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In the shape of its pinnae *A. mixtum* is truly intermediate, for whereas in *A. platyneuron* these are linear to linear-oblong or elliptical from a cordate, auriculate or subhastate base, which overlies the rachis (often widely so), and in *A. Trichomanes* are roundish-oval or oblong from a narrowly cuneate base, in the hybrid they are triangular, with a truncate or very bluntly cuneate base, which merely lies close to the rachis. Also the margins are evenly denticulate, being thus intermediate between the undulate-crenate or lightly bicrenate margins of *A. Trichomanes* and the serrate, biserrate, or variously incised condition shown by *A. platyneuron*. Furthermore, although the indusia are ample and perfectly formed, the fronds having been collected at the season of normal maturity, the sporangia are very few, nevertheless, and are apparently abortive.

The hybrid origin of *A. mixtum* seems to me beyond question.

WASHINGTON, D. C.

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## Pteridophytes of Sierra Ancha, Arizona

ELBERT L. LITTLE, JR.<sup>1</sup>

Specimens of 28 species of pteridophytes and 1 additional variety, including 24 species of true ferns and 4 species of fern allies, were collected on Sierra Ancha, Arizona, from 1935 to 1937. As Arizona has no published State flora, possibly this relatively large local list may be of interest to students of distribution.

Sierra Ancha is located in the central part of the State, by air line about 25 miles north of Globe and 15 miles

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northeast of Roosevelt Reservoir in the Tonto National Forest, Gila County. It rises gradually from about 2,100 feet above sea level at Roosevelt Reservoir to about 7,800 feet at the highest point. In origin it is not volcanic, as are many of Arizona's mountains, but is composed mainly of quartzite with intrusions of diabase. There are also some small outcrops of sandstone and limestone.

The collection was made mainly in and in the vicinity of Sierra Ancha Experimental Forest, branch station of the Southwestern Forest and Range Experiment Station, located at an elevation of about 5,000 feet on the southwest side of the mountain. Pteridophytes of all the species listed grow within 5 miles of this station but in a wide altitudinal distribution from about 3,000 feet up to 7,800 feet above sea level. Members of all except 5 species have been found inside the drainage of Parker Creek Canyon.

The vegetation of Sierra Ancha will be summarized briefly as the basis for notes on the zonal distribution and habitat of pteridophytes. Three climatic or life zones are represented: (1) semidesert, or Lower Sonoran life zone, from Roosevelt Reservoir to an elevation of about 3,500 feet; (2) chaparral-woodland, or Upper Sonoran zone, roughly from 3,500 feet to 6,000 feet; and (3) pine-fir forest, or transition zone, above 6,000 feet. While precipitation varies greatly from year to year within each zone, the annual precipitation is about 18 inches in the semidesert area, 25 inches in the chaparral-woodland zone, and 30 inches in the pine-fir forest.

The semidesert vegetation, which varies locally in composition, is characterized by scattered xerophytic shrubs and trees with weeds and grasses between them. Dominant woody plants include jojobas or "coffeeberries" (*Simmondsia californica*), paloverdes (*Cercidium* spp.),

and cacti (*Opuntia* spp.). In the Upper Sonoran zone the vegetation-type is chaparral of broad sclerophyll shrubs with some open areas occupied by perennial grasses. Dominant chaparral species are shrub live oak (*Quercus turbinella*), mountain-mahogany (*Cercocarpus breviflorus*), and Gregg hornbush (*Ceanothus greggii*). On the more moist sites are oak-woodland stands of broad sclerophyll trees, in which Emory oaks (*Quercus emoryi*) and Arizona white oaks (*Quercus arizonica*) are dominant. The pine-fir forest has as its dominant species ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga taxifolia*). Small stands of aspens (*Populus tremuloides* var. *aurea*) occur near the mountain top.

The pteridophytes of Sierra Ancha are most numerous both as individuals and species in the chaparral-woodland zone, but, in general, are not common. Species of the list most commonly represented in the semidesert zone are *Selaginella arizonica* and *Pellaea longimucronata*. In chaparral vegetation *Cheilanthes wrightii* and *Pellaea longimucronata* are perhaps the most commonly represented species. *Pteridium aquilinum* var. *lanuginosum* is abundantly represented in both oak-woodland and pine-fir zones, and *Cheilanthes fendleri* is characteristic also of the latter zone.

