratiola* Linn. (Scrophulariaceae).

CARPANTHUS AXILLARIS Raf. ll. cc. prob. = *Gratiola virginiana* Linn. var. *aestuariorum* Pennell, Mem. Acad. Nat. Sci. Philadelphia **1**: 96. 1935.

Rafinesque's very inadequate description is as follows: "*Carpanthus* Cryptog. filices; natural order of the carpantheous, fructification: capsul axillar, solitary, globulous 1 locular semi 4 sperm dehiscent in the maturity, in 4 obtuse semi valves; seeds lenticular, *C. axillaris*, axillar

carpanthus: leaves opposite, sessile, oblong, obtusinervous. This plant grows under the water of some creeks in Pennsylvania and New Jersey; it may belong with the genusses pilularia, salvinia, lemna, marsilea, sivetes, &c. A new natural order a kin to the ferns." Desvaux,[3] and perhaps other early authors, lists the genus as a representative of the Marsileaceae, while Christensen,[4] whose entry is correct, erroneously reduced it to *Azolla* Lam. There is a very poor illustration of it in the sole existing set of Rafinesque's unpublished plates, now in the library of the New York Botanical Garden, and a copy of this plate is in the library of the Gray Herbarium. Although the drawing is very crude, the habit sketch is reasonably good for Pennell's variety of *Gratiola virginiana* Linn., which occurs in the Delaware drainage basin. Professor Fernald's original suggestion was that *Lindernia dubia* (Linn.) Pennell var. *inundata* Pennell might have been the plant Rafinesque attempted to describe, but he noted too many discrepancies. He also suggested as possibilities *Rotala ramosior* (Linn.) Koehne and the *Gratiola*. Dr. Pennell writes that he has no better suggestion than the *Gratiola*, which, as he states, has a globose capsule (*Lindernia* has elongated capsules) that does split into four valves, but which has many elongated seeds. We can only assume that Rafinesque erred in some of his observations. *Rotala* does not grow in creeks in the region indicated. In any case *Carpanthus* has nothing to do with *Azolla* Lam.; and no matter where it be placed, as among the three genera briefly discussed, no change in nomenclature is involved. The reasons for including *Carpanthus* in this paper are that it was originally placed by Rafinesque in the Filicales, that the name still encumbers the literature of the vascular cryptogams, and that

[3] Prodrome de la Famille des Fougères. Mém. Soc. Linn. Paris 6: 171–337. 1827.

[4] Ind. Fil. 168. 1905.

currently it is erroneously placed as a synonym of *Azolla* Lam.

*DRIOPTERIS Raf. Med. Fl. **1**: 32. 1828; Man. Med. Bot. 32. 1841 = Dryopteris Adans.

*FILINGUIS Raf. Med. Fl. **2**: 220. 1830 = *Phyllitis* Ludwig, 1757 (*Scolopendrium* Adans. 1763).

Rafinesque's statement is very brief: "*Filinguis* Raf. (*Scolopendrium officinale* Sm. same as *Scolopendria!*) Hart's tongue." There is no binomial.

*GLOSSOPTERIS Raf. Anal. Nat. Tabl. Univ. 205. 1815; Chloris Aetn. 13. 1815; Amer. Monthly Mag. Crit. Rev. **2**: 268. 1818; op. cit. **4**: 195. 1819; Journ. Phys. Chim. Hist. Nat. **89**: 262. 1819; Fl. Tellur. **1**: 85. 1836 [1837] = *Phyllitis* Ludwig, 1757.

In each place *Glossopteris* was substituted for *Scolopendrium*, as explained in the 1818 reference: "*Scolopendrium* Smith is quite similar to *Scolopendria* L. Therefore it must be changed into *Glossopteris.*" The Index Filicum entry is not to the original place of publication of *Glossopteris* Raf., but to Journ. Phys. Chim. Hist. Nat. **89**: 262. 1819. This generic name has nothing to do with the latter palaeobotanical name *Glossopteris* Brongn. (1828), widely used to indicate the *Glossopteris* flora by palaeobotanists. If the latter is to be retained, it must be conserved by some future action of the palaeobotanists.

*GLOSSOPTERIS HEMIONITIS Raf. Chloris Aetn. 13. 1815 (*Asplenium hemionitis* Linn.) = *Scolopendrium hemionitis* Willd. = *Asplenium hemionitis* Linn.

*GLOSSOPTERIS SCOLOPENDRIUM Raf. Chloris Aetn. 13. 1815 = *Asplenium scolopendrium* Linn. = *Phyllitis scolopendrium* (Linn.) Newm.

*GLOSSOPTERIS ANGUSTIFOLIA Raf. Herb. Raf. 52. 1833, *nom. nud.* Oregon.

*GLOSSOPTERIS FURCATA Raf. op. cit. 53, *nom. nud.* Oregon.

*GLOSSOPTERIS OBTUSA Raf. op. cit. 53, *nom. nud.* Oregon.

LEMAPTERIS Raf. Journ. Phys. Chim. Hist. Nat. **89**: 262. 1819 = *Pteris* Linn.

There is no binomial. *Lemapteris* was proposed as a new name for *Pteris* Linn. The entry in Christensen's Index Filicum is correct.

*LEPTOPHYLLUM Raf. Chloris Aetn. 13. 1815, non Ehrh. 1789, nec Blume[5] 1898. = *Anogramma* Link (1841).

*LEPTOPHYLLUM ACROSTICHOIDES Raf. l. c. = *Anogramma leptophylla* (Linn.) Link.

The entire entry consists merely of the following: "*Leptophyllum acrostichoides* Raf. *Fl. Polypodium leptophyllum* L. *Acrostichum leptophyllum* Dec." This does not constitute valid publication, hence *Leptophyllum* Raf. may be ignored; if it were valid, *Leptophyllum* Raf. (1815) would replace *Anogramma* Link (1841). *Leptophyllum* Ehrh. (Beitr. **4**: 147. 1789) is certainly not validly published. The entire entry is merely "*Leptophyllum-Arenaria tenuifolia* Linn."

*MARSIGLIA Raf. Fl. Tellur. **1**: 18. 1836 [1837] = *Marsilea* Linn.

In discussing certain types of generic names Rafinesque cites this as an example, stating that for "*Marsilea* read *Marsiglia*." This is an older change than that of Trevisan, *Marsiglia* Trev. (Atti Soc. It. Sci. Nat. **19**: 475. 1877),

[5] Blume's name appears only on plates 95 and 96 of the unnumbered "Fasciculus" of the Flora Javae that was issued under the auspices of Messrs. J. Frank and H. Remy in Brussels long after the earlier parts of the work had been issued. It consists of plates 1–7, 7B, 7C, 9, 14, 15, 19, 20, 23, 30–32, 95 and 96. There is no text. The entry on plate 95 is "Olfersia (Leptophyllum) gracilis" and that on plate 96 is "Olfersia (Leptophyllum) aculeata." The cover of this fascicle bears the printed date 1829, but it was not issued until 1898, according to a penciled entry on the copy in the Arnold Arboretum library. This is also marked, in pencil, "Planches inédites." Christensen's entry of *Leptophyllum* Blume in his Index Filicum is incomplete, lacking the date. Of the plates listed above only two represent ferns. The Christensen entry is "Leptophyllum Blume, Fl. Javae, Fil. Suppl. t. 95, 96–. (*Olfersia* §) = Stenochlaena." To this the date 1898 may be added. This is the group for which Holttum, in recent years, has reinstated the generic name *Teratophyllum* Mett. as a segregate from *Stenochlaena* J. Smith.

the latter also not appearing in Index Filicum. Trevisan states the case thus: "Il genere *Marsilea* di Linneo essendo intitolato dal nome del Conte Luigi Ferdinando Marsigli, dovrà appellarsi *Marsiglia*, non *Marsilea*, come, del resto con migliore digione, fu più di recente proposto." Rafinesque made the same change forty years earlier for the same reason.

*MENOPTERIS Raf. Herb. Raf. 53. 1833 = *Botrychium* Swartz.

*MENOPTERIS REMOTILOBA Raf. l. c. *nom. nud.* = *Botrychium* sp.

Rafinesque's very inadequate data are as follows: "*Menopteris remotiloba*, Raf. N. G. 1815. *Lunaria* of some Botanists, but not *Lunaria* a Cruciferous genus." The date, 1815, indicates the year in which Rafinesque originated the name, not the date of publication. What he had in mind was a new name for *Lunaria* Bauhin, the latter in part the basis of *Botrychium Lunaria* (Linn.) Swartz. Rafinesque's material was from the Rocky Mountains or Oregon.

*NESORIS Raf. New Fl. No. Amer. **4**: 104. 1836 [1838] = *Pityrogramma* Link (1833), *Ceropteris* Link (1841).

*NESORIS DISCOLOR Raf. l. c. = *Pityrogramma calomelanos* (Linn.) Link.

In his discussion of *Acrostichum aureum* Linn., Rafinesque states: "I have found in Collins Herb. a very curious fern of Florida collected by Kin or Baldwin again as a doubtful *Acrostichum aureum?* which forms a most beautiful and wonderful N.G. of dorsiferous ferns without Sori, but with capsules unconnected punctiform scattered like minute dots. It shall be fully described and figured in my Pterikon, a work now preparing. I announce it meantime as a great discovery proving that the capsules of ferns may be solitary, and I call it *Nesoris discolor* Raf. smooth, bipinnate, yellow beneath, pinnules sessile oblong crenate lobate base acute and obtuse, above nervose flabelate, behind enerve golden furfurescent cap-

sules irregularly scattered. Pedal, stipes brown shining convex behind, grooved before, pinnules alternate, 25 to 33 on each branch, gradually smaller and nearly confluent.—In Florida. I have several other N.G. of Ferns, but none so beautiful and anomalous; probably type of a new family Nesorides.''

This record places *Pityrogramma calomelanos* (Linn.) Link as actually growing in Florida some time previous to 1836. Small[6] states that the first collection made in Florida *from naturalized plants* was that by W. A. Knight in December, 1931. There is no possible doubt as to the identity of *Nesoris discolor* Raf. with *Pityrogramma calomelanos* (Linn.) Link, Link's generic name being fortunately three years older than that of Rafinesque. The species was originally introduced into Florida more than a century ago as an ornamental plant.

*ONOCLEA[7] COSTATA Raf. Herb. Raf. 66. 1833, *nom. nud.* Appalachian Mountains.

*ONOCLEA DENTATA Raf. op. cit. 63. 1833, *nom. nud.* Central United States.

*ONOCLEA LACINIATA Raf. op. cit. 68. 1833, *nom. nud.* Appalachian Mountains.

*ONOCLEA REPANDA Raf. op. cit. 63. 1833, *nom. nud.* Central United States.

*OSMUNDA FUSCATA Raf. Herb. Raf. 53. 1833, *nom. nud.* Oregon.

*OPHIOGLOSSUM LINEATUM Raf. Med. Repos. II. **5**: 353. 1808, *nom. nud.*; Journ. Bot. (Paris) **2**: 173. 1809, *nom. nud.* = *O. vulgatum* Linn. (prob.).

Rafinesque's specimen was certainly from one of the Central Atlantic States and undoubtedly was a form of *Ophioglossum vulgatum* Linn. The binomial is not ac-

[6] Ferns of the Southeastern States 94. *fig.* 1938.

[7] Rafinesque's unpublished manuscript descriptions of these four suggested species of *Onoclea* are preserved in the library of the Philadelphia Academy of Natural Sciences. It was doubtless his intention to include these in his proposed but never completed Pterikon.

counted for by Clausen in his monograph of the Ophioglossaceae.[8]

*OPHIOGLOSSUM PUBESCENS Raf. Med. Repos. II. **5**: 353. 1808, *nom. nud.*; Journ. Bot. (Paris) **2**: 173. 1809, *nom. nud.*; Précis Découv. Somiol. 46. 1814, *descr.*; Journ. Bot. (Desv.) **4**: 273. 1814 = *Ophioglossum vulgatum* Linn.

Rafinesque's type was from New Jersey. The entry in Christensen's Index Filicum is to "Journ. de Bot. **4**: 273. 1814." Clausen[9] left Rafinesque's species among the dubious and rejected ones, quoting the reference as given by Christensen and stating: "The writer has not found the description of this species in the volumes of the Journal de Botanique which he has examined." Rafinesque's original description (Précis Découv. Somiol. 46. 1814) is: "*Ophioglossum pubescens.* Tige monophylle pubescente, feuille ovale-oblongue, pétiolée, presq' obtuse, pubescente, épi lancéolé plus court de la feuille. *En. Amer. dans le N. Jersey.*" In the Journ. Bot. (Desv.) entry this description is abbreviated to "feuille pubescente, *N. Jersey.*" I suspect that Rafinesque had specimens of the common *Ophioglossum vulgatum* Linn. with mouldy leaves.

*OPHIOGLOSSUM PUSILLUM Raf. Précis Découv. Somiol. 46. 1814; Journ. Bot. (Desv.) **4**: 273. 1814, non Nutt. 1818 = *Ophioglossum vulgatum* Linn.

Clausen[10] placed this as a doubtful synonym of *Ophioglossum crotalophoroides* Walt. thus: "? *Ophioglossum pusillum* Raf. in Desv. Journ. de Bot. **4**: 273. 1814." this being the entry as given by Christensen (Ind. Fil. Suppl. **3**: 134. 1934). Clausen's quotation marks indicate that he did not see the original description, which is as follows: "*Ophioglossum pusillum.* Feuille glabre lancéolée aigue pétiolée, épi presque lineaire plus long de la feuille. —Obs. Dans le bois de la Pensylvanie boréale, à peine élevé de 3 pouces." Northern Pennsylvania is far out

[8] Mem. Torr. Bot. Club **19**: 1–177. *f. 1–33*. 1938.
[9] Mem. Torr. Bot. Club **19**: 164. 1938.
[10] Mem. Torr. Bot. Club **19**: 157. 1938.

of range for *Ophioglossum crotalophoroides* Walt. What Rafinesque had was undoubtedly a small form of the common *O. vulgatum* Linn.

*OPHIOGLOSSUM REPANDUM Raf. Herb. Raf. 53. 1833, *nom. nud.* Oregon.

*PERIPTERIS Raf. Anal. Nat. Tabl. Univ. 205. 1815; Amer. Monthly Mag. Crit. Rev. **2**: 268. 1818; Journ. Phys. Chim. Hist. Nat. **89**: 262. 1819; Fl. Tellur. **1**: 83. 1836 [1837] = *Pteris* Linn.

The entry in Christensen's Index Filicum is to the 1819 reference. The reason for this change is given by Rafinesque in the 1819 entry thus: "*Pteris* L. is objectionable, being radical to many genera; therefore *Peripteris* might be substituted."

*PERIPTERIS ? EDULIS Raf. Herb. Raf. 54. 1833, *nom. nud.* = *Pteris* vel *Pteridium* sp.

The basis of this name was Lewis and Clark Expedition data, rather than specimens; from some part of the northwestern United States. A form of *Pteridium aquilinum* (Linn.) Kuhn is indicated by the specific name.

*PERIPTERIS RUGOSA Raf. Herb. Raf. 41. 1833, *nom. nud.* = *Pteris* sp.

Rafinesque's specimen was collected by Bradbury in the "Mandan country" north of the Missouri River. The name appears in his "Index to the Florula Mandanensis of Bradbury and Rafinesque, published in 1817 and in 1820, with notes and additions." (Herb. Raf. 37–41. 1833). The date 1817 is that of Bradbury's own list published in his "Travels" (pp. 335–338. 1817), which was compiled from the works of Pursh and Nuttall; not a single Rafinesquian binomial is included and there is no evidence that Rafinesque had anything to do with the preparation of this list. In the preface (pp. vi, vii) Bradbury states that his plans for publication on his plants were frustrated because his collection "was submitted to the inspection of a person of the name of Pursh

who published the most interesting of his plants in an appendix to the Flora Americae Septentrionalis.'' Rafinesque had some duplicate material from the Bradbury collection in his herbarium, for he states: ''These plants were collected by Bradbury on the Missouri and at the Mandans, in 1811, named and described by me in 1817. The specimens are in my herbarium.'' I have not been able to trace the 1820 ''publication'' referred to. It, like Rafinesque's 1817 list, was probably a manuscript.

*PHYLLITIS Raf. Princ. Somiol. 29. 1814; Fl. Tellur. **1**: 85. 1836 [1837] = *Phyllitis* Ludwig.

In 1814 Rafinesque stated: ''Il faudra . . . changer . . . *Scolopendrium* en *Phyllitis* R.,'' thus clearly accrediting this *Phyllitis* to himself, although one might assume that he intended to indicate *Phyllitis* Ludwig. In the 1837 entry he merely said: ''*Scolopendra, Scolopendrium,* this last becomes *Glossopteris* or *Phyllitis.*'' There is no binomial.

*PHYLLITIS Raf. Amer. Monthly Mag. Crit. Rev. **4**: 195. 1819, non Ludwig = *Pteris* Linn.

Rafinesque's statement here is: ''To the unlucky names *Struthiopteris, Scolopendrium,* and *Pteris,* we have substituted *Pterilis, Glossopteris,* and *Phyllitis.*'' If we accept this sequence as correct, then *Struthiopteris* = *Pterilis* Raf. (but he apparently meant to write *Pteretis,* q. v., infra), *Scolopendrium* = *Glossopteris* Raf., and *Pteris* = *Phyllitis* Raf., non Ludwig. There is no binomial.

*PILLULARIA Raf. Med. Repos. II. **5**: 358. 1808; Journ. Bot. (Paris) **1**: 222. 1808 = *Pilularia* Linn.

*POLYPODIUM[11] BULLATUM Raf. First Cat. Bot. Gard. Transylv. Univ. 15. 1824, *nom. nud.*; Herb. Raf. 41. 1833,

[11] ''Pleoptan'' Raf. has been ignored. This name appears in the Filson Club Historical Quarterly (12: 231. 1938) in Perkins' paper, in which are reproduced a number of letters from Rafinesque to Dr. Short which, unfortunately, contain a number of binomials as *nomina nuda* that do not appear elsewhere. The entry is: ''Your *Polypodium incanum* is the N.G. *Pleoptan* of the English botanists.'' It is probable that *Pleopeltis* was intended.

nom. nud., non Baker = *Polypodium polypodioides* (Linn.) Watt var. *Michauxianum* Weatherby.

Rafinesque's first specimens were from Kentucky; later he recorded the same species from the Mandan country (north of the Missouri River). No description was ever published. The specimen on which the second reference was based is preserved in the Darlington Herbarium at the West Chester Teachers' College, data regarding it having been supplied by Dr. Robert S. Gordon. It bears the number 78, this being the serial number under which it is listed in Rafinesque's Index Florula Mandanensis.

*POLYPODIUM EROSUM Raf. Ann. Nat. Ann. Synop. 16. 1820 = *Cystopteris fragilis* (Linn.) Bernh. (prob.).

Rafinesque's description is as follows: "Stem filiform and smooth; frond pinnated; folioles pinnatifid; pinnules erose, obtuse, notched, thin and smooth; nerves flexuouse; sores scattered, rounded, unequal.—a small species, six inches high at utmost, with a short frond; it grows on rocks in the knob-hills of Kentucky." The identification was suggested by Dr. Frank T. McFarland of the University of Kentucky, *Cystopteris fragilis* (Linn.) Bernh. being the only fern known from the region that conforms reasonably well with Rafinesque's meagre description. What he had was apparently a somewhat dwarfed form as it grows on talus slopes, etc.

*POLYPODIUM MEDIUM Raf. Amer. Journ. Sci. **1**: 79. 1818, *nom. nud.*

Rafinesque's specimens were from the vicinity of Philadelphia.

POLYPODIUM VULGARE Linn. var. LEVIGATUM, var. MULTICAULE,* and var. LATIFOLIUM* Raf. Med. Fl. **2**: 27. 1830.

There are no descriptions for these three varieties, nor any indication, for that matter, that Rafinesque originated these varietal names.

PTERETIS Raf. Amer. Monthly Mag. Crit. Rev. **2**: 268. 1818.

Rafinesque states: "*Struthiopteris* Wild. is abominable, should *Pteris* stand, being formed of two coupled names *Struthio* and *Pteris;* and at all events it is bad, therefore *Pteretis* may be substituted." While his reason for proposing this new name is an invalid one, it so happens that *Struthiopteris* Willd. (1809) is invalidated by the earlier and different *Struthiopteris* Weis (1770) and *Struthopteris* Bernh. (1801). *Matteuccia* Todaro (1866) has been adopted in recent years, but it is long antedated by *Pteretis* Raf., which was accepted by Nieuwland[12] and by Small[13] for perfectly valid reasons. See, however, Mattfeld ("Zur Nomenclatur der Farn- und Blüthenpflanzen Deutschlands," in Repert. Sp. Nov. Fedde **44**: 289. 1938), who apparently wishes to retain *Struthiopteris* Willd. *Pterinodes* Kuntze (Rev. Gen. Pl. **2**: 819. 1891) is another synonym. *Pteretis* Raf. first appears in Christensen's Index Filicum in Suppl. **2**: 30 (1917), the entry there being correct.

