FERNS OF NORTH AMERICA.
THE FERNS OF NORTH AMERICA.

COLORED FIGURES AND DESCRIPTIONS,

WITH SYNONYMY AND GEOGRAPHICAL DISTRIBUTION,

OF THE

FERNS

(INCLUDING THE OPHIOGLOSSACEÆ)

OF THE

UNITED STATES OF AMERICA
AND THE BRITISH NORTH AMERICAN POSSESSIONS.

BY

DANIEL CADY EATON,

PROFESSOR OF BOTANY IN YALE COLLEGE.

THE DRAWINGS BY J. H. EMERTON AND C. E. FAXON.

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CONSPECTUS
OF THE
FERNS DESCRIBED IN THIS WORK.

Synopsis of the Genera.

COHORT FILICINEÆ.

Vascular Cryptogamia having leaves or fronds usually raised on a stalk, rising commonly from a creeping or assurgent or even erect root-stock, and bearing on the back or margins sporangia containing spores of but one kind, which in germination produce a minute cellular prothallus, on which are borne antheridia and archegonia, the latter after fertilization producing a new plantlet. Stems never hollow, nor covered with subulate leaves.

ORDER FICICES.

Leafy plants; the leaves or fronds circinate in vernation, rising from a root-stock and bearing reticulated sporangia which are homologous with leaf-hairs, being outgrowths from the epidermis. Prothallus above ground, green, monocious, in some cases producing new plants from unfertilized archegonia. The sporangia are usually collected in little masses called sori, which are oftenest found on the veins or at the tips of the veins, and are often covered either by a little scale (indusium) produced from the epidermal cells, or by a general involucre formed from the recurved margin of the frond or its divisions.

The characters of all the usually recognized suborders are indicated below, though but four of them are represented in our Flora.

SUBORDER I. POLYPODIACEÆ.

Sporangia globular, or slightly flattened laterally, collected in patches, lines or dots of various shapes, stalked, and provided with a vertical incomplete many-jointed ring which straightens at maturity and discharges the very minute spores, the sporangium opening by a transverse split across the side not occupied by the ring.—Terrestrial ferns.

TRIBE I. ACROSTICHEÆ. Sporangia collected in large or indefinite masses on the back of the frond, or entirely covering its ultimate divisions; indusium none.

1. Acrostichum. Sporangia covering the whole lower surface of the frond or of some of its upper pinæ.

TRIBE II. POLYPODIEÆ. Sori round or oblong, placed on the veins or at the ends of the veins; indusium none. Stalk articulated to a slightly prominent knob of the usually elongated creeping root-stock. Veins free or variously reticulated.
2. Polypodium. The only genus of the tribe.

Tribe III. Grammitidæ. Sori more or less elongated, without indusium, superficial, placed on the back of the frond or its divisions, and usually following the veins, or only near the tips of the latter and near the margin. Fronds sometimes scaly or tomentose, or covered beneath with colored powder.

3. Gymnogramme. Sori much elongated, following the veins, and like them often branched or reticulated.

4. Notholesna. Sori but little elongated, often of very few sporangia, placed below the tips of the veins near the margin of the divisions of the frond.

Tribe IV. Vittaridæ. Sori much elongated, borne in a continuous furrow which is often marginal or sub-marginal.

5. Vittaria. Fronds simple, narrowly linear, the sporangia mixed with paraphyses or abortive sporangia.

Tribe V. Pterididæ. Sori close to the margin, sometimes extending partly down the veins, covered, at least when young, by an involucre opening inwards and either consisting of the margin or produced from it.

6. Cheilanthes. Sori minute, at the ends of the unconnected veins, covered by a usually interrupted involucre.—Small ferns, often woolly, chaffy or pulverulent.

7. Pellsea. Sori near the ends of the veins, often confluent. Involucre membranaceous, continuous round the pinnules. Sterile and fertile fronds much alike and smooth; the stalk dark-colored.

8. Cryptogramme. Sori extending down the free veins. Involucre very broad, at length flattened out and exposing the now confluent sori. Sterile and fertile fronds unlike, smooth; the stalk light-colored.


10. Adiantum. Sporangia borne at the ends of the veins, on the under side of the reflexed margin of the frond. Midvein of the pinnules mostly eccentric or dissipated intoforking veinlets. Stalk dark-colored.

Tribe VI. Blechnidæ. Sori more or less elongated, borne on a fruiting veinlet or on a special receptacle parallel to the midrib, either near it or remote from it, and provided with a special usually concave or arched indusium attached to the receptacle outside the sori and opening along the inner edge.

11. Lomaria. Sori continuous from the base of the pinna to its apex, the receptacle nearer the margin than the midvein. Fronds in our species once pinnate, the fertile ones with contracted pinnae.

12. Blechnum. Sori continuous from the base of the pinna to its apex, rarely interrupted, the receptacle parallel to the midrib and close to it, or sometimes between it and the margin. Involucre a special organ, never formed from the margin. Fronds in our species pinnate, the pinnae articulated to the rachis.

13. Woodwardia. Sori interrupted, forming a chain-like row each side of the midvein. Fronds in our species ample, compound; the veins reticulated.

Tribe VII. Asplenidæ. Sori more or less elongated, borne on veins oblique to the midvein, covered by a special usually flattened indusium attached to the fertile veinlet by one edge and free on the other.
14. *Asplenium.* Sori on the upper side of the fertile veinlets, less commonly on both sides of them. Veins free in our species.

15. *Scolopendrium.* Sori linear, straight, confluent in pairs, borne facing each other on contiguous veins, the two indusia meeting by their free edges over the sporangia, and at length disclosing the latter between them. Frond simple and veins free in our species.

16. *Camptosorus.* Veins reticulated, many of the sori continuous along two or three sides of the areoles and therefore bent or angled; other sori opposite and facing each other in pairs, and some single on either the upper or lower sides of the veins. Frond simple, the apex slender and elongated.

**Tribe VIII. ASPIDIÆ.** Sori round or roundish, on the back, or sometimes at the tip of the fertile veinlets, naked or provided with a special indusium. Stalk not articulated to the root-stock, the tropical genus *Oleandra* excepted.

* Fertile and sterile fronds nearly alike; receptacle not elevated.
  ➔ Indusium none.

  ➔ Indusium orbicular or reniform.

18. *Aspidium.* Sori round, borne on the back or at the apex of the veinlets; indusium attached at the centre or at the basal sinus, free around the margin. Pinnae not articulated to the rachis. Frond often decompound.

19. *Nephrolepis.* Sori round, at the enlarged apices of the veinlets; indusium reniform with the sinus either broad or narrow. Pinnae articulated to the rachis. Fronds once pinnate.
  ➔ Indusium fixed across the fertile veinlet at the lower side of the sorus, ovate or roundish, very delicate. Small ferns.

20. *Cystopteris.* (Character of the subsection.)
  ** Sterile fronds foliaceous, the fertile frond with contracted and pod-like or berry-like divisions.

21. *Onoclea.* Sporangia on an elevated receptacle, which is half surrounded at the base by an obscure collar-like indusium.

**Tribe IX. WOODSIEÆ.** Sori round, borne on the veins; indusium fixed beneath the sori, saucer-shaped and long-ciliate, or at first globose and at length breaking into several segments.


**Tribe X. DICKSONIEÆ.** Sori roundish, marginal, or submarginal. Indusium cup-shaped or two-valved, its outer part composed of a reflexed lobe of the frond, or more or less united with it.


**SUBORDER II. CERATOPTERIDEÆ.**

Sporangia globose, not collected in sori, scattered on longitudinal veins; the ring very broad, flattened, nearly complete, or imperfect, or obsolete.—Aquatic fern.
24. Ceratopteris. Fertile fronds having the segments with strongly revolute or recurved margins; sterile fronds with broader segments; veins closely reticulated.

**SUBORDER III. CYATHEACEÆ.**

Sporangia roundish or obovate or irregularly cuneate, borne on raised receptacles and forming rounded sori; ring more or less oblique, commonly complete; indusium various, usually cup-like, or wanting.—Mostly tree Ferns; none growing naturally within our limits. (The genera are *Cyathia, Alisphila, Hemitelia, Matonia* and *Diacalpe*.)

**SUBORDER IV. GLEICHENIACEÆ.**

Sporangia sessile, few in a sorus, provided with a broad transverse complete ring. Fronds rigid, often dichotomously branched and producing axillary buds. (Tropical Ferns, the genera being *Platyzoma* and *Gleichenia*, from which *Mertensia* is not different.)

**SUBORDER V. HYMENOPHYLLACEÆ.**

Sporangia sessile on a bristle-like receptacle; the ring transverse and complete. Involucres marginal, at the ends of the veins, cup-shaped or two-valved. Mostly small Ferns with delicately membranaceous fronds.

25. Trichomanes. Involucres cup-shaped or funnel-form.

**SUBORDER VI. SCHIZÆACEÆ.**

Sporangia variously placed, globose or acorn-shaped, opening longitudinally; the ring an apical cap of cells radiating from a central point or minute circular space.

**Tribe I. LYGODIEÆ.** Sporangia attached laterally; the cells of the ring radiating from a central point.

26. Lygodium. Sporangia each with a special indusium. Climbing Ferns, the fruit on narrow lobes of the upper pinnae.

**Tribe II. SCHIZÆEÆ.** Sporangia attached basally; the cells of the ring radiating from a circular space.

27. Schizaea. Sporangia in two or four rows on the narrow divisions of little pinnate (rarely digitate) terminal appendages of the simple or dichotomous fronds.

82. Aneimia. Sporangia in two rows on the narrow divisions of the pinnately stalked lowest pinnae, or on separate pinnate fronds. Fronds pinnately divided.

**SUBORDER VII. OSMUNDACEÆ.**

Sporangia naked, globose, short-pedicelled, reticulated, opening into two valves by a longitudinal slit and having only a vestige of a transverse ring near the apex.—Large Ferns, the bases of the stalks dilated into stipuliform appendages.

29. Osmunda. Sporangia borne on the thread-like divisions of a separate frond or of a special part of a frond; the fruit-bearing portion normally destitute of green coloring matter.

**ORDER OPHIOGLOSSACEÆ.**

Leafy plants; the leaves (*fronds*) simple or branched, often fern-like, erect in vernalation, developed from underground buds formed from one to three years in advance either within the base of the stalk of the old frond or by the side of it, bearing in special spikes or
panicles subcoriaceous exannulate bivalvular sporangia formed from the main tissue of the fruiting segments of the frond. Prothallus underground, destitute of chlorophyll, monocous.

1. Botrychium. Frond with a posterior pinnatifid or compound sterile fern-like segment and an anterior panicoled fertile segment, the separate sporangia in a double row on the branches of the panicle. Bud enclosed in the base of the stalk. Veins free.

2. Ophioglossum. Frond with a posterior simple or forked or palmated sterile segment and one or more anterior or lateral simple spikes of fructification; the connate sporangia in a row along each side of the spike. Buds exterior to the base of the stalk.

Synopsis of the Species.

FILICIES.

1. ACROSTICHUM. L.

1. A. aureum, L. Tall, evergreen: fronds simply pinnate with elliptical or oblong pinnae, having finely reticulated veins; sporangia covering the back of all the pinnae or the upper ones only.—Vol. II. t. lviii. p. 93.—Florida.

2. POLYPODIUM. L.

§ 1. EUPOLYPODIUM. Veins free.

1. P. Plumula, H. B. K. Frond linear lanceolate, 3 to 15 inches long; pinnatifid with very numerous segments scarcely one line wide; veins mostly once forked.—Vol. II. t. lxiii. p. 135.—Florida.

2. P. pectinatum, L. Frond lanceolate, 1 to 3 feet long, much narrowed at the base, pinnatifid with numerous segments 2 to 4 lines wide; veins more than once forked.—Vol. I. t. xlii. p. 317.—Florida.

3. P. vulgare, L. Fronds evergreen, subcoriaceous, 2 to 10 inches long, ovate-oblong to oblong-linear, pinnatifid into linear-oblong obtuse or acute segments, the lowest ones rarely diminished; veins branched into 3 or 4 veinlets.—Vol. I. t. xxxi. p. 237.—Alaska to North Carolina.

4. P. falcatum, Kellogg. Fronds evergreen, thinish, 9 to 15 inches long, broadly lanceolate, pinnatifid into long-acuminate serrate segments; veins with 3 or 4 veinlets.—Vol. I. t. xxvi. p. 201.—Oregon and California.

§ 2. GONIOPHLEBium. Veinlets more or less reticulated, forming one or more rows of areoles each side of the midvein, the areoles often enclosing a free soriferous veinlet.

*Fronds smooth.

5. P. Californicum, Kaulf. Fronds thin or thickish in texture, 3 to 12 inches long, ovate or ovate-oblong, pinnatifid into oblong-linear obtuse or acute, more or less serrate, segments; veins sometimes mostly free, but commonly forming a few areoles along the midveins; sori often oval.—Vol. I. t. xxxi. p. 243.—California.
6. **P. Scouleri**, Hook. & Grev. Fronds very thick and coriaceous, cartilaginous-margined. 2 to 12 inches long, broadly ovate, pinnatifid into broad linear-oblong obtuse segments; areoles regularly formed; sori very large.—Vol. I., t. xxvi., p. 193.—British Columbia to California.

* * Fronds scurfy beneath with appressed scales.

7. **P. incanum**, Swartz. Fronds evergreen, contracted when dry, scurfy beneath with roundish or ovate peltate scales, nearly smooth above, 1 to 6 inches long; pinnatifid into oblong obtuse entire segments; areoles rare in the plant of the U. S.—Vol. I., t. xxvi., p. 197.—Indiana and Virginia to Florida and Texas.

§ 3. **Phlebodium**. Veins forming narrow empty areoles along the midveins, and outside of these larger ones commonly enclosing two veinlets which bear a sorus at their united tips; outside of these are numerous empty areoles.

8. **P. aureum**, L. Fronds subcoriaceous, smooth, usually glaucous beneath, 1 to 3 feet long, ovate; pinnatifid into very large oblong-lanceolate somewhat wavy-margined segments; sori large, forming one or two rows each side the midveins.—Vol. I., t. xvi., p. 115.—Florida.

§ 4. **Campylyneuron**. Primary veins running straight from the midrib to the margin, connected by several rows of arched transverse veinlets, the areoles with free often soriferous veinlets extending from the inner sides of the areoles.

9. **P. Phylliti is**, L. Frond chartaceous, smooth, 1 to 3 feet long, linear-lanceolate, entire; areoles in from 6 to 12 rows, sori in a double row between the primary veins.—Vol. I., t. xlii., p. 321.—Florida.


1. **G. triangulii** Kaulf. Fronds deltoid or pentagonal, 2 to 5 inches long and nearly as wide, pinnate with once or twice pinnatifid pinnae, the lowest pair much the largest; lower surface covered with yellow or white powder.—Vol. II., t. xlviii., p. 15.—British Columbia to California.

2. **G. hisp da**, Mett. Fronds pentagonal, 1 to 3 inches broad and long, pinnate with once or twice pinnatifid pinnae, the lower pair much the largest; upper surface hispid; lower surface tomentose.—Vol. II., t. xlviii., p. 19.—Western Texas to Arizona.


* Fronds scaly beneath.

1. **N. sinuata**, Kaulf. Fronds coriaceous, 6 to 24 inches high, narrowly oblong-linear, pinnate, pinnae numerous, roundish or ovate, obtuse, often sinuate or sinuately lobed, lower surface covered with ovate ciliated scales; upper surface more or less scaly also.—Vol. I., t. xxxix., p. 293.—Texas to Arizona.

* Fronds tomentose beneath.

+ Fronds pinnate with pinnately lobed pinnae.

2. **N. ferruginea**, Hook. Fronds linear-lanceolate, 4 to 12 inches long, subcoriaceous, grayish-villous above, heavily tomentose beneath; pinnae numerous, oblong-ovate, half an inch long, pinnatifid into little oblong lobes.—Vol. I., t. xxxix., p. 297.—Western Texas to Arizona.
CONSPECTUS.

+= Fonds 3 or 4 times pinnate with minute roundish crowded ultimate segments.


4. N. Newberryi, Eaton. Fronds 3 to 6 inches long, oblong-lanceolate, tripinnatifid; ultimate segments 1-2 to 3-4 of a line long, covered, most densely beneath, with a web of very fine whitish hairs. — Vol. I., t. xxxix., p. 301. — Southern California.

* Fronds covered beneath with a white or yellow powder.

+= Fronds once pinnate, the pinnae with sessile segments; inferior basal segments of the lowest pinna elongated and pinnatifid, the other segments entire or nearly so.

5. N. candida, Hook. Frond 2 to 4 inches long, deltoid-ovate, second pair of pinnae larger than the third pair; color of powder mostly white with us, yellow farther south. — Vol. II., t. xlix., p. 21. — Western Texas to southern California. (See end of conspectus.)

6. N. Hookeri, Eaton. Frond 2 to 2 ½ inches long and broad, pentagonal, lowest pair of primary pinnae nearly as large as the rest of the frond; the second pair smaller than the third; powder mostly yellowish. — Vol. II., t. xlix., p. 25. — Western Texas to Arizona.

+= Fronds 3 to 5 times pinnate; primary and secondary pinnae distinctly stalked; ultimate pinnaules very small, oval or 2-3 lobed.

7. N. Fendleri, Kunze. Frond 2 to 5 inches long, broadly deltoid-ovate, 4 to 5 times pinnate; rachis and all its branches flexuous and zigzag, the pinnae alternate; ultimate pinnaules 1 to 2 lines long. — Vol. I., t. ix., p. 65. — Colorado to Arizona.

8. N. dealbata, Kunze. Frond 1 to 3 inches long, triangular-ovate, 3 to 4 times pinnate; rachis and branches straight, the pinnae mostly opposite; ultimate pinnaules scarcely a line long. — Vol. I., t. ix., p. 69. — Missouri to Arizona.

*** * Frond naked beneath, pinnately compound.

9. N. tenera, Gillies. Frond 1 to 4 inches long, oblong or pyramidal-ovate, 1-3-pinnate; ultimate segments 1 to 2 lines long, ovate or sub-cordate, obtuse, smooth and green on both surfaces. — Vol. I., t. xliii., p. 335. — Southern Utah.

5. VITTARIA, SMITH.

1. V. lineata, Swartz. Fronds commonly pendent, narrowly linear, 1 to 3 feet long, scarcely twolines wide, smooth, sub-coriaceous; sori sunk in two deep intramarginal furrows; sproangia mixed with twisted ribbon-like paraplasties. — Vol. I., t. xxxvii., p. 289. — Florida.

6. CHEILANTHES, SWARTZ.

§ 1. ADIANTOPSIS. Involutees separate, one to each fertile veinlet.

1. C. Californica, Mett. Frond 2 to 4 inches long, deltoid-ovate, smooth, delicately quadripinnatifid; ultimate pinnaules lanceolate, very acute, incised or serrate; involucres crescent-shaped, placed in the sinuses between the teeth. — Vol I., t. vi., p. 45. — California.

§ 2. EUCHEILANTHES. Involutees more or less confluent, usually extending over the apices of several veinlets, but scarcely continuous all round the segment; segments not bead-like.
CONSPECTUS.

* Segments of the frond smooth or slightly hairy.

2. C. Wrightii, Hook. Fronds 2 to 3 inches long, ovate-oblong, smooth, herbaceous, pinnate; pinnae about five pairs, deltoid-ovate, bipinnatifid; segments oblong, incised; involucres herbaceous, terminal on the ultimate segments.—Vol. II., t. lvi., p. 85—Western Texas to Arizona.

3. C. vi cida, Davenport. Fronds 3 to 5 inches long, oblong-lanceolate, herbaceous, viscid and minutely glandular, pinnate; pinnae 5 to 6 pairs, deltoid, bipinnatifid; involucres herbaceous, terminal on the ultimate segments.—Vol. I., t. xii., p. 85—California.

4. C. Alabamensis, Kunze. Fronds 2 to 8 inches long, chartaceous, smooth, lanceolate, bipinnate; pinnae numerous, oblong-lanceolate; pinnales triangular-oblanceolate, rather acute, often auriculate or lobed; involucres pale, rather broad, sub-coriaceous.—Vol. II., t. lvii., p. 89—Virginia to Alabama and Texas.

5. C. microphylla, Swartz. Fronds 4 to 10 inches long, chartaceous; sparingly pubescent beneath, oblong-lanceolate or somewhat pyramidal, bipinnate; pinnales ovate-oblong, obtuse, entire or pinnately incised, involucres narrow, scarcely different from the texture of the frond, interrupted or sub-continuous.—Vol. II., t. lvii., p. 81—Florida and New Mexico.

* Segments decidedly hairy or glandular, but not tomentose.

6. C. vestita, Swartz. Fronds 5 to 12 inches long; herbaceous, hirsute with articulated and pointed rusty hairs, oblong-lanceolate, bipinnate; pinnales oblong-ovate, obtuse, toothed or incised, the ends of the lobes reflexed and forming herbaceous involucres.—Vol. I., t. ii., p. 13—New York to Georgia and westward to Kansas.

7. C. Cooperse, Eaton. Fronds 3 to 8 inches long, herbaceous, hirsute with articulated and often gland-bearing viscid hairs, ovate-lanceolate, bipinnate; pinnales roundish-ovate, crenate and incised; involucres herbaceous, formed of the ends of the lobes.—Vol. I., t. ii., p. 7—California.

8. C. leucopoda, Link. Fronds 3 to 4 inches long and broad, broadly deltoid or pentagonal, viscidly puberulent, 3-4-pinnate; pinnales ovate, obtuse, divided into rounded lobes which are reflexed to form herbaceous involucres.—Vol. II., t. xlvi., p. 29—Western Texas.

§ 3. Physapteris. Involucres continuous around the greater part of the margin of the very minute and boat-like ultimate segments; fronds 2-4-pinnate, the lower surface tomentose or scaly.

*Fronds tomentose beneath, but not scaly.

→ Upper surface smooth.

9. C. gracillima, Eaton. Fronds mostly 2 to 4 inches long, linear-oblong, bipinnate or partly tripinnate; pinnales crowded, oblong-oval, about one line long, very woolly beneath; involucres yellowish-brown, rather broad.—Vol. II., t. lxxix., p. 247—Oregon and California.

→ → Upper surface pubescent or somewhat tomentose.

= Fronds only 2 to 4 inches long.

10. C. lanuginosa, Nutt. Frond ovate-lanceolate, tripinnate or bipinnate with pinnatifid pinnales; ultimate segments less than a line long; upper surface scantily tomentose, the lower surface matted with jointed woolly hairs; involucres herbaceous, very narrow.—Vol. I., t. vi., p. 41—Rocky Mts. of British America to Illinois and Arizona.
CONSPECTUS.

--- Fronds 4 to 12 inches long, or longer.

11. C. tomentosa, Link. Stalks hairy; fronds 8 to 15 inches long, oblong-lanceolate. both surfaces webby-tomentose with whitish hairs, tripinnate; ultimate segments roundish obovate, 1-2 to 3-4 of a line long; involucres whish, continuous round the segment.—Vol. I., t. xlv., p. 345.—Virginia to Missouri and Texas.

12. C. Eatonii, Baker. Stalks with narrow scales as well as hairs; fronds 4 to 9 inches long, oblong-lanceolate, above woolly-pubescent, beneath matted-tomentose and partly scaly, tripinnate; ultimate segments half a line long, rounded-obovate; margins continuously recurved, the edge membranaceous. Vol. I., t. xlv., p. 349.—Colorado to Arizona.

** Fruits very tomentose beneath, the tomentum mixed with ciliated scales.

13. C. Lindheimeri, Hook. Root-stock slender, creeping; fronds 3 to 5 inches long, above whitish tomentose, beneath covered with ciliate scales passing into tomentum. 3-4 pinnate; ultimate segments 1-4 of a line long, very densely crowded; involucres very narrow, herbaceous.—Vol. II., t. lxxiv., p. 213.—Texas to Arizona.

*** Fronds very scaly beneath, tomentum scanty or none.

→ Scales nearly entire; root-stock slender.

14. C. Fendleri, Hook. Scales of root-stock loose, nerveless; frond 3 to 6 inches long, tripinnate; ultimate pinnules rounded and entire or obovate and 2-3 lobed; scales broadly obovate, acuminate, sometimes sparingly ciliate at the base.—Vol. II., t. lxxix., p. 241.—Colorado to Arizona.

→ Scales conspicuously ciliated.

15. C. myriophylla, Desv. Root-stock short, often nodose, covered with strongly nerved scales; fronds 3 to 8 inches long, 3-4 pinnate; ultimate segments roundish or roundish-obovate, sometimes 3-lobed, covered beneath with ovate ciliate scales, and sometimes more or less hairy on one or both surfaces.—Vol. II., t. lxxix., p. 243.—Western Texas to California.