Usually the pteridophytes occur on rock outcrops, in crevices of quartzite cliffs and in the shade of boulders. Around rocks the supply of soil moisture is probably greater and conditions are more favorable for growth, especially of gametophytes. The presence of extensive areas of cliffs and stony soils is probably an important factor in the occurrence of a wide representation of pteridophyte species on Sierra Ancha but is supplementary, of course, to the great range in elevation.

Of special interest are the adaptations of pteridophytes of various xerophytic species to limited water supply in

dry seasons. Lipferns (*Cheilanthes* spp., with the exception of *C. wrightii*) have mats of scales and hairs over the fronds which probably aid both in reduction of transpiration and in absorption of water. Absorption of water directly through the leaves seems to be rather common in xerophytic ferns. These ferns exhibit hygroscopic movements, such as curling parts of their fronds into compact masses when dry and unrolling them into flat blades when wet. A curled or rolled frond will unroll when water is added directly to the frond. A detached frond will even unroll when inverted with only the blade in water. Ferns of Sierra Ancha that exhibit hygroscopic movements and adaptation for absorption of some rain water directly through their leaves include *Cheilanthes* spp., *Notholaena* spp., *Bommeria hispida*, and *Pityrogramma triangularis* var. *maxoni*. Similar adaptations were observed in selaginellas (*Selaginella arizonica*), in which the scalelike leaves are tightly appressed when dry and widely spread when moist. Gray, dry selaginella mats quickly become green as the leaves absorb rain water.

For assistance in checking the determinations of specimens, the author is indebted to Jack Whitehead, of the Boyce Thompson Southwestern Arboretum, and to Dr. William R. Maxon, curator of the United States National Herbarium. Duplicate sets of specimens have been deposited in those institutions, also in the herbarium of the University of Arizona, and in the U. S. Forest Service herbaria at the Sierra Ancha branch station and in Washington, D. C.

The pteridophytes of Sierra Ancha represent 24 species and 1 additional variety of *Polypodiaceae*, 3 species of *Equisetaceae*, and 1 species of *Selaginellaceae*. The largest genera are *Cheilanthes* (lipferns, 6 species), *Notholaena* (cloakferns, 5 species and 1 variety), *Pellaea* (cliffbrakes, 4 species), and *Equisetum* (horsetails, 3 species).

The remaining 10 species are distributed among an equal number of genera.

In distribution, the members of these species are principally those of the semiarid Southwest. Only 8 of the species are represented in the eastern part of the United States: *Adiantum capillus-veneris*, *Asplenium resiliens*, *Cystopteris fragilis*, *Pellaea atropurpurea*, *Pteridium aquilinum*, *Equisetum arvense*, *E. kansanum*, and *E. praealtum*. On Sierra Ancha all except the first one of these 8 species are confined to the higher mountain zones, where the flora is more nearly related to that of the North and East.

Still fewer species of the list are distributed on the Pacific Coast. The record of one of these, *Dryopteris arguta*, represents the second locality of the species reported in Arizona.

The list of species with notes on abundance, habitat, and zonal distribution follows:

### POLYPODIACEAE

*ADIANTUM CAPILLUS-VENERIS* L. Found only at the lower end of Parker Creek Canyon in the semidesert zone. Here the plants are common on constantly moist and shaded deposits of calcium carbonate on the canyon walls.

*ASPLENIUM RESILIENS* Kunze. Rare on a shaded limestone cliff in an oak-woodland.

*BOMMERIA HISPIDA* (Mett.) Underw. Common on exposed rocky slopes in the chaparral-woodland zone.

*CHEILANTHES EATONI* Baker. Uncommon in rock crevices in the chaparral-woodland zone.

*CHEILANTHES FEEI* Moore. Rare on dry limestone outcrops in the chaparral zone.

*CHEILANTHES FENDLERI* Hook. Common among rocks in chaparral-woodland and pine-fir forest zones.

*CHEILANTHES LINDHEIMERI* Hook. Uncommon in rock crevices in the chaparral-woodland zone.

*CHEILANTHES WOOTONI* Maxon. Uncommon on rock outcrops in the chaparral-woodland zone and rare in the semidesert zone.

*CHEILANTHES WRIGHTII* Hook. Common on open, rocky areas in the chaparral-woodland zone and rare in the semidesert zone.

*CYSTOPTERIS FRAGILIS* (L.) Bernh. Uncommon on shaded soil and rock outcrops in the pine-fir forest along Workman Creek.