*PTERIDIUM Raf. Princ. Somiol. 26. 1814, non Gleditsch. 1790 = *Pteris* Linn.

Under his own rule 30 Rafinesque cites as an example, among other proposed changes in generic names, *Pteris* L., which "doit être changé en *Pteridium* R.," thus accrediting *Pteridium* to himself and not to Gleditsch.

*PTERILIS Raf. Amer. Monthly Mag. Crit. Rev. **4**: 195. 1819 = *Pteretis* Raf.

Probably Rafinesque intended to write *Pteretis* instead of *Pterilis* in this case, but in this entry he clearly proposed *Pterilis* as a substitute for *Struthiopteris* Willd.; see *Pteretis* Raf., *supra.*

(*To be concluded*)

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[12] Amer. Midl. Nat. 3: 197. 1914; 4: 334. 1915.
[13] Ferns of the Vicinity of New York 140–143. *fig.* 1935.

Porcupines and Ferns

EDWARD M. SHIELDS

Early in August, 1940, while at our summer home in the Catskills, I received a letter from a friend, asking me to collect some ferns she listed—*Asplenium Ruta-muraria, Onoclea Struthiopteris, Cryptogramma Stelleri, Polystichum Braunii, Cystopteris bulbifera, Woodsia glabella,* and *Lygodium palmatum,* also *Dryopteris fragrans* —adding that the last had the fragrance of violets, but there was no use searching, as it grows only on the most inaccessible cliffs and was not known so far south. At that time I knew but three ferns, and these by their Christian names only—Christmas, Maidenhair, and Rattlesnake Fern—so the formidable scientific names literally threw me into a tailspin.

Being an enthusiastic dry fly fisherman, I know well the magnificent gorges and tumbling streams of this section. Very often I have felt that the attributes of a mountain goat were more to be desired than those attributed to Izaak Walton. The endless challenge and the superb environs which accompany the sport have always held me spellbound. At that time, however, my share of trout had been taken, and as the season was rapidly drawing to a close the rod was laid aside with the decision to spend some time looking for ferns. So the next morning saw me—accompanied by my son, aged eight—with the assurance that comes with ignorance, going down the trail. We were looking for the fern that grows only on inaccessible cliffs, smells like violets, and does *not* grow in this part of the country.

It was a glorious morning. The cool air flowed down from the wooded heights in a limpid stream. I was, naturally, besieged with a million questions. Porcupines seemed to be particularly on Townsend's mind. Finally,

more or less in desperation, I told him there were a lot of them around and I would catch him one that morning. Signs had been noted, but up to that moment "Porcie" had evaded me entirely. We left the trail, and on scrambling down a small cliff I spied, just too late to call to the lad's attention, a large porcupine disappearing into his den. What appeared to me to be the only chance in a thousand to keep my word had been taken away. Sooner or later that day I would be known for the fraud I really was.

After continuing for about half an hour or so along the base of the cliff, we turned and started to scale part of it. I had hold of Townsend with one hand, a small sapling with the other; and upon looking up, there in the sapling was just the right-sized porcupine. It was shaken down and tapped lightly on the nose with a twig. This seems to be a very satisfactory method, which for some reason or other works, to lull a porcupine into comparative inactivity. With great pride, and realizing the gods were with me, I handed over "Porcie" by the tail to Townsend to take home as a pet. My honor was saved, the day was made; but we were still looking for the fern that doesn't grow there.

Completing the ascent of the cliff, we turned and walked along the talus at the base of another. Approaching a wild ravine, into which a small stream of water fell, I noticed on the cliff a fern which was strange to me. It had lots of curly brown leaves next to the cliff. I pulled it off. It smelled like violets. And now *Dryopteris fragrans* does grow there. We returned home—porcupine, fern, and all—in time for lunch. That afternoon I borrowed a fern book.

There are two remarkable stations for this Arctic wanderer within three miles of each other in the locality. Both have literally hundreds of the ferns. It will al-

ways be a matter of utter amazement to me that these stations on the ramparts of the Hudson, almost within sight of the city of New York, had not before been reported. Specimens were seen by Dr. Wherry and Dr. Svenson, and sent to the University of Pennsylvania, the Gray Herbarium, and the U. S. National Herbarium. Before the month was out, with the exception of *Lygodium palmatum* I had found in the vicinity, without aid or guide, all the ferns listed by my correspondent.

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More About the Distribution of Ferns in Florida

EDWARD P. ST. JOHN

Interest in the problems raised by the remarkable distribution of ferns in Florida prompts a response to the recent discussion of the subject by Mr. Stephen H. Spurr.[1] The explanation which he rejects[2] was based upon botanical considerations. The writer has slight knowledge of geology, but such information as was available to him when the paper was prepared seemed to confirm and elucidate the conclusions reached by studies of the distribution and ecology of the plants. Five years of continued study have brought much added evidence in favor of the general hypothesis, the essential elements of which are that *the rare ferns of the northern part of the peninsula are relicts of a former extensive tropical flora which existed in that region before the southern part of the peninsula had emerged from the sea;* also that *the northern peninsular region was a center of dis-*

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[1] Stephen H. Spurr. Factors Determining the Distribution of Florida Ferns. Amer. Fern Journ. 31: 91–97. 1941.

[2] Edward P. St. John. Rare Ferns of Central Florida, I. Some Peculiarities of Distribution. Amer. Fern Journ. 26: 41–50. 1936.

tribution, both northward and southward, of other ferns that are now abundant because they do not require specially protected habitats. It is now desirable that my original statement should be corrected so that it will conform to the new views, held for several years past, that the new evidence should be outlined, and that attention should be directed to facts that are not given due consideration in Mr. Spurr's paper.

The significant correction to be made relates to the time of permanent emergence of the islands which later were incorporated into the Florida peninsula. Final determination of this must wait upon further geological investigation, but it seems clear that it can not have been earlier than the middle Miocene. The botanical evidence indicates that it can not have been much later. In any case, the use of the term "Oligocene island region" was an error, since the island that existed in that time was later submerged. Doubtless other corrections must be made as further knowledge is gained, especially as to the geographic history of certain species. It is possible that some tropical ferns which have migrated farthest northward may have been established on the southern margin of the continent even before the final emergence of land in the central Florida region. The circumstances under which *Vittaria lineata*, a plant of the coastal plain, has been found in the Piedmont of Georgia indicate this. The distribution of *Trichomanes Petersii* suggests it, but details of its occurrence in Hispaniola and in central Florida argue against it. On the other hand *T. Boschianum* is not found in the Caribbean region, and has been reported but once (a doubtful record) from Florida.

The new data will be most useful if presented in a general statement which includes all the facts. In brief, as now known to the writer they are as follows: In the Florida peninsula, which is about 400 miles long and 150

miles wide, are two distinct areas in each of which many fern species of tropical origin are found. One of these is included within the southern third of the peninsula; the other includes substantially the northern half. A summary[3] of facts as to the distribution of ferns in these areas is presented herewith in tabular form.

DISTRIBUTION OF FERNS OF TROPICAL ORIGIN IN FLORIDA

Species found in southern Florida but not in central Florida (climate and general flora tropical to subtropical)		*Species found in central Florida but not in southern Florida (climate and flora subtropical to north-temperate)*	
Caribbean species	30	Caribbean species	22
Endemic species of Caribbean relationship	2	Endemic species of Caribbean relationship	7
	32		29
Caribbean species common to both regions	26	*Caribbean species common to both regions*	26
		Mexican species	2
Total	58	Total	57

This table excludes 18 species of northern origin; also 9 species that seem to be escapes from cultivation, and 5 published species concerning which there is some question as to whether they should be assigned specific or sub-

[3] It is regrettable that limitations of space do not permit the publication herewith of the names of the 123 species of ferns to which recurrent reference is made in this paper. With few exceptions they are described and their distribution is indicated in "Ferns of the Southeastern Flora," by John K. Small. Frequently "Index to North American Ferns," by Maurice Broun, gives more definite information as to distribution.

The list of those which in the light of present knowledge seem to be endemic is short and of special interest. Those of the southern area are *Asplenium biscaynianum* and *Tectaria Amesiana*, both long in good standing. In the northern area *Asplenium Curtissii* has long been recognized. The others are recent discoveries of the writer, and it is not strange that there should still be a questioning attitude concerning them. *Thelypteris macilenta* and *T. macrorhizoma* are well marked species that do not intergrade with others and that show no evidence of hybridity. Both have been observed in cultivation for several years. *Ophioglossum mononeuron* is a small form, but well defined and certainly not an immature plant. It has been collected at four stations, the most distant 100 miles apart.

specific rank. In addition to all those mentioned above, two well-defined subspecies are found in the northern but not in the southern area. Inclusion of any one of these groups would increase the differences shown between the two floras.

Thus it appears that in an area no larger than England or the state of Illinois there are two fern floras so different that although 26 species are common to both, each has about 30 species that are not found in the other. The peculiar rocky habitats of the northern region are about 200 miles distant from the similar formations in the south. These are separated by about the same distance from the nearest of the islands, still farther south and strictly tropical in climate, from which both floras are derived. The writer's explanation of the differences between the floras is based upon the fact that in previous geological periods islands existed substantially at the location of the northern area, while other parts of the peninsula were submerged. He believes that these islands, which at some periods were encircled by the Gulf Stream, had an extensive tropical flora (which must have

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I have found no specimens in the larger herbaria of the eastern United States; possibly it has been overlooked in the Caribbean region. *Asplenium subtile* has been found in the deep vertical entrances of two caves 50 miles apart. At one of these stations the lowest temperature recorded by a maximum-minimum thermometer during a continuous period of nearly three years was 52° F. The lowest reading taken at the surface of the ground was 16 degrees below the freezing point. The average of hygrometer readings at the habitat showed nearly 10% higher relative humidity than at the surface. *Asplenium scalifolium* was found at the station just mentioned. Both ferns seem to be valid species. *Asplenium plenum* is found at the same station. Its nearest relative is *A. Curtissii*, from which it is distinguished by several characters. After cultivation for several years, side by side in an outdoor fernery, the differences between the plants are lessened in some characters.

The two species which are supposed to have reached Florida from Mexico are *Ophioglossum crotalophoroides* and *O. Engelmannii.*

by migration from that of the islands of the Caribbean region; that when the continent in its southern extension made connection with these islands, certain species of ferns that were there established migrated northward; that as the peninsula gradually extended southward, some species made their way into the newly emerged land, while others were introduced there by wind-blown spores from the Caribbean region; that with changes of climate and geological modification of the habitats the greater part of the tropical flora of central Florida was exterminated, but that a considerable number of ferns that were more adaptable or that found protected habitats survived to the present time. For further elaboration of this hypothesis, and for the argument against it, the reader is referred to the two papers first cited above.

Several lines of evidence indicate that many of the species of the northern area are of earlier introduction from the Caribbean region than those of the southern region which lies between, and that they are relicts of a former flora. The number of endemic species is larger; several of the species which require less specialized habitats have migrated far northward; many of the species are found only in protected habitats,[4] such as sinks, grottos, and the openings of caves; usually the colonies of these species are small (some of those of 7 species consisting of no more than 5 plants) and manifestly not increasing in numbers; and, finally, while there is no reason to doubt that spores have been carried by winds from the Caribbean islands to central Florida, it is incredible that it should have happened in recent times in the case of more than 20 species, no one of which found a foothold in the southern third of the peninsula.

Other interesting facts, probably significant in this connection, appear in relation to the habitats of several

[4] See latter half of footnote 3.

species. Ferns that are epiphytic in the tropical parts of southern Florida very frequently appear as epipetric ferns in central Florida. Occasionally this is true even of *Vittaria lineata*, which has also been found growing upon rock *in the Piedmont of Georgia at an elevation of over 900 feet.*[5] *Campyloneuron phyllitidis* is invariably epipetric, except as to sporelings which never mature, in the northern stations. The essential ecological difference between the epiphytic and epipetric habitats is not extreme, but the change to the unusual one seems much more likely to occur in relict plants than in those that are in the van of migration. More important is a change, noted at many stations, in the life habits of *Pycnodoria cretica*. This fern is so widely distributed in sinks and similar habitats for a distance of several hundred miles that its dispersal by spores is certain. At the present time in the majority of stations it is spreading little, if at all, save by vegetative process. The change is connected with the normal geological development of the sinks, which in their earlier stages have abundant exposed rock, together with moisture both from surface drainage and by evaporation from the underground outlets. Subsequent geological processes divert the surface waters to other connections with the underground drainage system, dissolve and erode the rocks and bury them with sand, and fill the underground outlets. Under these conditions propagation by spores can not continue and the plants are now sparingly found in very dense colonies which cover from a square foot (with more than 200 fronds in that space) to ten times that area. Apparently distribution was accomplished while the present stations were joined by continuous broad-leaved forests which sheltered abundant rock. When the surface rock

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[5] Joseph H. Pyron and William H. Duncan. Vittaria lineata in Lincoln Co., Georgia. Amer. Fern Journ. 29: 142–144. 1939.

disappeared by erosion and solution, and complete underground drainage was established by the formation of a network of caves, these forests with their attendant fern flora were followed by the xerophytic high pinewoods association which now isolates the more favorable habitats. These in turn are now being unfavorably modified by the very rapid geological processes of this limestone region.

The writer's interest in the subject under discussion is not in maintaining a theory, but in finding a solution of the problems involved. Desiring to avoid the appearance of controversy, he still ventures to suggest that a careful reading of Mr. Spurr's paper should precede acceptance of his conclusions. It should also be said that although his review of the conclusions of scientists as to the geological history of Florida is pertinent, it is true that knowledge of the subject is far from complete. Only about one-tenth of the area in question is covered by published topographical maps of the U. S. Geological Survey, and there are vital problems back of the present topography. Some geologists who have recently given special attention to these problems disagree with so good an authority as Cooke, who indeed is careful to state that his conclusions are not final. There is evidence that during the Pleistocene there were three islands of considerable size from 50 to 100 miles south of the one mentioned by Mr. Spurr in his summary of Cooke's view, and in locations of the greatest significance in relation to the hypothesis that is in question. Mr. Spurr believes that if such islands persisted through the Pleistocene, tropical ferns could not have survived on them, since the ice sheet approached within 700 miles of Florida; but he forgets that at that same time the warm waters of the Gulf Stream literally washed the shores of those islands.

A fault of Mr. Spurr's argument from geology is that he offers as evidence data which have no pertinence to the problem. When a fossil is found in a rock the period of its life in that region is geologically dated, but an epipetric species of fern during 10,000 years may have migrated from rock to rock, wherever suitable habitats were found, a thousand times. The presence of a fern in a locality where there is reason to believe that a succession of suitable habitats has persisted for a long time may, in the light of other data, be of the greatest significance; but the fact that today it is growing upon a recent formation has not the slightest bearing upon the time of its introduction to that region, unless it can be shown that there are and have been no older rocks from which it may have migrated.

A single illustration from the many that are available may be offered. For many years Dr. John K. Small believed that *Anemia adiantifolia* was confined to the Miami oölite, and here the writer made acquaintance with it growing in the pockets of the deeply eroded rock. Later he was impressed by the strikingly similar appearance of rocks some 200 miles farther north—so much so that he searched for the fern, and found it abundant over a large area of the Ocala limestone. One of these is the oldest, and one the most recent of the exposed rocks of the Florida peninsula.

That Mr. Spurr's argument was based upon very inadequate information as to the ferns of the central Florida region appears in the statistics presented in the early part of this paper. In the case of endemic species, the consensus of botanical authority must finally decide as to their systematic status; but they are not to be carelessly dismissed. For example, *Thelypteris macilenta*, both the validity and the significance of which he seems to question, is a very distinct species which intergrades

with no other. Its characters diverge so greatly from those of its nearest relatives that it can not be a hybrid between known species. It has been passed upon by the best fern authorities in the United States, and the writer does not know that its standing as a species has been questioned by any botanist. The fact that only three plants have been found at the only known station makes it one of the strongest single items of evidence for the hypothesis under discussion.

Facts as to the presence of endemic species and of limited and peculiar areas of distribution which strikingly parallel those that appear in the ferns have recently been reported for the crustaceans, insects, fishes, reptiles, and the small burrowing mammals of Florida. Plans for the collation of this varied evidence are now in progress. One zoological study which discusses the problem at some length has already been published.[6]

FLORAL CITY, FLORIDA.

The Type Species of Cheilanthes

C. A. WEATHERBY

Dr. Ching[1] opens his "Studies of Chinese Ferns—XXXI" with the remark, "Whatever *Cheilanthes* Sw. may stand for . . . ," thus indicating that he was uncertain as to its typification. Christensen[2] also hesitated to choose a type species. I do not mean to assert any particular qualification on my part to choose one; but some discussion of possible candidates may narrow the field of uncertainty.

Various considerations may influence the choice of a type species from among several assigned to a genus,

[6] Archie Fairly Carr, Jr. A Contribution to the Herpetology of Florida. Univ. Florida Publ., Biol. Series 3[1]: 1–118. 1940.

[1] Hong Kong Naturalist **10**: 194–204. 1941.

[2] Ind. Fil. XLI. 1906.

when the author himself has not designated one. It must, of course, be one of the original species and, save under exceptional circumstances, it should agree with the generic description. It should, preferably, not be a species which has been made the type of a segregate genus; otherwise, nomenclatural complexities are likely to result. Ordinarily, a species which the author has chosen to illustrate as representative is a good choice; if that, or any other chosen, is a wide-spread and familiar species, so much the better. And one should always bear in mind that a type is a practical device for fixing the application of names to the end of uniformity of usage and that, therefore, when one has already been designated by a previous author it is better, for the sake of uniformity, to accept his designation unless there is good reason to the contrary.

As to the type of *Cheilanthes*, no species with continuous indusium need apply. Swartz described his genus as possessing discrete sori and indusia "of membranous, distinct scales" or formed of reflexed lobes, and he included no species which does not answer more or less well to this description except *Ch. viridis* (now considered a *Pellaea*), which, if the current interpretation of it is correct, he seems to have misunderstood, and perhaps *Ch. lendigera*.

Of his species, *Ch. lendigera* is synonymous with the type of *Myriopteris* Fée. *Ch. capensis* has been placed in *Adiantopsis*, though apparently with little reason. *Ch. pteroides* is currently placed in *Pellaea*. *Ch. dichotoma* is referred to *Adiantopsis;* and though that genus is none too clear and may very possibly eventually be returned to *Cheilanthes*, a species referred to it is not the best type for the latter. *Ch. arborescens* is a *Hypolepis*, and *Ch. tennifolia* was included in and may be reasonably regarded as the type of *Cheilosoria* Trevisan.

There remain, as candidates, *Ch. micropteris*, *Ch.*

microphylla, *Ch. fragrans* (= *Ch. mysurensis*), *Ch. odora* and *Ch. suaveolens*, both synonyms of *Ch. pteridoides*, *Ch. hirta*, *Ch. vestita* (= *Ch. lanosa*), *Ch. parviloba*, and *Ch. multifida*. Of these, Swartz illustrated *Ch. micropteris* and *Ch. fragrans*, apparently because they were new and little known and to show extremes of habit, rather than as being particularly representative. The bibliographically oldest species are *Ch. microphylla*, common in the West Indies, and *Ch. suaveolens* (*pteridioides*), equally common in the Mediterranean region and eastward to the Himalayas. Of these, *Ch. microphylla* shows a strong tendency to continuous indusia; in the nearly related *Ch. notholaenoides* and *Ch. alabamensis* the indusia are nearly or quite so on each ultimate segment. *Ch. pteridioides* shows signs of the same failing. Among the other species there is little to choose; they are similar in habit, agree with Swartz's description, and are to all appearance closely congeneric.

There remains the matter of usage. Two species have been designated as type, *Ch. tenuifolia* by John Smith and *Ch. micropteris* by Britton and by Maxon. John Smith's is, of course, the prior designation and the species one of the earliest known. But it is also the type of *Cheilosoria*. *Ch. micropteris*, on the other hand, has, except for one transfer to *Notholaena* (and nobody has ever known the boundary between that so-called genus and *Cheilanthes*), remained always in *Cheilanthes*, was illustrated by Swartz (for whatever reason), and was included by Trevisan and by Diels in the section *Eucheilanthes* and by John Smith in his section *Pteridopsis* which also included his type. It seems as good a choice as any.