16. C. Clevelandii, Eaton. Root-stock cord-like, covered with strongly nerved scales; fronds 4 to 6 inches long, tripinnate; ultimate pinnules rounded and entire or obovate and 2-3 lobed; scales broadly obovate, acuminate, sometimes sparingly ciliate at the base.—Vol. I., t. xii., p. 89.—Southern California.

§ 4. Aleuritopteris. Involucres various, confluent or distinct; fronds covered beneath with white or yellow powder.

17. C. argentea, Hook. Fronds 1 to 4 inches long, deltoid-obovate, pedately tripartite with pinnatifid divisions, the lobes entire or crenately lobed; powder varying from white to yellow; involucres scarious.—Vol. II., t. xlii., p. 31.—Alaska.

7. PELLÆA, Link.

§ 1. Cheiloplecon. Fronds herbaceous or sub-coriaceous; veins clearly visible; involucre broad and usually covering the sporangia till they are fully ripe.


2. P. gracilis, Hook. Root-stock very slender, creeping, nearly naked; fronds very delicate, 2 to 4 inches long, oblong-obovate, pinnate with a few once or twice pinnatifid pinnæ; segments oblong or obovate; involucres broad and delicate.—Vol. II., t. liv., p. 65.—Labrador to Colorado.
§ 2. Allosorus. Fronds sub-coriaceous or coriaceous; veins rather obscure; involucre conspicuous.

* Pinnules obtuse, or at least not mucronate.

← Fronds only 1-2 pinnate.

3. P. atropurpurea, Fée. Fronds 6 to 12 inches long, evergreen, nearly smooth, ovate-lanceolate, usually bipinnate below, simpler upwards; pinnules oval to linear-oblong, 6 lines to 2 inches long.—Vol. II., t. liv., p. 61.—Canada to Arizona.

4. P. aspera, Baker. Fronds 4 to 6 inches long, harsh and minutely roughened on the upper surface, oblong-lanceolate, bipinnate; pinnules 2 to 3 lines long, oblong, often auriculate or somewhat lobed.—Vol. II., t. lxxiv., p. 205.—Texas and New Mexico.

+ ← Fronds often 3-4 pinnate.

5. P. andromedæfölia, Fée. Stalks light-colored; fronds commonly 8 to 12 inches long, smooth and glaucescent, ovate, oftenest tripinnate; ultimate pinnules 2 to 5 lines long, oval, sub-cordate and emarginate, the edges often much revolute.—Vol. I., t. xxvii., p. 203.—California.

6. P. pulchella, Fée. Stalks blackish; fronds 4 to 6 inches long, smooth, deltoid-ovate, 4-pinnate at the base; ultimate pinnules 1 to 3 lines long, cordate-ovate, the edge often much revolute.—Vol. I., t. xi., p. 81.—Texas and New Mexico.

* Pinnules decidedly acute or mucronate.

← Fronds rarely more than twice pinnate.

7. P. ternifolia, Link. Fronds 3 to 9 inches long, linear-oblong, pinnate; pinnæ uniformly trifoliolate, pinnules obovate-oval or linear-obovate.—Vol. II., t. liv., p. 59.—Western Texas.

8. P. Wrightiana, Hook. Fronds 4 to 8 inches long, lanceolate to triangular-ovate, bipinnate; pinnæ longer than broad, having 3 to 13 oval or oblong oval pinnules, fertile ones with the margins rolled in to the midvein.—Vol. II., t. xlvii., p. 5.—Colorado to southern California.

9. P. brachyptera, Baker. Fronds 4 to 8 inches long, narrowly linear-oblong, bipinnate; pinnæ very short, often broader than long; pinnules few to a pinna, crowded, oblong-linear, 3 to 6 lines long.—Vol. II., t. xlvii., p. 9.—California.

+ ← Fronds normally tripinnate.

10. P. Ornithopus, Hook. Fronds 4 to 12 inches long, rigid, somewhat glaucescent, broadly ovate-lanceolate, tripinnate; primary pinnæ spreading; ultimate segments mostly in threes, like the claws of a bird's foot, scarcely two lines long, the margins rolled into the midvein.—Vol. II., t. xlvii., p. 11.—California.

11. P. densa, Hook. Fronds 1-2 to 2 inches long, ovate, closely tripinnate; ultimate segments linear, 3 to 6 lines long, sessile, sterile ones serrated.—Vol. I., t. xi., p. 77.—Oregon and California.

§ 3. Platyloma. Texture coriaceous, usually concealing the veins; ultimate segments broad and flat, the involucre narrowly and at length hidden by the confluent sporangia.

12. P. Bridgesii, Hook. Fronds 3 to 6 inches long, linear-oblong, simply pinnate; pinnae sub-sessile, glaucescent, orbicular or sub-cordate, 4 to 5 lines long; fertile ones often conduplicate.—Vol. I., t. xiii., p. 327.—California.
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13. **P. flexuosa**, Link. Fronds 6 to 30 inches long, ovate-oblong, 2-3-pinnate; rachis flexuous or zigzag, pinnae deflexed; ultimate pinnules 5 to 10 lines long, roundish-ovate or sub-cordate, very obtuse; margin at first recurved. —Vol. I., t. xxvii., p. 207. —Texas to Arizona.

8. **CRYPTOGRAMME, R. BROWN.**

1. **C. acrostichoides**, R. Br. Fronds 2 to 4 inches long, chartaceous, ovate, closely 2-4-pinnate; pinnules ovate or obovate, adnate-decurrent, those of the fertile fronds narrower and longer, the involucres very broad; sori extending far down the veinslets. —Vol. II., t. lix., p. 99. —Arctic America to California and Lake Superior.

9. **PTERIS, L.**

* Fronds simply pinnate.

1. **P. longifolia**, L. Fronds 1 to 3 feet long, lanceolate in outline, pinate; pinnae very many, several inches long, linear, often sub-cordate at the base. —Vol. II., t. lxxvii., p. 235. —Florida.

** Fronds clustered, the lower pinnae branched, the upper ones simple and linear, and the terminal one very long.

2. **P. Cretica**, L. Fronds 4 to 12 inches long, chartaceous; rachis winged only in the upper part; pinnae with a narrow cartilaginous thread-like border, sterile ones serrated, the teeth pellucid. —Vol. II., t. lix., p. 141. —Florida.

3. **P. serrulata**, L. fil. Fronds 4 to 12 inches long, membranaceous; rachis conspicuously winged; pinnae destitute of cartilaginous border, sterile ones serrulate with herbaceous teeth. —Vol. II., t. lxxvii., p. 239. —South Carolina and Alabama.

** Root-stock cord-like; fronds scattered, ternate, the divisions decompound.

4. **P. aquilina**, L. Frond often very large, sub-coriaceous, broadly triangular, primary divisions stalked; pinnae mostly pinnately lobed with several to many rather short obtuse lobes, and with sometimes very long sub-entire apex. —Vol. I., t. xxxv., p. 263. —Common almost everywhere.

10. **ADJANTUM, L.**

* Frond pyramidal, the rachis continuous to the terminal pinnule.

→ Pinnules smooth, not separately deciduous.

1. **A. Capillus-Veneris**, L. Fronds 9 to 18 inches long, often pendent, ovate or ovate-lanceolate, 2-3-pinnate at the base; pinnules wedge-ovobate or rhomboid, ⅓-1 inch long, deeply and irregularly incised; involucres lunulate or transversely oblong. —Vol. I., t. xxxvii., p. 281. —Virginia and Florida to California.


→ → Pinnules hairy, not separately deciduous.

3. **A. tricholepis**, Fée. Fronds 6 to 12 inches long, deltoid-ovate, 3-4-pinnate at the base; pinnules roundish with a truncate or sub-cordate base; 3 to 6 lines broad, rarely lobed, softly hairy on both surfaces; involucres both roundish and elongated on the same pinnules. —Vol. II., t. lix., p. 193. —Western Texas and possibly California.
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11. LOMARIA, WILLD.

1. L. Spicant, Desv. Fronds 8 to 24 inches long, narrowly linear-lanceolate, pinnatifid to the rachis into very numerous oblong or oblong-linear entire or crenulate segments; those of the taller fertile fronds longer and narrower; involucres near the margin, but distinct from it. — Vol. I., t. xxxii., p. 249.

12. BLECHNUM, L.

1. B. serrulatum, Richard. Fronds 1 to 5 feet long, oblong-linear, simply pinnate; pinnae several inches long, linear or oblong-linear, finely serrulate, glossy above, articulated to the rachis; involucres closely parallel to the midrib. — Vol. I., t. xix., p. 141. — Florida.

13. WOODWARDIA, SMITH.

* Fronds dimorphous, the fertile ones with very narrow segments, the sterile more leaf-like.

1. W. angustifolia, Smith. Root-stock creeping, elongated; sterile fronds 6 to 12 inches long, ovate-oblong, pinnately lobed into a few tongue-shaped netted-veined segments connected by a broad wing on the rachis; fertile fronds taller and having very narrow almost disconnected segments. — Vol. I., t. xxii., p. 165. — Massachusetts to Florida and Louisiana; also in Arkansas.

* * Fronds not dissimilar.

2. W. Virginica, Smith. Root-stock creeping, often very long; fronds 1 to 3 feet long, oblong-ovate or ovate-lanceolate, pinnate; pinnae numerous, 4 to 8 inches long, linear-lanceolate, pinnately lobed into numerous ovate-obtuse segments; areoles in a single series each side of the midveins. — Vol. II., t. lii., p. 45. — Canada to Florida, and westward to Arkansas and Louisiana.

3. W. radicans, Smith. Root-stock short and stout, very chaffy; fronds 2 to 10 feet high, sub-coriaceous, oblong-ovate, pinnate; pinnae 4 to 15 inches long, 1 to 4 broad, deeply pinnatifid into numerous triangular-lanceolate pointed serrate and sometimes pinnately lobed segments; veins forming a few areoles outside of the fertile ones. — Vol. II., t. lxi., p. 117. — California.

14. ASPLENIUM, L.

§ 1. EUASPLENIUM. Indusium straight or nearly so; rarely a few of them are double or diplazioid.

* Frond simple, entire or serrate.

1. A. serratum, L. Fronds 1 to 2½ feet long, 3 to 4 inches broad, linear-oblancoolate, narrowed to the base, crenulate-serrate; midrib stout; veins oblique, free, closely parallel; sori very long and narrow. — Vol. I., t. iii., p. 17. — Florida.
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** Small ferns; fronds pinnatifid or pinnate only near the base.

2. A. *pinnatifidum*, Nutt. Fronds 4 to 9 inches long, lanceolate-acuminate from a broad and sub-hastate base, pinnatifid; lower lobes roundish ovate, rarely ciliate, sometimes distinct, the upper ones very short, and passing into the long and slender acumination of the frond; veins always free. — Vol. I., t. viii., p. 61. — Pennsylvania to Alabama and Missouri.

3. A. *ebenoides*, R. R. Scott. Fronds 4 to 9 inches long, broadly lanceolate, pinnate near the base, pinnatifid above; the apex elongated and slender, often proliferous, as are the lanceolate pinnae and segments. — Vol. I., t. iv., p. 25. — Connecticut to Alabama.

** Frons once pinnate, the pinna sometimes toothed but not again divided.

← Small ferns with a green or greenish rachis.

4. A. *viride*, Hudson. Fronds 2 to 5 inches long, linear-lanceolate, herbaceous, pinnate; pinnae numerous, 2 to 4 lines long, short-stalked, roundish-ovate or ovate-rhomboid, more or less ciliate. — Vol. I., t. xxxvi., p. 275. — New Brunswick and Northern New England to the Rocky Mountains.

5. A. *dentatum*, L. Fronds 4 to 6 inches long, oblong-linear, herbaceous, pinnate; pinnae few, distant, 4 to 6 lines long, moderately long-stalked, roundish-obovate or ovate-rhomboid, ciliate at the lower side of the base, truncate at the upper, obtuse; those of the lower sterile fronds rounder. — Vol. II., t. lxxx., p. 249. — South Carolina to Florida.

6. A. *firim*, Kunze. Fronds 4 to 8 inches long, oblong-ovate, acuminate, broadest at base, pinnate; pinnae usually few, the lower ones 1 to 3 inches long, half an inch wide, oval to rhomboid-lanceolate, crenate or serrate, often acuminate, lower side of base excised, the upper truncate and parallel to the rachis. — Vol. II., t. lxxx., p. 259. — Florida.

← + Small ferns having a dark and often polished rachis, and somewhat rigid fronds with numerous pinnae.

7. A. *Trichomanes*, L. Fronds usually 4 to 6 inches long, narrowly linear, pinnate; pinnae sub-sessile, roundish-oval or oval-oblong from an obtusely cuneate or truncate base, entire or crenulate, rarely incised, falling separately from the persistent rachis. — Vol. I., t. xxxvi., p. 271. — Canada to California.

8. A. *parvulum*, Mart. & Gal. Fronds 4 to 10 inches high, narrowly linear-oblongate, pinnate; pinnae 2 to 6 lines long, rigid and thickish, mostly opposite, sub-sessile, more or less deflexed, oblong, obtuse, entire or crenulate, auricled on the upper side, the lower ones on both sides; sori as near the margin as the midvein. — Vol. I., t. xxxvi., p. 279. — Virginia to New Mexico.

9. A. *ebeneum*, Aiton. Fronds 9 to 18 inches high, linear-oblongate, pinnate; pinnae 6 to 18 lines long, firmly membranaceous, mostly alternate, sessile, spreading, oblong or oblong-linear, somewhat auricled, crenately serrate or incised; sori near the midvein. — Vol. I., t. iv., p. 21. — Canada to Florida and Indian Territory.

← + Tall fronds with a green and herbaceous rachis and narrowly lanceolate pinnae.

10. A. *angustifolium*, Michx. Fronds 2 to 4 feet high, herbaceous, lanceolate, pinnate; pinnae numerous, 2 to 4 inches long, lanceolate-acuminate, minutely serrulate; those of the fertile fronds narrower; sori slightly curved, very numerous, often confluent when ripe. — Vol. II., t. lvi., p. 73. — Canada and Wisconsin to Tennessee and perhaps Georgia.
* * * Fronds more than once pinnate or pinnatifid.

† Small ferns with sub-coriaceous fronds and forking veinlets.

= Ultimate segments very few, long and narrow.

11. A. septentrionale, Hoffm. Fronds 3 to 6 inches high, the stalk alternately forked; branches widening into a few (2 to 5) very narrowly cuneate and acuminate entire or sparingly toothed segments; veins closely parallel; sori elongated, 1 to 3 to a segment. — Vol. I., t. xv., p. 111. — Colorado and New Mexico.

= = Ultimate segments wider and shorter.

12. A. Ruta-muraria, L. Fronds 1 to 2½ inches long, deltoid-ovate, laxly 2-3-pinnate at the base, the divisions alternate; ultimate segments few, stalked, 2 to 5 lines long, from narrowly cuneate to roundish-ovate, crenate or toothed or incised at the apex; veins forking; sori 2 to 4 on a segment. — Vol. I., t. xiv., p. 107. — Vermont to Tennessee.

13. A. montanum, Wild. Fronds 2 to 4 inches long, sub-coriaceous, ovate or lanceolate from a broad base, pinnate; pinnæ ovate or ovate-oblong, the lower ones largest and pinnately cleft into a few oblong-rhomboid or ovate cut-toothed lobes, the upper ones gradually simpler. — Vol. II., t. li., p. 41. — New York to Alabama.

14. A. Bradleyi, Eaton. Fronds 4 to 7 inches long, membranaceous, oblong-lanceolate to linear-oblong, pinnate; pinnæ rather numerous, the lower ones no larger than the middle ones, all short-stalked, oblong-ovate, obtuse, toothed, or in large fronds pinnatifid into oblong toothed lobes. — Vol. II., t. li., p. 39. — Kentucky and Tennessee to Arkansas.

† † Tall ferns with herbaceous pinnate fronds, and long pinnately-lobed pinnae.

15. A. thelypteroides, Michx. Fronds 1½ to 3 feet long, lanceolate, membranaceous, slightly hairy; pinnate; pinnæ spreading, linear-lanceolate, acuminate, deeply pinnatifid; lobes crowded, oblong, obtuse, obscurely serrulate; indusia mostly single, silvery-white when young. — Vol. II., t. l., p. 33. — New Brunswick to Wisconsin and Alabama.

† † = Fronds very delicate, 2-3-pinnate, veins single in the ultimate segments or lobes.

16. A. myriophyllum, Presl. Fronds spreading, 3 to 8 inches long, delicately membranaceous, lanceolated, narrowed towards the base, 1-3-pinnate; pinnules 2 to 4 lines long, simple and obtuse or else cut into a few obvate segments. — Vol. II., t. li., p. 37. — Florida.

17. A. cicutarium, Swartz. Fronds erect, 6 to 15 inches long, membranaceous, ovate-lanceolate, 2-3-pinnate; lower pinnæ deflexed; pinnules rhomboid-ovate, more or less deeply cleft into several linear-oblong lobes, the larger of these again lobed. — Vol. II., t. lvi., p. 77. — Florida.

§ 2. Athyrium. Indusia variously curved, often crossing the fertile veinlet and continued a short distance down on the other side of it.

18. A. Filix-femina, Bernh. Fronds 1 to 3 feet long, softly membranaceous, oblong-lanceolate, 2-3-pinnate; pinnæ adnate to the secondary rachis, ovate or elongate-lanceolate, variously toothed or incised; indusia lacerate-ciliate. — Vol. II., t. lxxxvi., p. 225. — Common almost everywhere.

15. SCOLOPENDRIUM, SMITH.

16. CAMPTOSORUS, Link.

1. C. rhizophyllus, Link. Fronds usually 6 to 12 inches long, sub-coriaceous, evergreen, gradually narrowed from a coriaceous and more or less auricled base to a long and slender acumination, which often roots at the end and thus forms a new plant.—Vol. I., t. viii., p. 55.—Canada to Alabama and Kansas.

17. PHEGOPTERIS, Fée.

* Fronds triangular, hairy or puberulent, the rachis interruptedly winged by the adnate basal segments of the pinna; rootstock cord-like.

1. P. polypodioides, Fée. Frond 3 to 8 inches long, longer than broad, twice pinnatifid; secondary segments oblong, obtuse, entire or crenulate; sori near the margin.—Vol. II., t. lxv., p. 217.—Greenland and Alaska to the Middle States.

2. P. hexagonoptera, Fée. Frond 7 to 12 inches long, broader than long, twice pinnatifid; secondary segments entire or crenately toothed, or the larger ones elongated and pinnately lobed; some of the sori remote from the margin.—Vol. II., t. ixv., p. 147.—Canada to Florida and Louisiana.

** Fronds triangular, ternate, the primary divisions stalked; rachis not winged; rootstock very slender.

3. P. Dryopteris, Fée. Fronds smooth and thin, 4 to 10 inches wide and long; lateral divisions divergent; all triangular and pinnate, the pinna pinnatifid into oblong, obtuse, entire or even pinnately lobed segments; lowest inferior pinna of the lateral divisions equal to the second pinna of the middle division.—Vol. I., t. xxi., p. 157.—Arctic America to Oregon, Ohio, and the Eastern States.

4. P. calcarea, Fée. Fronds minutely glandular and somewhat rigid, 4 to 8 inches wide and long; lateral divisions ascending; all triangular and pinnate, the pinna pinnatifid into oblong obtuse or even pinnately-lobed segments; lowest inferior pinna of the lateral divisions equal to the third pinna of the middle division.—Vol. II., p. 277.—Minnesota.

*** Rootstock short and thick; fronds oblong-lanceolate, bi-pinnate or nearly so.

5. P. alpestris, Mett. Fronds 1 to 2 feet long; oblong-lanceolate, pinnate with delicately bi-pinnatifid deltoid-lanceolate pinna; pinnales oblong or oblong-lanceolate, doubly incised and toothed.—Vol. I., t. xxiii., p. 171.—British Columbia to California.

18. ASPIDIUM, Swartz.

§ 1. Dryopteris or Nephrodium. Indusium roundish-reniform or orbicular with a narrow sinus.

* Fronds membranaceous, decaying in autumn, rather tall, pinnate with closely pinnatifid pinnae; veins simple or once forked, normally free.

→ Root-stock cord-like, elongated, bearing scattered fronds.

1. A. Noveboracense, Swartz. Fronds 1 to 2 feet long, lanceolate, narrowed from the middle to the base, minutely ciliate and hairy; pinnae sessile, lanceolate, lobes oblong, obtuse, entire; veins almost always simple; sori near the margin; indusium delicate, hairy or glandular.—Vol. I., t. vii., p. 19.—New Brunswick to Wisconsin and North Carolina.

2. A. Thelypteris, Swartz. Fronds 1 to 3 feet long, ovate-lanceolate, rarely narrowed
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at the base, smooth or slightly pubescent; pinnae short-stalked, lanceolate; lobes oblong-ovate, obtuse, mostly entire; lower veins or all of them forked, sori not near the margin; indusia delicate.—Vol. I., t. xxx., p. 233. — Lake Winnipeg to Louisiana and Florida.

← Root-stock short, bearing clustered fronds.

Fronds conspicuously narrowed at the base.

3. A. Nevadense, Eaton. Fronds 1 to 3 feet long, narrowly lanceolate; pinnae linear-lanceolate; segments 3 to 5 lines long, scarcely one line broad, oblong, entire or sparingly toothed, resinous-dotted and slightly hairy beneath; veins mostly simple; sori near the margin; indusia minute, glandular and hairy.—Vol. I., t. x., p. 73. — California.

4. A. Oreopteris, Swartz. Fronds 1 to 3 feet long, lanceolate; pinnae lanceolate from a broad base; segments 3 to 6 lines long, about 2 lines broad, oblong, entire or crenulate, glandular beneath; veins often forked; sori near the margin; indusia fugacious.—Vol. II., p. 273. — Unalaska.

5. A. conterminum, Wild. Root-stock erect; fronds 1 to 4 feet long, lanceolate, rather rigid, very short-stalked; pinnae sessile, narrowly lanceolate, acuminate, segments 2 to 4 lines long, oblong, obtuse, subfalcate, resinous-dotted and slightly hairy beneath; veins simple; sori near the margin; indusia glandular and hairy, evanescent.—Vol. II., p. 278. — Florida.

Fronds scarcely narrowed at the base.

6. A. patens, Swartz. Fronds 1 to 3 feet long, oblong-ovate, acuminate; pinnae linear-acuminate, incised from half to three-fourths of the way to the midrib; segments obliquely oblong, rather acute, basal ones largest; veins simple, the lowest ones of adjacent segments sometimes united; sori rather remote from the margin; indusia pubescent.—Vol. II., t. lxx., p. 181. — Florida to California.

* * Fronds firmly membranaceous or sub-coriaceous, often evergreen; some of the veins pinnately branching or more than once forked, always free.

Fronds large, pinnate with pinnatifid pinnae; indusia flat, persistent.

7. A. cristatum, Swartz. Fronds smooth, linear-oblong or oblong-lanceolate, slightly narrowed towards the base, 1 to 2 feet long; fertile ones tallest; pinnae triangular-oblong, the lowest ones triangular-ovate; segments oblong, obtuse, mostly closely placed; sori midway from the margin to the midvein.—Vol. II., t. lxxi., p. 153. — Newfoundland to Arkansas.

8. A. Floridanum, Eaton. Sterile fronds like those of the last; fertile fronds with the lower and shorter pinnae triangular-lanceolate and deeply pinnatifid, the upper pinnae alone fertile, longer and narrower and with usually remote oblong obtuse crenulate-toothed pinnules sessile on a narrowly winged secondary rachis; sori as in the last.—Vol. II., t. lxxii., p. 159. — Florida to Louisiana.

9. A. Goldianum, Hooker. Fronds smooth, broadly oblong-ovate; 1 to 2½ feet long; pinnae mostly broadest in the middle, 5 to 8 inches long, 1 to 2½ broad; segments numerous, oblong-linear, slightly falcate, crenate or serrate; sori near the midvein; indusia very large, orbicular with a narrow sinus.—Vol. I., t. x., p. 305. — Canada to Kentucky.

← Fronds large, sub-coriaceous, twice pinnate near the base, but the upper pinules confluent on the secondary rachis; indusium firm, convex, persistent. Stalks very chaffy with large scales.