*DRYOPTERIS ARGUTA* (Kaulf.) Watt. A single large plant was found at the base of a boulder in the oak-woodland along Parker Creek Canyon. This is the second Arizona locality for the species, specimens of which have been found in Devil's Canyon near Superior, about 35 miles south. The Arizona specimens have recently been cited by Dr. William R. Maxon, Notes on American Ferns—XXI. AMER. FERN JOURN. 27: 109–111. 1937.

*NOTHOLAENA BONARIENSIS* (Willd.) C. Chr. Rare in rock crevices in the chaparral zone.

*NOTHOLAENA LIMITANEA* Maxon. Rare at one station on limestone rock at the upper border of the semidesert zone.

*NOTHOLAENA PARRYI* D. C. Eaton. Uncommon at a single station on limestone rock at the upper border of the semidesert zone. These minute, very hairy ferns represent an extreme in xerophytic appearance.

*NOTHOLAENA SINUATA* (Sw.) Kaulf. Uncommon in rocky soil in the chaparral-woodland zone and rare at the upper edge of the semidesert zone.

*NOTHOLAENA SINUATA* (Sw.) Kaulf. var. *INTEGERRIMA* Hook. Uncommon on rocky soil in the semidesert zone. Although generally found here at a lower elevation, in one place members of the variety were growing associated with those of the species proper.

*NOTHOLAENA STANDLEYI* Maxon. Uncommon in rock crevices of the semidesert and chaparral-woodland zones. Individuals of this species with their pentagonal fronds and yellow lower surfaces are among the most beautiful of the small southwestern xerophytic ferns and should be worthy of cultivation as ornamentals.

*PELLAEA ATROPURPUREA* (L.) Link. Uncommon in rocky soil of chaparral-woodland and pine-fir forest zones.

*PELLAEA INTERMEDIA* Mett. Uncommon in rocky soil in the chaparral-woodland zone.

*PELLAEA LONGIMUCRONATA* Hook. Rather common among rocks in semidesert, chaparral-woodland, and open pine zones.

*PELLAEA WRIGHTIANA* Hook. Uncommon in rocky soil in the chaparral-woodland zone.

*PITYROGRAMMA TRIANGULARIS* (Kaulf.) Maxon var. *MAXONI* Weatherby. Rare in rock crevices of the chaparral-woodland zone.

*PTERIDIUM AQUILINUM* (L.) Kuhn var. *LANUGINOSUM* (Bong.) Fernald. Abundant on soil sites in the undergrowth of oak-woodlands, pine-fir forests, and aspen forests. In these areas individuals of this species are far more numerous than those of all other pteridophyte species combined. The largest ferns of the area, they average  $1\frac{1}{2}$  to 2 feet in height but reach a maximum height of 4 to 5 feet.

*WOODSIA MEXICANA* Fée. Uncommon in rock crevices of oak-woodlands and pine-fir forests.

*WOODWARDIA FIMBRIATA* J. E. Smith. Rare in moist soil near stream, pine zone.

### EQUISETACEAE

*EQUISETUM ARVENSE* L. Common along streams and abundant in a cleared field in the pine-fir zone.

*EQUISETUM KANSANUM* Schaffner. Uncommon along Rose Creek in the pine-fir forest zone.

*EQUISETUM PRAEALTUM* Raf. Common in moist soils at borders of streams in the pine-fir forest zone.

### SELAGINELLACEAE

*SELAGINELLA ARIZONICA* Maxon. Common in the semi-desert and chaparral zones, where the plants form extensive mats on exposed rock outcrops and stony soils.

FLAGSTAFF, ARIZONA

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## **The Longevity of *Osmunda Cinnamomea* with Notes on Some Fern-Feeding Larvae**

HENRY BIRD

Four very diverse ferns serve as food-plants for an equal number of conspicuous lepidopterous larvae of endophytic, or boring habit, the latter however belonging to a single, compact genus. The adult insects maturing therefrom find a place systematically in the Noctuid group of moths generically known as *Papaipema*.

They should not be classed as particular enemies of the ferns because their work does not cause the demise of the plant, only the loss of a frond or two, or a section of the root as the case may be. In a way they are beneficial because they act as hosts for a great diversity of parasites which affect other species also, thus serving to work out that wonderful and little appreciated balance that occurs in the insect world.

While the ferns possess such a background of antiquity geologically, this *Papaipema* group suggests a new branch on its phylum, being confined to temperate North America and not very fixed in certain of its fifty-odd species. In most cases each confines itself to a preferred food-plant, often of a genus confined to America, and their unerring choice of a certain species of *Solidago*, *Aster*, *Laciniaria* and of other large genera brand them as belonging in good botanical company.