Shorter Notes

LYGODIUM PALMATUM IN WEST VIRGINIA.—The Climbing Fern seems extremely rare in West Virginia. Dr. M. G. Brooks in "Pteridophytes of West Virginia"[1] listed the only two known stations in West Virginia. Later a third station was mentioned by Dr. Edgar T. Wherry in his paper "Recent Fern Finds in West Virginia."[2] Since July 6, 1941, I have found three stations of this fern near my home in Nicholas County, West Virginia. Two of them are on Gauley River and the other station, five miles distant from these, is on Meadow River. All three stations are along old logging road grades in or at the edge of rhododendron thickets.—W. C. LEGG, *Mount Lookout, W. Va.*

TWO BOTRYCHIUM RECORDS.—Recently Prof. Frank T. McFarland, of the University of Kentucky, lent me the collection of *Botrychium* from his personal herbarium. In going over the specimens I noted two items which seem to be new records. One is typical *Botrychium multifidum* (Gmel.) Rupr., the variation that I have been calling ssp. *typicum*, from a moist meadow, Plainville, Hartford County, Connecticut, July 23, 1916, *H. C. Bigelow* 1120. This is my first record of ssp. *typicum* from Connecticut.

The other record is my first for Kentucky for *Botrychium dissectum* Spreng. var. *tenuifolium* (Underw.) Farwell. It is based upon material collected at Argyle, Powell County, Oct. 24, 1914, by Professor McFarland. Var. *tennifolium* has previously been reported from Kentucky, but all specimens which I have examined until now, although somewhat approaching this variety, have impressed me as nearer to var. *obliquum*.—R. T. CLAUSEN, *Cornell University*.

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[1] West Virginia University Bulletin, series 39, no. 2. 1938.
[2] Castanea 4: 1–4. 1939.

PELLAEA GLABELLA IN ADAMS COUNTY, OHIO.—On Sunday, October 18, 1942, a group consisting of Mr. Conrad Roth and Mr. Daniel Rowlands of Portsmouth, Ohio, and myself, made a trip to certain portions of Adams County, Ohio. Perhaps the most interesting incident of the day was the discovery that what had previously been taken for *Pellaea atropurpurea* (L.) Link by other workers in the region is in reality *Pellaea glabella* Mett. The former does grow here, but it is not nearly so common and there is a slight difference of habitat. *Pellaea atropurpurea* in Adams County prefers mossy shelves or humus-filled crevices of crumbling limestone in shade, whereas *P. glabella* grows in crevices of hard, more or less vertical limestone ledges and cliffs, often with very little shade. Specimens of the latter have been placed in the Ohio State University Herbarium, the U. S. National Herbarium, and the Marietta College Herbarium. They are labelled as coming from the farm of John Knauff, Jefferson Township, Adams County, Ohio, with the collection number 670. I believe that this species has previously been reported in Ohio only from Erie County.—GEORGE R. PROCTOR, *Marietta College.*

HYBRIDIZATION BY REMOTE CONTROL.—The wood-ferns in the Washington-Baltimore Flora region have given me more than one surprise. Perhaps the most unusual is what might be called, in lieu of a better phrase, "hybridization by remote control." I have in mind several instances of this that may be of interest to fern hunters in general.

In June, 1941, near the Columbia Turnpike Bridge over the Patuxent River in Montgomery Co., Md., while struggling through *Smilax* on a stream bank, I came across two strange-looking wood-ferns, fronds of which I later labeled *Dryopteris Clintoniana.* But recently Dr. Wherry identified them as the hybrid *D. cristata* × *mar-*

ginalis, a great surprise to me. This cross often simulates *D. Clintoniana*, so my misidentification might be expected. It was surprising, nevertheless, because although *D. marginalis* was seen growing there no trace of *D. cristata* could be found.

A similar instance was noted last January when Neal W. Gilbert and I, in examining a beautiful bed of *D. intermedia* near Northwestern Branch, a mile above Burnt Mills in the same county, found a plant of *D. intermedia* × *marginalis*. So far as we could discover, the nearest *D. marginalis* grew three-quarters of a mile away!

These are good examples of the unexplained fact, pointed out by Dr. Wherry in his "Guide to Eastern Ferns," that *Dryopteris* hybrids may be found in localities remote from either parent. Recently he kindly showed me a huge stand of *D. Goldiana* × *marginalis* miles from the nearest colony of *D. Goldiana*.

Hybridization seems to occur rather easily among the wood-ferns. To date, five of these crosses have been collected in the Washington-Baltimore region, two of them—*D. cristata* × *spinulosa*, from the Bull Run Mountains, and *D. intermedia* × *marginalis*, as above—by myself in the last two years, for the first time here.

It is remarkable that crosses have been described between most of our northeastern wood-ferns, but, generally speaking, they have been found in association with the parents. To account for those exceptional but frequently found hybrids where the parent species are absent, I suggest two possibilities: (1) They may be fertile plants that have withstood man-made or climatic changes through the years, in places where one or both of the parents have been killed by them. (2) On the other hand, they can be hybrids that spring up in a colony of one of the parents as a result of wind-blown

spores of the other. This other parent might live a considerable distance away, and its usual soil requirements might be notably different. This is not a far-fetched assumption, for fern breeders have found that, although particular soils may be unsuited to some ferns, their prothallia can develop in them with no apparent effect. It is therefore conceivable that gametes from these prothallia could cross-fertilize those of the species growing there.

Either of these suggestions may explain these peculiar wood-fern hybrids. Finding such crosses illustrates the unpredictability of nature, and certainly adds much to the fun of hunting rare ferns.—W. H. WAGNER, JR., *Washington, D. C.*

EQUISETUM PRAEALTUM IN DRY SOIL.—One of the pleasures of botanizing is the finding of plants in unusual and unexpected places. Sometimes it is easy to see that the occurrence of a plant where it would not be looked for is due to special circumstances that have created a suitable habitat in the midst of generally unfavorable conditions. One would not normally look for *Pellaea atropurpurea* on the brick walls of a long-abandoned iron furnace on the Coastal Plain, miles from any outcrop of limestone and from the nearest known colony of the fern. No doubt the ferns were brought there inadvertently with the limestone used as a flux in smelting the iron ore, and found the lime they needed in the mortar of the brickwork after the furnace was abandoned.

Again, in the Baltimore region *Lorinseria areolata* is a Coastal Plain plant, growing in low woods not many feet above sea level. Yet in 1894 a number of the plants were found in a wet spot in woods on the fairly steep slope of a ridge, at an elevation of nearly 500 feet.

Here, overlying a quartz schist of the Piedmont Plateau, is an area covered with a Pleistocene deposit characteristic of the Coastal Plain. The fern may have persisted there since before the uplift that permitted erosion to separate this portion of the deposit from its continuation on the Coastal Plain.

According to all the rules, *Equisetum praealtum* should grow in wet places, usually in alluvial soil along streams and lakes. Usually, too, the colonies do not cover a large area, though they may contain thousands of stems. This note is written to tell about a really large colony, in which it is no exaggeration to say there are a few million stems. It is not in alluvial soil, and over part of the area the soil is not very damp.

About a mile north of Towson, Baltimore Co., Md., the Dulany Valley Road is nearly level for a few hundred feet, and then drops 140 feet in about half a mile. Roughly parallel to the road and 50 to 75 yards from it, trickles a small run that joins a larger stream at the foot of the slope. All this region was well wooded in colonial days; but for about 250 years it has been part of one of the old manors, and because the spot is distant only half a mile across an open field from the manor house, presumably it was cleared a long time ago. For many years there have been no large trees to shade the little run, which flows through a grassy field with many bushes. The *Equisetum* grows abundantly over a large area well up the slope, on both sides of and along the run. Many of the plants are outside the fence, along the grassy edge of the road, where their further spread is stopped by the hard soil. Here they have no shade except from occasional tall weeds.

This colony has been known to me for 50 years. During that time—and no one can say how much longer—the soil must often have been baked dry. It is not especially

surprising for the *Equisetum* to have persisted along the run from the days before the land was cleared. Its long rhizomes would help it to survive, and to spread widely when the field lay fallow for years. At first sight the occurrence of a number of the plants in the dry spots shows considerable adaptability to adverse conditions, but it is possible that they are directly connected, by the rhizomes, with plants growing in moist soil several feet away. To test this idea would involve a great deal of digging, for the rhizomes run deep. Anyway, the place is 50 miles away.—C. E. WATERS, *Washington, D. C.*

ARKANSAS FERN NOTES.—Moore in 1940 reported 67 Pteridophyta from Arkansas. In the following list the first two entries are new for the state, and the four others are additional to single regional records. The specimens were collected by myself.

Cystopteris fragilis (L.) Bernh. f. *simulans* Weatherby. Optimus, Stone Co., July 12, 1942 (no. 23457).

Dryopteris Thelypteris (L.) Gray var. *Haleana* (Fernald) Broun. Wilmer, Drew Co., Oct. 17, 1942 (no. 24106).

Polypodium polypodioides (L.) Watt. var. *Michauxianum* Weatherby. Calico Rock, Izard Co., July 11, 1942 (no. 23438).

Woodwardia virginica (L.) J. E. Sm. Kingsland, Cleveland Co., sphagnum bog on hillside, June 28, 1942 (no. 23308).

Dryopteris noveboracensis (L.) Gray. Norman, Montgomery Co., Oct. 12, 1932 (no. 9836).

Equisetum arvense L. Sandy bottoms of Crow Creek, Madison Junction, St. Francis Co., June 2, 1941 (no. 22154).

DELZIE DEMAREE, *Monticello, Ark.*

Recent Fern Literature

The members of the Fern Society will welcome the second edition of Dr. Wherry's "Guide to Eastern Ferns."[1] Many of the drawings are new or revised, and sufficient material has been added to bring the volume to 252 pages. All ferns known to be native in the states of Pennsylvania, New Jersey, Delaware, Maryland, and Virginia, nearly a hundred in number, have been figured and described, and 53 forms, varieties, and hybrids are distinguished. The nomenclature has been revised, and the genera have been rearranged to conform in the main to the plan proposed by Christensen in Verdoorn's Manual. An adequate list of synonyms has been provided to facilitate the beginner's use of the more detailed writing of other authors. The range of species is revised according to the latest records.

An innovation is the placing of *Phegopteris Dryopteris* and *Phegopteris Robertiana* in the genus *Currania* Copeland. Another change is the use of the term Lycosphens for the conventional "Fern allies." This assemblage of the more primitive ferns has become established rather because they individually differ from the true ferns than because of any common relationship; but sooner or later they are bound to attract the attention of fern students and there is need of a convenient and definite name for the group.

A key to the classification, based mainly on natural relationships, has been added in this new edition. It contains considerable diagnostic material not included in the formal descriptions of the species and is well conceived, though the small pages of the pocket-size volume have made proper display difficult. Coördinate elements

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[1] Guide to Eastern Ferns. By Edgar T. Wherry. iv + 252 pages. 97 figures. Second edition. 1942. The Science Press Printing Co., Lancaster, Pa. ($1.00.)

are indicated by like indention rather than by letter or number, a system hard to interpret when items to be compared are separated by one or more pages. Some awkward abbreviations and other difficulties might have been avoided had the key been set in finer type, or the lines been run vertically instead of horizontally. The key, however, serves its purpose. It not only leads to a speedy identification of species, but it also impresses the student with the basis for the classification.

The usefulness of Dr. Wherry's Guide is attested by the sale of nearly 2,000 copies since the first edition was issued in December, 1937.—ROBERT P. ST. JOHN.

Prof. Kenneth W. Hunt of the College of Charleston, South Carolina, has published a handy little pamphlet on the ferns of the vicinity of that city, intended to aid the student in their identification. The work was based on personal observation, previously published lists covering the region, and specimens in seven herbaria, including the Philadelphia Academy, the Gray Herbarium, and the New York Botanical Garden. Thirty-one species are listed, four of them—*Lygodium japonicum*, *Cyrtomium falcatum*, *Pteris multifida*, and *P. vittata*—introduced. There is a key which reads well; there are full notes as to the habitat and frequency of occurrence of each species; and the location of noteworthy stations is indicated by references to grids on topographic maps. There is also a local bibliography, of the items in which, as well as of more general works, the author has evidently made good use; both his nomenclature and his information are well up to date, the only slips noted being the omission of one author-citation and one period. Altogether, the list is a thorough and satisfying bit of work.[1]—C. A. WEATHERBY.

[1] Hunt, Kenneth W. Ferns of the vicinity of Charleston, S. C. Charleston Museum Leaflets 17. 15 pp. 1942. (For sale at the Museum for ten cents.)

Mr. C. A. Weatherby has published[1] an account of the six Argentine species of *Notholaena*, two of which, *N. sinuata* and *N. aurea* (*N. bonariensis*), extend as far north as the southwestern United States. The work represents a valuable contribution to our knowledge of the genus, because of the accurate and detailed descriptions and the careful attention given to bibliography and synonymy. Mr. Weatherby has studied types or isotypes of all but one of the 18 species or varieties concerned. Maps showing the distribution of four of the species are given, as well as photographs of several type specimens. Of special interest are the line drawings, showing the venation and soriation.

Diels separates *Notholaena* from *Cheilanthes* as follows:

Vein ends scarcely thickened ..... *Notholaena*
Vein ends thickened ..... *Cheilanthes*

This key character has been repeated by various fern authors, but Mr. Weatherby's drawings and discussions bring out clearly the fact that the vein ends are conspicuously enlarged in many species of *Notholaena*. He points out also that the commonly accepted statement that the sori are confluent is not strictly true. The receptacles are wholly discrete, although the sporangia themselves may be contiguous in age.

Mr. Weatherby indicates that a natural arrangement of the species of the Cheilanthoid genera is yet to be made. It is to be hoped that he, who is eminently well qualified, will do that.—C. V. M.

Gualterio Looser continues his good work on Chilean ferns. In the current number of the Revista Universitaria of the Catholic University of Chile, he records two new stations for *Pellaea* (or *Notholaena*) *nivea*, a very rare fern in Chile, though common enough in the

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[1] The Argentine Species of Notholaena. Lilloa (Buenos Aires) 6: 251–275. 1941.

Andes farther north. In my own investigation of this group, covering most of the large herbaria of the United States and those of Kew, British Museum, Paris, Geneva, and Berlin abroad, I had found only one collection from that country. Looser lists six, all from the extreme northern part.

In another paper he gives a detailed account of the Chilean endemic, *Pellaea myrtillifolia*, a near relative of the Californian *P. andromedifolia* and one of the many cases of similarity in the floras of the two regions. Looser gives a comparative statement of characters, lists of localities recorded in literature and of specimens in Chilean herbaria, full bibliography, and some notes on uses. These last are medicinal, an infusion of the plant being employed in some parts of Chile to allay pain. The vernacular names "coca" and "yerba coca" refer to its sedative virtues.[2]—C. A. WEATHERBY.

American Fern Society

Matilda Nevins Ackley took up the collecting and study of flowering plants and ferns in about her sixty-fifth year and continued her interest nearly to the time of her death, August 19, 1942, at Los Angeles, in her eighty-sixth year. Born at Nashua, Chickasaw Co., Iowa, on May 30, 1856, she taught school at the little town on upper Cedar River, a tributary of the Mississippi, before marrying Henry C. Ackley. Meeting congenial spirits in later years at the Nature Club of Southern California's Tuesday evening lectures and week-end field trips, she first began collecting flowering plants about California. Soon she extended her interests to ferns, joined the American Fern Society, and began exchanging specimens with correspondents

[2] Looser, G. Dos nuevas localidades Chilenas del helecho Pellaea nivea (Poir.) Prantl. Revista Universitaria 27: 101–102. 1942. Sobre el helecho Pellaea myrtillifolia. Op. cit. 117–121.

whose specimens may be found today in the Ackley Herbarium at the Hancock Foundation of the University of Southern California. Her collection of California wild flowers is now at the Santa Barbara Museum of Natural History. Her own collecting reached at least as far as Portland, Oregon, with vacations at Towle, Placer Co., and Wrightwood, San Gabriel Mts. She also assembled a fine collection of living ferns at her former home in Eagle Rock City, bringing the roots home from field trips or exchanging with friends. To May N. Ackley, as she inscribed herself, I am indebteded for her encouraging interest in my study of ferns, for it was she who first extended my acquaintance with ferns and fern collectors and who shared her fern literature and fern duplicates with me. Many hours we checked over keys and descriptions together. Perhaps my most fragrant memory is the bed of native Wild Ginger (*Asarum Hartwegii*) in her lath house fernery!—J. EWAN.

Mr. F. N. Irving, 3323 Mt. Pleasant St., Washington, D. C., will send in exchange to members uncommonly good specimens of *Ophioglossum vulgatum*, if immediately requested to do so.

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To the Páramo de Chaquiro

FRANCIS W. PENNELL

To any Colombian the word *páramo* has but a single meaning—it denotes the bleak heights above timber line. Each of the three Cordilleras of the Andes rises to such heights, and through corresponding zones of plant and animal life. In the Central Cordillera many of the peaks pass higher into glistening snowcaps, but on the Eastern and Western Cordilleras the highest summits are mostly crowned by the cold-resistant vegetation of the *páramo*. On each Cordillera one climbs through tropical forest into its denser mountain climax of subtropical forest, then into the cold forest above, and higher still through the shrub zone (*paramillo*) out to the open *páramo*. In his classic "Distribution of Bird-Life in Colombia"[1] Dr. Frank M. Chapman has called these altitudinal stages the Tropical Zone, the Subtropical Zone, the Temperate Zone, and the Páramo; but the Colombians had long ago distinguished them as the *tierra caliente* (hot country), the *tierra templada* (temperate country), and the *tierra fría* (cold country), in which was included, but clearly designated, the *páramo*. The two lowest zones are untouched by cold, and the *tierra templada*, with its perpetual temperature of early summer and its abundance of rainfall from clouds that condense against the mountain slopes, must be the world's richest zone of ferns.

[1] Bull. Amer. Mus. Nat. Hist. **36**: 85. 1917.

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But the plant life of the *tierra fría* is adapted to cold—a cold that knows only a daily rhythm to warmth, and that when the sun is actually shining—and this cold becomes ever more severe as we ascend. The composition of the flora of the *tierra fría* is a fascinating problem: In part the cold forest and the *páramos* are occupied by plants of tropical groups, modified descendants of plants of the hotter lowland; in part by plants of groups pertaining to the far away temperate zones, groups quite unknown in the Colombian lowland; and in part by peculiar Andean genera most interesting in character. It is obvious why a botanist who had already climbed to the *páramo* on two of the Cordilleras should wish to ascend so high upon the third. Let us hasten to the Chaquiro!

But hasten is what one cannot do in Colombia, or at least one could not before the days of airplanes—and I am telling of a journey of 25 years ago. I had been hither and thither on the Eastern Andes about Bogotá and also opposite Neíva; I had climbed the Central Andes to the Páramo del Ruíz; now I wished to see the vegetation of the Western Andes, and hoped to reach *páramo*. For warrant that this was possible I had a map in the so-called "Atlas Completo de Geografía Colombiana"[2] of F. J. Vergara y Velasco; this traced the highlands at the northern extremity of the Cordillera Occidental and indicated a trail across the range from a spot on the Río Esmeralda that was significantly named Puerto Canoa. That meant "port of the canoe," and so could clearly be reached by dugout canoe from downstream. Now, the Río Esmeralda flows into the Río Sinú, and that I had been bidden ascend. The map gave the altitude of Puerto Canoa as 340 meters above the sea, that of the pass to Uramá in the Atrato Valley as about 3,000 meters,

[2] Bogotá, 1906. Although not so stated, I suspect that these are actually maps from the uncompleted survey of Colombia made by Codazzi about the middle of the last century.

with the intervening distance only 30 kilometers or 20 miles; nearer still to Puerto Canoa, in fact only nine miles away, was shown the mountain named Paramillo, 4,000 meters in altitude. A rise of over 3,600 meters (over two miles) in nine miles horizontally promised stupendous scenery. The upper Sinú Valley and this northern portion of the Western Andes were unexplored botanically, and it seemed certain that this remote and isolated portion of that Cordillera must contain many species still unknown to science.