Sori not close to the margin of the segments.
10. **A. Filix-mas**, Swartz. Fronds 1 to 3 feet long, broadly oblong-lanceolate, somewhat narrowed towards the base; pinnae lanceolate-acuminate from a broad base; pinnales or segments oblong to ovate-lanceolate, obtuse or acute, toothed or incised, not glandular but sometimes slightly crenate beneath; sori near the midvein, commonly only on the lower half of each segment. — Vol. I., t. xlii., p. 311. — Canada and North-western Michigan, Dakota, and Colorado.

11. **A. rigidum**, Swartz. Fronds 1 to 2 feet long, glandular beneath, ovate-lanceolate, scarcely narrowed at the base; pinnae oblong-lanceolate; pinnales or segments oblong, obtuse or acute, doubly serrate or incised, very venose; sori near the midvein, indusium glandular. — Vol. II., t. xlvii., p. 1. — Oregon and California.

== Sori very close to the margin.

12. **A. marginale**, Swartz. Fronds 1 to 2 feet long, ovate-lanceolate, not glandular; lower pinnae triangular-lanceolate, upper ones narrower; segments oblong or oblong-lanceolate, crenately toothed or lobed, obtuse or sub-acute; sori near the margin; indusium very firm, often lead-colored. — Vol. II., t. lv., p. 69. — New Brunswick to the Rocky Mountains, and southward to Alabama.

++ Frons long, firmly membranaceous, fully twice pinnate; indusium rather small, less firm, flat, at length shrivelled or deciduous.

13. **A. spinulosum**, Swartz. Fronds 1 to 3 feet long, all alike, ovate to ovate-oblong, but little narrowed at the base; pinnae short-stalked, the lowest ones triangular-lanceolate, upper ones gradually narrower; pinnales oblong, pinnate or pinnately incised with spinulose-serrate lobes; indusium either smooth or glandular. — Vol. II., t. lxviii., p. 163. — Newfoundland to British Columbia and Oregon, extending southward to Arkansas and North Carolina.

14. **A. Bootii**, Tuckerman. Fronds 1 to 2½ feet long; sterile ones smaller and simpler; fertile ones elongated-lanceolate, somewhat narrowed at the base; the lowest pinnae triangular-ovate, upper ones longer and narrower; pinnales oblong-ovate, sharply serrate with spinulose teeth, the lower ones often pinnatifid; indusium minutely glandular. — Vol. II., t. lxix., p. 175. — New England to Delaware.

++ Frons small, bi-pinnate with small and crowded pinnales; indusium very large, persistent.

15. **A. fragrans**, Swartz. Fronds 4 to 10 inches long, very chaffy, glandular and aromatic, lanceolate, narrowed towards the base; pinnales 1 to 2 lines long, oblong-obtuse, adnate by a decurrent base; indusia very large, imbricating, orbicular with a very narrow sinus. — Vol. I., t. xxiii., p. 175. — Arctic America to Lake Superior and the mountains of New York and New England.

*** Frons sub-coriaceous, pinnate with pinnatifid pinnae; lower veins forming angular areoles along the midrib, the rest simple and free.

16. **A. unitum**, var. glabrum, Mett. Root-stock long and cord-like, blackened; fronds 1 to 2 feet long, rigid, sub-coriaceous, smooth; pinnae pinnatifid half way to the midrib into rounded or obtuse lobes; lower veins of contiguous lobes united; indusium commonly smooth. — Vol. I., t. xiii., p. 93. — Florida.

§ 2. **Polystichum**. Indusia orbicular and entire, fixed by the depressed centre or short central stalk to the middle of the sorus; pinnae and pinnales often auricled on the upper side of the base; veins free. Fronds mostly evergreen.
* FRONDS SIMPLY PINNATE.

  17. A. Lonchitis, Swartz. Fronds 6 to 18 inches long, linear-lanceolate; pinnae broadly lanceolate, falcate, sharply spinulose-serrate, the lower ones symmetrically triangular and shorter, the upper ones strongly auricled. — Vol. I., t. xxiii., p. 101. — Arctic America to Canada, Northwestern Michigan, and Utah.

  18. A. acrostichoides, Swartz. Fronds 1 to 2 feet long, lanceolate from a scarcely narrowed base; pinnae nearly smooth, oblong-lanceolate, auricled, the lowest ones decurved, the rest spreading or upwardly falcate, serrulate with bristle-pointed teeth, or serrate, or even incised; fertile fronds with the upper pinnae contracted and covered with sori. — Vol. I., t. xxxiv., p. 237. — New Brunswick to Wisconsin, Arkansas, and Alabama.

  19. A. munitum, Kauf. Fronds 1 to 5 feet long, lanceolate, slightly narrowed at the base; pinnae very many, often chaffy beneath, usually linear-acuminate, very sharply and often doubly serrate with curved aculate teeth, auricled, all or the upper ones fertile but not contracted; sori abundant. — Vol. I., t. xxv., p. 187. — British Columbia to California.

  ** FRONDS PINNATE WITH PINNATIFID PINNAE, OR EVEN TWICE PINNATE.

  20. A. mohrioides, Bory. Fronds 4 to 12 inches long, oblong-lanceolate, pinnae; pinnae 6 to 18 lines long, often imbricated, ovate or ovate-lanceolate, obtuse, pinnately lobed or even again pinnate, the serrations not aculate; indusia very large and often imbricated. — Vol. II., t. lxx., p. 251. — California.

  21. A. aculeatum, Swartz. Fronds 1 to 2 feet long, oblong-lanceolate, normally bi-pinnate, but often only pinnate with deeply pinnatifid pinnae; pinna lanceolate, acute; segments from rhomboid-oval and confluent to triangular-ovate, auricled and incisely-serrate; teeth aculate or aristate; indusia not imbricated. — Vol. II., t. ixii., p. 123. — New Brunswick to Pennsylvania, Lake Superior and California.

§ 3. CYRTOMIUM. Indusia as in § Polystichum. Fronds simply pinnate; the veinlets more or less anastomosing in oblique or irregular arcades.

  22. A. juglandifolium, Kunze. Fronds 4 to 12 inches long, corticeous, smooth above, simply pinnate; pinnae few, short-stalked, ovate-oblong or broadly lanceolate, obtusely truncate or sub-cordate at the base, serrate, acute; sori in two irregular rows between the midrib and the margin. — Vol. II., t. lxxv., p. 221. — Western Texas.

19. NEPHROLEPIS, SCHOTT.

  1. N. exaltata, Schott. Fronds 2 to 6 feet long, 2 to 4 inches wide, linear in outline, simply pinnate; pinnae sessile, oblong-linear and slightly falcate, auriculate on the upper side of the base; sori sub-marginal; indusia roundish-reniform or sometimes merely curved. — Vol. II., t. ixii., p. 129. — Florida.

20. CYSTOPTERIS, BERNHARDI.

  1. C. fragilis, Bernh. Fronds 6 to 12 inches long, broadly lanceolate, usually bi-pinnate; pinnae oblong-ovate, pointed; pinnules ovate or oblone, variously toothed or incised. — Vol. II., t. liii., p. 49. — All North America.

  2. C. bulbifera, Bernh. Fronds 6 inches to over 2 feet long, commonly tapering from a
CONSPICATUS.

broad base to a long and narrow apex, often bearing bulblets at the base of the pinnae or elsewhere, bi-pinnate; pinnae oblong, obtuse, more or less toothed or lobed.—Vol. II., t. liii., p. 55.—Canada to Tennessee and Arkansas.

3. **C. montana**, Bernh. Root-stock excessively slender; fronds 3 to 5 inches long, ovate-pentagonal, delicately 3-4-pinnate; pinnae incised, the teeth mostly emarginately bi-dentate.—Vol. II., t. liii., p. 53.—Labrador to the Rocky Mountains of British America.

21. **ONOCLEA, L.**

1. **O. sensibilis**, L. Sterile fronds 2–15 inches long, triangular-ovate, pinnatifid; segments sinuate or sinuately lobed; veins reticulated; fertile fronds bi-pinnate; pinnae rolled up into berry-like bodies.—Vol. II., t. lxiii., p. 195.—New Brunswick to Dakota, Louisiana and Florida.

2. **O. Struthiopteris**, Hoffmann. Sterile fronds 1 to 10 feet high, broadly lanceolate, narrowed at the base, pinnate with many linear-lanceolate pinnatifid pinnae; veins free; fertile fronds shorter, pinnate with pod-like or somewhat articulated pinnae.—Vol. II., t. lxiii., p. 201.—New Brunswick to the Saskatchewan, and southward to the Middle States.

22. **WOODSIA, R. Brown.**

* Stalks obscurely articulated some distance from the base; fronds chaffy or smooth, never glandular; indusium divided into slender hairs nearly to the center.

1. **W. glabella**, R. Brown. Fronds 1 to 4 inches long, very delicate, smooth, linear-lanceolate, pinnate; pinnae 1 to 3 lines long, roundish-ovate, obtuse, crenately lobed.—Vol. II., t. ix., p. 115.—Arctic America to the mountains of New York and Northern New England.

2. **W. hyperborea**, R. Brown. Fronds 2 to 6 inches long, nearly smooth or sparingly paleaceous-hirsute, oblong-lanceolate, pinnate; pinnae 3 to 6 lines long, triangular-ovate, obtuse, pinnately lobed.—Vol. II., t. ix., p. 107.—British America and the northern parts of New England and New York.

3. **W. Ilvensis**, R. Brown. Fronds 2 to 6 inches long, very chaffy and pubescent with paleaceous hairs, lanceolate, pinnate; pinnae 6 to 9 lines long, oblong-ovate, rather acute, pinnatifid into rather numerous oblong often crenated lobes.—Vol. II., t. ix., p. 111.—British America to the Middle States.

* * Stalks not articulated; fronds glandular-pubescent or smooth, not chaffy.

→ Indusium of a few broad segments, at first covering the sorus.

4. **W. obtusus**, Torrey. Fronds 8 to 15 inches long, broadly lanceolate, minutely glandular, pinnate or nearly bipinnate; pinnae triangular-ovate or triangular-lanceolate, obtuse; segments oblong, obtuse, crenately toothed; indusia at first sub-globose, afterwards splitting into a few concave toothed segments.—Vol. II., t. lxxi., p. 189.—New England to Georgia and Indian Territory; also in British Columbia.

→ + Indusium of very narrow segments, or reduced to minute cilia, never covering the sorus.

5. **W. scopulina**, Eaton. Fronds 4 to 8 inches long, puberulent beneath with minute jointed hairs and stalked glands, oblong-ovate, pinnate with deeply pinnatifid pinnae, the lobes oblong-ovate and crenulate; indusia deeply cleft into narrow segments terminating in jointed hairs.—Vol. II., t. lxxi., p. 193.—Minnesota and Colorado to Oregon and California.
CONSPECTUS.

6. **W. Oregana**, Eaton. Very much like the last, but with smooth fronds, the fertile taller than the sterile, and the indusium reduced to a few moniliform hairs. — Vol. II., t. lxxi., p. 185. — British Columbia to Lake Superior, Colorado and Arizona.

23. **DICKSONIA, L'Heritier.**

1. **D. pilosiuscula**, Wild. Fronds 1 to 3 feet long, lanceolate from a broad base, long-acuminate, delicately herbaceous, hairy and minutely glandular, nearly or quite bi-pinnate with pinnatifid and cut-toothed rhomboid-ovate segments; involucres marginal, minute, cuplike. — Vol. I., t. xlv., p. 339. — New Brunswick to Alabama, and westward at least to Indiana.

24. **CERATOPTERIS, BRONGNIART.**

1. **C. thalictroides**, Brongn. Plant floating, succulent; sterile fronds from simple to tri-pinnate with large deltoid-ovate segments, having finely reticulated veins; fertile fronds taller, more compound, the segments long and narrow. — Vol. II., t. lxxx., p. 255.

25. **TRICHOMANES, L., Smith.**

1. **T. Petersii**, Gray. Fronds 2 to 6 lines long, cuneate-ovate or oblong-lanceolate, entire or somewhat lobed, narrowed into a slender stalk as long as the frond; veins forked, arising from a midvein; involucre solitary, terminal, funnel-form. — Vol. I., t. xxiv., p. 183. — Alabama.


26. **LYGODIUM, SWARTZ.**

1. **L. palmatum**, Swartz. Fronds climbing from 2 to 4 feet high, the stalk and rachis very slender; pinnax in pairs on short common petioles; sterile ones palmately 4-7-lobed, 1 to 2 inches broad; fertile ones decompound, the ultimate divisions very narrow. — Vol. I., t. i., p. 1. — Massachusetts to Tennessee and Florida.

27. **SCHIZAEA, SMITH.**

1. **S. pusilla**, Pursh. Sterile fronds linear, very slender, tortuous, 1 inch long, 1/3 of a line wide; fertile ones 1 to 4 inches high, consisting of a slender stalk bearing a minute pinnate fertile appendage at the top. — Vol. I., t. xxiv., p. 185 and II., p. 275. — New Jersey, Nova Scotia, and Newfoundland.

28. **ANEIMIA, SWARTZ.**

1. **A. Mexicana**, Klotzsch. Sterile fronds 4 to 9 inches long, deltoid-ovate, simply pinnate with a few large ovate-acuminate pinnax; fertile fronds having the two lowest pinnax converted into long-stalked panicles of fructification, otherwise like the sterile. — Vol. I., t. xiv., p. 99. — Western Texas.

2. **A. adiantifolia**, Swartz. Sterile fronds 6 to 12 inches long, deltoid-ovate, 2-4-pinnate with obovate or cuneate often lobed segments; fertile fronds having the two lowest pinnax converted into long-stalked panicles, as in the last. — Vol. I., t. xiv., p. 103. — Florida.
CONSPECTUS.

29. OSMUNDA, L.

* Sterile fronds fully bi-pinnate with separate pinnules.

1. O. regalis, L. Fronds 1 to several feet long; the sterile ones bi-pinnate with oval or oblong-lanceolate pinnules, the fertile like the others, but having the upper pinna converted into a panicle of fructification. — Vol. I., t. xxviii., p. 209. — Newfoundland to Louisiana.

* * Sterile fronds pinnate with deeply pinnatifid pinnae.

2. O. Claytoniana, L. Fronds 2 to 4 feet long; sterile ones oblong-lanceolate, short-pointed; pinnae with numerous ovate-oblong obtuse segments; fertile fronds taller than the others, and having several of the middle pinnae contracted and bi-pinnate, devoid of leaf-green and covered with blackish-green sporangia. — Vol. I., t. xxix., p. 219. — Newfoundland to Lake Winnippeg, and southward to North Carolina.

3. O. cinnamomea, L. Fronds 1 to 4 feet long; sterile ones oblong-lanceolate, long-pointed; pinnae with numerous ovate-oblong obtuse segments; fertile fronds usually with no green tissue, but all the pinnae contracted and bi-pinnate, and covered with cinnamon-brown sporangia. — Vol. I., t. xxix., p. 227. — Newfoundland to Wisconsin, and southward to Louisiana and Florida.

OPHIOGLOSSACEÆ.

1. BOTRYCHIUM, Swartz.

§ 1. EUBOTRYCHIUM. Base of stalk which encloses the bud closed on all sides. Sterile division more or less fleshy, the cells of the epidermis straight.

* Sterile division of the frond usually placed at or above the middle of the plant. Frond never hairy.

→ Sterile division once pinnate or pinnatifid, the pinnae never pinnately lobed.

1. B. Lunaria, L. Plant 4 to 10 inches high, very fleshy; sterile division sessile near the middle of the plant, oblong or ovate, pinnae or lobes semilunar from a broadly cuneate base, the sides concave, the outer margin crenate or even incised. — Vol. I., t. v., p. 29. — From Colorado and New England northward.

2. B. boreale, Milde. Plant 2 to 7 inches high, very fleshy; sterile division sessile above the middle of the plant, cordate-ovate, pinnately cleft; divisions few, often somewhat imbricated, rounded-ovate from a narrow base, entire or slightly lobed. — Vol. I., t. v., p. 37. — Unalaska.

→ → Sterile division in fully developed fronds mostly bi-pinnatifid.

3. B. matricariifolium, Al. Braun. Plant 2 to 12 inches high, moderately fleshy; sterile division placed high up on the plant, usually distinctly stalked, oblong, ovate or even deltoid, in small forms pinnate with roundish-ovate lobes, in larger plants bi-pinnatifid, the lobes oblong-ovate and obtuse. — Vol. I., t. xvii., p. 129. — New England to Lake Superior.

4. B. lanceolatum, Angstr. Plant 2 to 10 inches high, scarcely fleshy; sterile division high up on the plant, sessile, deltoid, once or twice pinnatifid with oblique oblong-lanceolate acute segments. — Vol. I., t. v., p. 33. — New Brunswick to Colorado; also in Unalaska.
**Sterile division placed low down on the plant.**

5. *B. simplex*, Hitchcock. Plant smooth, fleshy; 2 to 6 inches high; sterile division short-petioled, varying from simple and roundish-obovate and 2 to 3 lines long, to triangular ovate and deeply 3-7-lobed, or even to fully ternate with incised divisions; segments broadly obovate-cuneate or somewhat lunate; fertile division 1-2-pinnate. — Vol. I., t. xvii., p. 121. — New Brunswick to California.

6. *B. ternatum*, Swartz. Plant sparsely hairy, fleshy; 4 to 12 inches high; sterile segment long-petioled from near the base of the plant, broadly deltoid, ternate and variously decom-pound; ultimate segments from roundish-reniform and sub-entire to ovate-lanceolate and doubly incised; fertile division 2-4-pinnate. — Vol. I., t. xx. and xx., p. 147. — All North America.

§ 2. *Osmundopteris*. Base of stalk which encloses the bud open along one side. Sterile division membranaceous, the cells of the epidermis flexuos.

7. *B. Virginianum*, Swartz. Plant sparsely hairy; 8 to 24 inches high; sterile divisions sessile near the middle of the plant, broadly triangular, ternate; primary pinnæ short-stalked, 1-3 times pinnatifid; secondary pinnæ ovate-lanceolate; ultimate segments toothed at the ends; fertile division 2-4-pinnate. — Vol. I., t. xxxii., p. 253. — New Brunswick to Washington Territory and Oregon, southward to Florida and Texas.

2. **OPHIOGLOSSUM, L.**

* Sterile division of the frond entire; spikes solitary.

1. *O. vulgatum*, L. Fronds from a slender root-stock, 2 to 12 inches high, mostly solitary; sterile division sessile near the middle, ovate or elliptical, 1 to 3 inches long; midvein indistinct or none; veins forming small areoles enclosed in larger ones. — Vol. II., t. lxxi., p. 261. — Canada to Arizona; also in Unalaska.

2. *O. crotalophoroides*, Walter. Fronds 2 to 6 inches high, usually several from a tuberous root-stock; sterile segment set below the middle, cordate-ovate, 6 to 18 lines long, abruptly contracted into a short petiole; midvein none, areoles all small. — Vol. II., t. lxxi., p. 265. — South Carolina and Florida to Louisiana.

3. *O. nudicaule*, L. fil. Fronds 1 to 6 inches high, usually several from a slightly tuberous root-stock; sterile segments 5 to 9 lines long, elliptical-ovate, acute at both ends, sub-sessile near the base of the frond; midvein more or less distinct, areoles all small. — Vol. II., t. lxxi., p. 267. — South Carolina to Alabama and Florida.

* Sterile division of the frond palmately lobed; spikes several.

4. *O. palmatum*, Plumier. Fronds 4 to 12 inches long, several from a tuberous root-stock, long-stalked, from a cuneate base broadly expanded upwards and palmately 2-11-lobed; lobes tongue-shaped, several inches long; spikes several from near the base of the frond. — Vol. II., t. lxxi., p. 269. — Florida.
ADDENDUM.

6½. *Notholeana* Grayi, Davenport. Root-stock short, creeping, covered with rigid narrow blackish scales; stalks 1 to 3 inches long, slender, terete, glandular-puberulent, and, like the rachises and lower surface of the pinnules, more or less chaffy with delicate lanceolate ciliated scales; fronds 2 to 5 inches long, scarcely an inch broad, oblong-lanceolate, pinnate; pinnae rather distant, ovate, or the lower ones deltoid-ovate, but no longer than the others, all pinnately divided into a few oblong obtuse more or less falcate segments, the lowest ones largest and somewhat lobed, the rest crenate or entire; upper surface dotted with whitish glands, lower surface sprinkled with white ceraceous powder; margins slightly recurved; sporangia sub-marginal and brownish. — Davenport in Bulletin of Torrey Botan. Club, ined. — Mountains of southeast Arizona, W. M. Courtis, 1880. Also collected many years ago in Sonora, Mexico, by A. Schott. The fronds being both chaffy and pulveraceous beneath make it very distinct. It comes too late for description even in the “Additions and Corrections” of this work.

SUMMARY.

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PLATE XLVI.

ASPIDIUM RIGIDUM, var. ARGUTUM, D. C. EATON.

Rigid Wood-Fern.

ASPIDIUM RIGIDUM, var. ARGUTUM:—Root-stock stout, rather short, ascending, very chaffy; stalks a span to a foot long, erect, rigid, chaffy with ample bright-ferruginous pointed scales; fronds in a crown, half-evergreen, firm-membranaceous or sub-coriaceous, smooth and green above, paler and more or less glandular beneath, one to two feet long, ovate-lanceolate or triangular-lanceolate, usually fully bipinnate; pinnæ broadly oblong-lanceolate, the lowest ones widest but scarcely shorter than the middle ones; pinnules oblong, pinnately incised or doubly serrate with spinulose teeth, conspicuously veiny; veins much branched; sori large, nearer the midrib than the margin; indusia firm, convex, orbicular, with a very narrow sinus, the edge bearing short-stalked glands.

Aspidium rigidum, var. argutum, Eaton, Ferns of the South-West, p. 333.

Lastrea rigida, larger and more developed, Moore, Nat. Pr. Brit. Ferns. Nephrodium rigidum, ? var. Americanum, Hooker, Brit. Ferns, t. 16; Sp. Fil., iv., p. 120.


Hypodematium Californicum, Fée, MS. fide Milde.

Hab.—Rocky hillsides and canons, often in copses, from Oregon and California to the Sierra Madre of North-Western Mexico. One of the commonest ferns of California, but most abundant west of the Coast Ranges, though occurring as far east as Plumas County. Mr. John Smith, in the voyage of the Herald, reports it as found in Panama and the Hawaiian Islands, but there is reason to suspect some error either of identification or of locality. It was first discovered in California by Chamisso, probably near San Francisco. Hartweg's No. 2039, from the vicinity of Monterey, should be considered this species rather than A. Filix-mas, to which it is referred in Plante Hartwegianae. The type is found in Europe, and in the Mediterranean countries.

Description.—The root-stock of this fern is stout, ascending, and very chaffy with large ovate-acuminate light-brown scales. The stalks are terminal on the root-stock, and are similarly chaffy. Their adherent bases remain on the root-stock several years before they finally decay. In the section of a large stalk I find five roundish fibro-vascular bundles, two larger than the rest, and all surrounded by very narrow circles of sclerenchyma.
The fronds are from one to two feet long, ovate-lanceolate or somewhat triangular-lanceolate in outline, and usually bipinnate. They are nearly or perhaps quite evergreen, since good specimens were collected in the San Gabriel Mountains by Professor Brewer in January. The texture of the fronds is thickish, much as in the eastern *A. marginale*, which this species resembles a good deal also in its chaffy stalk and massive rhizoma. The color of the fronds is a deep green on the upper surface, but rather paler beneath, where also they are very frequently minutely glandular. The lowest pinnae are but little shorter than the others, but are rather broader at the base, so that they are triangular-lanceolate, while those in the middle of the frond are oblong-lanceolate.

The pinnules or secondary pinnae are ovate-oblung or oblong, from half an inch to an inch long, and very variable in their serration or incising, being now simply serrate with sharp-pointed teeth, but more frequently doubly serrate, and not seldom pinnately incised with doubly serrate lobes. The venation is likewise variable, but is usually much branched, so that a veinlet extends to the point of every tooth. The veinlets are very conspicuous on the lower surface of the frond, and are marked on the upper by faint depressions.

The fruit-dots are arranged in a single row each side the midveins of the pinnules, and are much nearer the midvein than the margin. The indusia are very large, usually convex, orbicular, and provided with a deep but very narrow sinus. They bear numerous stalked glands around the margin. The
sporangia have a ring of from fifteen to seventeen joints. The spores are bean-shaped, and have a decidedly roughened or wrinkled surface.

This fern is very fragrant in drying, so that a few fronds of it will serve to perfume a whole bundle of dried plants. It has a larger and broader frond than the European *A. rigidum*, but certainly presents no points of specific distinction; and some of the Oregon specimens collected by Mrs. Summers near the Willamette River are so nearly typical *rigidum* that they would not be challenged if mixed with European specimens. In the South of Europe is a paler and less acutely serrated form of the same species, the *A. pallidum*, of Link.

Plate XLVI.—*Aspidium rigidum*, var. *argutum*. The specimen represented was collected in Santa Cruz County, California, by Dr. L. G. Yates. Fig. 2 is a fertile pinnule, enlarged. Fig. 3, a sterile pinnule from one of the lower pinnæ, enlarged. Fig. 4, a magnified indusium. Fig. 5, a spore.
Pellaea Weddelliana, Fée, 8me Mém., p. 74.

Hab.—Western Texas and Colorado to New Mexico and Arizona, Wright, Nos. 2130 and 2131, Brandegee, Rothrock, Mrs. Sumner, etc. Also in Bolivia. It occurs mostly in exposed rocky places, especially in cañons. Attributed also to California in Synopsis Filicum, but probably through some error, as I have seen no true P. Wrightiana from that State.

Description.—This fern has a somewhat woody branched and knotted root-stock, which is densely covered with fuscous-brown scales, linear-acuminate in shape, denticulate along the edges, and mostly provided with a rigid blackish midnerve.

The stalks are very numerous, and persist long after the fronds have been broken off: they are almost black, but with a vinous tinge, wiry, rigid and highly polished. They are rounded at the back, and flattened or slightly furrowed in front. The section shows a firm exterior sheath, within which is brownish parenchyma, and in the middle a single rather large fibro-vascular bundle, which is in general roundish in form, but has a sharp furrow opposite the flattened side of the stalk.

The fronds are rigidly coriaceous, green above, paler and somewhat glaucous beneath, and in the native home of the fern probably evergreen. They are four to eight inches long, strictly bipinnate, and vary in outline from oblong-lanceolate to deltoid-ovate. The primary pinnæ are commonly from
nine to fifteen on each side, and are usually arranged in opposite pairs. A few of the highest pinnæ are simple; then come a few which are either trifoliate, or else composed of five pinnately arranged pinnules, and the rest are pinnate with from two to eight pinnules on each side. The basal pinnules are so close to the main rachis that the pinnæ scarcely have perceptible stalks, and the pinnules generally are also almost sessile. The longest pinnæ of the broadest fronds are not more than two inches long, and in the narrower fronds the longest pinnæ are only three-quarters of an inch long.

The pinnules of sterile fronds are roundish-oval, slightly cordate at the base, and tipped with a minute cartilaginous point at the apex. They are three or four lines long, and two-thirds or three-fourths as broad. In the fertile fronds the pinnules, which are also mucronate, have their edges rolled in, often so far as to meet at the midvein. The margin is a little thinner, and paler in color than the rest of the pinnule. The veins fork several times, so that the ultimate veinlets are very close together. The sori are borne on the veinlets near their tips, and are completely hidden by the involute margins. The spores are globose, and obscurely trivittate.

Two of the species originally described by Sir W. J. Hooker are now considered as slightly different forms of the same thing. The plant figured by Mr. Faxon in our plate is Hooker's *P. longimucronata*. The original *P. Wrightiana*
has shorter pinnae, with fewer and rather longer pinnules, and is identical with *P. Weddelliana*, of Fée, a specimen of which was sent to me by that learned Pteridologist. But the two forms differ very slightly, and are connected by intermediate forms; so that Mr. Baker has done well in uniting them in *Species Filicum*, though the name he has chosen, although given by myself, I must regard as not to be retained under the generally accepted laws of nomenclature. Moreover, my original *Allosorus mucronatus* was founded on small Californian specimens of *P. Ornithopus*, of Hooker, and it was after the publication of Hooker's species of *Pellaea* that I proposed, in the Botany of the Mexican Boundary, to unite his three species under the name of *Pellaea mucronata*.

Some of Mr. Brandegee's Colorado specimens show a slight tendency to become tripinnate; and it must be confessed that it is not easy to show any very clear distinction between the present species and *P. Ornithopus* on one side, and *P. ternifolia* on the other.

Plate XLVII.—Fig. 1-3. *Pellaea Wrightiana*, from Arizona, collected by Professor Rothrock. Fig. 2 is a pinnule, the margin partly turned back, to show the veinlets and the sporangia. Fig. 3, a spore.
Plate XLVII.—Fig. 4-6.

PELLÆA BRACHPYTERA, Baker.

Strict Cliff-Brake.

PELLÆA BRACHPYTERA:—Root-stock short, knotted, chaffy with very narrow ferruginous denticulate scales; stalks six to eight inches long, erect, wiry, blackish and shining; fronds nearly as long as the stalks, rigid, narrowly oblong-linear in outline, bipinnate; pinnæ several pairs, sessile, ascending or almost oppressed, very short, often broader than long; pinnules five to thirteen to a pinna, three to six lines long, very closely placed, coriaceous, greenish-glaucous, oblong-linear, mucronulate, the edges much rolled in, making the pinnules nearly terete; veins mostly twice forked; sporangia near the ends of the veinlets, covered by the revolute margins of the pinnules.


PLATYLOMA BRACHPYTERUM, Moore, in Gardener’s Chronicle, Feb. 1, 1873, p. 141.

PELLÆA ORNITHOPUS, var. BRACHPYTERA, Eaton, in Bulletin of the Torrey Botanical Club, iv, p. 16; Ferns of the South-West, p. 322.

Hab.—Rocky places in the Sierra of California, at 4000 feet elevation, Bolander, collected in 1869. Also sent by Mrs. Pulsifer Ames, and Mrs. R. M. Austin, and by Messrs. Kellogg & Harford (No. 1169).

Description:—This has a very similar root-stock and habit of growth to P. Wrightiana and P. Ornithopus, and may quite possibly be ultimately united with both of them. The fronds are more strict in habit than either of them, and are mainly distinguished by having comparatively short and erect or ascending pinnae. While the fronds are normally bipinnate, a few two-parted or three-parted pinnules are not unfrequently produced, and render the separation from P. Ornithopus very difficult. Moore’s P. bellum seems, from the description, to be only a smaller and still more constricted form of Pellaea brachyptera, which, according to Mr. Bolander’s observations, produces larger and less constricted fronds whenever the rocks on which it grows are moistened by spray, as happens sometimes where an aqueduct is carried along a mountain side. I have seen no sterile fronds.

Plate XLVII., Fig. 4–6.—Pellaea brachyptera, drawn from a plant collected on hills near Mill Creek, Plumas County, California, by Mrs. Ames. Fig. 5 is a pinnule, enlarged, and showing the venation and sporangia. Fig. 6, a spore.
Plate XLVII. — Fig. 7–10.

PELLÆA ORNITHOPUS, Hooker.

Bird-foot Cliff-Brake.

PELLÆA Ornithopus:— Root-stock short, thick, nodose, densely chaffy with very narrow dark-brown scales; stalks clustered, rather stout, dark-purplish or almost black, polished, rigid, two to ten inches long; fronds four to twelve inches long, very rigid, broadly ovate-lanceolate in outline, when fully developed tripinnate; primary pinnae spreading, or obliquely ascending, linear, the lower ones one-fourth to one-third the length of the frond, bearing from a few up to sixteen pairs of usually trifoliolate, but sometimes varying to simple or to five-to-seven-foliolate, nearly sessile pinnules; ultimate segments or pinnules commonly only one and a half to two lines long, coriaceous, slightly glaucous beneath, roundish-quadrate in the rare sterile fronds, and with the margins rolled in to the midvein in the fertile fronds, mucronulate.


_Allosorus andromedæfolius_, Hooker, in _Plantæ Hartwegianæ_, p. 342, (No. 2042), not of Kaulfuss.
Allosorus mucronatus, Eaton, in Silliman's Journal, July, 1856, p. 138.—

Hab.—California, common on dry exposed rocks from Mendocino County to San Diego. Also on Guadalupe Island, Palmer. Professor Brewer notes: "This species is abundant on the very dry mountains in the western part of the State;—grows often in tufts in the rocks, where it receives no moisture whatever for several months in the summer, and is exposed to an intensely scorching sun."

Description:—The root-stock of this fern probably attains a length of three or four inches: it is more or less branched, the branches often being short and nodose, giving the root-stock a somewhat knotted appearance. It has a dense covering of narrow cinnamon-brown scales, some with a strong blackish midnerve, and others on the same root-stock without midnerve, but all more or less denticulate along the edges, especially towards the tips.

The stalks are clustered on the knots of the root-stock, and near its end, and rise to a height of from two or three inches to nearly a foot. They are singularly rigid and wiry, as are the general and partial rachises. In the largest examples they are fully the tenth of an inch in diameter. Their color varies from nearly black to purplish-brown or dark-cinnamon-brown. Except at the very base they are devoid of chaff. One specimen from Long Valley, Mendocino County, has on the upper part several short and thorn-like, but blunt
protuberances; reminding one of the aculeate stalk occasionally seen in tropical ferns. The section shows a very thick exterior woody sheath, and in the middle a single fibro-vascular bundle, which is roundish-triangular, and has slight furrows along the three sides, the deepest one along the side next the anterior side of the stalk, which is slightly flattened.

The fronds are usually about half as long again as the stalks, and are broadly ovate-lanceolate or deltoid-lanceolate in outline. The fronds of mature plants are regularly tripinnate. The primary pinnæ are elongated, and commonly form an angle of about sixty degrees with the rachis, though sometimes they spread horizontally, and at others they rise very obliquely. The lowest pair of secondary pinnæ are placed very close to the main rachis. The secondary pinnæ vary from five to sixteen pairs, normally they are trifoliolate and resemble the three toes of a bird's foot, whence the very appropriate name given to this species by Sir W. J. Hooker. But in very small specimens, such as those on which my *Allosorus mucronatus* was founded, the secondary pinnæ are often simple, and then the plant approaches *P. Wrightiana* with inconvenient proximity. In very large plants, like those collected by Dr. Kellogg in Mendocino County, some of the secondary pinnæ are more or less elongated, and become pinnately five-to-seven-foliolate. The ultimate pinnules, in all the native specimens which I have seen, are less than three lines long, and have the edges rolled in revolutely almost or
quite to the midrib, entirely concealing the sporangia, which are borne on the upper part of the very obscure forking veinlets.

Plants cultivated in the moister atmosphere of eastern conservatories have the pinnules less revolute, and sometimes quite flat and destitute of sporangia. The pinnules have then much of the roundish-quadrate form seen in *Pellaea Wrightiana*, but are considerably smaller, even when, as is often the case, the fronds are only twice pinnate. Plants of this kind pass for *P. bella* among florists, but have probably little to do with *Platyloma bellum* of Moore. I am under obligations to Hon. J. Warren Merrill for a full set of cultivated forms of this species.

Plate XLVII., Fig. 7–10.—*Pellaea Ornithopus*, drawn from a plant sent by Mrs. Ellwood Cooper from Santa Barbara. Fig. 8 is a pair of the secondary pinnæ. Fig. 9, a pinnule. Fig. 10, a spore.
Gymnogramme Oregona, Nuttall, MS. in herb.

Var. viscosa:—Frond ovate-pyramidal in outline; primary pinnæ rather distant; upper surface viscid, as if varnished; powder of the lower surface creamy-white. — Gymnogramme viscosa and G. pyramidata, Nuttall, MS. in the herbaria at Kew and at Philadelphia.

Hab. — Common on rocky hills nearly throughout California, and extending northward to Oregon and perhaps still farther. It was collected on Guadalupe Island by Dr. Palmer, and is said in Synopsis Filicum to occur on Vancouver Island and in Ecuador. It was first found near San Francisco by Chamisso, and has since been gathered by nearly every botanist who has visited or resided in California. Specimens with the powder on the under surface very pale yellow, or even silvery-white, are not uncommon. Of the variety viscosa, I have seen only Nuttall's specimens, and some from San Diego collected by Mr. Cleveland, or sent by Mr. George C. Woolson.

Description:—The root-stock is rarely more than one or two inches long, and is rather slender, but covered with the broken bases of old stalks, so that it looks stouter than it really is. The chaff is moderately abundant, and consists of little lanceolate-acuminate fuscous-brown rather rigid scales, composed of irregularly oblong cellules, and entire on the margins. Some of the scales have a strong blackish mid-nerve, and in others no midnerve can be seen.

The stalks are clustered on the root-stock, and vary much
in length and thickness. They are most frequently about a span long and half or three-fourths of a line thick. Their color is dark-brown, sometimes almost black, and they have a high polish, like the stems of most Adianta. All that I have seen are perfectly smooth, but some Oregon specimens, collected by Douglas, and figured in Icones Filicum, have the stalks sparingly aculeate. The section shows a firm exterior sheath, and a single central roundish fibro-vascular bundle, the ducts being arranged in a figure resembling the right and left wings of a butterfly.

The fronds are commonly three or four inches long, and almost as wide. Though they were originally described as "triangular," their form is nearly pentagonal, with a deep sinus on the lower side, where the fronds rest on the stalk. The rachis is narrowly wing-margined between the lowest pinnæ and the next pair, and more broadly winged above. The lowest pinnæ are very much larger than the next pair, and have the segments on the lower side much elongated. The rest of the pinnæ decrease regularly upwards from the second pair. The second pair are pinnately lobed with oblong obtuse lobes, and the upper ones are less and less lobed, and so pass into the short and rounded lobes of the apex. The upper surface of the frond is usually dark-green and smooth; rarely it is minutely glandular, and in var. viscosa it is viscid, as if varnished with some adhesive material. The powder on the lower surface is most frequently deep golden yellow, but passes gradually to white. It is readily shaken off from the living
fronds, and seems to consist of minute elongated grains or spicules of wax, which is soluble in alcohol and ether, and melts on the surface of hot water.

The veins are free, and several times forked from a midvein. In the fertile fronds they bear the sporangia in long lines, which become broader as the spores ripen, and not rarely entirely cover the under surface of the frond. The spores are roundish-tetrahedral, and faintly trivittate.

The genus *Gymnogramme* is characterized by having the naked sori oblong or linear, following the course of the veinlets, and, like them, either simple or forked, pinnated, or variously anastomosing. There are nearly one hundred species in the genus, of which only two are known in the United States, and three in Europe. The subgenus *Cerapteris* includes the species, six or seven in number, which have fronds coated beneath with colored powder. Several of these are well known in cultivation under the name of Gold-Ferns and Silver-Ferns.

Plate XLVIII., Fig. 1-5. — *Gymnogramme triangularis*. Fig. 1 is a plant from Santa Barbara, sent by Mrs. Cooper. Fig. 2, a segment of one of the lower pinnae. Fig. 3, a part of a segment, more magnified. Fig. 4, a spore. Fig. 5 is the variety *viscosa*, sent from San Diego by Mr. D. Cleveland.

*The name of the genus was originally written *Gymnogramma*, a neuter noun, but was changed to the feminine form for sufficient reasons by Sprengel and Kunze. See the note under *Cryptogramme*, a precisely parallel case, in Hooker's *Species Filicium*, ii., p. 126.*
Plate XLVIII.—Fig. 6-11.

GYMNOGRAMME HISPIDA, METTENIUS.

Hispid Gymnogramme.

Gymnogramme hispida:—Root-stock very slender, creeping, somewhat chaffy; stalks scattered, four to six inches long, grayish-brown, puberulent; fronds pentagonal, one to three inches long and broad, hispid above, beneath tomentose and chaffy along the rachis and midveins with very narrow hair-like scales, pinnate; lower pair of pinnae much the largest, unequally triangular, again pinnated; the remaining pinnae and the lower pinnules of the first pair pinnately lobed; the lobes rounded and obtuse, the basal ones adnate to the rachis or the midrib, forming an interrupted wing alternating with the pinnae or principal segments; veins obscure, all free, sori in long lines along the veinlets, hidden by the tomentum.


Gymnogramme pedata, Eaton, in Robinson’s Check-list, not of Kaulfuss.

Gymnogramme podophylla, Hooker, Sp. Fil. v., p. 152, as to the New Mexican plant.
Hab.—First collected by Charles Wright in 1849 on a journey from Western Texas to El Paso, in New Mexico. The collectors of the Mexican Boundary Survey found it along the Rio Grande, the San Pedro and the Gila, mostly on rocks. I have also received specimens collected at Camp Bowie, by Mrs. Sumner, near Camp Grant, Arizona, by Mrs. A. T. Smith, and in Central Arizona by Clarence King and by Dr. Palmer.

Description.—This little fern has been confounded, first with Gymnogramme pedata, from which it differs in having a smaller frond, with obtuse lobes and a denser tomentum beneath, a stalk without lustre, and an elongated root-stock, and secondly with G. podophylla, from which the free veins sufficiently distinguish it.

The fronds have the same five-angled shape as those of G. triangularis, but have peculiar lobe-like wings along the rachis and midribs between the pinnæ and the principal segments, and are hispid with straight white jointed hairs on the upper surface, and both tomentose and somewhat pellaceous beneath. The veins are difficult to examine, but by soaking a piece of a frond in hot water, and then scraping off the tomentum, etc., they may be seen to be free and forking.

Plate XLVIII., Fig. 6–11.—Gymnogramme hispida. The drawing is mainly taken from Mr. King's specimens. Fig. 7 shows a half-denuded segment; Fig. 8, a scale of the rachis; Fig. 9, a hair from the upper surface, and Fig. 10, a little of the tomentum, from the under surface.
Plate XLIX. — Fig. 1–3.

NOTHOLÆNA CANDIDA, Hooker.

Bright Notholæna.

Notholæna candida:— Root-stock creeping, the scales narrow, rigid and nearly black; stalks tufted, three to six inches long, wiry, black and shining; frond not so long as the stalk, deltoid-ovate in outline, pinnate; pinnæ lanceolate from a broad base, deeply pinnatifid, the lowest pair having the inferior basal segments much elongated and again pinnatifid, the other pairs gradually decreasing to the apex of the frond; segments oblong, slightly curved, obtuse, minutely glandular above, beneath covered with white or yellow ceraaceous powder, except on the blackish midribs; margins slightly revolute, but not covering the intra-marginal line of dark-brown sporangia.


Notholcena cretacea, Liebmann, Mex. Bregn., p. 64.

Cheilanthes candida, Martens & Galeotti, Syn. Fil. Mex., t. 20, f. 1, a, (only this figure, according to Kunze, the description at p. 73 and the principal figure belonging to another fern).

Aleuritopteris candida, Fée, and A. cretacea, Fournier, Pl. Mex., Crypt., p. 121.


Ceropteris monosticha, Fée, 7me. Mém., p. 44, t. xx., f. 2.

** Much additional synonymy may be found in Species Filicum and in some of the other works above referred to, but as much of it cannot be verified without seeing the original specimens, it is better not to quote it here.

Hab.—In crevices of rocks, often in places exposed to the sun, from Western Texas and New Mexico to San Diego County, California, and southward to Peru. It is No. 820 of Charles Wright's first Texas distribution, and No. 2124 of the second. The collectors of the Mexican Boundary Survey found it on the lower Rio Grande, and on the Pecos and the San Pedro. A smaller form, with minute rounded segments, and yellow or yellowish-white powder, was discovered in Spring Valley, San Diego County, California, in 1876, by Miss Annie L. Burbeck, and has since been collected at several places in the southern part of that State by Mr. Cleveland, Dr. Parry and Mr. William Stout.

Description:—The root-stock is creeping, but short, and rather slender. It is adorned with scales having thin brownish edges and a very rigid blackened midnerve, which remains long after the more delicate portion has disappeared.
FERNS OF NORTH AMERICA.

These scales are also found on the lower part of the stalks, which are clustered on the root-stock, black and polished, slender, wiry, and from one to about six inches long. The rachis and all its branches are also black and shining.

The frond is deltoid-ovate in the larger forms, but the outline becomes almost regularly pentagonal in smaller specimens. In all the specimens which I have seen, the second pair of pinnae are nearly or quite as long as the lowest pair, and appreciably longer than the third. The lowest pinnae are much the broadest, from the fact that the basal pinnules on the lower side are much elongated, and more compound than those on the upper side. Sometimes several of the pinnules on the lower side are longer than the corresponding ones on the upper side. The pinnae are sometimes pinnate, making the frond fairly bipinnate, but commonly they are pinnatifid into oblong or more or less rounded lobes. The upper surface is dull-green, but copiously sprinkled with minute stalked whitish glands. The under-surface, in the New Mexican specimens, is covered with bright-white ceraceous powder, which, however, is absent from the midveins. In the California specimens this powder becomes yellowish, and even sulphur-yellow. Examples from Santa Martha, in Columbia, and from Peru, have the powder of a deep orange-yellow.

The margin is slightly recurved, but does not form a true involucre, such as is seen in *Cheilanthes farinosa*, a fern otherwise much like the present species. The sporangia
are found just within the margin; they are dark-brown in color, and contain spheroid-tetrahedral spores.

The true name of this fern has been the subject of much difference of opinion among Pteridologists. Mr. Smith considers it identical with the *Pteris sulphurea* of Cavanilles, but does not claim to have seen the original specimens of that author. The earliest name for it in the genus *Notholea* is *N. pulveracea*, of Kunze. But Kunze gave no specific character to his plant, and, moreover, chose a specific name which had been used already for another not very distantly related fern. I have preferred, therefore, to retain Hooker's name, as being the first name under the proper genus which was accompanied by an adequate specific character.

Plate XLIX., Fig. 1-3.—*Notholea candida*. The specimen selected for illustration was collected in the Mexican Boundary Survey. Fig. 2 is a segment of one of the middle pinnae, with the ceraceous powder removed, so as to show the veins. Fig. 3 is a spore.
Plate XLIX.—Fig. 4-7.

Notholæna Hookeri, D. C. Eaton.

Hooker's Notholæna.

Notholæna Hookeri:—Root-stock short, creeping, densely covered with rigid blackish-brown lanceolate scales; stalks clustered, four to eight inches high, wiry, reddish-brown, smooth and shining, bearing a few ovate scales near the base; frond two to two and a half inches long and broad, almost regularly pentagonal, composed of three divisions; the middle one raised on a short narrowly winged stalk, rhomboid-ovate, pinnatifid into a few oblong toothed segments, of which the first pair is smaller than the second; the side-divisions sessile, deltoid, pinnatifid on the upper side much as in the middle division, but each bearing on the lower side a single much elongated basal segment, and above it smaller segments like those of the upper side; upper surface dull-green, smooth, lower surface covered with a yellow or yellowish-white ceraceous powder; sporangia sub-marginal; the edge of the frond slightly recurved.

Hab.—Clefts of rocks, in canons and on mountains, from the Rio Grande to Arizona, and perhaps extending into Mexico. It is Charles Wright's No. 821, collected between Western Texas and New Mexico. It has been sent from New Mexico also by Dr. Bigelow, Mr. Schott and Dr. Seguin, and was found near Camp Bowie, in Arizona, by Professor Rothrock and Mrs. Sumner. It has recently been collected on the journey from San Luis Potosi, in Mexico, to San Antonio, Texas, by Dr. Parry (No. 992).

Description:—This fern has, like most of the ferns which grow in the clefts of rocks, a creeping and rather short root-stock, well covered with scales. The scales are two or three lines long, lanceolate, and appressed to the root-stock. They consist of a very broad and rigid, dark-brown and shining midnerve, which has a narrow border of more delicate and paler cells on each side. The stalks are clustered at the end of the root-stock, and are dark-brown, shining, wiry and nearly erect. Near the base they bear a few scales, which are shorter and broader than those of the root-stock, and have a narrow midnerve. The section discloses a single roundish fibro-vascular bundle, having the ducts which it contains arranged in a somewhat lunate form.

The fronds have an outline between that of a pentagon and that of a five-pointed star. They consist of a middle portion of a rhomboid-ovate form, supported on a short but narrowly winged stalk, and two lateral divisions, which are sessile. The middle part is pinnatifid nearly to the midrib into a few oblong-lanceolate crenate and often sub-falcate
lobes; while the lateral divisions have each on the lower side a very large pinnatifid basal segment, the rest of the segments being similar to those of the middle division, though a trifle smaller. The whole frond is thus five-rayed, the middle ray largest, and the two lower rays smallest. The upper surface of the frond is smooth, and of a dull, though rather dark, shade of green. The under-surface, with the exception of the midribs, is covered with a waxy powder, like that of Notholena candida and Gymnogramme triangularis, and probably equally variable in color. The specimens first collected by Mr. Wright have the powder almost white; those sent afterwards from New Mexico have it of a pale sulphur-yellow, and those just received from Dr. Parry have it of a deep yellow, inclining to orange.

The veins are free and forking. The sporangia are borne on the ends of the veins, just within the margin, which is slightly recurved, but not so as to form a true involucre. The spores are slightly trigonous, and have the usual three radiating vittae of such spores.