To reach the lower Sinú River I had descended the Magdalena in a river boat, swiftly gliding down the current it had taken thrice the time to ascend; and then from Magangué I had ridden horseback, mostly by moonlight, across the Bolívar plain to Montería, the emporium of the Sinú. At this frontier town I had arranged for further travel by dugout canoe. To ascend the Sinú one must wait for the low water of February, toward the end of the long dry season of lowland northern Colombia. Then only, when in the plain of its lower course the river was far beneath its banks, could the boatmen's poles reach bottom. Each canoe had its *patrón* (coxswain), who sat at the stern and steered with his round-bladed oar. My helper (*muchacho*) and I sat in the middle with the baggage. At the front worked the two *bogas*, each with his pole. With one end planted firmly against the bottom and the other braced against his bare chest, one of them would run back from the prow 10 or 12 feet, pushing the canoe upstream and shouting at each push. During this run his fellow, with pole held high in air, was returning to the prow. Progress was slow, and could not be made against much current. But a small river like the Sinú, comparable in size to the lower Shenandoah, has in its winding course a cutting and a lee shore. By taking advantage of the slack-water and the return-eddy we

crept upstream—indeed, only on the lee side could the poles touch bottom. So, at every curve of the river we must cross stream: The *bogas* push the canoe's prow into the current, the *patrón* steers across as we drift downstream with the current till the *bogas'* poles can again find the bottom. Poling a hollowed log upstream is slow enough at best, but when one loses distance at every river-bend one is ready to declare that dugout traveling is the slowest mode of progression yet discovered by man.

Thus, in the intensity of constant sunshine and deep within the breezeless depth of the river's trough below the plain, we started our ascent of the Sinú. The general course was southwestward, but the sinuous meanders made us face each direction in turn. *Caimanes* were basking on the mud bars. Now and then an alligator was with them, distinguishable by its dark body and rounded snout, and by its decent habit of keeping its mouth closed; but the yellowish-gray *caimanes* were far more numerous, their narrow pointed snouts habitually open and displaying long arrays of sharp teeth. Only big creatures, some 10 feet long or more, come out to bask—I have counted as many as 26 on a bar.

At Tierra Alta, where the river emerges from hilly country, we leave the open grassy plains and enter the forest. Now hamlets become few and remote, small, isolated clearings. Trees in great variety comprise the forest, but along the river courses are long lines of Cecropias with starlike leaves, Heliconias with huge banana-like foliage and gorgeous ladderlike inflorescences of yellow and red, and the large grass, *Gynerium*, with waving white plumes. Parrots, that chatter in flocks as they fly, or macaws, always flying in pairs, are most colorful. *Caimanes*, though fewer in numbers, are still along the river. But the most unforgettable creature of that forest, the one whose cry beyond all others resounds with

the savage joy of living, with an exuberant uncontrollable vitality, is the howling monkey. Each morning and evening, and at intervals during the day, we would hear its marvellous call.

At Boca Verde, reached even at our pace in 10 days upstream from Montería, we were at the last outpost of the frontier. There, with the aid of my map and a letter from the government in Bogotá, but chiefly I think due to the fact that my loquacious *muchacho* (familiarly called "Chuchu") had known settlers on the lower river and they had passed us upstream always as guests, I made arrangements for the trip ahead. Señor Lugo, the headman of the village, agreed to supply food and transportation for a 15 days' excursion; but his price was 60 pesos, whereas I had brought but 50 with me from Montería. This had been by advice of a lumberman originally from the United States and now in charge of obtaining mahogany; he had warned of outlaws upstream. So it was arranged that 30 pesos be paid in advance, and 30 on my return to Montería. It became known to all—for no transactions could be looked upon as private matters—that I had scarcely any money with me.

Boca means mouth. The river swarmed with *bocas chicas*, fish with little mouths, on which we and the *caimanes* fed. *Boca Verde* was the mouth of the Río Verde ("green river"), this (from the coast) the first water-bearing affluent of the Río Sinú in the dry season. All channels of the many side-streams yet seen, creeks and rivers that rose in the surrounding hills or came from the low Cerro de Murrucucú to our left, had been dry. Only four permanent streams now fed the Sinú. The Río Sinú itself came from the Cordillera to the south, but by a turbulent unnavigable course through canyons; the Río Manso ("gentle river") from the southeast was the first to join it, and its easy course afforded a means of passage from the Río Sinú by a trail at its headwaters

to the Río Cauca; the Río Esmeralda ("emerald river") from the southwest was next; and last toward the coast was the Río Verde, from the west. Up this were settlements of the Chocó Indians, and rafts came down to Boca Verde bearing maize and, most conspicuously, the Indians themselves. With copper-red bodies and round faces, the men clad only in loin cloths and the women with a light blanketlike garb, their lavish use of paint outdid the most vivid efforts of our contemporary feminine civilization. Taking the seeds of *achote* (*Bixa orellana*) that grew native in the forest, they made a median line of red from the forehead down over nose and chin, with cross-lines over the cheeks, repeating the pattern on the chest. Or they might make solid blotches of red or black. Etiquette demanded that even the babies be so improved. I had dreamed of using Indian help to reach the Andes, but it was explained to me that all these free-looking men were *compromisos*, each in debt to a trader down-river for whom only could he work. As I wished to reach higher mountains than those from which the Río Verde descended, I did not visit the homes of these Indians save for one near the mouth of the Río Esmeralda, where we passed our first night upstream from Boca Verde. After having my cot too often in the earth-floored huts of white or negro settlers, from which the "dangerous" night air was zealously excluded, it was exhilarating to lie on an open platform of split bamboo under a thatch of plantain leaves. Here in cleanliness and accessible to every breeze lived the Indians. Access to such a second-floor abode was by a stairway consisting of an upright notched log; and though the toeholds were small, dogs and children used them readily.

Reviewing my record books I see that there were many ferns at Boca Verde, although we were still in the lowland tropical forest where these plants do not constitute

a large proportion of the flora. I am merely an incidental collector of Pteridophyta, but from a conjectured altitude of 90 to 300 meters I gathered species of *Adiantum, Tectaria, Diplazium, Campyloneurum,* and *Cyclopeltis.*

In our ascent from Montería we had several times changed from larger to smaller canoes, and it was in a still smaller dugout that we started upstream from Boca Verde. But our crew was still the same, two *bogas* poling at the prow, my boy and I in the middle, and Señor Lugo as *patrón* in the bow. After a morning's poling from Boca Verde we left the turbid water of the Río Sinú (made so from clearings above on the Río Manso), and started up the clear cold current of the Río Esmeralda. At its mouth we saw our last crocodiles, for these reptiles do not like chilled waters. On this narrower stream we were intimately within the forest. In sunshine or in shade we made our way. Each vista opened new beauty before us. It was endlessly delightful to watch the water, green as emerald, sparkle and flow beneath the forest branches. Over the river's course great boughs and small branches would reach, and each would be a garden of air plants. Green and purple cups of bromeliads, now and then an orchid with fairy flowers, great streamers of moss, and then ferns—one fern I recall that draped down four, six, eight feet or more—all were set in the background and foreground of the emerald river!

The second day up the Esmeralda we encountered many riffles and small rapids, which required my wading while the men hauled up the canoe. That evening we came to a clearing, our first above that of the Indian near Boca Esmeralda, and to this some enterprising man had brought cattle. The owner, a white Colombian who had with him wife and children, seemed different from the

settlers we had seen below, and I was glad when we could leave in the morning.

The third day up the Esmeralda we reached Puerto Canoa. There was really such a place, but where were the Andes? According to my map, nine miles away they attained a height two miles above our level. Surely, well above the forest we should have been seeing their slopes. But no mountains were visible, and it now developed that we had reached the end of Señor Lugo's previous travels. Here at Puerto Canoa was a little clearing with a single small house, and to the shelter of the latter and the hospitality of Señor Saldáriaga we went. From him we learned of the trail ahead—four days' tramp to the mountains—and through him we obtained a guide. The Andes *could* be reached by trail from Puerto Canoa, but my map had been marvellously foreshortened.

All the afternoon I lay in Saldáriaga's bark hammock, while the men prepared for the journey overland. These bark hammocks, made from a local tree, were wonderfully comfortable, and I rested my badly sunburned ankles while Señor Saldáriaga told something of the country. Like Señor Lugo he was mainly negro, but in that world a man of standing and enterprise. He told me how the preceding year he had collected and taken to Medellín 5,000 orchid plants, apparently all Cattleyas. It is rarely that one sees these largest of showy orchids in the settled parts of Colombia, so thoroughly has the land been searched for them, but it was a surprise to realize that so remote a point as this had contributed its quota to the greenhouses of Europe and the United States. Like Señor Lugo, Saldáriaga had that innate quality of self-esteem, that we so rarely permit the negro to develop in our own country.

The men had arrived at Puerto Canoa with plenty of outfit and food but with not a vestige of baskets in which to carry them a four days' journey. In the rough coun-

try before us all loads must go on human backs. Lying in my hammock I watched them meet the emergency. Long stalks of a large cane (*Arundinella*) that grew by the river were brought in, and during the afternoon four carrying baskets were woven, with all attachments fitting over the shoulders and across the forehead. Of course the baskets were green and remained so throughout the journey.

Next morning our route lay first up the valley, and only the guide could have kept us on such a little-used trail. Repeatedly bending beneath branches or climbing over fallen logs or cutting aside heavy lianas, we made our way slowly. Then on rocky slopes we had to clamber by difficult passes. Several side-streams were crossed, and at each large one our course detoured until we found some tree fallen across it. Each of us had some load, and Chuchu had so good a share that I carried the camera and tripod. (Vain effort, for I later found that all my films had been ruined by being superheated in a state-room on the Magdalena riverboat, when for an hour I had left the door closed and the window unshaded so that the sun blazed in.) Chuchu carried the press for plants, and on the return journey his load increased rapidly. Now on the up-trip we traveled as light as possible.

We seemed to be in utterly untouched forest. We had left the frontier settlements far behind; surely we were now in forests uninhabited unless by Indians! But that afternoon we again came to a clearing, and again there were cattle wandering about. No one appeared, and we spent the night as sole occupants of the cabin of "Re-molino." The following day we again reached a tiny clearing, and in the cabin of "Las Dantas" found a white man who possessed a hammock of many colors (obviously a store product), the only slippers I saw on the Sinú, and a guitar. Clearly his arrival had been recent, for these objects all had a strange newness. On

our return journey down the river, as we drifted with the current, I heard my men recounting, so far as they had been able to gather the history up-river, why each of these worthies (including the one of the household below Puerto Canoa) had taken to the forest. I learned that each was a murderer, living on this remote trail because it offered the possibility of a quick flight over the mountain chain from the department of Bolívar into that of Antioquia. He whose house we had occupied alone had come back from hunting; but at the edge of the clearing had observed people in his house and thought it safer to pass the night in the forest. Although these men did not seem hardened ruffians, I was glad to have it generally known that I was nearly destitute of money. But my chief strength was in having as sponsor Señor Lugo, the most respected man on the upper Sinú.

Above "Las Dantas" ("the tapirs," the three-toed footprints of which we saw on beaches of the river) we passed into the mountains. Below us the Río Esmeralda fell by many a foam-white rapid, its placid courses a beautiful light green. Soon we came to a tributary from the south, the Río Antizales, which my map erroneously showed as simply a different name for the upper Río Esmeralda. After crossing to the hillside between the two streams, the trail turned southward up the Antizales. Now that torrent thundered beneath us, one long dashing line of white. But our course kept to the ridge west of its immediate valley, until at about 2,000 meters it dropped again through old clearings into the little mountain settlement of Antizales.

We had now reached the *tierra templada* or Subtropical Zone of the Andes. From my record book I note in sequence the genera of the ferns gathered since Boca Esmeralda, which lies at about 150 to 200 meters altitude. *Tectaria, Cyclopeltis, Nephrolepis, Vittaria, Polypodium, Adiantum, Campyloneurum,* and *Eschato-*

gramme bring us to Las Dantas at some 600 to 900 meters of altitude. As we enter the mountains ferns, bromeliads, and orchids increase greatly; and on to Antizales are *Danaea, Dryopteris, Diplazium, Tectaria, Asplenium, Lomaria, Rhipidopteris, Didymochlaena, Campyloneurum, Polypodium, Nephrolepis, Pteridium, Lindsaya, Dennstaedtia, Pteris, Hypolepis, Psilogramme, Cyathea,* and *Anisosorus.*

The existence of the village of Antizales was a surprise to me, and I think to Señor Lugo also. In Colombia the Indians of the highlands and lowlands were of different tribes, and each feared the change of altitude in passing to the others' territories. My men were lowland negroes, the negro in Colombia holding almost exclusively to the wetter *tierra caliente;* and I had passed one night with lowland Chocó Indians. But these folk of Antizales were mountain settlers from across the Cordillera. They were growing beans and potatoes, and I welcomed the change from a monotonous diet of rice. But not so our porters, the two *bogas* of the canoe portion of the journey; the rice brought with us ran short, and without it they felt themselves up against starvation.

Above Antizales we left the stream of that name and climbed more steeply upward. But now we had a much more traveled trail. We passed into forest, and by the Cascada Chorrón into a fog formed by clouds that I suspect scarcely ever lift. It was our initiation into the *tierra fría.* We were approaching the last northernmost highland of the Western Andes, exposed to winds from both the Pacific and the Caribbean that are ever bringing water from one or the other ocean. Certainly the vegetation suggested such constant wetness. Everywhere were ferns and mosses on the tree limbs, and if one wandered at all from the trail it was to sink knee-deep into beds of moss or to clamber over seeping rotting logs. Such a forest does not show much blossom, but I gathered mem-

bers of various families, Gesneriaceae, Ericaceae (tribe Thibaudeae), Lobeliaceae, Rubiaceae, Melastomataceae, and Orchidaceae being most in evidence. Among pteridophytes there were species of *Lonchitis, Hemitelia, Blechnum, Polypodium,* and *Hymenophyllum.*

At last, presumably at about 2,800 to 2,900 meters altitude, we passed above this forest. Areas of bush growth began to appear, and in an open place in a little hollow well above the forest we pitched our tent for the night.

At Boca Verde I had tried to tell Señor Lugo how cold it would be, but I suspect that neither he nor his helpers had more clothes or blankets to take with them, had they wanted to do so. I remember how the cold settled down upon us after sundown. The tent was small, and was completely filled with Chuchu and me, Señor Lugo and his two helpers, the mountaineer guide from Antizales, and last, in hospitality, a young mountaineer who had expected to sleep alone in the open—seven of us in a tent intended for two or three, and every breath of fresh air shut out to exclude a cold greater than most of them had ever experienced! I had arranged to spend five days and nights on the mountain summits, but the men were delighted when I was ready to return after only three nights.

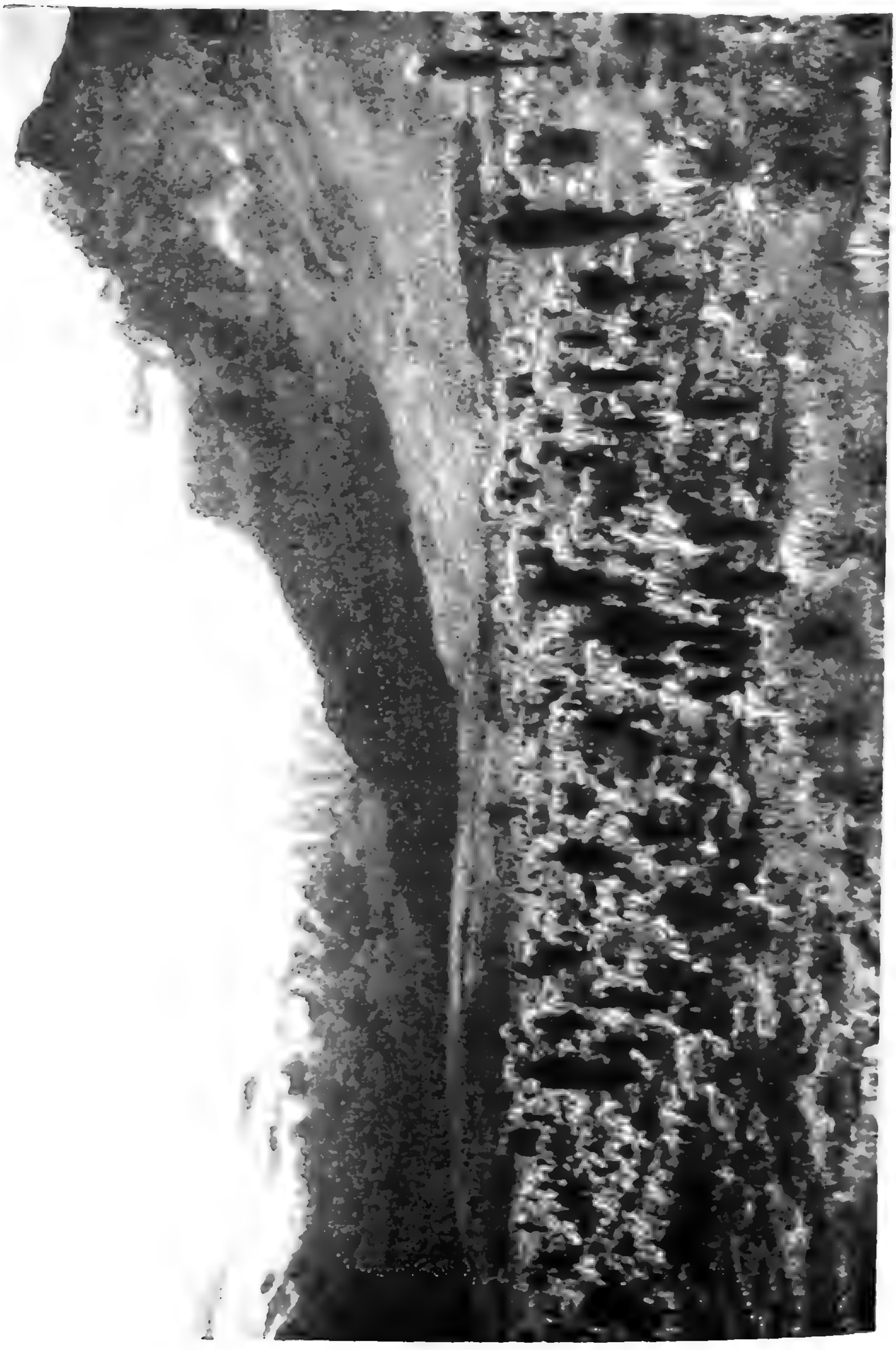
Under a beautiful sky next day we climbed by a gradual ascent through the shrub zone, and at last found good shelter for a camp a little way below the summit of the range. We were still in this world of bushes which in Colombia is called the *paramillo.* The altitude was presumably about 3,000 meters. A little above the forest, water proved to be very scarce and the land was surprisingly parched. The rock was a sandstone that does not hold the water well. We found in the bed of a rivulet a little pool which we soon exhausted, and then had recourse to a strictly botanical source of water supply. There was growing plentifully a species of Bromeliaceae,

Guzmania multiflora, with leaves forming so tight a rosette as to hold water perfectly. (Because of this habit bromeliads vie with orchids as successful epiphytes, rainwater being caught in the cuplike crowns of the plants and there retained.) Here on the *paramillo* this species, though rooted in the soil, still had water in its crown, and because of the cool nights this was cool and delicious. We found nothing worse than a green alga growing in it, although lowland epiphytic bromeliads are very aquaria of life. For two days we drank this supply joyfully.

Among the bushes of the *paramillo* are many herbs also, and of Pteridophyta I gathered at this level species of *Lycopodium*, *Polypodium*, *Alsophila*, and *Psilogramme*.

At the summit of the Cordillera the trail crossed a minute *páramo*. The tiny Páramo de Chaquiro, duly provided with a name and bearing a flora characteristic of such bleak open highlands, comprised only about five acres. In February its soil was parched, but various perennials were in blossom. Presumably it bore an attenuated sample of what would have been found on the great peak named Paramillo not far away to the eastward. If that barely reaches 4,000 meters, surely Chaquiro cannot attain to more than 3,200 to 3,400 meters altitude. But small as it is, the fact that Chaquiro was earlier reached by a botanist will cause it to be remembered as the place of first collection of certain of the species characteristic of the northern Western Andes.

Among the 30 plants gathered on the Páramo de Chaquiro pteridophytes are few. There are species of *Jamesonia*, striking and peculiar to the northern Andes; of *Histiopteris* and *Lycopodium*; and of a genus that Dr. Maxon regards as probably undescribed. In the family of my special interest, Scrophulariaceae, all but absent throughout our climb from the Río Sinú, this *páramo*



Frailejones (Little Friars) on the Páramo del Quindío, Colombia

had two species, both new to science, and both of peculiar alpine genera; one is a *Bartsia*, a genus with endemic members throughout the Andean highlands from Colombia to Bolivia; the other is an *Aragoa*, a genus hitherto known only from the Cordilleras of eastern Colombia and Venezuela.[3] In the Asteraceae (Compositae) Dr. A. C. Smith has described as new *Espeletia occidentalis*, the *frailejón* of this *páramo*.[4] Species of *Espeletia*, the *frailejones* or "cowled friars," with massive unbranched erect stems, dense radiating silvery- or golden-haired leaves that, after functioning, persist as a dense covering on the old stems, and loose clusters of small sunflower-like heads, are the most characteristic plants of *páramos* throughout the Andes of Colombia, Ecuador, and Venezuela.