This fern was considered “probably a distinct species” by Sir W. J. Hooker, though at the same time he made of it a variety of N. candida. I have thought, at times, that I could identify it with N. cretacea, of Liebmann, or with Cheilanthes Borsigiana, of Mettenius; but both of these seem to be forms of N. candida, from all forms of which species this one can be distinguished by the lowest segments of the middle division being smaller than the next superior segments.
FERNS OF NORTH AMERICA.

This is the plant from La Cuesta, in New Mexico, which was confused with the very similar Gymnogramme triangularris in Pacif. R. Reports, IV., p. 160. Some of the same specimens, sent to Kew by Dr. Torrey, were attributed to California in Species Filicum, either because of some error in the label, or because La Cuesta was thought to be in that state.

Plate XLIX., Fig. 4-7.—Notholana Hookeri. The principal figure is drawn from a specimen collected near Camp Bowie, Arizona, by Professor Rothrock. The details are a segment, with a portion of the same, more enlarged, and a spore.
CHEILANTHES LEUCOPODA, Link.

White-stalked Lip-fern.

Cheilanthes leucopoda:—Stalks three to six inches long, pale straw-color, pubescent with white spreading hairs, stout for the size of the frond, clustered on a short chaffy root-stock, chaffy at the base with soft narrow rusty scales; fronds three to four inches long and broad, broadly deltoid or somewhat pentagonal, at the base quadripinnate, gradually simpler upwards, everywhere viscid-puberulent; lowest pair of pinnæ unequally deltoid-ovate, the longest branches being on the lower side; middle and upper pinnæ oblong-ovate; secondary pinnæ oblong, short-stalked; ultimate ones divided into minute rounded lobules, which when fertile are strongly revolute, concealing the sporangia.


Hab.—Uvalde Cañon, Rio Nueces, Texas, Mrs. M. J. Young, 1876. Also found in Mexico.

Description:—This fern has much more compound fronds than the other species represented on our Plate XLIX. It comes very near the better-known C. viscosa, of Link, and
is only incidentally mentioned in *Synopsis Filicum* in the account of that species. Both plants have rather small deltoid quadripinnate fronds, pubescent stalks and surfaces, and rounded ultimate divisions. But *C. viscosa* is more glandular and viscid than *C. leucopoda*, has dark-brown stalks, and a well-developed white-membranaceous involucre. In the present plant the stalks are pale straw-color, and pubescent with delicate white spreading hairs. The rachis and its divisions are similarly hairy, though the pinnules are somewhat glandular-viscid. The recurved lobules, which form the involucres, do not lose their herbaceous character. These points of difference seem sufficient to keep the two ferns apart. *C. leucopoda* is given simply as Mexican by Link, but it has been collected near San Luis Potosi, according to Fournier. Of *C. viscosa*, fine specimens, also from San Luis Potosi, have just been distributed by Drs. Parry and Palmer (No. 990). The reference of that species to New Mexico in *Synopsis Filicum*, arose, as I learn from Mr. Baker, from a typographical error, North Western Mexico having been intended.

The figure in Plate XLIX. was drawn from a specimen kindly lent for the purpose by Mr. Davenport. The details explain themselves.
Plate XLIX.—Fig. 12-14.

CHEILANThES ARGENTEA, Kunze.

Silvery Lip-Fern.

**Cheilanthes argentea:**—Root-stock short, clothed with rigid pointed blackish scales; stalks clustered, two to six inches long, wiry, dark-brown, glossy, sparingly chaffy towards the base; fronds one to four inches long, deltoid-ovate, pedately tripartite; divisions deeply pinnatifid, the middle one short-stalked, triangular, the side ones sessile, unequally triangular, broadest on the lower side; lobes oblong, often subfalcate, entire or crenately lobed, obtuse, smooth and green above, beneath covered with white or yellow ceraceous powder; veins forked from a midvein, free; sporangia at the ends of the veins, covered when young by a manifest scarious crenulate involucre formed from the margin of the frond.


FERNS OF NORTH AMERICA.

Hab.—Siberia, from the Ural Mountains to Kamtschatka; Japan, Northern China and India. Said by Pallas to have been found in Alaska by Steller, but not collected in America for many years, and having at best a very doubtful claim to be counted in our Flora.

Description:—The various forms of this fern are beautifully figured in *Filices Exoticae*, and the plate is accompanied by a particularly full and careful description. The general form of the frond is deltoid, or more properly, pentagonal-ovate. The three primary divisions of the frond are nearly equal, the middle one being commonly only a little larger than the others. All the divisions are pinnately lobed almost to the midrib, the middle division having the two sides equal, and the lateral divisions having the inferior lobes very much larger than the superior ones. The waxy powder has the same variation in color that we have noticed in the other ferns which have this peculiar coating on the under-surface of the frond. The well-developed involucre determines the position of the species to be in *Cheilanthes*.

Plate XLIX., Fig. 12–14.—*Cheilanthes argentea*, drawn from a specimen collected by Hon. S. Wells Williams near the city of Pekin, China. Fig. 13 shows a lobe of one of the lower divisions. Fig. 14 is a spore.
**Plate L.**

**Asplenium Thelypteroides, Michaux.**

**Silvery Spleenwort.**

*Asplenium thelypteroides:* — Root-stock creeping, covered, on the upper side at least, with persistent stalk-bases; stalks nearly a foot long, sparingly chaffy when young; fronds growing in a crown, one and a half to nearly three feet long, lanceolate in outline, slightly narrowed towards the base, membranaceous, often somewhat hairy along the veins, pinnate; pinnae spreading, linear-lanceolate, acuminate, deeply pinnatifid; lobes crowded, oblong, obtuse, obscurely serrulate, each with a central midvein and three to eight oblique simple veins on each side, all but the few uppermost veins of each lobe fertile; indusia oblong, mostly single, but those on the acuminations of the pinnae often double, when young arched and with a silvery lustre, soon opening along the outer margin and disclosing the sporangia.

*Asplenium thelypteroides,* ¹ Michaux, Fl. Bor.—Am., ii., p. 264.—Swartz, Syn. Fil., p. 82.—Schkuhr, Krypt. Gew., p. 71, t. 76, b.—

¹This name was written *thelypteroides* by Michaux, Schkuhr, Pursh and Torrey. Willdenow has it *thelyptroides.* The remaining authors have the orthography here used, which is in accord with common usage in words of like derivation. Swartz's name, *Asplenium acrostichoides,* is really the oldest by three years, but is badly chosen, and has never come into general use.
Asplenium acrostichoides, Swartz, "in Schraders Journ., 1800, ii., p. 54;" —
Syn. Fil., p. 82, 275.

p. 186.—Moore, Index, p. 188.

Diplazium thelypteroides, Presl, Tent. Pterid., p. 114.

Hab. — Deep rich woods; not rare from New Brunswick and Canada to Central Alabama, and westward to Wisconsin. Also in Penang, the Himalayas, and in Amur-land.

Description: — This is one of the more conspicuous ferns in the forests of the Northern States, and is most frequently found where a rivulet trickles through deep forests on the lower slopes of a mountain, keeping the earth at all times moist. The root-stock is several inches long, and creeps just beneath the surface of the ground, the advancing end bearing a crown of large and deep-green lustreless fronds, and the older part bearing the up-curved and adherent bases of former stalks. It is covered with branched and entangled rootlets, but bears little or no chaff, differing in this respect from the otherwise somewhat similar root-stocks of several of our common species of Aspidium.
FERNS OF NORTH AMERICA.

The stalk, though chaffy when very young, is when mature nearly smooth, and is stramineous when dry. It is furrowed on the anterior side and contains two flattened fibro-vascular bundles.

The fronds are herbaceous, rather thin in texture, and wither at the first touch of frost. They are commonly about two feet long, exclusive of stalk, and one-fourth as wide in the middle. Towards the base they are moderately contracted, sometimes much contracted, and they taper to a slender apex. The pinnæ of a large frond are five or six inches long, and rarely as much as an inch wide. They are attached to the rachis by so short a stalk as to be almost sessile, and spread obliquely, or are even slightly decurved, as in *Aspidium Thelypteris*, from its resemblance to which fern the present one was named. The lower pinnæ are much more widely separated than the middle and upper ones, as is the case in most pinnated ferns. The pinnæ are cut into numerous oblong lobes, the incisions extending to within half or three-fourths of a line of the midrib. Usually the pinnules are but slightly toothed, but Dr. Lawson has described in the Canadian Naturalist a var. *serratum*, with the “lobes of the pinnæ ovate-oblong, approximate, strongly and incisely serrate.” The veins diverge obliquely from the midvein, and are simple, running nearly straight to the margin. Sterile fronds have rather wider pinnæ and lobes than the fertile ones; in the latter all, or all but a very few, of the lowest pinnæ are well covered with fruit.
The sori are oblong, and extend nearly from the mid-vein to the margin. Though mostly single, and confined to the upper side of the fruiting veinlet, the lowest one of a lobe is often double or diplazioid, and such double sori are almost always found on the long and slender tips of the pinnæ.

The indusia are of a rather firm texture, moderately vaulted or convex, and when young give to the lower surface of the frond a silvery sheen, whence the common name, given, as it appears, by Dr. Jacob Bigelow.

The spores are bean-shaped, and are irregularly and narrowly winged.

This fern is not closely related to any other occurring within our limits, but there are several in Asia, or in tropical America, which more or less closely resemble it.

Plate L.—Aspleniun thelypteroides. The specimen drawn was collected near New Haven, Connecticut. Fig. 2 is a lobe of a pinna, and Fig. 4 the apex of a pinna, the latter showing the diplazioid sori. Fig. 3 is a spore.
PLATE LI.—Fig. 1-3.

ASPLENIUM MYRIOPHYLLUM, PRESL.

Milfoil Spleenwort.

Asplenium myriophyllum:—Root-stock very short; stalks dark-brown, slender, one to three inches long; rachis green, very narrowly wing-margined; fronds spreading, three to eight inches long; delicately membranaceous, smooth, lanceolate in outline, narrowed towards the base, twice or thrice pinnate; pinnæ closely placed, ovate-lanceolate; pinnules two to four lines long, simple and obovate or obovate-oblong or else cut into a few obovate segments; veins single in each pinnule or segment, bearing on the upper side a somewhat elongated solitary sorus; indusium thin and delicate.

Asplenium myriophyllum, Presl, Reliquiae Hænkeanæ, i., p. 48; Tent. Pterid., p. 108.—Eaton, in Chapman's Flora, p. 593.—Moore, Index, p. 147.

Caenopteris myriophylla, Swartz, Fl. Ind. Occ., p. 1626; Syn. Fil., p. 88 (fide Presl).


Asplenium Anchorita & A. pusillum, Chapman, MS.
Hab.—On the walls of a limestone cave at Schurlock’s Spring, Jackson County, Florida, Dr. Chapman. Also near Ocala, Florida, collected by Mr. W. H. Shockley, and by Captain John Donnell Smith, who found it “growing in tufts at the bottom of pocket-like holes in cavernous lime rock, the fronds spreading flat around the orifice.” Also in the West Indies, Mexico, and parts of South America.

Description:—This is the most delicate and finely divided of all our Spleenworts, and need not be confounded with any other native species.

The lower pinnules of each pinna are more or less lobed, being usually cleft into from three to five little lobes. A few of the next pinnules are often two to three-lobed, and the rest are mostly entire. The solitary veins and sori show a close approach to the section Darea of the genus Asplenium.

A. cicutarium, recently collected in Sumpter County, Florida, by Mr. Shockley, comes nearest to it, but has broader and, when fully developed, much larger and coarser fronds. A. monteverdense, of Hooker, is scarcely distinguishable from our plant, and, indeed, Wright’s 1092 seems to be precisely A. myriophyllum, and was collected also “at the entrance of caverns.” A. rhizophyllum is a larger plant, and has usually a prolonged radicant apex.

The specimen figured is among the largest of those collected by Dr. Chapman.
Plate LI. — Fig. 4–8.

Asplenium Bradleyi, D. C. Eaton.

Bradley’s Spleenwort.

Asplenium Bradleyi:— Root-stock short, covered with narrow acuminate blackish-fuscosus scales; stalks clustered, slender, ebeneous, as is the lower portion of the rachis; fronds four to seven inches long, membranaceous, oblong-lanceolate varying to linear-oblong, pinnate; pinnae rather numerous, the lower ones no larger than the middle ones, all short-stalked, oblong-ovate, obtuse or acutish, more or less toothed, in the largest fronds pinnatifid into oblong lobes which are toothed at the apex, sori short, placed near the midveins; indusia delicate.


Hab.— Discovered in 1871 by the late Professor F. H. Bradley, growing on shaded sandrock on the top of Walden’s Ridge, in the Cumberland mountains of East Tennessee. Also found by Professor Bradley in Morgan County, and by Mr. James Constable, Jr., in Roane County in the same State; Lookout Mountain, Dr. Gattinger; Kentucky, Edmonson County, Professor Hussey; Estill and Rockcastle...
Counties, Mr. Williamson; Arkansas, near the White River, Professor F. L. Harvey. Specimens of a less developed form were collected on limerock near Newburg, New York, by Dr. F. J. Bumstead and myself, in 1864.

**Description:** This varies a good deal in the shape of the fronds and in the degree of incision of the pinnae, the narrower and less divided forms having some resemblance to *A. ebeneum*, and the larger forms looking more like *A. montanum*, or the European *A. lanceolatum*. If there could be a hybrid between *A. ebeneum* and *A. montanum*, it would be much like our plant. The stalks are dark and polished, sometimes almost black, and the color continues up to the middle part of the frond, except in the smallest specimens. The fully developed plant has the fronds almost bipinnate, but differs from *A. montanum* in having the lowest pinnae not larger than the others, in the thinner texture, and in the shorter stalks of the pinnae. It will probably prove to be less rare than is supposed, and to have a wide range, since the Newburg plant is manifestly identical with that found by Mr. Williamson in Estill County, Kentucky.

Plate LI., Fig. 4-8.—*Asplenium Bradleyi*. Three plants from Walden's Ridge are represented, showing the variations in form and cutting. Fig. 7 is an enlarged pinna from the largest frond. Fig. 8, a spore.
FERNS OF NORTH AMERICA.

Plate LI.—Fig. 9-11.

ASPLENIUM MONTANUM, WILDLDENOW.

Mountain Spleenwort.

Asplenium montanum:—Root-stock short, copiously rooting, chaffy at the apex with dark-fuscous narrow pointed scales; stalks one to four inches long, somewhat ebeneous near the base, becoming green higher up, and so passing into the narrowly winged herbaceous rachis; fronds sub-coriaceous, two to four inches long, ovate or lanceolate from a broad base, pinnate; pinnae ovate or ovate-oblong, the lower ones pinnately cleft into oblong-rhomboïd or ovate cut-toothed lobes, the upper ones gradually simpler; sori short, placed near the midvein, the lower ones often double; indusia delicate, entire.


Asplenium Adiantum-nigrum, Michaux, Fl. Am.-Bor., ii., p. 265.—Heufler, Aspl. spec., p. 300 (as far as concerns the American plant).
Hab. — Crevices of rocks in mountainous districts, from Ulster County, New York, where it was discovered by Rev. H. M. Denslow, southward along the Alleghanies, and west of them, to Kentucky, Tennessee and Alabama.  

Description: — This plant grows in dense tufts, the root-stocks so matted and fastened together by interlacing rootlets that a single plant is not easily separated from the mass. The scales of the root-stocks appear nearly black to the eye, but when placed under the microscope are seen to be composed in the lower portion of nearly square cells, the cell-walls of a deep vinous red. The slender acumination of the scales is formed of the persistent thickened walls of adjacent cells, the thin exterior walls having probably disappeared, much in the same way as the teeth of the peristome are formed in most mosses.

The stalks are dark-brown and somewhat polished in the lower part, but become green and herbaceous below the base of the frond. A section near the base shows two fibro-vascular bundles, but these are united near the middle of the stalk, and a section made just below the frond shows but one.

I have specimens from several places in Pennsylvania, collected by Professor Porter and Mr. E. Diffenbaugh; from the vicinity of Mammoth Cave, Kentucky, Professor Hussey; from Eastern Tennessee, Professor Bradley; from North Carolina, Professor Gray, and abundant specimens from Northern Alabama, sent by Hon. T. M. Peters. Professor Eugene A. Smith sent it from the valley of the Cohaba River, in central Alabama. Mr. Albert K. Smiley writes that it grows abundantly at Lake Mohonk, and in several other places in the Shawangunk Mountains in Ulster County, New York, where it has also been collected by Miss C. C. Haskell and Professor Peck.
The fronds are but two or three inches long, and decidedly triangular-ovate in shape; in the specimens collected by the earlier botanists, and in those figured by Mettenius; but some of the plants sent by Mr. Peters have fronds four inches long, exclusive of stalk. Mr. Williamson speaks of still larger fronds, but it is probable that his “six or seven” and “ten” inches include the stalk as well as the frond. The fronds are apparently evergreen, and are of a thicker texture than those of _A. Bradleyi_;—Hooker calls them subcoriaceo-membranaceous. They are always broadest at the base, so that the shorter ones are triangular-ovate, and the longer ones triangular-lanceolate. The longest ones often end in a long and slender pinnatifid acumination. The rachis is flattened and narrowly winged. The fronds are pinnate, and have several pairs of ovate or ovate-lanceolate pinnae, the lowest ones pinnately divided into irregular oblong or rhomboid-ovate segments, which are dentate or more or less cut-toothed. The pinnae are gradually smaller and simpler towards the apex of the frond. The sori are rather short, and are placed near the midveins of the segments. The lower one on the upper side of the midvein is very often diplazioid, as is frequently the case in many other _Asplenium_ with compound fronds. The indusia are very thin, and have an entire margin; as the sporangia ripen the indusia are reflexed and hidden by the fruit. The spores, as in the other species figured in our fifty-first plate, are ovoid or slightly reniform, and irregularly but very narrowly winged.
This fern bears a good deal of resemblance to small forms of the European *A. Adiantum-nigrum*, for which it is taken by Michaux. Very small forms of it are somewhat like *A. Ruta-muraria*, and the authors of the *Synopsis Filicum* remark that it is intermediate between the two.

Plate LI., Fig. 9–11.—*Asplenium montanum*. The specimen figured was sent from Northern Alabama by Hon. T. M. Peters. Fig. 10 represents two or three of the fertile segments, and Fig. 11 a spore.
WOODWARDIA VIRGINICA, Smith.
WOODWARDIA VIRGINICA, Smith.

Virginia Chain-Fern.

WOODWARDIA VIRGINICA:—Root-stock fleshy, subterranean, wide-crawling, the newer portion sparingly chaffy with appressed scales; stalks scattered, erect, one to two and a half feet high, stout, ebeneus near the base; fronds about as long as the stalks, oblong-ovate or ovate-lanceolate in outline, subcoriaceous, smooth, pinnate; pinnae numerous, mostly alternate, sessile, four to eight inches long, rarely an inch wide, deeply pinnatifid into crowded ovate obtuse segments having a callose and minutely serrulate edge; veins forming a series of narrow areoles along the midribs and midveins; areoles emitting free forking veinlets; sori oblong-linear, one to each areole, and therefore forming a series each side the midribs and midveins; indusium arched, at length opening along the inner margin.


Woodwardia Banisteriana, Michaux, Fl. Am.-Bor., ii., p. 263.—Swartz, Syn. Fil., p. 117.


Blechnum Virginicum, Linnaeus, "Mantissa, p. 307."

Blechnum Carolinianum, Walter, "Fl. Carol., p. 257."


Hab. — A rather rare fern, though plentiful in certain favorable localities. It grows in swamps, often where the depth of the water renders the plant almost inaccessible. The range is from Canada and New England to Florida, and westward to Arkansas and Louisiana. It is named in the catalogues of the plants of Michigan and Ohio, but is apparently not found in the valley of the upper Mississippi. It is found also in Bermuda.¹

Description:—The root-stock of this fern is nearly as thick as a man's little finger, and creeps just beneath the surface of the fine mud at the bottom of the shallow ponds

¹ There is a fine station for this fern in a swamp on the top of Mt. Carmel, in New Haven County, Connecticut. I have also seen it plentiful on the borders of swamps in pine woods near Manchester, New Jersey. The most southern station I know of is near Indian River, Florida, whence it was brought by Dr. E. Palmer. In a swamp full of shrubs it faces every way, but in sunny places the fronds uniformly face the south.
where it prefers to grow. In seasons when the ponds are nearly dry the root-stock may be traced a long distance from the fronds. I have torn up a root-stock ten feet long, and found over six feet of it undecayed. It is irregularly branched, soft and fleshy; the rind is moderately tough, black, and naked, except near the advancing end, where it is thinly covered with small ovate entire yellowish-brown scales. It consists mainly of soft white parenchyma, through which there run several irregular bundles and threads of fibro-vascular tissue.

The stalks, which are continuous with the root-stock, rise from it a few inches apart, and those which support living fronds are found about six inches from the apex. Nearer the apex are found a few buds, representing undeveloped fronds, and a few old stalks may be seen back of the living ones; but they disappear in a year or two, leaving the root-stock bare, except for the not very abundant rootlets. The stalks vary in length from a few inches up to over two feet. They are erect, rigid, nearly black near the base, but of a dull brownish-green higher up. There are at first a few little appressed scales borne near the base of the stalk, but these soon disappear. The fibro-vascular bundles are about seven, arranged just beneath the outer sclerenchymatous sheath, the two anterior ones much larger than the others.

The fronds are nearly erect, sub-coriaceous in texture, and of a dark full herbaceous green. The largest ones are two and a half feet long and about a foot wide, and at a
distance look like the fronds of *Osmunda cinnamomea*. They are oblong-ovate in shape, slightly narrowed at the base, and short-pointed at the apex. There are about sixteen pinnae on each side, each one divided to within a line of the mid-rib into very numerous crowded slightly oblique triangular-oblong minutely serrulate segments or lobes. The veins form a series of very narrow areoles, running from the midvein of one lobe to that of the next. A like series of shorter areoles runs along both sides of the midveins of the lobes. Outside of these areoles the veinlets are free and forking. In fertile fronds, which are in other respects like the sterile, the areoles, or many of them, are filled each with a single oblong sorus, covered by a somewhat arched indusium which is attached to the enclosing vein, and opens along the side next the midrib. The spores are oval and irregularly winged.

Mettenius remarks of this fern:—"This species, distinguished by the formation of the frond, was raised by Presl to a genus, "Anchistea," and characterized by a flat indusium and by veinlets anastomosing in the callous border. These statements are erroneous, for the indusium is arched over the swelling sori, and the veinlets radiating from the areoles extend to the border composed of compact colorless cells without forming any anastomosis."

Plate LII. — *Woodwardia Virginica*. The plant figured is from Newton, Massachusetts, and is in Mr. Faxon's collection. Fig. 2 shows two segments enlarged. Fig. 3 is a spore; Fig. 4, a section of the stalk, and Fig. 5, of the root-stock.
Cystopteris Fragilis, Bernh.

Cystopteris Bulifera, Bernh.

Cystopteris Montana, Bernh.
Plate LIII.—Fig. 1–8.

Cystopteris fragilis, Bernhardi.

Brittle Fern.

Cystopteris fragilis:—Root-stock elongated, creeping, covered with persistent stalk-bases, very chaffy towards the apex with delicate ovate-acuminate ferruginous scales; stalks slender, brittle, stramineous or bright-brown, a few inches to a foot long, sparingly chaffy at the base; fronds broadly lanceolate, thin-membranaceous, smooth, usually bipinnate; pinnae oblong-ovate or somewhat deltoid, pointed; pinnules decurrent on the winged secondary rachis, ovate or ovate-oblong, obtuse, toothed or variously incised with toothed lobules; veinlets pinnately arranged on the midveins, running mostly to the teeth of the lobes, the lower ones forked, the upper ones mostly simple; sori small, roundish, seated usually on the middle of the veinlets nearest the midvein; indusium very delicate, roundish or ovate, convex, entire or toothed, placed on the veinlet below the sorus and at first covering it, afterwards reflexed.

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Nephrodium tenue, Michaux, Fl. Am.-Bor., ii., p. 269.
Cystopteris Sandvicensis, Brackenridge, Fil. U. S. Ex. Exped., p. 234.¹

Hab.—In crevices of shaded rocks and among stones, less commonly at the base of trees, or in earth along rivulets; from Arctic America to Tierra del Fuego, and from Iceland to New Zealand, one of the most universally distributed of ferns.

Description:—The root-stock of this fern sometimes attains a length of four or five inches, but is usually shorter and more condensed. While it is really quite slender, it is

¹ For much other synonymy see the writings above referred to, especially those of Hooker, Moore and Milde. Many nominal species of Cystopteris are now commonly referred to this one; and Milde even goes so far as to unite with it C. alpina (or regia), which most authors have considered fairly distinct.
made to appear rather stout by the fleshy bases of the stalks, which remain attached to it a long time. Mr. Moore considered the North American plant with a "wide-creeping rhizome" distinct from the European, and calls it *C. tenuis*, but admits that some of the North American specimens are true *C. fragilis*. I find as great a difference in the root-stocks of European as of American plants, and so far from recognizing two species, I can find no varieties sufficiently distinct to be worth careful definition. The scales, which are found at the apex of the root-stock, are thin and delicate, and usually entire and slender pointed; but in the plant selected for Mr. Faxon's pencil they are accompanied by slender moniliform filaments, and often terminate in a rounded gland.

The fronds grow in a dense cluster, and are supported on slender and brittle stalks commonly from four to six inches long. The bases of the stalks are enlarged and of a dark color, while the rest of the stalk is green like the fronds. The fronds are only three and a half inches long in some little specimens recently brought from Disko Island; but commonly the length is six or eight inches and the breadth about half as much. In the southern part of Mexico, in the Hawaiian Islands, and in the Canaries, fronds are found over a foot long. The general shape of the fronds is ovate-lanceolate, commonly a little narrower at the base than at the second or third pair of pinnae. The pinnae have a narrowly winged midrib, so that while the frond appears bipinnate, it is really but once pinnate, and has pinnatisect pinnae.
The segments of the pinnæ vary much in shape and much more in cutting. They are roundish-oval, ovate, rhomboid-ovate, or ovate-lanceolate in different forms; and are sometimes merely dentate with short and obtuse teeth (var. dentata); or more deeply toothed with narrow teeth (var. angustata); or are irregularly lacinate with still narrower teeth, the frond at the same time being narrow, and the segments scarcely distinct from each other (var. laciniata of Mr. Davenport). Milde gives seventeen forms and varieties.

The indusium is either rounded or ovate; sometimes ovate with a narrow beak-like point, which is lacinate at the tip. It rests directly on the fertile veinlet, and at first covers the rounded sorus, but is at length pushed back by the ripening sporangia, and is often at last entirely concealed by them. The spores are ovoid and usually muriculate.

*Cystopteris alpina* has the fronds more finely compound, and the lobules are generally emarginate, the veinlet running to the indentation. It has not, so far as I know, been collected on this continent, but may occur in the far North-West.

Plate LIII., Fig. 1–8. — *Cystopteris fragilis*. Fig. 1 is from New Haven, and is nearly typical; Fig. 2 is a pinnule, enlarged; Fig. 3, an indusium, seated on a veinlet, and covering a fruit dot; Fig 4 is a spore; Fig. 5 is a pinna of what is called var. dentata; Fig. 6, var. angustata; Fig. 7, a form with incised segments; Fig. 8 var. laciniata, of Mr. Davenport.
Plate LIII.—Fig. 9-12.

CYSTOPTERIS MONTANA, Bernhardi.

Mountain Cystopteris.

Cystopteris montana:—Root-stock creeping, cord-like and very slender, scaly near the apex; stalks scattered, delicate, four to ten inches long, bearing a few ovate scales, especially near the base; fronds three to five inches long, broadly deltoid or pentagonal-ovate, thin-membranaceous, three or four times pinnate; rachises all narrowly winged; lowest pinnae unequally deltoid-ovate, much larger than the second pair, which is larger than the third; ultimate pinnules oblong or ovate, pinnately incised with toothed lobes, the teeth mostly emarginately bidentate; veins pinnated, the superior basal veinlets soriferous near the middle; indusia very delicate, ovate, cucullate, irregularly toothed towards the apex.

Polypodium montanum, Lamarck, "Fl. Fr. i., p. 23."


Description: — The long and slender root-stock is very unlike what we find in the other species of this genus. The slender stalks are sparingly chaffy with entire ovate scales, and dark brown at the base, but green and herbaceous towards the frond. They contain two oval fibro-vascular bundles. The fronds are very tender and delicate, and are fully thrice pinnate,—almost quadri-pinnate. The veinlets generally end at the indentation between two teeth, much as in C. alpina. The spores are finely muriculate.

This is certainly one of the very rarest of North American Ferns.

Mr. Faxon has drawn the fronds from the Labrador specimens, but supplied the root-stock from a plant from Lake Superior. The details are a magnified pinnule, a sorus with indusium and a spore.
Plate LIII.—Fig. 13-17.

CYSTOPTERIS BULBIFERA, Bernhardi.

Bulblet Cystopteris.

_Cystopteris bulbifera:_—Root-stock short, covered with fleshy stalk-bases, sparingly chaffy at the apex; stalks clustered, slender, six to ten inches long; fronds membranaceous, excessively elongated, tapering from the base to the slender apex, commonly one to two feet long and three to five inches broad at the base, bipinnate, often bearing bulblets at the base of the pinnae and elsewhere; main rachis wingless; pinnae very numerous, ovate-oblong; pinnules oblong, obtuse, pinnately lobed or toothed, the lower ones distinct, the rest adnate to the secondary rachis; sori abundant, placed on the back of the veinlets near the midveins of the segments; indusium very delicate, roundish-truncate, convex, somewhat glandular.

Hab.—Dripping rocky banks and moist places among rocks, sometimes where there are no rocks; from Canada and New England to Tennessee, and westward to Wisconsin and Arkansas. It is not universally distributed over the country, but is abundant in favorable localities, and seems to prefer a calcareous soil.

Description:—The root-stock of this fern is usually quite short, seldom over an inch long, and is covered with the persistent and somewhat fleshy bases of old stalks. The chaff consists of a very few little ovate dark-brown scales at the very base of the stalks, or at the apex of the root-stock.

The stalks are very slender and often nearly a foot long, smooth and rather brittle, usually green in color, except at the very base, where they are dark-brown; but sometimes the whole stalk and the rachis will be brownish nearly to the apex of the frond. The stalk is rounded at the back, but
has a deep though narrow furrow in front. It contains two oval fibro-vascular bundles, which coalesce just below the base of the frond into one which has a crescent-shaped section.

The fronds of mature plants are seldom less than a foot long and sometimes very much longer. Professor F. L. Harvey tells of fronds measuring, with the stalk, fully four feet in length. The fronds are broadest at the base, where the width is from three to five or perhaps six inches. From the base they are gradually narrowed to the apex, giving a narrower and more tapering outline than any other of our ferns which have compound and feathery fronds. The fronds are herbaceous, and rather thin in texture, and yet not without a kind of brittle rigidity. They are produced in early summer, and wither at the coming of frost. The rachises and midribs are very minutely glandular in the living plant.

The lowest pinnæ stand forward while the frond is growing, and are often slightly deflexed in dried specimens. A large frond has as many as forty pinnæ on each side, those near the apex of course very small. In the lower pinnæ the secondary rachises are not winged, but in the rest there is a narrow wing formed by the decurrent bases of the pinnules. The pinnules are oblong, obtuse, and more or less incised or toothed according to their size and position. The veins are translucent in the living plant. The sori are scattered all over the frond, often even to the very base. They are placed on the lowest superior veinlet of each group, near its middle, and so very near the midvein. The indusium is
very delicate, usually rather dark in color, and is truncated at the top, as if broken off. The spores are muriculate.

The bulbs are found on the under side of the frond, mostly at the base of the pinnae, but occur often in various other positions. They consist of two, sometimes three or four, rounded fleshy cotyledon-like greenish or deep-colored masses, containing a rudimentary frond or two between their bases, like a plumule. Falling to the ground they soon emit a few slender rootlets, and send up a few little fronds the next season. The second year they produce fully developed fronds.

Plants from Eastern Tennessee and some from Wisconsin and Arkansas have shorter fronds and few bulblets, the fronds being sometimes broadly ovate and by no means acuminate. Professor Lawson, in the Canadian Naturalist, has proposed two varieties, as follows: "horizontalis; frond triangular-lanceolate, broad at base, not more than three or four times longer than broad, pinnae horizontal;" and var. "flagelliformis; frond linear, attenuated upwards, very long and narrow, six or seven times longer than broad; pinnae less horizontal." His first variety is pretty nearly our Arkansas plant: the second is the normal form of the species.

Plate LIII., Fig. 13-16.—Cystopteris bulbifera, from Brattleboro, Vermont. Fig. 14 is a pinnule, moderately enlarged, and Figs. 15 and 16 are a sorus and a spore, magnified.
PELLÆA TERNIFOLIA, LINK.

Trifoliate Cliff-Brake.

PELLÆA TERNIFOLIA:—Root-stock short, thick, nodose, chaffy with very narrow dark-brown scales; stalks clustered, purplish-black and polished, three to six inches long; fronds as long as or longer than the stalks, oblong-linear; pinnæ from four to fifteen pairs, all but a few of the highest ones deeply tripartite; segments elongated-oval or linear-ovate, subcoriaceous, somewhat glaucous beneath, green above, slightly mucronate, the middle one in large fronds indistinctly petiolulate; fertile ones with the edges much recurved; involucre broad, the edge only membranaceous.


Pteris ternifolia, Cavanilles, "Præcl. 1801, No. 657."—Hooker & Grville, Ic. Fil., t. 126.


Allosorus ternifolius, Kunze, in Linnaea, xxiii., p. 220.

Hab.—Texas, Trécul, No. 1334, according to Fournier. New Mexico, Wright, according to Hooker in Filices Exoticae. The only specimens from Texas which I have of this species were collected by Dr. Sutton Hayes, near the headwaters of the Rio Colorado of Texas. It is a common Mexican species; it is found as far South as Peru, and reappears in the Hawaiian Islands.

Description:—This belongs to the same group of species as P. Wrightiana, brachyptera and Ornithopus. It has the same nodose and scaly root-stock, dark and polished stalk, glaucous frond and mucronulate pinnules. In Mexico, South America and the Hawaiian Islands it never occurs with more than trifoliolate pinnules, and this is perhaps the best reason for considering P. Wrightiana a distinct species. The pinnae are tripartite rather than trifoliolate, while in the other fern just referred to, when trifoliolate the odd pinnule is more distinct and usually stalked, a distinction indicated by Hooker, but for which I am more indebted to the accurate discrimination of Mr. Faxon. In more southern localities the fronds are considerably larger than Dr. Hayes' specimens, and the segments of the pinnae ampler. In very dry seasons the pinnae are considerably deflexed. The spores are trivitate as in the related species.

Plate LIV., Fig. 1-3.—Pellaea ternifolia, from Texas. Fig. 2 is a tripartite pinna, enlarged, and showing the venation, involucre, etc. Fig. 3 is a spore.
FERNS OF NORTH AMERICA.

Plate LIV.—Fig. 4-7.

PELLÆA ATROPURPUREA, Link.

Clayton’s Cliff-Brake.

PELLÆA ATROPURPUREA:— Root-stock short, knotted, chaffy with very narrow long-pointed soft cinnamon-brown scales; stalks four to eight inches high, terete, wiry, dark-purple or reddish-black, polished or more or less pubescent with paleaceous hairs; fronds six to twelve inches long, ovate or oblong-lanceolate in outline, evergreen, subcoriaceous, pinnate, usually twice pinnate near the base; rachises smooth or hairy; pinnae four to twelve pairs, the lower ones long-stalked, and divided into five to nine pinnules; upper pinnae and the pinnules nearly sessile; oval to linear-oblong, at the base truncate or subcordate or sometimes hastate, obtuse or obtusely mucronulate, terminal ones longest; veins obscure, mostly twice forked; involucre rather broad, formed of the continuously recurved margin, paler and membranaceous on the edge, not fully covering the ripened sporangia.

Hab. — Crevices of shaded calcareous rocks; from Canada to the Rocky Mountains of British America, and southward to Alabama, Arkansas, Indian Territory and Arizona. It has been found in several parts of Mexico, and even in South America ("Andes of Meccoya, Pearce," according to Synopsis Filicum). It was collected by John Clayton about 1736, "on the shore of the river Rappahannock in a shady place by the root of a juniper near the promontory called Point Lookout," and I take pleasure in giving it an English name in his honor.

Description: — The root-stock of this fern is rather short, usually somewhat nodose, and densely chaffy with very
narrow long-pointed soft bright-brown scales, which in the specimens examined are destitute of midnerve.

The stalks are rigid and wiry, terete, nearly black in color, but with a slight reddish tinge, and usually more or less pubescent with very narrow chaffy hairs, which are often more abundant and harsher along the rachises, making them almost hirsute. *Pellaea glabella* was founded on specimens from Missouri and the North-West, which had the stalk perfectly smooth, and the chaff of the root-stock a trifle wider than usual. The section of the stalk shows a single U-shaped fibro-vascular bundle, and a strong outer sclerenchymatous sheath.

The fronds are developed late in the Spring, and remain green through the next Winter. They are almost coriaceous in texture, smooth and dark-bluish-green above, paler, and sometimes slightly chaffy beneath. They are from a few inches to about a foot in length, and vary in outline from ovate to oblong-lanceolate. In seedling plants the earliest fronds are round-cordate, the next cordate-ovate, and then follow trifoliate, pinnate, and finally mature bipinnate fronds. The largest fronds have about five pairs of compound pinnae, each with from three to eleven pinnules, and above these are from four to six pairs of simple pinnae, besides the terminal one, which is often the longest of all.

The pinnules and the simple pinnae of the sterile fronds are commonly oval, and not more than half an inch long, but those of the fertile fronds are narrower and longer, some-
times nearly two inches long. The base is either truncate or slightly cordate; sometimes where there is a transition from compound to simple pinnae, a pinna will be found conspicuously auricled on both sides, or on the upper side only. Forked pinnules are occasionally seen.

The margin is continuously recurved to form a rather broad involucre, and the very edge is somewhat thinner and whiter. The veins are pinnately arranged on both sides of the midvein, and fork about twice before reaching the margin. The upper part of the veinlets is covered with sporangia, which as they ripen push out from beneath the involucre. The spores are obscurely tetrahedral and trivittate, as in the other species of the genus.

This fern very often grows in company with *Camptosorus rhizophyllus*, and its root-stock is often hidden beneath mosses of the genus *Anomodon*: it takes kindly to cultivation, especially if it be planted in the crevices of calcareous rock-work. It may occur on other than calcareous rock, but I have never seen it on either granite, sandstone or basalt.

Names for varieties of this species have been proposed by Pursh, and by Fournier, but the characters assigned do not seem sufficiently distinctive.

Plate LIV., Fig. 4–7. — *Pellaea atropurpurea*. Fig. 4 is a plant of ordinary size. Fig. 5 is a seedling. Fig. 6 is a pinna, enlarged, and Fig. 7 a spore.
PELLÆA GRACILIS, Hooker.

Slender Cliff-Brake.

PELLÆA GRACILIS:—Root-stock slender, creeping, cord-like, scantily furnished with little ovate appressed scales; stalks scattered, slender, a span long or less, brownish-stra-mineous, somewhat shining, darker and slightly chaffy at the base; fronds two to four inches long, thin and tender, smooth, ovate or ovate-oblong, pinnate; pinnae few, the lower two to four pairs once or twice pinnatifid, the uppermost simple; segments of the sterile fronds adnate-decurrent, roundish-ovate, crenately lobed and toothed; those of the taller fertile fronds lanceolate or linear-oblong, and more distinct, entire or auricled, terminal ones longest; veins rather distant, mostly once forked; involucre broad and continuous, delicately membra-naceous.


Pteris Stelleri, Gmelin, "Nov. Com. Petrop., xii., p. 519, t. 12, f. 1."


Allosorus minutus & Pteris minuta, Turczaninow, fide Moore.

Hab.—Crevices of damp and shaded calcareous rocks, especially in deep glens; Labrador, Butler, to British Columbia, and southward to Iowa; Parry, Wisconsin and Pennsylvania. Also in Colorado, near Breckinridge City, Brandegee. Siberia, Tibet and the Himalayas. It is found in Sunderland, Massachusetts; at Trenton Falls, Chittenango Falls, and other deep glens in Central New York; in Lycoming and Sullivan Counties, Pennsylvania, and in other similar places in Vermont, Michigan, etc., but is by no means a common plant.

Description:—This is the most delicate of all the Pellæas, and has fronds a good deal like those of Cryptogramme acrostichoides, but tenderer, and with sub-marginal fructification. The root-stock is very slender, scarcely more than half a line in thickness, and sometimes two or three inches long. It is so hidden in the crevices of the rocks that it is seldom secured by collectors. The scales are minute, appressed to the root-stock, and almost filmy in their delicacy.
The stalks are scattered along the root-stock, and are generally about five or six inches long, those of the fertile fronds longer, stouter and of a darker color than the others. They are smooth and somewhat polished, but lighter in color and far more tender in consistency than in most of our other species of this genus.

The fertile and the sterile fronds are unlike, though both are very delicately membranaceous, and pinnate with once or twice pinnatifid pinnae. The rachis is not winged in its lower half, except in very small fronds, but above the middle it is narrowly winged, as are also its divisions. The lowest one or two pairs of pinnae are twice pinnatifid in the largest specimens, but more commonly but once pinnatifid. In the sterile fronds the segments of the pinnae are very plainly adnate to the secondary midrib, and are roundish or roundish-ovovate in shape. They are from three to six lines long and about two-thirds as broad. Their margin is more or less lobed and crenately toothed. In the fertile fronds the segments are more distinct, longer and narrower, measuring often six to ten lines in length and one or two in width. The terminal pinna of the frond and the terminal segments of the pinnae are considerably longer than the others. The veins are conspicuous, and distant, much more so than in our other species of *Pellaea*. They fork once about midway between the midvein and the margin, and sometimes, especially in fertile fronds, a second time just within the margin.

The involucre is continuous, broad, and even more del-
icate than the frond itself. The sporangia are comparatively scanty, and are fully covered by the involucre. The spores are spheroid-tetrahedral and obscurely trivittate.

Mr. Moore and some other authors are disposed to insist on the right of priority belonging to the specific name *Stelleri*. But the name *gracilis* has been used by nearly every writer on American Ferns since the time of Michaux, and will most probably be kept up rather than the other.

It should be noted that Ruprecht considered his *Alloso-rus Stelleri* to be distinct from our plant, and mentions several points of difference in his work on the Distribution of Vascular Cryptogamia in the Russian Empire.

The figure is taken from specimens collected in Sunderland, Hampshire County, Massachusetts, by the late Rev. David Peck.
ASPIDIUM MARGINALE, Swartz.
Plate LV.

Aspidium Marginale, Swartz.

Evergreen Wood-Fern.

Aspidium marginale:—Root-stock ascending, stout, shaggy with long shining-brown chaffy scales; stalks rather stout, a few inches to a foot long, more or less chaffy with shining scales; fronds standing in a crown, one to two feet long, evergreen, sub-coriaceous, ovate-lanceolate, scarcely narrowed at the base, pinnate or sub-bipinnate; pinnae almost sessile, the lowest ones broadest, unequally triangular-lanceolate, the middle ones lanceolate-acuminate, slightly broader above the base; pinnules or segments smooth and dark-bluish-green above, paler and sometimes slightly chaffy beneath, adnate to the narrowly winged secondary rachis, oblong or oblong-lanceolate, often sub-falcate, varying from crenately-toothed to pinnately-lobed with crenulate lobes, obtuse or sub-acute, those next the main rachis sometimes distinct, short-stalked, sub-cordate at the base and with rounded auricles; veins free, forked or pinnately branched into from two to five curved and usually conspicuous veinlets; sori rather large, placed close to the margin of the segments; the orbicular-reniform indusia firm in texture, convex, smooth, often lead colored.
FERNS OF NORTH AMERICA.


Hab. — Rocky hill-sides in rich woods, especially where black leaf-mold has gathered between masses of rock; one of our most abundant and characteristic ferns, confined to North America, but extending from New Brunswick to Central Alabama, Professor Eugene A. Smith; westward to Arkansas, Professor F. L. Harvey; Wisconsin, Parry, T. J. Hale; and brought from the Saskatchewan and the Rocky Mountains of British America by Drummond.

Description: — Professor Robinson has remarked of this species: — "This comes nearer being a tree fern than any other of our species; the caudex, covered by the bases of fronds of previous seasons, sometimes resting on bare rocks
for four or five inches without roots or fronds." The root-
stock is much like that of A. Filix-mas, being very stout-
closely covered with persistent stalk-bases and very chaffy.
The chaff really grows mainly on the bases of the stalks, or
covers the closely coiled buds which crown the root-stock. It is
composed of shining ferruginous-brown thin lanceolate acumi-
nate scales fully an inch in length, and destitute of a thick-
ened midnerve. The fronds grow in elegant crowns from the
apex of the root-stock, some six or eight or perhaps ten to
a plant. The stalks vary in length, but are seldom more than
a foot long. They are rather stout, round, but with a slight
furrow in front, commonly reddish-brown in color, fading when
dry to straw-color, and contain five or seven roundish fibro-
vascular bundles, of which the two anterior ones are largest,
and the next two the smallest.

The outline of the fronds is ovate-lanceolate, varying to
oblong-lanceolate. The frond is commonly not quite so wide
at the base as in the middle, though in small specimens the
base is often the widest. The texture is thicker than in any
other of our Wood-ferns, and the fronds are fairly evergreen,
not withering until the next year's fronds begin to uncoil.
In cutting, the fronds vary from pinnate, with pinnatifid pinnæ
and short nearly entire lobes, to twice pinnate, with pinnately-
lobed segments. In the example selected for our plate the
pinnules are oblong, obtuse and crenulate, or at most, cre-
nately-toothed. Other, and perhaps no larger, fronds will have
most of the pinnules twice or even thrice as long as these,
ovate-lanceolate and pointed, narrowed to a sub-cordate and obscurely-stalked base, and deeply pinnately-lobed. This is var. *elegans* of Professor Robinson. Professor Lawson has a var. *Trailliae*, which has "very large bipinnate fronds, all the pinnules pinnatifid." A very common form noticed by Mr. L. M. Underwood in Bulletin of the Torrey Botanical Club, has fronds only four or five inches long, the lower pinnæ only pinnatifid and the upper ones lobed, the sori mostly solitary on the lobes.

The veins and veinlets of the frond are very distinct, being marked by depressions in the upper surface in the living fronds, and visible as dark lines in the dried specimens. The veins fork near the midvein; the upper branch may be fertile at its tip; the lower branch is either simple, or forks a second, and perhaps a third time. All the veinlets are curved. On account of the venation Presl referred this plant to his section *Arthrobotrys*.

The sori are close to the margin of the lobes, and vary from one to twelve to a lobe. They are very large and prominent, and have firm lead-colored orbicular-reniform indusia, which are slightly incurved round the edge, and depressed at the sinus. As the fronds mature the indusia become brownish. The spores are ovoid-reniform and have a narrow crenulate wing.

Plate LV.—*Aspidium marginale*, from the vicinity of Boston. Fig. 2 is a pinnule, enlarged; Fig. 3, a sorus; Fig. 4, a sporangium; Fig. 5, a spore; Fig. 6, a section of the stalk.
Plate LVI.—Fig. 1-3.

**Asplenium angustifolium, Michaux.**

*Narrow-leaved Spleenwort.*

*Asplenium angustifolium*: — Root-stock creeping, bearing crowded blackened stalk-bases and abundant rootlets, chaffless; stalks clustered, smooth, green, fleshy-herbaceous, a foot high or less; fronds two to three feet long, lanceolate, tapering both ways from the middle, membranaceous, smooth, simply pinnate; pinnæ numerous, short-stalked, lanceolate-acuminate, two to four inches long, obscurely crenulate, very minutely serrulate on the hyaline edge; those of the sterile fronds half an inch wide, sub-cordate at the base; those of the taller fertile fronds much narrower, obtuse or truncate at the base; veins once or twice forked; sori very many, crowded, oblique to the midrib, slightly recurved, indusium rather firm, slightly convex, at length hidden by the confluent sporangia.

FERNS OF NORTH AMERICA.


*Asplenium pycnocarpon*, Sprengel, Anleitung, p. 112; Engl. version, p. 123.


**Hab.**—Ontario and New England westward to Wisconsin, and southward to Kentucky, Virginia, and probably the mountains of Northern Georgia. It is found in damp rich woods, especially in mountainous districts, and is more common in the States bordering on the Ohio river than in New England.