Not the *páramo* alone, but all the *tierra fría* on this climb yielded a rich harvest of new species. Although many of my collections remain to be carefully studied, there have already been reported such species also in *Satyria*, *Psammisia*, *Lysiclesia*, and *Gaultheria* of the Ericaceae; in *Hoffmannia* and *Palicourea* of the Rubiaceae; and in *Burmeistera* of the Lobeliaceae. The *tierra fría* is not continuous through the length of the Cordillera Occidental, as is the *tierra templada* below it, and on this account most trails over the Western Andes do not reach this upper world of life at all. North of Chocó Bay there are some five portions of the Cordillera that rise independently above timber line. Each carries its isolated world of *tierra fría*—its cold forest, its shrub zone, and its *páramo*. So far as I am aware, my later climb to the most southern of these, the Cerro Tatamá, where by

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[3] Described as *Aragoa occidentalis* in Proc. Acad. Nat. Sci. Phila. 89: 429, 1938. The paper was entitled "Taxonomy and Distribution of Aragoa, and Its Bearing on the Geological History of the Northern Andes."

[4] Another, somewhat larger species, of the Central Cordillera, is shown in the accompanying plate.

a yet more difficult ascent I reached a far richer world of endemic life, has been the only other botanical assault upon this great mountain chain. We need to reach, with adequate time and facilities for collecting, each of these highlands from Cerro Tatamá to El Paramillo. They are remnants of a single mighty Cordillera, against the western face of which beats the heaviest rainfall in the Western Hemisphere. What genera and species occur upon them all? What endemism has isolation resulting from long erosion produced upon the different sections? What unexpected relationships, such as that revealed by *Aragoa*, not with the nearer and more recent Central Andes but with the more remote older mountain systems of eastern Colombia, remain to be discovered?

In the marvellous sunset as seen from the summit of Chaquiro this problem lay spread before me. Below on every side was cloud, the dense cloud zone through which we had climbed. It was not smooth cloud, but billowy turbulent cloud—cloud of irregular outline that rose repeatedly upward into round cumulous masses. Above the white cloud-world stood only the isolated mountain peaks of my concern, following like a chain of islands the axis of the Western Cordillera. One or two tiny areas showed northward; eastward was the extensive mountain-mass of El Paramillo, and then southward far away rose the Páramo del Frontino, another link of our chain, with its secrets yet unknown. All was colored and tinged with unspeakable delicacy and glory of gold and purple, but too quickly did the tropical sunset pass into night.[5]

ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

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[5] The narrative has been previously told in the Westonian (31: 14–25, 1925), but as a tale of adventure and without the botanical emphasis now given it. The Westonian is the organ of the Alumni of Westtown School, Westtown, Pa.

New Names for Ferns and Fern Allies Proposed by C. S. Rafinesque, 1806-1838

E. D. MERRILL

(*Conclusion*)

*PTERILIS Raf. Med. Fl. **2**: 254. 1830; Fl. Tellur. **1**: 83. 1836 [1837] = *Pteris* Linn.

In the first entry Rafinesque merely states: "*Pterilis* Raf. *Pteris* L. Brake," having in mind the common bracken, *Pteridium aquilinum* (Linn.) Kuhn. In the second he states: "*Pteris* which means fern must be changed to *Peripteris* or *Pterilis*."

RHIZAKENIA Raf. Aut. Bot. 188. 1840.

In describing this genus Rafinesque stated "singular G. of the Rhizospermous family near to *Pilularia, Isoetes* &c." The somewhat indefinite description apparently applies to a form of *Limnobium Spongia* (Bosc.) L. C. Rich., a flowering plant of the family Hydrocharitaceae. The genus is mentioned here because Pennell, in his list of Rafinesque's new genera published in the Autikon Botanikon (Bull. Torr. Club **48**: 95. 1921), repeats Rafinesque's statement "near *Pilularia, Isoetes*, &c." The genus is omitted in Index Kewensis and supplements, nor is it mentioned by Christensen.

*SCIPHOFILIX Raf. Princ. Somiol. 26. 1814 = *Scyphofilix* Thouars.

*SCYPHOPTERIS Raf. Princ. Somiol. 26. 1814; Fl. Tellur. **1**: 84. 1836 [1837] = *Scyphofilix* Thouars, Nov. Gen. Madagasc. 1. 1808; J. Roem. Collect. Bot. 195. 1808–09.

Rafinesque's reason for changing Thouars' generic name was that *Scyphofilix*, which he incidentally spelled *Sciphofilix* in the 1814 reference, was "mongrel," part Greek and part Latin. Christensen's entry for *Scyphofilix* Thouars is incomplete, lacking the date. I have added this from the copy of this undated work in the library of the Arnold Arboretum, for Hiern[14] determined its date of issue. Rafinesque published no binomial.

[14] Journ. Bot. 38: 493. 1900.

*SIVETES Raf. Med. Repos. II. **5**: 358. 1808, *nom. nud.*

There is no way by which the status of this name can be determined, it merely appearing in the text in the description of *Carpanthus axillaris* Raf., thus: "it [*Carpanthus*] may form with the genusses pillularia, salvinia, lemna, marsilea, sivetes, &c. a new natural order a kin to the ferns." *Carpanthus, supra*, is a synonym of the scrophulariaceous genus *Gratiola*. *Lemna* belongs in the monocotyledonous family Lemnaceae. *Sivetes* is regarded by Mr. C. A. Weatherby as in all probability a misprint for *Isoetes*. It is so corrected in the French translation (Rafinesque 1808b, p. 222).

*SYNOTELIS Raf. New Fl. No. Amer. **1**: 59. 1836 = *Cyclophorus* Desv. vel *Dryopteris* Adans.

Rafinesque's statement is ambiguous: "The *Acrostichum lanceolatum* is become the *Nephrodium acrostichoides* of India, not ours, both of my genus *Synotelis*." I find no record of an Indian "*Nephrodium acrostichoides*" as early as 1836. The type of *N. acrostichoides* Desv. (Mém. Soc. Linn. Paris **6**: 255. 1827) was from Timor, and the description is so short that one can say with reasonable certainty only that it represents a species of *Dryopteris*. *Nephrodium acrostichoides* J. Sm. was not published until 1841. If by *Acrostichum lanceolatum* Rafinesque meant the Linnaean species, then the very common Indo-Malaysian *Cyclophorus lanceolatus* (Linn.) Alston (*C. adnascens* Desv.) is represented. The type of *Acrostichum lanceolatum* Roxb.[15] [= *Elaphoglossum nervosum* (Bory) Christ] was from St. Helena, not from India, and there is little chance that Rafinesque had any knowledge of that species. *A. lanceolatum* Hook. was not published until 1864. By the words "not ours" Rafinesque had in mind *Nephrodium acrostichoides* Michx., i.e., *Polystichum acrostichoides* Schott. In spite of the fact that Rafinesque proposed the new generic name *Synotelis*,

[15] In Beatson, Tracts St. Helena 296. 1816.

it is not impossible that he actually intended "*Nephrodium acrostichoides* of India" to be a new binomial; yet this would be strange, in view of the fact that he was familiar with the American *Nephrodium acrostichoides* Michx.

*THELIPTERIS Raf. Med. Fl. **1**: 32. 1828; Man. Med. Bot. 32. 1841 = *Thelypteris* Adans. = *Pteris* Linn.

EQUISETACEAE

*EQUISETUM MONTANUM Raf. Amer. Monthly Mag. Crit. Rev. **2**: 206. 1818 = *Equisetum sylvaticum* Linn.

The description is: "*Equisetum montanum* Raf. Rough, sterile and fertile stems very branched, striated, sheaths rufous nearly quadrifid, divisions ovate acute trinerved, branches two- or three-chotomous, small branches adscendent filiform, flexuouse triqueter or compressed, rufous caliculated, leaves subulate, ternate or opposite.—Obs. A singular species found with Mr. Knevels on the Catskill Mountains, in woods near the two lakes; it has some affinity with the *E. Sylvaticum*, and rises about two feet." This can scarcely be other than the common *E. sylvaticum* Linn.

EQUISETUM PRAEALTUM Raf. Fl. Ludov. 13. 1817 (as *prealtum*).

Rafinesque's technical description was based on Robin's cursory one and is as follows: "*Equisetum prealtum* Raf. N. Sp.? Caulibus simplicibus erectis scabris fistulosis; vaginis nigrescens, crenulatis, corona emulans—Prele, Rob. p. 350. A large specie akin to *E. hyemale*, grows on the bank of the Mississippi in large bushes rising about six feet; the stems are about as thick as the finger: the cattle are fond of it in winter, and the joiners employ it to polish wood." Robin's original French description[16] is: "Prêle (Equisetum) Une très-grande espèce croît le long du fleuve, occupe en touffes de larges places: elle s'élève jusqu' à cinq à six pieds. Ses tiges sont de la

[16] Voy. Louisiane 3: 330. 1807.

grosseur du doigt, nues, scabres, fistuleuses; les gaînes, noirâtres, légérement crénelées, ont la forme d'une couronne. Cette plante a beaucoup de rapport avec notre prêle d'hiver; elle est d'une grande utilité pour le bétail dans l'hiver. Les menuisiers l'emploient aussi pour polir le bois.'' Rafinesque's binomial is now widely accepted as the proper one for this widely distributed North American species, confused by many authors with the European *Equisetum hyemale* Linn., and in 1844 characterized by A. Braun as *E. robustum* A. Br. ex Engelm.[17]

There are doubtless those botanists who still would ignore *Equisetum praealtum* Raf. (1817) and retain *E. robustum* A. Br. (1844), merely because Rafinesque saw no specimens and depended entirely on Robin's rather informal description of 1807, whereas A. Braun had specimens before him, his type—and doubtless duplicate types—being preserved. For those who dissent merely on the basis that Rafinesque had no ''type specimen'' I would call attention to the fact that this is the only common *Equisetum* in Louisiana, but two species being known from that large state. Brown and Correll cite many individual collections representing *Equisetum praealtum* Raf., some of them from the banks of the Mississippi River, whereas *E. laevigatum* A. Br., the only other Louisiana species, is known from the state by a single collection only from the Red River at Bossier. This is an excellent illustration of how the status of an originally incompletely described species, of which no type specimen was preserved, can definitely be placed through the simple process of elimination, once the constituent elements of a flora are reasonably well known.

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[17] Amer. Journ. Sci. **46**: 88. 1844. See Schaffner, Amer. Fern Journ. **11**: 71. 1921, and 22: 124. 1932; Small, Ferns of the Southeastern States 394. *fig.* 1938, synonymy p. 483; Brown & Correll, Ferns and Fern Allies of Louisiana 145. *f. 43A*. 1942.

*EQUISETUM TUBEROSUM Raf. Med. Fl. **2**: 218. 1830, *nom. nud.*; Herb. Raf. 54. 1833, *nom. nud.* = *Equisetum telmateia* Ehrh. (prob.).

All that Rafinesque states regarding this species is: "The *Equisetum tuberosum* Raf. of Oregon, roots food of Indians." Dr. G. N. Jones suggests that this was probably *Equisetum telmateia* Ehrh., which is the commonest species on the Pacific coast, and which produces numerous tuberous growths from the rhizome rich in starch.

LYCOPODIACEAE

*CLOPODIUM Raf. Anal. Nat. Tabl. Univ. 205. 1815 = *Lycopodium* Linn.

*COPODIUM Raf. Amer. Monthly Mag. Crit. Rev. **2**: 286. 1817 = *Lycopodium* Linn.

The reason for this change—and this applies also to *Clopodium*, as given by Rafinesque under the latter—is that *Lycopodium* is objectionable, "being similar in sound and meaning to *Lycopus* whence it must be altered into *Copodium*."

*COPODIUM OXYNEMUM Raf. Amer. Monthly Mag. Crit. Rev. **2**: 44. 1817 = *Lycopodium clavatum* Linn.

The description is: "*Copodium oxynemum*. Stem creeping branched, leaves imbricate scattered oblique incurved linear-subulate flat entire awned, awns long filiform flexuose.—Obs. Differing from *annotinum* (*Lycopodium* L. too similar to *Lycopus*) by the entire scattered leaves, etc. Found with Mr. Knevels on the Catskill mountains: we did not find it in blossom." On a very strict interpretation one might consider that in his peculiar reference to *Lycopodium annotinum* Linn. he transferred the latter name to *Copodium*, but I do not consider that this represents a valid transfer. Rafinesque's intent seems to be clear, but he scarcely published any binomial under *Copodium*, other than *C. oxynemum* Raf. The reduction of this Rafinesque species has been

made from the description; see Small, Ferns of the Vicinity of New York, p. 222 (1935).

*LYCOPODIUM VIOLACINUS Raf. Journ. Bot. (Desv.) **1**: 236. 1813, under *Mycastrum sessile* Raf.

This is a *lapsus calami* on the part of Rafinesque, the generic name *Lycoperdon* being intended; the very brief description is that of a species of *Lycoperdon* from the vicinity of Philadelphia.

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All items in the following list contain data on ferns or fern allies and are in the nature of additions to the bibliographies published by Christensen in his Index Filicum and its several Supplements. To the strictly Rafinesque papers I have added the one by Robin that was the basis of Rafinesque's "Florula Ludoviciana," one by Fox that repeats certain data originally published by Rafinesque, and two by Desvaux that are really republications of Rafinesque's papers, one a translation from the original English to French. These two Desvaux papers are not exact reproductions of the originals on which they were based, but in most cases Desvaux did republish all that Rafinesque said regarding individual species. Sometimes he abbreviated, as in the case of *Ophioglossum pubescens* Raf., where he reduced Rafinesque's original 23-word description to merely "feuille pubescente, *N. Jersey.*"

ROBIN, C. C.
1807. Flora Louisianaise. *In his:* Voyages dans l'intérieur de la Louisiane. **3**: 313–538.

Though Robin usually gave reasonably ample cursory descriptions of the species that he observed, he apparently preserved no botanical material. His "species" are arranged under natural groups, but he rarely used binomials, characterizing each under its generic name or under local French names. This was the basis of Rafinesque's "Florula Ludoviciana" (1817), wherein, on the sole basis of Robin's descriptions, he applied binomials to the various entities, describing numerous new genera and new species. For this he was very severely censured by his contemporaries and successors.

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1806. [Additions to Michaux's Flora of North-America. In a letter from Mr. Rafinesque to Dr. Mitchell, dated Palermo, in Sicily, August 8, 1805.] Med. Repos. II. 3: 422–423.
1808. Prospectus of Mr. Rafinesque Schmaltz's two intended works on North-American botany; the first on the new genera and species of plants discovered by himself, and the second on the natural history of the fungusses, or mushroom-tribe of America. Med. Repos. II. 5: 350–356.
1808a. [Essential generic and specific characters of some new genusses and species of plants observed in the United States of America, in 1803 and 1804. In a communication to Dr. Mitchell, dated Palermo, Sept. 1st, 1807.] Med. Repos. II. 5: 356–363.
1808b. Description des plantes trouvées dans les Etats-Unis d'Amerique, en 1803 et 1804, par M. Rafinesque-Schmaltz, communiquée à M. Mitchell. . . . Translated by M. Warden. . . . Journ. Bot. (Paris) 1: 218–234.

DESVAUX, N. A.
1809. Prospectus de M. Rafinesque Schmaltz, relatif à deux ouvrages sur la botanique du Nord de l'Amérique; traduit du Medical Repository de New-York, vol. 5, p. 350, par M. N. A. Desvaux. Journ. Bot. (Paris) 2: 166–178.
This was based on the preceding paper.

RAFINESQUE, C. S.
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DESVAUX, N. A.
1814. Sur les ouvrages de M. Rafinesque-Schmaltz. Journ. Bot. (Desvaux) 4: 268–277.
This was based on the preceding paper by Rafinesque and most of Rafinesque's original descriptions are repeated.

RAFINESQUE, C. S.
1815a. Chloris Aetnensis o le quattro florule dell' Etna. *In* RECUPERO, A.: Storia naturale e generale dell' Etna. 1: [App.] 1–15.
1815b. Analyse de la nature ou tableau de l'universe et des corps organisés. 1–224. 1 pl. (portr.)
1817a. Florula Ludoviciana; or a flora of the State of Louisiana, translated, revised, and improved, from the French of C. C. Robin. 1–178. (See Robin, above.)
1817b. First decade of undescribed American plants or synopsis of new species from the United States. Amer. Monthly Mag. Crit. Rev. 2: 43–44.

1818a. A journal of the progress of vegetation near Philadelphia, between the 20th of February and the 20th of May, 1816, with occasional zoological remarks. Amer. Journ. Sci. **1**: 77–82.

1818b. [Review of] Flora Americae Septentrionalis, or a systematic arrangement and description of the plants of North America, etc. By Frederick Pursh, London, 1814. Amer. Monthly Mag. Crit. Rev. 2: 170–176, 265–268.

1818c. Third decade of new species of North American plants. Amer. Month. Mag. Crit. Rev. 2: 206–207.

1819a. [Review of] The genera of North-American plants and a catalogue of the species to the year 1817. By Thomas Nuttall, F. L. S. &c. &c. 2 vols., 12 mo., Philadelphia, 1818. Amer. Monthly Mag. Crit. Rev. **4**: 184–196.

1819b. Remarques critiques et synonymiques sur les ouvrages de MM. Pursh, Nuttall, Elliott, Jorrey [Torrey], Eaton, Bigelow, Barton, Muhlenberg, etc., sur les plantes des Etats-Unis. Journ. Phys. Chim. Hist. Nat. **89**: 256–262.

1820. Annals of nature, or annual synopsis of new genera and species of animals, plants &c. discovered in North America. 1–16.

1821. Western Minerva, or American annals of knowledge and literature. **1**: i–vi, 7–88.

Only a single copy of this work is known to exist; the contents of it are summarized by W. J. Fox, in Science II. **12**: 211–215. 1900.

1824. Florula Kentuckensis. Catalogue of the principal trees, shrubs and plants of Kentucky. . . . *In his:* First catalogues and circulars of the botanical garden of Transylvania University at Lexington, Kentucky. 12–20.

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1833b. Index of the Florula Mandanensis of Bradbury and Rafinesque, published in 1817 and in 1820, with notes and additions. *In his:* Herb. Raf. 37–41.

1833c. Florula Oregonensis. *In his:* Herb. Raf. 49–54.

1833d. Florula Centralis or Illinoensis. *In his:* Herb. Raf. 59–63.

1833e. Florula Apalachensis seu Apalachica, or some rarest new plants of the Apalachian mts. of Virginia, Carolina, and Georgia, many from the Unaka and Iron mts. for North Carol, those of Virginia collected by myself, the others procured by exchange, purchase, or in gardens. *In his:* Herb. Raf. 65–66.

1836. New Flora and botany of North America. 1: 1–100.
1836[1837]. Flora Telluriana. . . . 1: 1–104.
1836[1838]. New flora and botany of North America. 4: 1–112.
1841. Manual of medical botany of the United States. . . . i–xii. 1–239. *pl. 1–52.*
This is a page-for-page reprint of Volume 1 of Rafinesque's "Medical Flora" (1828).

Fox, W. J.
1900. Rafinesque's Western Minerva, or American annals of knowledge and literature. Science II. 12: 211–215.
Summarizes the contents of this very rare work, only a single copy of which is known to exist, and repeats the essential botanical data contained therein.

ARNOLD ARBORETUM.

Is Polypodium virginianum f. deltoideum a Constant Form?

RICHARD C. HARLOW

The following notes are offered as of possible value in future study of the forms of our eastern *Polypodium virginianum*. The case is presented as a simple statement of facts, not with the idea of stirring up latent argument. Others, far more capable than the writer, may judge.

During the years 1938 to 1942 inclusive, the writer has been deeply interested in the various forms of the Polypody, his investigations having consisted of transplanting many of these forms to carefully prepared rock ledges in a wooded fernery, where they could be grown under similar conditions of soil, shade, moisture, and exposure.

It had been noted that forma *deltoideum* seldom ran true from the same rootstock in the wild. In 1940 some 25 rootstocks bearing from one to four typical fronds of this form were transplanted from various sections of the Pocono Mountains of Pennsylvania to the fernery at La Anna, Pennsylvania. These were all well-marked specimens, 11 being distinctively lobed on the lower side of the lowermost segment, 8 lobed on the upper side of the lowermost segment, and 6 lobed on both sides of the lower-

most segment; all blades were typically broad and more or less triangular in outline. In nearly every case it was noted, in digging out the rootstock, that the most typical deltoid fronds came from root areas which were starved from lack of soil (as in an extremely narrow, dry crack), or where the rootstock was protruding, through outgrowing the available soil.

All these were planted under simple, typical Polypody conditions, but with soil a half inch in depth on the top of the rocks. They were planted in both shade and and filtered sunlight.

In 1941 new growth was carefully studied. In every case, perfectly normal fronds appeared and the features which marked the so-called forma *deltoideum* entirely disappeared. The entirely normal fronds appeared again in all cases in 1942.

In 1941 the reverse experiment was tried. Twenty-five plants of perfectly normal *Polypodium virginianum* were planted where either the ends or some sections of the rootstock were exposed and not covered by leaf mold. Four plants threw up normal fronds in 1942, while the remaining 21 all had one to three fronds showing typical *deltoideum* characters.

It is realized that the experiments have not been extensive enough to justify very definite conclusions, but they have gone a long way in the writer's mind to establish the fact that *deltoideum* is not a constant form, being rather a leaf form caused by unnatural conditions of growth.

It may also be of interest to know that *Polypodium virginianum* forma *acuminatum* (Gilbert) Fernald, planted to the extent of 20 different rootstocks in 1940, came absolutely true in 1941 and 1942 under typical Polypody conditions of sun, shade, exposure, and moisture.

CAMBRIDGE, MASS.

New Occurrences of Dryopteris Clintoniana in Tennessee

JESSE M. SHAVER

On August 29, 1937, I went to Fayetteville, Lincoln County, Tennessee, to spend a Sunday botanizing with Mr. Harvey Bridges, a former student. During the day, while we were working up a wooded ravine about five or six miles south of Fayetteville, Mr. Bridges pointed out to me some large, dark green ferns that he had previously discovered. At first I took these to be aberrant forms of Goldie's fern, *Dryopteris Goldiana* (Hook.) A. Gray. However, when I got home I found that it was not Goldie's fern, so I made additional trips at different times to study the fern at this station. Still I could not satisfactorily classify it, and it was not until I read Wherry's paper on "Southern Occurrences of Dryopteris Clintoniana" that I was able to identify it as *Dryopteris Clintoniana* (D. C. Eaton) Dowell var. *australis* Wherry.[1] My specimens are almost exactly like sheet No. 667180 (Acad. Sci. Phila.) grown in Washington from a Fordney, Alabama, rootstock and kindly lent me through Dr. Wherry and Dr. Pennell.[2] So far as I was aware at the time, this was the first station known for this fern from Tennessee.

However, in his fern book (1938) Small mentioned (p. 274) the finding of *Dryopteris celsa* in 1931 in Tennessee near Hot Springs, North Carolina. In a review of this book, Wherry (1939, pp. 25–28) refused to accept this Tennessee fern as *D. celsa*. He thinks it is *D. Clintoniana*; but Small's material has apparently been lost and

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[1] The author prefers to use the old names for these ferns as given by Wherry (1937), rather than the newer names *Dryopteris cristata* (L.) A. Gray var. *Clintoniana* (D. C. Eaton) Underw. and *D. cristata* var. *australis* (Wherry) Blomquist & Correll.

[2] Dr. Pennell has graciously lent specimens from the herbaria of the Academy of Natural Sciences of Philadelphia for this study.

local horticulturists have destroyed the original station, so in the absence of specimens it is not possible to determine the variety.

Another Tennessee station for this fern was discovered in a rather peculiar way. In the spring of 1941, Dr. Aaron Sharp of the University of Tennessee told me of two sheets of badly preserved fronds of what might be *D. Clintoniana* that had mysteriously escaped the fire which destroyed the University herbaria. Through the courtesy of Dr. Sharp I have had the opportunity of examining these. Though badly eaten by insects, the two sheets together apparently have three fronds, the basal portions of some fronds being on a separate sheet from their tops. They had originally been labeled: "Flora Tennesseensis, Legit Dr. A. Gattinger. *Aspidium Filix-mas* Swartz. Tallahoma (sic) July," with the year not clearly legible but apparently 1867. Below this in pencil had been written "probably *Cristatum* var. *Clintonianum.*" These fragments were carefully studied and sketched. I identified them as *D. Clintoniana*, but could not be sure of the variety. The shape of the fronds, the small sinuses between fertile segments, and the two or three reduced pairs of basal pinnae are much like those in Blomquist's plate (1934, p. 65) and a specimen collected by Fred W. Gray near Charlotte, North Carolina, September 11, 1936, with the notation in pencil "v. *genuina* Wherry E.T.W. 1939." The single fertile pinna figured by Blomquist is unlike any of this material. Furthermore, the sori appeared to be toward the midrib, rather than medial as in var. *genuina* Wherry. These facts made me hope that if I could rediscover this station I might find var. *genuina* in Tennessee.

The first procedure was to consult Oakes' "The Life and Work of Doctor Augustin Gattinger," in order to find out whether Dr. Gattinger had a friend living in Tullahoma about 1867 whom he was in the habit of

visiting. I found (p. 13) that Prof. Alexander Kocsis was a very dear friend of Dr. Gattinger, that he moved from Nashville to Tullahoma immediately after the close of the Civil War, and that Dr. Gattinger was a very frequent visitor in his friend's home. Through the aid of a former student, I was able to locate the site of Professor Kocsis's home (the building has disappeared long ago) near the outskirts of the present city. Then, reasoning that Dr. Gattinger's trips would probably not cover a great distance from this home, a plan of locating and exploring all likely habitats was prepared and put in operation in the fall of 1941, with the result that one of my students, Mr. James Shaw of Chattanooga, relocated the station and I was able to make collections. The more complete collection contains no plants exactly like those in the Gattinger collection, so this may really be a new station, although this seems hardly likely. These later plants I have classified as var. *australis* Wherry, although most specimens have slightly inframedial sori and rather narrow sinuses, but no more so than the Fordney, Alabama, material mentioned above. There are no sori on the lower pinnae and most of the pinnae are acuminate. However, this material is being carefully studied and a more detailed report will be published elsewhere.

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Shorter Notes

TWO COLORFUL ORIENTAL FERNS FOR THE GARDEN.—The first of these is *Dryopteris erythrosora*, of eastern Asia. The Journal of the New York Botanical Garden for September 1935 contained an article by D. T. Walden describing this interesting species, several plants of which had then been growing for many years in the fern garden north of the old rockery at the Garden. These were described as having bipinnate, broadly triangular blades 15 to 20 inches long, on 10-inch, dark brown stipes. The author mentioned as the special contribution of this fern to the garden the bronzy variegated coloring of the young blades in May and early June, and described the color at maturity as a rich glossy green, showing whitish areas where the heavy sori are impressed beneath.

It was probably not long after this that energetic workmen with scythes cut everything in the fern garden, which had become overgrown with weeds, close to the ground, destroying the specimens just mentioned. Fortunately, a plant had been given to the Brooklyn Botanic Garden, however, from spores of which the writer has been able to raise young plants. These are now four to six inches high. The little fronds are reddish orange in color, but thus far the whitish areas have not appeared.

The second fern is a form of *Athyrium Goeringianum* known to me as var. *pictum*. This variegated Lady-fern, a native of Japan, is 10 to 18 inches high, with narrow blades 3 to 4 inches broad. In spring the young fronds are a rich purple in color, but as they mature the purple fades somewhat and the blades become green. The typical (non-variegated) form of this species, *Athyrium Goeringianum*, shows no purple or whitish areas, the fronds being of a uniform dark green color. Like *Dryopteris erythrosora* this species is perfectly hardy, and can be

easily grown. It makes an attractive addition to the fern garden, the variegated form appearing to special advantage against gray rocks.

A limited number of young plants of both species are available for distribution to Fern Society members who may wish to try their hand at growing them.—W. HERBERT DOLE, *23 Overlook Ave., West Orange, N. J.*

ASPLENIUM PALMERI IN TEXAS.—In December of 1941 Mr. H. B. Parks and I were graciously entertained by Mr. George M. Soxman at his home at Dallas, Texas, and were privileged to examine his neat and very excellent collection of the ferns and fernlike plants of Texas. Among these was a collection of *Asplenium Palmeri* Maxon, which was taken August 22, 1941, in Limpia Canyon of the Davis Mountains, and which since has been reported in this Journal as the first Texas station for this fern.

I wish now to make a second report of the occurrence of this species in Texas. Strangely enough my collection antedates that of Mr. Soxman, for it was taken on July 4, 1941. This species, which occurs from Guatemala north through Mexico into southern Arizona and New Mexico, thus becomes known from two widely separated localities in Texas. Mr. C. A. Weatherby informs me that my No. 37695, taken at the Blue Hole of Pulliam Creek, a tributary of the Nueces River—which locality is in Edwards County at 16 airline miles directly southeast of Rocksprings, at an elevation of 1750 feet—is this species. Mr. Soxman took this fern in Limpia Canyon, Jeff Davis County, at approximately 11 airline miles northeast of Ft. Davis and at an approximate elevation of 4475 feet; it was growing on igneous rocks. This locality is 230 airline miles northwesterly of the station in Edwards County and has an elevation greater by more than 2700 feet. Moreover, the rocks in the latter locality are of limestone. Collectors in southwestern Texas should be

on the watch for this species, which evidently is rare with us.—V. L. CORY, *Texas Agricultural Experiment Station.*

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American Fern Journal

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The Group of Selaginella Parishii

C. A. WEATHERBY

The American Selaginellas of the subgenus *Euselaginella* (that to which the common eastern *Selaginella rupestris* and the widely distributed western *S. densa* and *S. Wallacei* belong) have, in the past 35 years, received critical attention from Underwood, A. A. Eaton, Hieronymus, van Eseltine, and Maxon. Their cumulative labors have accounted very satisfactorily for the species of the United Stated and a fair proportion of those of Mexico; and though these species are rather numerous and often very local, and rest on minute and somewhat repetitious characters, it does not appear that the group has been at all seriously over-segregated. For the United States, it can be regarded as now reasonably well understood. Nevertheless, except for Hieronymus's very condensed and now out-of-date synopsis in Die Natürlichen Pflanzenfamilien and Underwood's amplification of it,[1] no one has recently attempted to key out the species of more than a relatively limited area. In the course of determining Prof. Ivan M. Johnston's collections from northern Mexico, it became necessary for me to make rather wide comparisons. One of the results is the following key which, with its accompanying list of species, citation of specimens, and bibliography, may, it is hoped, be of use in making identifications.

[1] Fern Bull. **10**: 8–12. 1902.

[Volume 33, No. 3, of the JOURNAL, pages 81–112, was issued September 22, 1943.]

Up to the present time the main divisions used in *Selaginella* and, so far as can now be seen, the most practicable are habital. The small group here considered is characterized by its (for *Euselaginella*) strongly dorsiventral repent stems. The numerous, closely set, and (when lying flat) imbricated leaves are in six or more ranks. Those of the lower ranks (i.e., those next the ground) are larger than those of the upper and often otherwise different. According to Prof. Johnston's observations in the field, after rains, when the plant has abundant moisture, all the leaves spread horizontally, making a strongly flattened spray. This condition may often be seen in new shoots of herbarium specimens. In dry weather and in most herbarium specimens, however, the leaves of the lower ranks turn upward at the ends and those of the upper assume a nearly or quite vertical posture, giving the stems a very characteristic appearance, as of fur rubbed the wrong way. These arrangements —the close-set leaves protecting one another and the upright position of the upper ones, presenting their edges to the light—tend to reduce transpiration and have obvious advantages for plants of hot and for long periods rainless habitats; as suggested by Dr. Maxon, they are probably to be regarded as adaptations to such habitats. They are least pronounced in *S. arizonica,* most in *S. Landii,* where even the shape of the upper leaves, broadest at base and tapering evenly to the apex, tends further to reduce the exposed leaf-area. In the list which follows, the species are arranged with *S. arizonica* first and *S. Landii* last, as indicating a possible developmental series.

In all four species the stems and branches are prostrate or assurgent at their tips and form dense colonies. The megaspores in all are much alike, yellow and rugose-reticulate. In *S. eremophila* and *S. arizonica* they are described as more finely reticulated on the commissural face.

The leaves of the upper ranks seem to offer the most obvious distinguishing characters and these are primarily used in the key. To be seen clearly, they often need rather high magnification (a 20× or even 40× setting in a binocular dissecting microscope is not too much); but it is hoped that they will be more readily made out than the minutiae of microscopic measurements and the counts of cilia so much relied upon by Hieronymus. The characters of ciliation given do not apply to the leaves of the lower ranks. It must also be borne in mind that in herbarium specimens the cilia are rather easily broken off.

The bibliography makes no pretense to completeness; it is intended only to supply references to reasonably accessible publications in which descriptions and other information may be found. Specimens cited are all in either the Gray Herbarium (G) or the United States National Herbarium (US). As on many previous occasions, I am deeply indebted to Dr. Maxon for the loan of specimens and for generously given information.

KEY TO THE SPECIES

Leaves with a subpersistent, stiff, straight, scabrous terminal seta (readily broken off in age, but to be found on some leaves in all specimens). Southwestern Texas; southern Arizona and northern Sonora ..... 1. *S. arizonica*

Leaves without a terminal seta, or this (if present) weak, smooth, and very soon deciduous.

Leaves of the upper ranks with a tortuous, very early deciduous, weak terminal seta, nearly or quite without cilia toward the obtusish or acutish, usually minutely apiculate apex. Southern California and southwestern Arizona ..... 2. *S. eremophila*

Leaves of the upper ranks without a terminal seta, ciliate or serrulate to the acute apex.

Leaves of the upper ranks oblong- or subulate-lanceolate, relatively thin, ciliate throughout, narrowed to a flattened herbaceous or hyaline apex. Northern Mexico. 3. *S. Parishii*

Leaves of the upper ranks narrowly deltoid or deltoid-lanceolate, thick, serrulate in the upper third, gradually and evenly acuminate to the thickened, cartilaginous apex. Central Mexico ..... 4. *S. Landii*

1. SELAGINELLA ARIZONICA Maxon in Smithsonian Misc. Coll. **72**, no. 5: 5, *pl. 3* (1920) and in Kearney & Peebles, U. S. Dept. Agric. Misc. Pub. **423**: 44 (1942) [Flowering Plants and Ferns of Arizona]; Little in Amer. Fern Journ. **28**: 147 (1938); Tidestrom & Kittell, Fl. Ariz. & N. Mex. 880 (1941). Type from Santa Catalina Mts., Arizona, July 28, 1914, *Shreve* (US); isotype, G.

Other specimens seen:

TEXAS. Six miles west of Van Horn, Culberson Co., alt. 4300 ft., June 25, 1940, *Hitchcock & Stanford* 6780 (G); Davis Mts., 6 miles west of Alpine, Brewster Co., Sept. 25, 1942, *Cory* 40232 (G); on rocks near stream-bed, Upper Juniper Canyon, Chisos Mts., Brewster Co., alt. 6000 ft., July 15–18, 1921, *Ferris & Duncan* 3592 (US); near Shafter, Presidio Co., June 6, 1924, *Orcutt* (US).

ARIZONA. Without definite locality, 1881, *Pringle* (G). GRAHAM Co.: Arivaipa Cañon, April, 1873, *Mohr* (US). GILA Co.: Steep, rocky slope, Roosevelt Dam, Aug. 3, 1910, *Goodding* 722 (G, US); bluffs, Tonto National Forest, 3500 ft. alt., May 10, 1921, *Talbot & Chapline* 39191 (US). MARICOPA Co.: Moist, rocky banks on north slopes, Canyon Lake, March 20, 1930, *A. Nelson* 11217 (US), 11217a (G). PINAL Co.: Ray, 1913, *V. Bailey* (US); Sacaton Mts., Oct. 14, 1925, *Kearney* 480 (US); Superstition Mts., Jan. 23, 1929, *Goodding* 101 (US). PIMA Co.: Sabino Canyon, Santa Catalina Mts., alt. 2900 ft., June 15, 1903, *Thornber* 315 (US); Soldier Canyon, alt. 2600 ft., Jan. 27, 1923, *Bartram* (US); Pino Canyon, near Tucson, Feb., 1913, *Parish* 8513 (US); Tucson Mts. (west side), Feb. 1913, *Ferriss* (US); Covered Wells, Nov. 1937, *Sister Thomas Marie* 486 (US); Coyote Mts., 48 miles west of Tucson, March 5, 1937, *Wiggins* 8694 (US).

SONORA. Poso de Luis, Jan. 6, 1894, *Mearns* 2701 (US); granitic mountain, northwest end of Sierra Cubabi, 7 miles northwest of Quitovac, March 13, 1936, *Wiggins* 8330 (US).

A number of other Arizona collections from the same localities as those cited above, or from other places near by, may be found in the United States National Herbarium.

Selaginella arizonica, as here understood, exhibits considerable variability in the length of the terminal seta and of the cilia. In the Texan material seen these tend to be long; in the Arizonan, short. The Sonoran falls somewhere between. In each of these regions, and even in single collections, there is so much variability that, on the basis of the specimens at hand, the safest course seems to be to treat them all as belonging to one plastic species, rather than to attempt segregation—especially as inconstancy in degree of ciliation and length of seta is a rather common phenomenon in *Selaginella*.

As noted in the key, the terminal seta in this species is, though rigid, apparently fragile and easily broken off. In at least some of the upper leaves, however, it persists to full maturity; it is by no means a juvenile and immediately deciduous structure as in *S. eremophila*. Tidestrom & Kittell place *S. arizonica* among non-setigerous species, stating that "at least the lower leaves" do not bear setae. This is true of the old leaves of the lower ranks; but I should approach the matter from the opposite direction. In the group to which *S. arizonica* belongs, the characters of the upper leaves are more distinctive than those of the lower and the presence, even on some of the leaves only, of setae of a kind common in other groups of *Selaginella*, but otherwise unknown in this, is more important and rather to be emphasized than their absence in some of the leaves. I have accordingly used their presence as a leading key-character.

2. SELAGINELLA EREMOPHILA Maxon in Smithsonian Misc. Coll. **72**, no. 5: 3, *pl. 2* (1920) and in Abrams, Ill. Flora Pacific States, **1**: 47, *fig. 101* (1923); Munz & Johnston in Amer. Fern Journ. **13**: 1, 2 (1923); Munz, Man. So. Cal. Bot. 13 (1935). *S. Parishii* Underw. in Bull. Torr. Bot. Club **33**: 202 (1906), as to Californian element. Type from Riverside Co., California, Palm Canyon, April 4, 1917, *I. M. Johnston* 1047 (US), not seen.

Specimens seen:

CALIFORNIA. RIVERSIDE Co.: West Canyon, western edge of Colorado Desert, alt. 200 m., April 18, 1907, *Parish* 6111 (G); dry, rocky hills, Palm Springs, March 27, 1919, *Parish* 19190 (G); desert sand near Palm Springs, alt. 400 ft., April 1, 1920, *Mary F. Spencer* 1468b (G); rocks, base of San Jacinto Mts., Colorado Desert, March 1908, *Saunders* (US); Pinyon Wells district, Little San Bernardino Mts., April 1921, *Jaeger* (US); base of high rocks, Corn Springs, Chuckwalla Mts., alt. 2500 ft., April 9–12, 1922, *Munz & Keck* 4865 (US).

ARIZONA. 40 miles southeast of Yuma, near Tinajas Altas, Yuma Co., Dec. 17, 1934, *Jaeger* (US).

Several other collections from Palm Springs are in the National Herbarium.

The weak, tortuous terminal seta in the very young leaves (somewhat suggestive of that in the eastern *S. tortipila*) seems not to have been observed before, but is present in all the specimens I have examined. The minute cusp at the apex of the mature leaves is presumably the persistent base of this seta.

3. SELAGINELLA PARISHII Underw. in Bull. Torr. Bot. Club **33**: 202 (1906), as to Mexican element and cited type: Maxon in Smithsonian Misc. Coll. **72**, no. 5: 4 (1920). Type from Mexico: Concepción del Oro, Zacatecas, Aug. 11–14, 1904, *E. Palmer* 306, in herb. New York Bot. Gard.; isotype, G.

Other specimens seen:

COAHUILA: Near Saltillo, alt. 2000 m., June 1909, *Nil* (US), *Arsène* 3453 (US); July 10–13, 1934, *Pennell* 17272 (US).

ZACATECAS: Clefts of slate rocks, Tarey Cañon, near Cedros, alt. 7000 ft., Feb. 7, 1911, *Chaffey* 58 (US).

4. SELAGINELLA LANDII Greenm. & Pfeiff. in Ann. Missouri Bot. Gard. **5**: 205, *pl. 11, 12* (1918); Maxon in Smithsonian Misc. Coll. **72**, no. 5: 4 (1920). Type from Mexico: "In dense mats on large, rounded granite boulders, San Estebán Mts., about 32 km. from Guadalajara, Jalisco, 1908, *Barnes & Land* 2024," in herb. Missouri Bot. Gard.; isotypes, G, US.