**Description:**—The root-stock of this fern is very much like that of *Asplenium thelypteroides*, figured on our fiftieth plate. It creeps just beneath the surface of the ground, and attains a length of at least five or six inches. It is mainly composed of the adherent bases of old stalks, and bears a very great multitude of branched fibrous but somewhat fleshy rootlets. The stalks which support the fronds come from just back of the apex, which is hidden by the buds of fronds for the next year's growth. These buds or rudimentary fronds are about three-fourths of an inch long, and are light-green in color. A close inspection of them detects a few very thin chaffy scales, which fall off as the fronds uncoil, leaving the plant entirely destitute of chaff.

The stalks are usually from eight inches to a foot in length, and about one-sixth of an inch in diameter. They
are rounded or slightly flattened at the back, and in the front
a little narrowed, but with a rather deep and narrow furrow,
which is deeper, and has more elevated sides, nearer the
base of the frond. In the living plant the stalk is herba-
ceous, rather brittle, smooth, and green, except at the very
base, where it is blackened like the root-stock. The section
discloses two strap-shaped fibro-vascular bundles, one running
along each side of the stalk, the furrow partly separating
them.

The sterile and fertile fronds are a little different from
each other, the latter having longer stalks and much narrower
pinnae. The fronds are smooth, dark-green, membranaceous,
and unable to endure the lightest frost. They are lanceolate
in outline, and sometimes, with the stalks, attain a height of
three and a half to four feet. The pinnae are very numerous,
sometimes as many as forty along each side of the rachis.
The middle pinnae are the longest, the lower ones being gradually shorter, more distant, and slightly deflexed; so that the
very lowest ones are often only little auricles a few lines
long. The pinnae of the sterile fronds are slightly cordate
at the base, where they are about half an inch wide. From
the middle they taper to a long and slender point. The mar-
gin is wavy and finely crenulate, or even slightly serrate, as it
was in the form on which Sprengel founded his *A. pycno-
carpon*. The very edge consists of triangular transparent
cellules, arranged in two rows, and by their outer angles,
which are slightly rounded, giving an appearance of minute
serrulation, much like that seen in the leaves of certain mosses, especially of the genus *Mnium*. The pinnæ of the fertile fronds are but half as wide as the others, and the base is rounded or truncate.

The veins are mostly twice forked in the sterile fronds, once forked in the fertile. The veinlets are placed about the twenty-fifth of an inch apart: their apices are slightly enlarged, and terminate in the transparent border, just at the indentations of the margin. In the fertile pinnæ the upper veinlet of each pair bears a long and slightly recurved prominent sorus, which extends from close to the midrib to near the margin, there being often eight sori on a pinna. The indusium is somewhat arched over the sorus, and is composed of rather thick-walled irregularly polygonal or roundish cells. The spores are ovoid and covered with anastomosing ridges.

This spleenwort is easily cultivated in a shady corner of a garden. The spores are produced in the greatest profusion, and readily germinate when sowed on damp earth and kept moist by a glass cover of some sort.

No other species of spleenwort is closely related to this plant; the nearest one is perhaps *A. anisophyllum*, of Kunze, which is found in South Africa and the Mauritius.

Plate LVI., Fig. 1-3.—*Asplenium angustifolium*. The plant figured is from Danville, Vermont. The details represented are the base of a fertile pinna and a spore.
Pl. LVI. — Fig. 4-6.

Asplenium Cicutarium, Swartz.

Hemlock Spleenwort.

Asplenium cicutarium: — Root-stock short, erect, chaffy at the apex with rigid dark-fuscous entire lanceolate scales; stalks a few inches to a foot long, dark-gray, nearly terete, very narrowly wing-margined on each side from the base upwards; fronds erect, membranaceous, smooth, seldom over a foot long, ovate-lanceolate, bipinnate or tripinnate, primary and secondary rachises very narrowly winged; pinnae sessile, lanceolate, the lower ones usually deflexed and shorter than the middle ones; pinnules rhomboid-ovate, more or less deeply cleft into several linear-oblong lobes, the lowest superior one often bifid, in larger fronds most of them again pinnately lobed with the lowest lobes bifid; veinlets solitary in the lobes; sori elongated, one on the upper side of each fertile veinlet; indusium very delicate, entire on the margin.

Ferns of North America.

fig. 1, t. F, fig. 2." — Swartz, Syn. Fil., p. 88.

Darea cicutaria, Smith, Mém. Acad. Turin, v., p. 409. — Willdenow,

Asplenium dissectum, Link, "Hort. Berol., iv., p. 68."

Felix pinnulis cristatis, Plumier, Traité des Fougères de l'Amerique,
p. 14, t. xlviii., A.

Hab. — Calcareous rocks near Lake Panasofkee, Sumter County,
Florida, discovered by Mr. W. H. Shockley, in 1878. Common in the
West Indies, Mexico and South America, and reported in Synopsis Fil-
cum as occurring in several parts of Africa.

Description: — Mettenius simply says of the root-stock
that it is "erect." Hooker says: — "caudex stout, erect, scaly
above." Plumier, who found the fern in almost every place
he visited in the "American Islands," says: — "La racine de
cette Fougère est toute chevelue par quantité de petites fibres
grisastres, et longues de deux à trois pouces, d'où sortent
quatre ou cinq pedicules ou costes menuës, rondes, d'un vert
sale, et longues d'environ un pied." His "racine" is undoubt-
edly the root-stock or caudex, and the grayish fibres are the
rootlets. The root-stocks on the specimens in my collection
are not over an inch long, but are broken off at the lower
end, and very incomplete. The apex, and the very base of
the stalks, are chaffy with rigid lanceolate fuscous-black
scales, composed of thick-walled cellules arranged in longitudi-
nal rows, like the scales of Asplenium ebeneum [See page
22 of this work]. The Florida plants are few and much
less in size than those from Cuba and Venezuela, and the caudex is much less developed. The stalks are of a dark dull grayish-green; they are rigid and from a few inches to a foot in height. From the very base there is on each side of the stalk a very narrow herbaceous wing, which is continued along the rachis to the very apex of the frond. The section of the stalk is roundish, or slightly flattened, and shows a firm exterior sheath of sclerenchyma and a solitary central oval fibro-vascular bundle.

The fronds of Mr. Shockley's specimens are only four or five inches long, but some of those from Venezuela are a foot long. The shape of the fronds is ovate-lanceolate varying to lanceolate. The lower pinnæ are usually dwarfed and deflexed, very much so in some of the Venezuela plants, but much less so in the Florida specimens.

The pinnæ are from twelve to twenty-five on each side of the rachis, decreasing gradually from the middle of the frond to the usually acute or acuminate apex, and rather closely placed. Their general shape is oblong-lanceolate. They are sessile on the rachis, and taper from near the base to a pointed apex. The largest ones are tri-pinnatifid, but more commonly they are only bi-pinnatifid. The secondary rachises are even more plainly wing-margined than the primary rachis, which is, however, variable in respect to the breadth of the wing. The pinnules, or secondary pinnæ, are rhomboid-oval, being most developed on the superior side. They are sometimes but slightly lobed into three or four
short triangular lobes, and at others pinnately cleft into four or five often bifid lobes on the superior side, and into three or four rather shorter and simpler ones on the inferior side. They are thin-membranaceous, but not so delicate as those of *Asplenium myriophyllum*, the only other fern hitherto detected in Florida, with which this one may be compared.

There is but a solitary vein in each ultimate lobe, and in the fertile fronds there is one oblong sorus to each vein, the thin and delicate indusium attached on the upper side of the vein. Rarely a sorus is diplazioid, and has a double indusium. The spores are ovoid or roundish, and irregularly wing-marginated.

The group of species referred by Swartz to *Cenopteris*, and by Smith and Willdenow to *Darea*, consists of about 30 *Asplenia* with the ultimate divisions of the frond narrow and containing but one vein. But the group has no certain boundary, and the present plant, though called *Cenopteris* by Swartz, and *Darea* by Willdenow, is excluded from the group by Hooker and Baker. Hooker's *A. monteverdense* is partly a young form of this plant, and partly *A. myriophyllum*.

Plate LVI., Fig. 4–6. — *Asplenium cicutarium*, from Florida. Fig. 5 is a pinnule, less deeply lobed than is often seen on South American specimens, and Fig. 6 is a spore.
CHEILANTHES MICROPHYLLA, Swartz.

Plumier's Lip-Fern.

CHEILANTHES MICROPHYLLA: — Root-stock creeping, slender, often branched, chaffy with very narrow ferruginous scales; stalks four to six inches long, erect, slender, terete, wiry, blackish-brown and somewhat shining, often rusty-pubescent, especially along the anterior side; fronds four to ten inches long, two to three inches broad, oblong-lanceolate varying to deltoid-lanceolate, usually bipinnate; primary pinnæ oblong-ovate, the lowest ones commonly largest; pinnules ovate-oblong, rather obtuse, broadest at the upper side of the base, entire or more or less pinnately incised, smooth above, sparingly pubescent beneath; involucres narrow, scarcely different in texture from the frond, interrupted or sub-continuous.


FERNS OF NORTH AMERICA.


Lonchitis minima, ramosa, Plumier, Fil. Amer., p. 44, t. 58.

*** For additional synonymy see Synopsis Filicum, where also may be found mention of several tropical varieties of this species.

Hab.—On ancient shell-heaps, Stratton Island, near the mouth of the St. John’s River, Florida, Mr. A. H. Curtiss, April and August, 1878. A few specimens of a form with sub-deltoid and nearly tripinate fronds were collected on the Survey of the Mexican Boundary, the precise locality not known, and the species was also found many years ago on the calcareous rocks of the Hot Springs of Arkansas by Dr. Engelmann (See Silliman’s Journal, July, 1848, p. 87). The range extends through Mexico and the West Indies southwards to Venezuela and Peru.

Description.—The root-stock of this fern is seldom over a line and a half in diameter, and is several inches long. It is covered with very minute subulate ferruginous scales, and bears somewhat scattered stalks. The stalks are erect, wiry, nearly black in color, but not very highly polished. In the several forms of the species they vary a good deal in pubescence, being now nearly smooth, now rusty-pubescent along the anterior side, and now almost hirsute on all sides. The rachis varies similarly, but is usually more hirsute than the stalk. The section shows a very strong exterior sheath of dark tissue, and a central butterfly-shaped fibro-vascular bundle.
The fronds of the Florida specimens are from five to eight inches long, and from one to two and a half inches wide. They are mostly lanceolate from a base but little wider than the middle of the frond; but some of them show a tendency toward the sub-deltoid form which is seen in the specimens from the Mexican Boundary, and especially in the var. Moritziana, which form occurs in the more tropical parts of America. The texture is firmly chartaceous, or even sub-coriaceous. The surfaces are green, and more or less minutely paleaceo-pubescent, at least when young. In *Synopsis Filicum* both surfaces are said to be glabrous, but this is rarely the case. The fronds are bipinnate, or in the larger forms tripinnate. The pinnae are rather numerous, oblong-ovate in shape, or the lower ones deltoid-ovate, usually an inch to an inch and a half long, and five to twelve lines wide, and have a midrib, which is, at least in its lower part, blackened and ferruginous-hirsute like the rachis.

The secondary pinnae are ovate-oblong, usually obtuse, broader and somewhat auricled on the upper side of the base, excised on the lower, and vary from entire to pinnately lobed or even parted. The margin is narrowly recurved to form an involucre, but is scarcely changed in texture. The involucre is nearly continuous in the strictly bipinnate forms, but is more and more interrupted in more compound forms, so that it presents much variation in this respect. The spores are nearly globose.

This species is extremely variable in the form and com-
position of the frond, abundance or scantiness of the pubescence, continuity of the involucres, etc. While Hooker & Baker have, as I think, judiciously united several species of the older authors, it should be noticed that Fournier recognizes three species, *C. elongata*, *C. Moritziana* and *C. microphylla*.

Since the Rev. Charles Plumier, a Franciscan who visited the West Indies nearly two centuries ago, and published several magnificent folios on their botany, was the first to notice this fern, it is proper that the English name assigned to it should commemorate his discovery.

Plate LVII., Fig. 1-3.—*Cheilanthes microphylla*, from specimens collected in Florida by Mr. A. H. Curtiss. Fig. 2 is an enlarged pinnule, and Fig. 3, a spore.
CHEILANTHES WRIGHTII, Hooker.

Wright's Lip-Fern.

Cheilanthes Wrightii:—Root-stock slender, creeping chaffy with very narrow acuminate brownish scales; stalks one to three inches high, slender, chestnut-brown, slightly chaffy at the base; fronds two to three inches long, ovate-oblance, herbaceous, smooth, pinnate with about five pairs of deltoid-ovate bipinnatifid pinnae, the lower ones rather distant; pinnules oblong, more or less decurrent, pinnately incised, the upper ones confluent; involucres mostly terminal on the ultimate segments, scarcely altered from the texture of the frond.


Hab.—Between Western Texas and New Mexico, C. Wright, Nos. 823 and 2128. Arizona, in the Chiricahua Mountains, near Camp Grant, and in the Sanoita Valley, Dr. J. T. Rothrock. Mrs. A. T. Smith also collected it near Camp Grant in 1877. The collectors of the Mexican Boundary Survey obtained it somewhere near the Gila, but no one has recorded the nature of the place where he found it. It most probably grows in the crevices of rocks.
Description:—The creeping root-stock is scarcely a line in diameter, and is covered, as are the bases of the stalks, with very small lanceolate slender-pointed ferruginous scales. The stalks are more or less scattered, and are wiry, furrowed along the anterior side, chestnut-brown in color, smooth and shining. The color is continued as far up the rachis as there are distinct pinnae, and also for a short distance up the midribs of the pinnae. In a section of the stalk may be seen a rather thick outer sclerenchymatous sheath, and a central heart-shaped fibro-vascular bundle, the lobes of the heart being directed toward the sides of the conspicuous furrow.

The fronds are about as long as the stalks, herbaceous, green, smooth on both surfaces, ovate-oblong, and composed of from four to six pairs of pinnae, the lower ones rather distant, and the upper ones gradually passing into the pinnatifid apex of the frond.

The pinnae are nine or ten lines long, and the lower ones nearly as broad. The lower pairs are deltoid or triangular-ovate in shape, but the upper ones are ovate or oblong-ovate. They are short-stalked, and are obliquely divided into a few adnate-decurrent oblong segments, the three or four lowest ones of which are again pinnately lobed or incised, and the upper ones nearly entire and confluent into a broadly-triangular incised terminal portion. The ultimate lobes are only one or two lines long, triangular-ovate and mostly obtuse. The ends of the smaller lobes and the sides
of the larger ones are revolute, forming usually separated but sometimes continuous involucres, which have the same green color and herbaceous texture as the frond itself.

The spores are sub-globose, and very obscurely or not at all trivittate.

This is one of the rarest of our species of Cheilanthes, having been collected by only three or four persons, and at distant intervals. Among our many species of the genus it is characterized by the smooth and glabrous surfaces of the deltoid bipinnatifid pinnae, and the herbaceous involucres.

Apparently it has not been brought into cultivation, either in Europe or America. Hooker wrote of it:—“A small and very pretty, and, as far as I can judge, very distinct species, somewhat allied in its fructifications to the East Indian Cheilanthes varians of Dr. Wallich, but very much smaller and with ample distinguishing characters from that.” Dr. Mettenius had seen no specimens of it when writing his monograph of the genus, and so merely mentioned it next after C. multifida of South Africa. In Synopsis Filicum it is placed between C. multifida and C. tenuifolia, with the remark that “in habit it comes very near the small forms of C. tenuifolia, but the involucres are less confluent.” Of these three species C. multifida is certainly the nearest to it, having a similar texture and similar segments, but a ten times larger frond and distinct squamiform involucres. Cheilanthes viscida of Davenport, figured at Plate XII of this work, is probably its nearest ally, but differs slightly in the
outline of the frond, and more decidedly in the glandular and viscid surface, in the terete stalk, in the minuter involucres, etc.

Plate LVII., Fig. 4–6. — *Cheilanthes Wrightii*, from Dr. Rothrock's Arizona specimens. Fig. 5 represents a secondary pinna or segment enlarged about six diameters. Fig. 6 is a spore.
Plate LVII.—Fig. 7-9.

CHEILANTHES ALABAMENSIS, Kunze.

Alabama Lip-Fern.

Cheilanthes alabamensis:—Root-stock creeping, silky-villous with very slender bright-brown scales; stalks three to six inches high, wiry, terete, black and polished like the rachises, at the base villous with soft ferruginous paleaceous hairs, scantily hairy along the anterior side; fronds lanceolate, two to eight inches long, chartaceous, green and glabrous, bipinnate; pinnae very numerous, closely placed, ovate-lanceolate, six to eighteen inches long, the lowest pair not enlarged; pinnules adnate to the secondary rachis, mostly triangular-oblong, rather acute, usually auriculate on the upper side of the base, or the larger ones with several lobes on each side; involucres rather broad, membranaceous, pale, interrupted only by the incising of the pinnules.

Pteris Alabamensis, Buckley, in Silliman's Journal, 1843, p. 177.

Hab.—On rocks, certainly on sandstone and perhaps on limestone, along the banks of the rivers of Eastern Tennessee and the western parts of Virginia and North Carolina, Rugel, Buckley, Bradley, W. Faxon, James Constable, Jr., etc. Franklin County, Kentucky, Professor Wildberger. Valley of the Cohaba River, Alabama, Prof. Eugene A. Smith. Mouth of Rio Pecos, Texas, Dr. J. M. Bigelow, and along the lower Rio Grande, Arthur Schott.

Description:—The Alabama Lip-Fern is beautifully figured and admirably described in Hooker's Filices Exoticae. But little of the root-stock is preserved on the specimens I have received. Hooker says:—"Caudex creeping and branched, with the stipites rising in tufts from their short, almost shaggy, sericeo-villous branches: their hairs or hair-like scales are of a rich ferruginous color." The scales of the root-stock are a little broader than those of the base of the stalk, but are softer and more silky than in C. microphylla, to which the present species is so closely related that Hooker had to the last considerable doubt of its specific distinction.

The stalks are usually about four or five inches long, erect, terete, wiry, black and polished. Along the anterior side there is a faint line of short paleaceous pubescence, which is continued along the rachis of the frond. The section of the stalk is round and contains a single rounded-
heart-shaped fibro-vascular bundle. The exterior sheath of sclerenchyma is moderately thick and very opaque.

The fronds are rarely over eight inches long and an inch and a half broad. They are lanceolate or oblong-lanceolate in shape, rather long-pointed, and usually a little narrower at the base than in the middle. The primary rachis and the lower half or two-thirds of the midribs of the pinnæ are ebeneous like the stalk. There are from twelve to twenty pinnæ each side of the rachis, besides the minuter pinnæ which pass into the segments of the pinnatifid apex. The principal pinnæ are about an inch long and nearly half as wide, short stalked, and ovate-lanceolate from a broad base. They are divided quite to the midrib into rather numerous triangular-oblong adnate-decurrent pointed pinnules, three or four lines long; the smaller ones of which are either entire or auricled on the upper side of the base, but the larger ones are pinnately incised into three or four short lateral lobes and a much larger terminal one. The texture is firmly chartaceous, though both Kunze and Hooker call it subcoriaceous, a term implying a somewhat heavier frond than the plant really possesses. Both surfaces are smooth and of a clear herbaceous green color.

The edges of the lobes are rather broadly reflexed, and are more delicate and paler than the rest of the frond, forming a well-defined involucre, which would be continuous were it not interrupted by the lateral incisions of the pinnules.

The spores are rounded, and apparently destitute of vittæ.
Mr. Baker has referred this plant to the genus *Pellaea*, principally on account of its continuous involucres, but its near relationship to *C. microphylla* seems to demand that both should rest in one genus. A frond sent by Professor Smith from Alabama is so imperfectly fruited that the involucres are by no means continuous. A specimen from Tennessee has the two lowest pinnæ half as large as the rest of the frond—no doubt an accidental 'sport.'

Plate LVII., Fig. 7-9. *Cheilanthes Alabamensis*. The drawing represents a plant collected by Professor Bradley on the rocky banks of the Holston River, near Knoxville, Tennessee. The details are a pinnule, enlarged, and a spore.
ACROSTICHUM AUREUM, L.
Ferns of North America.

Plate LVIII.

Acrostichum Aureum, Linnaeus.

Golden Acrostichum.

Acrostichum aureum:—Root-stock short and thick, creeping; stalks clustered, stout, often several feet long and as thick as one's finger; fronds standing in a crown, three to six feet long, evergreen, smooth above, rarely hirsute beneath, coriaceous or subcoriaceous, pinnate; pinnae numerous, a few inches to a foot long, half an inch to three inches wide, short-stalked, elliptical, lanceolate, or oblong-linear, entire, or rarely auricled on the lower side near the base, the base acute, rounded or subcordate, the apex either obtuse, acute or emarginate, the edge thickened and often slightly revolute; terminal pinna commonly distinct; midveins strong, prominent beneath; veinlets conspicuous, anastomosing in very fine oblique-oblong four- to six-sided areoles; the terminal and some or all of the lateral pinnae of the fertile fronds covered beneath with a mass of naked sporangia.

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Acrostichum fraxinifolium, R. Brown, Prodr., p. 145.

Acrostichum danæfolium, Langsdorff & Fischer, Ic. Fil., p. 5, t. i.

Acrostichum juglandifolium, Kaulfuss, Enum. Fil., p. 66.

Acrostichum obliquum, Blume, Flora Javae, p. 30, t. 9.


Lingua cervina aurea, Plumier, Fil. Am., p. 87, t. civ.

**The writings of Fée, Presl, Hooker and Luerssen give many more references and several additional synonymes, Luerssen most of all.**
FERNS OF NORTH AMERICA.

Hab.—Muddy shores of brackish marshes, creeks and bayous in Southern Florida, very often associated with the Mangrove. It is found in similar places in nearly all tropical regions, and is perhaps the only known fern which grows only within the influence of salt water. Dr. Garber says that in ascending the creeks of South Florida this fern is found as far as the water is brackish, and ceases as soon as the water becomes entirely free from salt. Blume reports that he has seen one form in the interior of Java, in places full of springs abounding in carbonate of lime and chloride of sodium.

Description:—The largest of all the Ferns of the United States. Captain John Donnell Smith notes that it is often eight to eleven feet high, and Fée gives three metres as the extreme. The root-stock forms a mass sometimes six or eight inches long and two or three inches thick, and sending out numerous soft and spongy roots as thick as a goose-quill and a foot long [Dr. Garber]. It is more or less chaffy with large opaque lanceolate scales, which are also found on the base of the stalk.

The stalks vary in size according to the proportions of the whole plant. Specimens from Rio Janeiro, collected by the U. S. Exploring Expedition, have stalks which when fresh must have been nearly an inch thick. In the living plant the stalk is nearly semi-cylindrical, the anterior side flat, and the rounded side with several shallow longitudinal furrows. The fibro-vascular bundles vary in number from thirteen, according to Mettenius, to sixty, according to Presl, or to eighty-four as counted by myself. More than half the
bundles, all of which are slender, are arranged in a circle just beneath the surface of the stalk. Usually there is a second imperfect circle, and in large stalks some rudiments of a third, but the exact position of the inner bundles is different in different stalks. I find no one large central bundle, as observed by Mettenius.

The pinnae are sometimes as many as thirty on each side, besides the terminal pinna, which is about as large as those next to it, or even larger. More commonly there are from fifteen to twenty pinnae on each side, though sometimes much fewer; and in one form, _A. obliquum_ of Blume, the fronds are simple and only a foot long. The pinnae, even of our Florida plants, vary in length from two inches to a foot, and in width from half an inch to two inches. Some of the smaller plants have elliptical pinnae, the base equal and sub-acute, and the apex rounded. Other plants have pinnae linear-strap-shaped, and over a foot long, the base rounded on the lower side and cuneate on the upper, the apex obtuse but mucronate. This is the _A. inaequale_ of Willdenow, which is beautifully figured by Blume. The larger Florida plants have the base of the elongated pinnae equally cuneate, and the apex barely acute. A specimen from Tahiti has very broad pinnae with an acuminate apex. In some specimens, collected in S. W. Florida by Dr. Garber, several of the pinnae bear a distinct auricle on the lower side, an inch or two above the base. This auricle is from one to five inches long, and has a special midvein. One pinna has two such auricles, side by side.
In the living fern the pinnae have their edges more or less undulate, a character which may often be seen also in herbarium specimens. The pinnae have an almost coriaceous texture; the upper surface is dark green and shining; the lower surface paler and usually smooth, but hairy in a form found in Brazil, the Cape of Good Hope, etc. The mid-nerve is strong, and prominent beneath. The veinlets are copious, and anastomose in very fine obliquely-placed oblong or oblong-hexagonal areoles. The very edge of the pinnae is translucent and somewhat thickened, and is often slightly recurved. The surface cells are irregularly star-shaped, with rounded interlocking points. In the lower surface there are numerous stomata, much like those of common flowering-plants. Fee comments on the presence of these stomata, and seems to consider them a rarity among Ferns. But they exist, though perhaps less abundantly, in Onodea sensibilis, Woodwardia angustifolia, Aspidium Filix-mas, Polypodium vulgare, etc., etc., and not improbably in all Ferns.¹

The sporangia are produced in great masses entirely covering the under surface of the pinnae. Dr. Garber states that, in plants near the seacoast of Florida, a few of the fronds are taller than the others, and have all the pinnae fertile and closely appressed to the rachis; but that in a form frequently seen on the Corkscrew river, the fronds are only two or three feet high, the pinnae few, distant on the rachis, and all the fronds with from one to five of the highest

pinnae fertile, the lower pinnae uniformly sterile. Fée noticed that among the sporangia are great numbers of smaller pedicelled corpuscles, peltate, radiate, palmate, intestiniform, etc., and, as he supposed, each kind peculiar to the species, as he regarded the species. Sometimes what appeared to be a mass of sporangia he found to consist wholly of these corpuscles.