Other specimens seen:

JALISCO: Type locality, Sept. 28, 1908, *Pringle* 10823 (G, US); Sept. 30, 1903, *Rose & Painter* 7499 (US).

NAYARIT: La Barranca, Feb. 21, 1927, *M. E. Jones* 23495 (US).

MEXICO: East slope of Popocatepetl at 12,000 ft. alt., July 2, 1938, *Kenoyer* 25 (US).

GRAY HERBARIUM.

Observations on Western Botrychiums

CARLOTTA C. HALL

When the Carnegie Institution of Washington was establishing its transplant experiments in the Sierra Nevada of California, from Mather, Tuolumne County at 4,600 feet elevation, along the Tioga Road to Tioga Pass at 9,945 feet and on down the Leevining Grade towards Mono Lake, it was the writer's good fortune to be one of the party. During the years 1922 to 1926 the latter part of July and a part of August were spent along the eastern part of the transect, with headquarters at Tuolumne Meadows. The camp was situated at 8,600 feet elevation on the Dana Fork of the Tuolumne River at the foot of the low fall in the river and between two rather small granite domes. The dome to the north had been dubbed "Puppy Dome" by a Sierra Club member, and it is so designated in the Sierran transplant records of the Carnegie Institution. During the weeks at Tuolumne the writer studied and collected ferns. The genus that interested her most was *Botrychium.*

I. BOTRYCHIUM SILAIFOLIUM AND B. COULTERI

The following notes record the results of some transplant experiments with *Botrychium Coulteri* Underw. (*B. multifidum* subsp. *Coulteri* Clausen). · This "spe-

cies'' differs from *B. silaifolium* Presl (*B. multifidum* subsp. *silaifolium* Clausen) in being coarser, generally smaller, and in having a short-stalked sterile blade with crowded segments. It was amazing to see the fronds of *Botrychium Coulteri* Underw. embedded in the short meadow grass, *Stipa occidentalis* Thurb. Seeing this fern in the herbarium does not adequately give us the impression of how low and stemless it appears in the field. In this high country (Hudsonian Zone) it was always found in the open meadow with no shade whatever, though it was continually sought in shaded forest borders and other likely places. Due to the writer's interest two sets of transplants of *B. Coulteri* (*B. silaifolium* Presl in the transplant records of the Carnegie Institution) were made from the open meadows to nearby shade. One set of four plants from a point $\frac{1}{4}$ mile south from camp was moved on August 22, 1922, from the open meadow on the Lyell Fork of the Tuolumne River to the shade of a group of small, young lodgepole pines only a few yards distant. They were covered by a wire cage which defined the group, but which was designed primarily to keep out the many little rodents that flourish there. One sterile frond from this set (V 527) was taken for a voucher on August 31, 1922. The stalk of this frond is $\frac{5}{8}$ of an inch long. Each year these transplants were observed. On September 9, 1925, a voucher was taken which has a definitely elongated stalk, $3\frac{1}{4}$ inches long. The comment on its folder is that most of the fronds are pale. On August 1, 1926, the following entry in the transplant records was made, "Six old fronds with stalks 7 cm. long; also 8 fronds of this year, not yet unfolded but stalks elongating." When these Botrychiums were moved from the open meadow two plants had fertile spikes. No spikes were produced on the transplanted plants. The fronds were all spindling

and plainly not thriving in the shade at this elevation (8,600 ft.).

A second set (V 528) of *B. Coulteri* was moved in 1922 (some replacements made in 1923) from the meadow on the Lyell Fork to wet shade close to and on the north side of Puppy Dome. Two plants lived through 1925, but all were dead in 1926. This location was in a group of large trees of *Pinus Murrayana*, where the shade was deep and the snow melted late. The conclusion reached from these two experiments is that this *Botrychium* can endure some shade for a time at least in the Hudsonian Zone but cannot reproduce itself, and that it thrives and completes its cycle there only in open unshaded situations.

The same year, 1922, a set of six plants (V 588) of *B. Coulteri* was taken to Mather at 4,600 ft. elevation, where the principal transplant gardens are located. These Botrychiums were set out in shaded places near where water flowed part of the year. Only one of these localities could be protected and for one reason or another most of the plants were lost.

The next year, 1923, a fenced garden was established at Mather, now known as the "old central gardens."[1] Plants of *B. Coulteri* were again brought from Tuolumne Meadows and planted in several of its environmental plots. The plant that did best was in wet light shade. It was given the number 670–B. All transplants of *B. Coulteri* were taken from the same part of Tuolumne Meadows, near the Lyell Fork. Two whole plants were preserved as vouchers for all the transplants and a sterile frond was taken from one plant of each set of transplants made. Later the old frond of the previous year was

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[1] In 1926 new gardens were established a few hundred feet to the west on the border of a large meadow with irrigating facilities and controlled lath shade.


4
1
2
3

taken for a voucher when possible; it was cut at the level of the ground.

The following table of measurements shows some of the changes that took place in this transplant. The length of the stalks of the sterile blades has been measured from the surface of the ground, which is usually the point of separation of the sporophyll. The first two sets are from the two specimens of whole plants from the original locality preserved as vouchers. The four sets following are from the transplant 670–B of years as indicated:

MEASUREMENTS OF WILD PLANTS FROM TUOLUMNE MEADOWS, 8,600 FEET ELEV.

	Stalk of sterile blade	*Width of sterile blade*	*Length of sterile blade*	*Length of sporophyll*
Plant 1	½ in.	2¾ in.	1¾ in.	2½ in.
Plant 2	¾ in.	3 in.	1⅞ in.	4 in.

MEASUREMENTS OF PLANT 670–B TRANSPLANTED TO MATHER, 4,600 FEET ELEV.

1926	2¾ in.	8½ in.	5¾ in.	Not developed
1927	3 in.	8 in.	5½ in.	10 in.
1928	3¼ in.	7¼ in.	5 in.	Not developed
1930	3¾ in.	7 in.	4¾ in.	Not developed

The foregoing measurements and observations indicate that by transplanting *B. Coulteri* from full sun at 8,600 feet to light shade at 4,600 feet the following changes took place: The length of the stalk of the sterile blade increased 5 to 7 times; the width of the blade increased more than twice; the length of the blade increased 2 to 3 times; and the sporangiophore lengthened 2½ to 3 times. The plants lost their characteristic extreme stoutness and

EXPLANATION OF PLATE 2.

FIG. 1. Typical specimen of *B. Coulteri* from open sunny meadow at Tuolumne Meadows, 8,600 feet elevation.

FIG. 2. Sterile blade of V–527 at the time of transplanting to shade in 1922.

FIG. 3. Sterile blade from preceding plant after growing in shade at 8,600 feet elevation until 1925.

FIG. 4. Specimen taken in 1927 from plant 670–B transplanted in 1923 to Mather, 4,600 feet elevation.

the small stiff ultimate segments became much larger, thinner in texture, and not at all crowded. In fact, the plants in their new environment in the Transition Zone differ in no way from typical specimens of *B. silaifolium* Presl. So it is obvious that *B. Coulteri* does not deserve the rank of a species or subspecies. It is merely an ecological phase, which may be known as *B. silaifolium* forma **Coulteri** (Underw.) C. C. Hall, comb. nov.[2] The range of forma *Coulteri* is from the Sierra Nevada of middle California north to Washington and east to Montana, Wyoming, and Colorado.

After 1922 and 1923 the climate at Mather became drier and drier. The small stream that in those years flowed through the "old central gardens" far into July scarcely flowed after June in the later years of these experiments. Also, normally, there is little or no rainfall at Mather after early June until late September. It is mainly to this increasing dryness that the writer attributes the smaller size of the fronds and the absence of sporophylls in the years 1928 and 1930.

Botrychium silaifolium Presl is retained by the writer as the name of the large *Botrychium* of the Pacific coast, rather than *B. multifidum* subsp. *silaifolium* (Presl) Clausen. Typical *B. multifidum* is unknown in this area. Neither that species nor intergrading forms from this region are represented in the herbaria of the Oregon Agricultural College, State College of Washington, University of Washington, Stanford University, California Academy of Sciences, or the University of California. Dr. Robert Clausen in his monograph of the Ophioglossaceae cites a collection from British Columbia under *B. multifidum* ssp. *typicum,* but does not seem entirely satisfied with the determination, for he says (p. 32),

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[2] Based on *Botrychium Coulteri* Underw. Bull. Torr. Bot. Club 25: 537. 1898.

"There is also a collection from eastern British Columbia which has seemed best referred here."

II. BOTRYCHIUM SIMPLEX HITCHC.

Botrychium simplex Hitchc. is also a species of the Hudsonian Zone in California. It grows in abundance in several places along the Tioga Road from Porcupine Flat to Tioga Pass. Large and luxuriant plants were seen at Porcupine Flat at an elevation of 8,200 ft., growing on grassy hummocks on a wet slope south of the creek. At Tuolumne Meadows (8,600 ft.) it grows in abundance between the Dana and Lyell Forks of the Tuolumne River. Robust plants were found at Moraine Flat (9,000 ft.), which is at the left of the Tioga Road as it climbs up and out of Tuolumne Meadows. At Tioga Pass (9,945 ft.) it grows around the small alpine lakes. Other colonies were seen, but at the above localities the writer made collections and studied the forms of the frond.

All stages of development from simple fronds to the pinnate and ternate forms of the sporophyte were seen in each locality. The idea that there is a "strain" consisting of only the ternate stage, i.e., *B. simplex* var. *compositum* (Lasch) Milde as recognized by Clausen, is probably due to the natural impulse a collector has of putting into the plant-press the largest specimens that he finds, which would be plants of the ternate stage. When a new colony starts, the first sporophytes would quite certainly be the forms with simple fronds. Afterward the stages of frond-development would increase yearly until all forms of the frond would be present. It is conceivable that for several succeeding years there might be climatic conditions which would prevent the germination of spores, in which case all the plants of the colony would progress to the ultimate ternate stage.

Such continued adverse conditions probably seldom occur.

At Tioga Pass, where existence is difficult, the plants of *B. simplex* are small. In the writer's collection from this locality, which contains several forms of the sterile blade, there are plants with ternate fronds which measure as little as $1\frac{1}{8}$ inches in height, including the sporophyll. Each of these small plants has a sheath at its base made up of several layers of the stalk-bases of previous fronds, indicating that these tiny plants are several years old. They appear to be depauperate; they are certainly not young plants of a ternate "strain." Several western botanists who have examined colonies of *B. simplex* report that they too have always found present the various forms of the frond. It would seem to the present writer that in the west there is little evidence of a variety of *B. simplex* which produces only ternate fronds.

The stage of *B. simplex* with the simply pinnate blade is sometimes confused with its close relative, *B. Lunaria*. Usually the pinnate blade of *B. simplex* is long-petioled and rises from near the rootstock; but when the plant must push up through leaves, shifting sands, short thick grass, or other vegetation, the commonstalk elongates, carrying the blade to the surface or up into the light, in which case the blade is usually sessile or nearly so. A good example of a similar response is seen in the closely related species, *B. pumicola* Coville. The blade of that species is carried up by a long stalk through the pumice gravel to the surface of the ground and there is sessile against the sporophyll. Many plants of *B. pumicola* were observed for this character by the writer at the type locality on the rim of Crater Lake. Mr. Elmer I. Applegate, who with Dr. Frederick V. Coville collected the type and has collected the species several times since, confirms this observation. The conclusion to be drawn

is that the length of the commonstalk depends on environment and that a sessile or nearly sessile blade is associated with an elongated commonstalk.

The writer is not acquainted with *B. Lunaria* in the field and so cannot say what the relation of its blade to the surface of the ground may be. Through study of herbarium specimens no definite characters have been found by which to separate the pinnate stage of *B. simplex* from *B. Lunaria*, except that *B. Lunaria* is a larger, stouter plant with a comparatively broad, usually sessile blade. It is not surprising therefore that the pinnate stage of *B. simplex* is sometimes determined as *B. Lunaria*. In addition to specimens from the herbaria mentioned earlier in this paper, the specimens of *B. simplex* and *B. Lunaria* in the herbarium of Pomona College have been studied. In all this material there is not a fully developed, typical, robust plant of *B. Lunaria* from the stage of *B. simplex* is sometimes determined as *B. Lunaria*. both as to identification and distribution. In the herbarium of the University of California is a collection by Baker and Nutting from near Whitehorse Lake, Modoc County, California. It consists of ten plants, all of which are stoutish and simply pinnate, with no indication of becoming ternate; and it is probable that although young seasonally (collected June 20), these plants from the extreme northern part of the state would have expanded into typical *B. Lunaria* later in the summer.

Several recent California collections determined as *B. Lunaria* or *B. Lunaria* var. *minganense* have been investigated by the writer and found to have been collected with ternate plants of *B. simplex* or to have grown not far from colonies of *B. simplex*. Other collections, such as those made by Dr. Philip Munz and Dr. Ivan Johnston on the Coldwater Fork of Lytle Creek in the San Antonio Mountains of southern California are all plants with

simply pinnate blades, but none of these are of the comparatively large robust type of *B. Lunaria.* Nor are there in these collections any of the unusual and interestingly cut forms which Frère Marie Victorin found on the Mingan Islands and named *B. minganense.* It is hoped that for a better understanding of *B. simplex* and *B. Lunaria* collectors will search a colony for all stages of the species and will revisit, for as many succeeding years as possible, seemingly pure stands of these Botrychiums.

III. BOTRYCHIUM BOREALE MILDE

A comparison of Milde's illustrations of *B. boreale* and *B. crassinervium* Rupr.[3] with herbarium specimens of these species from Sweden and Norway has led to the conclusion that *B. crassinervium* represents only the fully developed robust state of *B. boreale.* Since there is no need for giving such plants varietal rank, *B. crassinervium* becomes a straight synonym of *B. boreale* Milde. The herbarium specimens examined are as follows:

SWEDEN: *C. Baenitz* 4225; *C. Hakansson,* Aug. 31, 1886; *Even Tratteberg* 635; *Gottfrid Lidman,* July 4, 1920.
NORWAY: *C. Baenitz,* Aug. 11, 1892.

IV. BOTRYCHIUM PINNATUM ST. JOHN

It is evident, as Clausen has indicated, that Dr. Harold St. John did not realize that his *B. pinnatum,* collected in the state of Washington, was the same as *B. crassinervium* var. *obtusilobum* Rupr., collected in Unalaska by Eschscholtz. The writer has not seen the Eschscholtz specimens but accepts Dr. Clausen's opinion. There is a good specimen in the herbarium of the University of Washington collected in Kamtchatka in 1928 by W. J. Eyerdam, and young stages collected in Alaska and

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[3] Nov. Act. Nat. Cur. 26: 763. *pls. 51, 55.* 1858.

British Columbia are represented in various western herbaria. Dr. St. John had at hand all ages of this plant, including abundant material of fronds in the climax of their development, collected by William Suksdorf on Mount Adams. He recognized in this material a distinct species, but he was mistaken in stating that the blade is reflexed in the bud, a point which Dr. Clausen has already corrected. That its relationship is with *B. boreale* Milde and *B. matricariaefolium* A. Br. is apparent.

The geographical range of *B. pinnatum* is mainly distinct from that of *B. boreale* to the west and of *B. matricariaefolium* to the east. It extends from Kamtchatka and Alaska south along the Pacific coast to isolated occurrences in the mountains of Washington and the highlands of Oregon, and in the Rocky Mountains to Colorado. In Colorado, Mr. E. Bethel collected it at Glacier Lake, Boulder Co., July 5, 1914, this collection being the basis of *B. matricariaefolium* ssp. *hesperium* Maxon & Clausen. On sheet no. 694,412 of the United States National Herbarium are two plants of his collection, both collected early in the season. The specimen at the left is a young plant. These plants are matched by specimens of *B. pinnatum* collected on Mount Adams by Suksdorf (no. 1220; sheet no. 119,100, herbarium of the State College of Washington). Bethel's plants were collected more than a month earlier than *Suksdorf* 7075, on which *B. pinnatum* was based. This earlier date of collecting, at an altitude 1,000 ft. higher, may account for the lack of fully expanded fronds in the Bethel collection. In the Ira W. Clokey Herbarium, deposited at the University of California, is a fairly well developed mature plant of *B. pinnatum* collected by Bethel and Clokey (no. 3987A) near Glacier Lake, Colorado, July 20, 1921. The later in the season a *Botrychium* is collected, the better devel-

oped is the blade. This is especially obvious in specimens of *B. silaifolium* that have the preceding year's fronds attached.

Even if Dr. St. John had been aware that he was renaming *B. crassinervium* var. *obtusilobum,* there is no nomenclatorial rule requiring the use of that varietal epithet as the specific name. The synonymy is as follows:

BOTRYCHIUM PINNATUM H. St. John, Amer. Fern Journ. **19**: 11. 1929.

Botrychium crassinervium var. *obtusilobum* Ruprecht, Beitr. zur Pflanzenkunde des Russ. Reiches **11**: 42. 1859.

Botrychium boreale subsp. *obtusilobum* (Rupr.) Clausen, Mem. Torr. Bot. Club **19**: 81. 1938.

Botrychium matricariaefolium subsp. *hesperium* Maxon & Clausen, Mem. Torr. Bot. Club **19**: 88. 1938.

BERKELEY, CALIFORNIA.

Trailing Bommerias in Texas

ELSIE MCELROY SLATER

We know where to find Bommerias—after a rain. Last year there was a spread of them up by Indian Springs, where a persistent line of bright water slides out from under gray rock that shelves away from the steep slant of one of the lower peaks of the 20-mile range, "The Franklins," which begins in our town, El Paso.

Our canyon lies above Fort Bliss, the big Army post. It was windy that Sunday morning when our party of three women, two Scotties, and a College of Mines boy climbed the boulder-interrupted trail. We found everything but Bommerias, and had grand moments looking back down the view framed by canyon walls, across the Rio Grande valley far below, past distant peaks to the beautiful whirling, circling horizon turning every shade of blue and every shade of green, 60 miles away.

There had been quite a bit of rain. Pellaeas were in good shape, brisk and glossy; sturdy plants of *Cheilanthes* held their usual ledges; and Star Cloakferns (*Notholaena Standleyi*) were unusually expansive, every point of their stars opening out flat and dark. (Incidentally it may be noted that here we find *Notholaena Standleyi* with bone-white backs only,—not a yellow-backed frond in the canyon. Curling back into stiff balls when the rain is past, they remain white beneath through the dry periods.) Mosses bordered a narrow pool, Selaginellas ruffled a near-by shelf, and monkey-flowers crowded their way to the water. Here we had always found crowding Bommerias in other years.

The Bommerias of the United States belong to a single species, *B. hispida*. These southwesterners are particular in choosing their ledges. In our region Pellaeas and Notholaenas grow in every canyon, and several species of *Cheilanthes* are everywhere one looks for ferns; but to find *Bommeria* you have to remember its lodgings from year to year, and then you may be too late or too early in your search for it. Our other rock-loving ferns keep some semblance of themselves through the dry season; broken and brittle Pellaeas, brown-sheathed Cheilanthes, hard-clenched fists of Notholaenas hold their places the year round, but Bommerias seem to disappear. They grow in patches with little else, running out from dark caves under ledges to narrow perches or balconies in steep walls. Although at first glance, underfoot, the fronds suggest tiny geraniums, the fern look is manifest in the straight, slender, dark, slightly scaly stipes.

The very young Bommerias happen to be dear to our hearts. One small roundish frond—soft, velvety, with pinked, ruffled edges—will stick up out of the gray earth as much as an inch high, while following it close, pushing away the mountain, will come the smallest possible speck

of a green crook. In plants a little older the blade, albeit triangular, has a three-lobed roundish look. In those approaching maturity the two lower lobes seem to split off a small side lobe, which becomes almost as large as the original, and before one knows it one is counting five lobes instead of three.

From this simple outline it is a long step to the dissected pentagonal form of fully mature blades. Sometimes the pinnae are shaped like an oak leaf, and sometimes they are bluntly oblong. In a favorable season, with rain and soil plentiful, luxuriant ones will have their lobes ample and overlapping, but in hard times the fronds are amazingly skeletonized. Under varying conditions the fronds may be as high as ten inches or possibly as low as two, depending on last December's one snowstorm or on their earliness or tardiness in getting into the rainy season of this semi-arid country, where good opportunities to grow are none too numerous. At first the blades are bright green above and white-velvety underneath. As they mature, russet and touches of coral come into the velvet, and at length the underside becomes cinnamon-brown, chaffy along the midribs, and everywhere coarsely hairy. The sporangia are borne along the veins and are mostly concealed by the hairy covering.

The name commemorates J. E. Bommer, a Belgian botanist who published several papers upon ferns 50 to 75 years ago.

A few months after our hunt the United States Army took over the eastern slopes of our city mountain and with scrapers and mighty dust cleared and leveled a long stretch of foothills. Anemones in the rocks, Opuntias in purple fruit, formal creosote bushes, Ephedras offering medicine, poppies and composites paying out gold—all these followed the dust into the dust. Where they had been there sprouted long lines of brown tents, and these

in time put out a grand enough crop of soldier boys. Long-worded Government signs now forbid our following nearby mountain trails.

But neither war nor politics nor big yellow signs can change or erase the lovely dancing pattern of Bommerias which carry on in the highest lonely places. On little platforms and balconies overlooking the country, they express over and over again, accurately, unalterably, their idea. The great world cannot, if it would, leave them out.

EL PASO, TEXAS.

New Tropical American Ferns—XIV[1]

WILLIAM R. MAXON

The following new species are both from the northern Andes of South America. The *Polypodium* is of special interest, as will be noted, on account of its relationship to two other species with cavernous tubers, whose function is supposed to be physiological, in storing water necessary to growth, as in the well-known case of *Nephrolepis tuberosa* (Willd.) Schott.

Dicranopteris peruviana Maxon, sp. nov.

§ *Sticherus.* Rhizoma repens, paleis rigide ciliatis fusco-castaneis deltoideis minutis perpaucis praeditum. Folia suberecta; stipes nudus, glaber, apice trifurcatus; brachia lateralia unijuga, ter dichotoma, gemmis inclusis omnibus abortivis; internodi primarii et secundarii basi solum segmenta parva pauca ferentes, tertiarii partim vel interdum omnino pectinati; pinnae lineares, pinnatisectae, rhachibus paleis patentibus basi fusco-castanea adpressis apice pallidiore dissectis onustis, costis paleis similibus sed minoribus praeditis; segmenta linearia, tenere herbacea, glabra, infra pallide papillata; venae

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

25–30-jugae, furcatae, pleraeque infra parce et minute filamentoso-paleaceae; sori inframediales.

Plants of medium size. Rhizome wide-creeping, 3–4 mm. in diameter, dark brown, nearly naked; scales few or mostly caducous, elongate-deltoid, acuminate, 1–1.3 mm. long, dark castaneous, thick, rigidly ciliate; stipe pale brown from a dark base, smooth, naked, glabrous, about 70 cm. long, bearing a single pair of lateral branches, the included bud giving rise to a slowly developing primary axis; lateral branches 30–35 cm. long, thrice dichotomous, the internodes diverging at an angle of 30°–40°; included buds dormant, the scales similar to those of the rhizome, but thinner, paler, and more laxly ciliate; first internodes 5–13 cm. long, naked except for 2 or 3 small segments at inner base; second internodes 4.5–7 cm. long, bearing 2 or 3 small segments at inner base; third internodes 2.5–6 cm. long, partially or sometimes wholly pectinate; pinnae mostly diverging at an angle of 40°–50°, linear, acuminate, 16–22 cm. long, 2.5–4.5 cm. broad, pectinately pinnatisect, the sinuses acutish; rachis of pinnae persistently paleaceous beneath, the scales about 1 mm. long, similar to those of the buds, the dark castaneous base closely appressed, the apical portion paler and filamentous, above very delicately paleaceous, the scales substellately dissected, with filiform divisions; segments 45–60 pairs, linear, 1.3–2.5 cm. long, 2–2.5 mm. broad, pale-papillate beneath, thin-herbaceous; midribs paleaceous beneath, the scales like those of the costa or paler and with more numerous filiform divisions; veins 25–30 pairs, barely elevated beneath, once forked, at first bearing a few filamentous scales, often naked with age; sori inframedial, 3–6-sporangiate.

Type in the herbarium of Field Museum of Natural History, no. 535,597, a somewhat immature plant collected at Playapampa, Peru, altitude about 2,700 meters, June 16–24, 1923, by J. Francis Macbride (no. 4510); isotype in U. S. National Herbarium, no. 1,193,440. A more mature specimen of somewhat simpler structure, but doubtless to be referred here, is *Macbride* 2217, from a locality 12 miles south of Panao, Peru, elevation about 3,000 meters; likewise a fragment from Altura de Lecre,

altitude 3,000 meters, *Bues* 1537. Also, as represented in the National Herbarium, *Ruiz* 28 (4559) from Peru is the same, in mature condition.

The present species is related to *D. rubiginosa* (Mett.) Maxon, of the northern Andes, but that species is at once distinguished by its much broader, closer, rigidly coriaceous segments, which as a rule are strongly pruinose beneath, and by its very much larger, bright ferruginous, lanceolate scales, borne abundantly along the rachises and secondary internodes beneath.

Polypodium tuberosum Maxon, sp. nov.

§ *Phymatodes.* Ob rhizomatis tubera concava paleacea cum *P. bifrons* Hook. et *P. Brunei* Werckle solum consociandum, foliis ut in illis valde biformibus. A priore foliis sterilibus ovalibus, integris vel subintegris, coriaceis (nec angustis, grosse dentatis, membranaceis) inter alia longe recedit; a posteriore foliis sterilibus multo majoribus et crassioribus, etiam rhizomatis et tuberorum paleis sat differt; et ambobus soris maximis vel aetate plerumque confluentibus vel in coenosorum verum conjunctis conspicue dissimile est.

Epiphytic. Rhizome funiform, 2–3.5 mm. thick, sparingly branched, minutely appressed-paleaceous, the scales firm, castaneous with pale erose-denticulate borders, varying from rotund or subovate and about 0.5 mm. long to ovate, long-acuminate, and 1.5 (rarely 2) mm. long, lightly peltate, contiguous to imbricate, mostly persistent; tubers few, sessile, subglobose, cavernous, 5–10 mm. thick (doubtless very immature), covered with firm, imbricate, ovate-attenuate, castaneous scales. Fronds 1–3 cm. apart, simple, exstipitate; sterile blades oval or broadly oblong, 3–5 cm. long, 2–2.5 cm. broad, rounded-truncate or very broadly cuneate at base, rounded or barely acutish at apex, entire or occasionally sinuate, elastico-coriaceous, translucent, brownish, glabrous, nearly naked at maturity, a few minute elongate scales discernible on the lower surface and rarely the margins; main lateral veins 8–11 pairs, oblique, dark, prominulous; costal areoles small, in an incomplete

series; paracostal areoles large, transversely divided or not; minor areoles various, mostly with 1–3 short, recurved included venules. Fertile blades linear, 8–11 cm. long, 8–13 mm. broad, long-attenuate at base, acutish at blunt apex, entire or lightly sinuate; sori superficial, copiously paraphysate, oval, very large, 5–8 mm. long, contiguous and mostly confluent at maturity, or a majority structurally joined in a thick linear coenosorus 3–5 mm. broad, 1–1.5 mm. distant from the stout elevated costa, reaching nearly to the margin, and extending from near the apex to a point 2 or 3 cm. distant from base of blade.

Type in the U. S. National Herbarium, no. 1,022,962, collected in the vicinity of La Chonta, Ecuador, October 16, 1918, by J. N. Rose, A. Pachano, and George Rose (no. 23468). There is a second specimen of the same collection.

This is the third "tuberous" *Polypodium*, subgenus *Phymatodes*, to be described from tropical America. All have dimorphic fronds. From *P. bifrons* Hook.,[2] which is now known from Colombia, Ecuador, and Peru, *P. tuberosum* differs very widely in its coriaceous, entire or subentire blades (those of *P. bifrons* being membranous, the sterile ones deeply dentate-lobate) and in its sori, which are largely confluent, forming true coenosori. In the latter respect it differs markedly from *P. Brunei* Werckle[3] also, and in the shape and more pronounced dimorphism of the fronds. The type specimen bears the note "with bulbs," but mature tubers (if any were present) have been lost, only two small inconspicuous ones now being attached to the rhizome. Further material will presumably show a chambered interior similar to that described for *P. bifrons* and *P. Brunei*. These "pouch-like urns," as Bower calls them, are inhabited by ants, but the association is not regarded as symbiotic.

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[2] Fil. Exot. *pl. 52*. 1858.
[3] Bull. Soc. Bot. Genève, II. 1: 221. 1909.

They are currently looked upon as water-storage structures, serving to tide the plant over unfavorable seasons. Their structure and function have been discussed by several writers.[4]

Shorter Notes

CYRTOMIUM FALCATUM WINTERING OUTDOORS IN PENNSYLVANIA.—The Asiatic Holly-fern, *Cyrtomium falcatum* (L. f.) Presl, has been recorded as an escape from cultivation in the mild climates of Florida and Alabama,[1] and the writer has also observed it growing luxuriantly on the grounds of the Howard estate at Biloxi, Mississippi. A related species, the Toothed Holly-fern, *C. caryotideum*, has been recorded as a volunteer in a garden in Louisiana.[2] These subtropical ferns would scarcely be expected to survive outdoors much farther north, however. In a recent list of the ferns of Charleston, South Carolina, the occurrence of the Holly-fern as an escape there was noted, but with the prediction that it would not survive a really cold winter.[3] Nevertheless there have been two reports of its winter survival in colder regions, viz. near Orange, New Jersey (no details as to habitat given)[4] and at Cromwell, Connecticut,[5] in an old well. And Dr. Maxon has had it winter over in his garden in Washington, D. C.

The writer's experience indicates that the Holly-fern

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[4] Senn, G. Die Knollen von *Polypodium Brunei* Werckle. *In* Verhandl. Naturf. Ges. Basel 21: 115–125. *fig. 1–6.* 1910.
Christ, H. Die Geographie der Farne, 96–99. *fig. 68, 69.* 1910.
Ule, E. Ameisenpflanzen. *In* Bot. Jahrb. Engler 37: 335–349. 1906.
Bower, F. O. The Ferns (Filicales) 1: 43, 44. *fig. 51.* 1923.
Goebel, K. Organographie der Pflanzen, Teil 2, Bryophyten-Pteridophyten, ed. 3, 1170. *fig. 1234.* 1930.

[1] Broun, Index N. Amer. Ferns, p. 54, 1938; see also Small, Ferns of the Southeastern States, p. 202. 1938.

[2] Brown & Correll, Ferns of Louisiana, p. 66. 1942.

[3] K. W. Hunt, Charleston Museum Leaflet No. 17. Dec., 1942.

[4] R. C. Benedict, This JOURNAL 23: 63. 1933.

[5] F. C. Hubbard, This JOURNAL 21: 76. 1931.

may not be so intolerant of frost as usually supposed. In June, 1941, a plant which had been purchased from a florist and kept indoors over the preceding winter was removed from the pot and set out in the ground. The location, chosen at random, was under a rose bush and a small tree of *Pinus virginiana*, on the west side of the house, in Swarthmore, Pennsylvania, altitude about 100 ft. above sea-level. The soil is heavy, acid clay, which becomes dry and hard during the summer, when rain is infrequent, but the wind blows in a layer of maple and sycamore leaves which serve as a mulch. During a four-months absence the plant was left to itself, but in October was observed to be in healthy condition. The intention had been to repot it and take it indoors again, but there was no opportunity to do so before cold weather had set in. As it unexpectedly proved uninjured by several successive frosts I left it to winter in the open, to see what would happen. The old fronds withered away, but healthy croziers appeared in May and four or five normal sterile fronds unfolded during the season.

Again it had to be left to its own resources for four months, but proved able to withstand the recurring droughts and floods of that summer. Exposure to a second winter seemed worth trying. This time (1942–43) the weather conditions were severe, with two periods of near-zero temperature and many snowfalls and alternations of freezing and thawing. Yet now, as spring opens in 1943, several shoots are pushing through the litter. Evidently the vitality of the Holly-fern is not easily destroyed.—FRANK G. SPECK, *University of Pennsylvania.*

PELLAEA GLABELLA ON MASONRY.—That the Smooth Cliff-brake may become more luxuriant on masonry than on natural rocks was noted by Knight[1] at a Virginia locality. In southeastern Pennsylvania the same rela-

[1] This JOURNAL 29: 32. 1939.

tion holds, our largest colonies being on masonry in Berks and Bucks counties. For some years commuters on the Chestnut Hill branch of the Reading railroad have been commenting on the development of fern clumps in the retaining wall south of Mt. Airy station, in Philadelphia County. These prove unexpectedly to represent the Smooth Cliff-brake, for there are no calcareous cliffs where this fern might be native in that vicinity.

Before the advent of civilization, *Pellaea glabella* grew on dolomite lenses in an outcrop of soapstone at the northwest corner of this county, 4 miles as the spore blows from the wall under consideration. One of the earliest known collections of this species—then not differentiated from *P. atropurpurea*—was made there: *A. H. Smith*, July, 1861 (Herb. University Pennsylvania). This station was later destroyed by quarrying operations, but the fern persisted on nearby masonry, from which it was collected July 2, 1902, by S. S. Van Pelt (Herb. Academy Natural Sciences, Philadelphia). This too seems to have been destroyed, but the spores could have reached the Mt. Airy wall before that happened. There are or were other colonies on limestone cliffs along the Schuylkill River 7 to 10 miles away, and still others persist 20 and 40 miles to the north. Evidently the spores of such ferns can be blown many miles and colonize weathered masonry.—EDGAR T. WHERRY.

NEW STATIONS FOR EQUISETUM HYEMALE VAR. JESUPI F. MULTIRAMEUM.—The few published records for *Equisetum hyemale* L. var. *Jesupi* (A. A. Eaton) Vict. forma *multirameum* (Blake) Vict. indicate that this form is known only from Maine, Vermont, Michigan, and Quebec. In the Chrysler Herbarium at Rutgers University there are two specimens from New Jersey; one is from Blairstown, Warren County, August 2, 1931, *Loughridge*, and the other from The Glen, Sparta, Sussex County, June 5, 1929, *Chrysler*. Also, in the herbarium of the Brooklyn

Botanic Garden there is a specimen from Lake George, New York, August 1898, *Hulst.*

Broun in his "Index to North American Ferns" calls this form *Equisetum trachyodon* A. Br. f. *multirameum* (Blake) Broun, but gives no reason for doing so. The specimens which I have examined key down to *Equisetum hyemale,* not to *E. trachyodon,* and I have thought it best to follow the treatment given by Victorin in his "Les Equisetinées du Quebec." This form is distinguished by having the fertile stems with 1 to 7 many-jointed branches arising from the upper nodes.—WILLIAM F. RAPP, JR., *Highland Park, New Jersey.*

NEW BOTRYCHIUM FINDS IN WEST VIRGINIA.—On June 17, 1943, during the Brooks Bird Club field trip to Terra Alta, Preston County, West Virginia, Miss Edith Dobbins and Legg were hunting ferns along the bank of a road near Lake Terra Alta. In a shady, weedy spot a small colony of Dwarf Grape-fern (*Botrychium simplex* var. *tenebrosum*) was found. No extensive search for additional plants was made at the time, but two specimens were taken. Legg's specimen was, unfortunately, lost, but Miss Dobbins sent hers to Brooks for identification, and subsequently presented it to the herbarium of West Virginia University, where it constitutes a new record for the state. According to Wherry,[1] the nearest stations to West Virginia for this little circumboreal fern are in Philadelphia County, Pennsylvania, and Howard County, Maryland.

Brooks visited the Terra Alta locality on July 30, 1943, finding the station without difficulty. Around a dozen plants of *Botrychium simplex* were located, and with them were found about the same number of plants of *Botrychium lanceolatum* var. *angustisegmentum.* The

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[1] Wherry, Edgar T. Guide to Eastern Ferns. Second Edition. Science Press, Lancaster, Pa. 1942.

latter has previously been reported from Randolph and Pocahontas Counties, West Virginia, but in both cases the single specimen found became misplaced, so the two specimens taken by Brooks and deposited in the West Virginia University herbarium are the first to be preserved.

The station for the two Botrychiums is along the Cranesville highway one mile north of Terra Alta, on a northeast-facing slope well covered with weeds and grasses. It is worth noting that every *Botrychium* thus far recorded from West Virginia is to be found in the immediate locality.—W. C. LEGG, *Mt. Lookout, W. Va.*, and MAURICE BROOKS, *West Virginia University, Morgantown, W. Va.*

NOTE ON DRYOPTERIS CELSA.—In 1899 William Palmer described *Dryopteris Goldiana* subsp. *celsa* in the Proceedings of the Biological Society of Washington, vol. 13, p. 65. However, in the index to volume 13 this is listed as *Dryopteris celsa.* At that time it was the practice of the editors of the Proceedings to index all names as binomials, regardless of their status in the text. This usage is reprehensible, but should not occasion any difficulties. These binomials, which were used doubtless for the sake of simplicity, were in no sense intended as new combinations, and should not be so considered.

In Broun's Index to North American Ferns the authority for *D. celsa* is given as "Palmer, Knowlton and Cook." These men were the editors of the Proceedings during 1899, but the index to the volume did not appear in 1899 as given by Broun, not having been issued until March 9, 1901. It is not certain whether the editors for 1900 (Knowlton, Palmer and Pollard) prepared the index, or whether that was done by the editors for 1901 (Pollard, Palmer and White). However, this point is not of importance. If this use of the name is to be men-

tioned at all, it should be cited, as it is in the Gray Herbarium Card Index and the Gray Herbarium Exsiccatae (no. 1003): *Dryopteris celsa* Anon. in Index. However, "Anonymous" is not a proper authority. Small in his "Ferns of the Vicinity of New York" (1935, p. 105) uses the name *Dryopteris celsa*, but the nomenclatural basis is not given. The first valid combination was made by Small in 1938 and the proper citation is as follows: *Dryopteris celsa* (Wm. Palmer) Small, Ferns of the Southeastern States 477. 1938.—C. V. MORTON, *Smithsonian Institution.*

American Fern Society

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Dr. C. Stuart Gager

In the recent death of Dr. Gager the American Fern Society has lost one of its strong supporters. Although Dr. Gager was a member for only a short time, his interest and effective support date back almost 30 years, to 1915, when the writer was accorded laboratory and greenhouse space for fern research. At the start, help to the Fern Society was incidental; but as time passed, the Brooklyn Botanic Garden, through Dr. Gager's interest and hospitality, came to accord greater and greater support to our activities. Repeatedly, meetings of the Fern Society have been held at the Brooklyn Garden. A program for the conservation of native plants, sponsored in a Fern Journal article in 1922, was amplified in effect by the reprinting of a special article, "Game Laws for Ferns and Wild Flowers," jointly by the Botanic Garden and the Fern Society, with a circulation of many thousands of copies. Leaflets on native ferns in need of protection were issued also by the Garden. Repeated cultures of the Hart's-tongue were raised, and hundreds of plants were distributed as a demonstration of one way in which rare species can be preserved.

Many other phases of fern research were made possible and the results announced through the Garden's support. Although Dr. Gager did not himself carry on research relating to ferns, it is a matter of interest that in his first text in botany, "Fundamentals of Botany" (1916), he used the life history of the fern as the beginning of his main section dealing with plant groups in general.

It was, however, in the general administrative and editorial phases of the American Fern Society and the American Fern Journal that Dr. Gager's help proved of inestimable value. The Garden has repeatedly expanded facilities for the Fern Society. When Mr. Winslow felt that he had to give up the business managership, the

Garden made space for the storage of all back numbers of the Journal—space which has greatly expanded year after year. A little later, arrangements were made for the deposit of the Fern Society Library in the stacks of the Botanic Garden Library. Soon after, study by members of the Society was greatly aided by making the fern books of the Botanic Garden Library also available for loan to Fern Society members. At this time a Fern Society Librarian was appointed, the position now being held by Miss Hester M. Rusk, of the Botanic Garden staff. In 1934 Dr. Henry K. Svenson, of the Botanic Garden, accepted the treasurership of the Fern Society. His service and that of other members of the Garden staff have since contributed greatly to the gradual rebuilding of the Society's financial condition. In January, 1941, the Fern Society's herbarium was transferred to the Garden as a repository, and Miss Rusk added the duties of Curator to those of Librarian. A more recent instance of cooperation has been the addition of a considerable number of new lantern slides of ferns to the Garden collection and making them available for loan to Society members. The slides also are in Miss Rusk's care.

The foregoing may seem to be chiefly a recital of contributions of one institution to a botanical society. The fact of the matter is, however, that the facilities of the Brooklyn Botanic Garden were originally made available, and the subsequent expansion of these facilities which the Society now enjoys were made possible, through the belief of Dr. Gager in the value of the work of the Society, and through his personal interest in promoting its welfare. It is difficult to imagine that the Society would have been able to make the very considerable growth which the years since 1915 have shown, and to have reached its present maximum, without the support he gave it so freely.—R. C. B.

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ERRATA

Page 50, line 23; for DISCOLOR read BICOLOR.
Page 50, line 35; for *discolor* read *bicolor*.
Page 51, line 12; for *discolor* read *bicolor*.