In the Indian River specimen, which Mr. Faxon has figured, these corpuscles are intestiniform, as in Fée's *C. sculpturatum*, and in the Corkscrew river plants they are irregularly radiate, with rounded points, as in Fée's *C. Cayennense*. The spores are spheroid-tetrahedral, smooth, and plainly trivittate.

The generic character of *Acrostichum*, as understood by Hooker, consists in the sporangia being spread over the whole lower surface or over large portions of the surface, sometimes both surfaces, of the frond. Hooker & Baker describe about two hundred species. Fée divided the genus into eighteen genera, and even Mettenius admitted five genera as distinct.

Plate LVIII.—*Acrostichum aureum*. The specimen is a small one, and was collected at Indian River, Florida, by Dr. Edward Palmer. Fig. 2 is a part of a fertile pinna, enlarged, so as to show the sporangia, which are partly removed. Fig. 3 is a spore. Fig. 4, a section of the stalk.
Plate LIX.—Fig. 1-5.

CRYPTOGRAMME ACROSTICHOIDES, R. BROWN.

American Rock-Brake.

Cryptogramme acrostichoides:—Root-stocks short, creeping, tufted, chaffy; stalks, densely clustered, stramineous; fronds ovate, smooth, chartaceous, bi-tripinnate, two to four inches long, of two kinds; the sterile ones short-stalked, and with narrowly winged rachises, the ultimate segments crowded, ovate or obovate, adnate-decurrent, crenately toothed or somewhat incised; fertile fronds long-stalked, the rachises scarcely winged, the ultimate segments fewer, petiolulate, oblong or linear-oblong, three to five lines long and scarcely one line wide; involucres herbaceous, very broad and at first meeting at the midvein, at length opened out; sporangia seated on the forked veinlets in lines extending down almost to the midvein, when ripe confluent and covering the segments.

Cryptogramme crispa, forma Americana, Hooker, Sp. Fil., ii., p. 130.


Allosorus crispus, Kaulfuss, Enum. Fil., p. 143 (excl. syn.).


Phorobolus acrostichoides, Fée, Gen. Fil., p. 131.

Hab.—In dense tufts and patches, among rocks and in their crevices, from Arctic America southward to Lake Superior, Colorado, Alaska, and the Sierra of California, where Professor Brewer reports finding it at 8,000 to 10,000 feet above the sea. The species was first collected by Menzies at Nutka Sound.

Description:—This fern grows in large masses, formed of many crowded root-stocks, which are chaffy with ovate-lanceolate long-pointed dark-ferruginous scales. The stalks are green when living, but stramineous in dried specimens, rather slender, slightly furrowed in front, and chaffy below the middle; the scales with a broad dark-brown midnerve, but paler on the margins. There is a single fibro-vascular bundle, obtusely-triangular in section.

The sterile fronds have stalks from two to four inches long: they are chartaceous or subcoriaceous, smooth, ovate in outline, rather densely twice or three times pinnate, and have
FERNS OF NORTH AMERICA.

The general and partial rachises narrowly winged. Their ultimate segments are oval or ovate, sometimes obovate, rarely over five lines long, and crenately toothed, or less commonly incised-toothed.

The fertile fronds stand nearly twice as high as the others, and have fewer and more distant, longer, narrower and distinctly stalked pinnules rather than segments. These pinnules are pod-like, having the edges so far recurved as to meet at the midvein, or even to overlap, forming herbaceous involucre. The veinlets are mostly once forked near the midvein, and are covered with sporangia arranged in lines hidden beneath the involucre, whence the name given by Brown.¹ The sporangia at length become confluent, and cover the under surface of the pinnules. The spores are tetrahedral with rounded sides, and plainly trivittate.

Robert Brown, in proposing this genus, observed that the type of it is *C. acrostichoides*, but that he had so con-

¹ I have followed Hooker’s orthography in this word. It was originally written *Cryptogramma*.

For a full discussion of the reasons for adopting the name *Cryptogramme* for this genus, rather than *Allosorus*, see Hooker’s *Species Filicium*, volume second, and page 131. I have only to add to his remarks that the “*Adianta spuria*” of Swartz, which Bernhardt included in his genus *Allosorus*, is a division to be found in Schraders *Journal für die Botanik*, 1800, ii., p. 84. The species are *Ad. viride*, *microphyllum*, *fragrans*, *Caffrorum*, *parvifolium*, *capense*, *pteroides*, *tenuifolium* and *multifidum*. The first of these is now a *Pellaea*; all the rest species of *Cheilanthes*. So that *Allosorus* was made up of eight or nine species of *Cheilanthes*. So *Pellaea*, one *Pteris* and *Pteris crispä*. So ill-assorted a congeries was never deserving of preservation.
structured the generic character as to admit *Pteris crispa* of Europe, which agrees well enough with the former species in habit, although the sori are roundish rather than linear, and terminal on the veinlets. The two plants are in fact so nearly allied that Hooker and Milde have considered the American only a variety of the European, and Hooker said that some of the Scottish specimens in his collection were almost identical with those from North America, and that he had some from the United States and from British Columbia quite agreeing with the common European form. While it is indisputable that there may be specimens from one continent much resembling the type usually seen in the other, yet the normal type of *C. acrostichoides* is so different from that of *C. crispa*, that, for the present purpose certainly, it is better to keep them apart. *Allosorus foveolatus* is certainly a stunted form of our plant from Alaska, with the ends of the veinlets in the sterile plant enlarged and marked by a semi-translucent oval depression, which may be seen also in specimens from Colorado, Lake Superior and California. *A. Sitchense* I have not seen, but it may be safely assumed to be but little different from small specimens of our common plant.

Plate LIX., Fig. 1-5.—*Cryptogramme acrostichoides* from California. Fig. 2 is an enlarged view of a fertile pinnule. Fig. 3, the same after it has been opened and the sporangia partly removed. Fig. 4 is a pinnule of a sterile leaf, enlarged, and Fig. 5 is a spore.
ADIAN'TUM TRICHOLEPIS, Fée.

Soft Maidenhair.

ADIAN'TUM TRICHOLEPIS:—Root-stock short, creeping, chaffy; stalks clustered, slender, about a span long, reddish-black and polished, like the rachis and its branches; fronds six to twelve inches long, deltoid-ovate or broadly pyramidal, three or four times pinnate at the base, simply pinnate at the apex; primary pinnae triangular-lanceolate, rather long-stalked; ultimate pinnules petiolulate, three to six lines broad, roundish with a truncate or subcordate base, rarely lobed, hairy on both surfaces; margins obscurely denticulate, the veinlets extending to the points of the teeth; involucres finely pubescent, roundish-oblong and transversely elongated on the same pinnules.

Adiantum tricholepis, Fée, 8me Mém., p. 72.—Keyserling, Adiantum, pp. 15, 37.—Eaton, Ferns of the South-West, p. 326.

Adiantum dilatatum, Nuttall, MS., and as quoted in Hooker, Sp. Fil., ii., p. 43.

Adiantum fragile, var. pubescens, Martens & Galeotti, Syn. Fil. Mex., p. 72, according to Fée.

Adiantum Chilense, var. pilosulum, Liebmann, Mex. Bregn., p. 115, according to Keyserling.

Adiantum pilosum, Eaton, in Robinson's Catalogue, but not of Fée, whose plant is said by Keyserling to be A. Chilense.

Hab. — A single specimen in the Herbarium at Kew is marked by Mr. Nuttall: — "Adiantum *dilatatum, Nutt., Monterey, Cal." I cannot learn that any one has found it in California since his time, nor does the specimen accord perfectly with the type of the species. The true plant was collected in a rocky ravine near the mouth of the Rio Pecos, in Western Texas, during the Survey of the Mexican Boundary. I have Ervendberg's No. 11, from Wartenberg, in the province of Huasteca, Mexico, referred to this species by Keyserling, and specimens from the ruins of Uxmal, in Yucatan, collected by Arthur Schott (No. 687). Fée established the species on Galeotti's No. 6445, collected on rocks along the shore of Rio Grande de Lerma, near Guadalaxara. Liebmann's plants were gathered on calcareous cliffs near Papantla, and Keyserling states that Karwinsky's specimens came from the apex of a pyramid near the same place.

Description: — This, the rarest of the North American species of Maidenhair, belongs to the same subsection with the Californian Maidenhair and the true Venus-hair, a subsection characterized by the ovate-pyramidal decompound fronds, by the terminal pinnules having a rounded outer or upper margin, and by the veinlets running to the points of the teeth rather than to the minute indentations between them. The remaining species of this subsection,¹ in Keyserling's

¹Keyserling's arrangement of the genus is altogether the most satisfactory of all that have been published. He divides the genus into four sections: — Simplicia, Radi-
arrangement, are *A. Æthiopicum*, *A. venustum*, *A. Andicola* and *A. glaucophyllum*.

How long the root-stock may be I cannot tell, having only a fragment: Fée says it is "rampant," an expression equivalent to our "creeping." The scales with which it is covered are ovate-acuminate, toothed with often recurved processes, and of a brownish-yellow color. A section of the single fibro-vascular bundle has the form of a broad open V.

The fronds are from six inches to a foot long; triangular ovate in outline, and three or four times pinnate at the base, gradually becoming simpler towards the apex. The primary pinnæ are mostly alternate, there being from five to seven compound ones on each side, besides a smaller number of simple pinnæ towards the apex. The arrangement of the pinnules is anadromous throughout the frond, the pinnule nearest the rachis or midrib being on the upper side of the pinnæ, as it is, indeed, in the whole genus.

The pinnules of the Texas specimen are only three or four lines broad, and are roundish with a truncate or occasionally subcordate base. They are generally entire; but a few of them show a slight tendency to become three-lobed.

cantia, Acuminata and Obtusata. *Obtusata* corresponds to Hooker’s "Capillus-Veneris group," and comprises nineteen species, two in *Articulata*, seven (including our present plant) in *Dentalia*, and ten in *Interdentalia*. Fée's specific character of *A. tricholepis* reads thus:—Fronde ovale en son pourtour; pétiole et rachis glabres, lisses, de couleur noire-foncée; frondules arrondies, assez longuement pétiolulées, poilues sur les deux lames; sporothèces très-peu nombreux, de grandeur inégale; indusium très-velu; rhizome rampant, écailleux; écailles linéaires, acuminées, fauves."
In the Yucatan and Mexican specimens they are a little larger, and if the figure at Plate lxxv, B, of the *Species Filicium* be really taken from Nuttall’s specimen, the pinnules of his plant are still larger and more semicircular. Both surfaces are pubescent with soft whitish hairs.

The involucres are of unequal size in the Texas plant, as they are in those from Mexico and Yucatan, some of them being four times broader than deep, others barely oblong, and others roundish. They are brownish-yellow in color, and even more pubescent than the pinnules themselves. The spores are trigonous and plainly trivittate.

Plate LIX., Fig. 6–10.—*Adiantum tricholepis*. The frond represented is from the Pecos River, in Western Texas. Fig. 7 shows an enlarged pinnule. Fig. 8, a position of the margin of the same, with the involucre turned back to show the position of the sporangia on the tips of the veinlets. Fig. 9 is a spore, and Fig. 10, a part of a pinna from a Yucatan specimen, of the natural size.
Woodsia hyperborea:—Root-stocks ascending, tufted; stalks crowded, articulated and chaffy near the base, sparingly chaffy upwards, as is the rachis, castaneous and shining when dried; fronds two to six inches long, oblong-lanceolate, nearly smooth, or sparingly paleaceous-hirsute, pinnate; pinnae three to six lines long, triangular-ovate, rounded at the apex, pinnately lobed into a few obtuse rounded nearly entire flattened lobes; sori sub-marginal, distinct; involucre saucer-like, deeply cleft into long incurved filiform rays.


*Acrostichum alpinum*, Bolton, ‘‘Fil. Brit., p. 76, t. 42.’’

*Polypodium arvonicum*, Smith, ‘‘Fl. Brit. iii., p. 1115.’’

Hab.—British America, the limits not ascertained, and in the northern parts of Vermont and New York. To Mr. D. A. Watt, of Montreal, I am indebted for a very copious series of specimens collected by himself “on a moist mossy bank near the falls on the Rivière-du-Loup, and within reach of the spray from the falls, Sept. 1, 1865,” and “on moist mossy rocks, in a ravine, Temiscouata, Canada East, 1868;” also for others collected on the northern shore of Lake Superior by Mr. Macoun. The late Horace Mann, jr., discovered it on Willoughby Mountain, in Vermont, and Mr. C. C. Pringle has gathered it in the same place, and also in Smuggler's Notch, Mount Mansfield, Vermont. Professor C. H. Peck has sent it from the Adirondack Mountains of New York. I have not seen the plant from Boylston, Massachusetts, but doubt very much if it can be true *hyperborea*. In the Herbarium at Kew is a specimen from Norway House, on the Saskatchewan River, collected by Dr. Richardson, and the species is said to have been seen in Newfoundland. Its range extends through the northern and alpine regions of Europe and Asia.

Description:—The root-stocks are clustered, and hidden by a multitude of stalk-bases, which persist long after the fronds have fallen off. The stalks and the rachis as far as
the middle of the frond are bright-chestnut-brown and shining. The stalks in large specimens are two inches long, and one-sixteenth of an inch thick. In this species, as in *W. Ilvensis* and *W. glabella*, there is a manifest articulation in the stalk, about half an inch from the root-stock. Below this articulation the stalks are chaffy, the scales being bright-ferruginous, ovate-acuminate, distantly ciliate-toothed, destitute of midnerve, and about two lines long. Above the articulation the scales are very narrow, almost hair-like, and so few that often the frond seems perfectly smooth. I find a solitary roundish-triangular fibro-vascular bundle. A delicate, funnel-shaped expansion of the fibro-vascular bundle connects it with the surface of the stalk just at the articulation.

The fronds are oblong-lanceolate or linear-lanceolate in outline, usually about four inches long, and scarcely one inch wide. They have about twelve or fifteen pinnæ on each side, those towards the base being a little shorter than the others and more distant. The texture is soft and membranaceous:—Hooker says "rather flaccid." The middle pinnæ are seldom over half an inch long, and a quarter of an inch broad at the base. They are ovate from a broad base, obtuse or rounded at the apex, and pinnately lobed rather than cleft from three to seven short rounded lobes on each side. The veins are free, and mostly simple, and bear rounded fruit-dots just below the apex.

The indusium is placed beneath the sorus, instead of above it as in most of our ferns, and consists of a minute
pateriform or saucer-like central portion, and a marginal fringe of long radiating jointed hairs, which are more or less incurved over the sporangia. This indusium is most beautifully represented in Francis Bauer's drawing which accompanies Robert Brown's original paper on the genus. The spores are bean-shaped, and are slightly roughened.

Brown himself remarked of this fern and *W. Ilvensis*: “These two plants are indeed so nearly related, that I find myself unable to construct for them clear specific characters; and therefore, in proposing them here as distinct species, I am, from want of sufficient materials to determine the question, rather following the prevailing opinion than my own.” Hooker's last words on the subject are:—“I have wavered in my opinion as to their distinctness; but my late examinations incline me to lean to their validity.” *W. hyperborea* is tenderer in its texture than *W. Ilvensis*, much less paleaceous, narrower in outline, and has shorter, more obtuse, and less divided pinnæ.

Plate LX., Fig. 1-4. — *Woodsia hyperborea*, a Canadian specimen from Mr. Watt. Fig. 2 is an enlarged pinna. Fig. 3, a sorus; and Fig. 4, a spore.

1 This paper was published in 1812. Other specific names are older than "hyperborea," but as that is the name chosen by the author of the genus, it was not in accordance with the principles of sound nomenclature to substitute "alpina," as was done by S. F. Gray, whose example was followed by Moore and Newman, and at one time, I regret to say, by the present writer.
WOODSIA ILVENSIS, R. BROWN.

Rusty Woodsia.

WOODSIA ILVENSIS:—Root-stocks ascending, growing in great tufted masses; stalks crowded, articulated near the base, very chaffy with rusty brown scales and paleaceous hairs, greenish-brown, becoming brownish-stramineous when dry; fronds two to six inches long, lanceolate, paleaceous and hirsute, pinnate; pinnae six to nine lines long, oblong-ovate, acute, pinnatifid into rather numerous oblong obtuse usually crenated lobes, the margins slightly reflexed; sori numerous, at length confluent; involucres saucer-like, deeply cleft into long incurved filiform rays.


Woodsia hyperborea, Pursh, certainly as to the original specimens preserved at Kew.


Nephrodium rufidulum, Michaux, Fl. Bor.-Am., ii., p. 269.


Some additional synonymy may be found in Moore's Nature-Printed British Ferns, and in Milde's work above referred to.

Hab. — On high exposed rocks and in their crevices, in the mountainous regions of the Northern United States, and throughout British America as far as the Rocky Mountains, Drummond, and Norway House, Mr. George Barnston. In New England it is sometimes found at low elevations near the sea, as on Mount Desert Island, Maine. It is particularly fine and abundant on the tops of the mountains above West Point, on the Hudson River; and along the Saguenay river, in Canada, Mr. Watt. It occurs as far north as Disco Head, in Greenland, and is common in the northern and alpine parts of Europe and Asia, extending as far east as Hakodadi, in Japan.

Description: — Though the individual root-stocks of this fern are slender and ascending, and only one or two inches long, yet by their branching they form large tufts of the plant, the patches being not infrequently two or three feet in extent. The stalks are continuous with the root-stock, and those that support living fronds grow from the apex of it:
they are from one to four inches long, and about three-fourths of a line in diameter. They are rounded at the back, furrowed in front, and usually very chaffy. The chaff near the base of the stalks consists of thin ferruginous ovate-acuminate scales, composed of straight rhomboid-oblong or oblong-linear cells, and scantily denticulate with slender and often recurved teeth. Higher up the scales become narrower, and are intermixed with paleaceous hairs. The same scales and hairs beset the rachis and the lower surface of the frond, but the upper surface bears only a few short hairs. The stalks are articulated about half an inch from the base, as in *W. hyperborea*, and have a similar fibro-vascular bundle.

The fronds are commonly a little larger than in that species, and have a broader outline. They are also a little thicker in texture, and more rigid. When young they are whitish, from the color of the scales, but turn to a rusty-brown in maturity. The pinnæ are oblong-ovate, rather acute, and pinnatifid into about seven to ten oblong obtuse lobes on each side. The margin is commonly somewhat recurved. The sori are abundant, and set near the margin of the lobes. When ripe the sporangia are more or less confluent.

The indusium does not differ from that of *W. hyperborea*, and when examined by a lens of moderate power is very beautiful, the long white cilliiform processes being curled over the sporangia, as if trying to protect what they cannot fully cover. The spores are bean-shaped, marked with a single vitta, and slightly roughened on the surface.
Plants grown in moist and shady situations are slenderer and less chaffy, and are sometimes hard to distinguish from the more chaffy forms of *W. hyperborea*.

Pursh describes not only *Woodsia hyperborea* and *W. Ilvensis* in his Flora, but *Aspidium rufidulum* also. His specimens of the first-named are, however, only *W. Ilvensis*.

Willdenow remarks:—"*Nomen triviale non mutavi, licet in insula Elba haud crescat, quam nomina non nisi urgende necessitate mutanda esse credam;*" and since Brown adopted the same specific name in proposing his genus *Woodsia*, it is to be hoped that no one will seriously attempt to change it.

Plate LX., Fig. 5–8.—*Woodsia Ilvensis*, from near Boston, Massachusetts. Fig. 6 is an enlarged pinna, the chaff removed. Fig. 7 is a sorus, and Fig. 8, a spore.
Plate L.X.—Fig. 9-12.

WOODSIA GLABELLA, R. Brown.

Smooth Woodsia.

Woodsia glabella:—Root-stocks short, ascending, clustered; stalks very slender, seldom an inch long, sparingly chaffy below the articulation near the base; fronds one to four inches long, three to six lines wide, linear-lanceolate, very delicate, smooth, pinnate; pinnae one to three lines long, roundish-ovate, obtuse, crenately lobed into three to seven short rounded lobes; sori very few; involucres saucer-like, deeply cleft into a few long incurved filiform rays.


Hab.—On moist mossy cliffs in the northern parts of New Hampshire, Vermont and New York, and from the Saguenay River and Montmorency Falls (Wait) to the Arctic Circle. Alpine and Arctic Europe, Siberia, Kamtschatka and on the islands near Behring’s Straits.
It was discovered at Little Falls, New York, by Dr. Vasey; at Willoughby Mountain, Vermont, by C. C. Frost; near Gorham, New Hampshire, probably by W. Faxon, in 1872; at Mount Mansfield, Vermont, by C. C. Pringle, in 1876; near Gorham, New Hampshire, probably by W. Faxon, in 1872; at Mount Mansfield, Vermont, by C. C. Pringle, in 1876; in the Adirondacks by Professor Peck; on the northern shore of Lake Superior by Professor Macoun; and originally at Great Bear Lake by Dr. Richardson.

**Description:**—As *W. hyperborea* differs from *W. Ilvensis* in being narrower, more delicate, smoother, and with less deeply lobed pinnæ, so *W. glabella* differs from the former species in being still narrower, more delicate, perfectly smooth, and in having very slightly lobed pinnæ. The mode of growth is similar; the stalks are articulated in the same way; the chaff is like the chaff of the others, and the only difference in the indusium is that there are fewer cilia on its margin. It is a very delicate little fern, and in habit is much like *Asplenium viride*.

Although this fern was first described from Dr. Richardson's specimens, it is worthy of note that it exists in the Linnean herbarium under the name of *Polypodium fontanum*. It is remarkable that Ruprecht, without seeing the specimens, should have guessed this very thing.

Plate L.X., Fig. 9–12.—*Woodsia glabella*, from Smugglers Notch, Mt. Mansfield, Vermont. Fig. 10 is an enlarged pinna. Fig. 11, a sorus. Fig. 12, a spore.

WOODWARDIA RADICANS, SMITH.

Great Chain-Fern.

WOODWARDIA RADICANS:—Root-stock stout, very chaffy with large thin ferruginous scales, assurgent or erect, often rising a few inches above ground; stalks strong, eight to twelve inches long; fronds growing in a crown, standing from two to ten feet high, sub-coriaceous, oblong-ovate in outline, pinnate; rachis often producing scaly proliferous buds near the apex (in the old-world plant); pinnæ four to fifteen inches long, one to four inches broad, lanceolate, pinnatifid nearly to the midrib; segments triangular-lanceolate, slightly falcate, often acuminate, spinulose-serrate and in large plants more or less pinnatifid; veinlets forming a single row of oblong often sorus-bearing areoles each side of the midvein, besides a few oblique empty areoles outside of the fertile ones; outer veinlets free, running into the teeth of the margin; sori oblong, often slightly curved, the sporangia resting in the hollowed areole, and covered by a convex indusium, which at maturity turns back and discloses the sporangia.

Woodwardia radicans, var. spinulosa, Fee, Gen. Fil., p. 207.


Eaton, Ferns of the South-West, p. 328.


Woodwardia spinulosa, Martens & Galeotti, Syn. Fil., Mex., p. 64. — Fee, 8me Mém., p. 122.


Blechnum radicans, LINNÆUS, Mantissa, p. 307.

Hab. — By living streams in shaded places, especially in the valleys and canyons of the Coast ranges, and of the Sierra also, in California from Long Valley to San Diego. Mexico and Guatemala, a common fern. From Madeira and the Canaries throughout Mediterranean Europe; in Congo, Abyssinia, Northern India and Java. Peru, China and Australia are also given by various authors.

Description: — After Acrostichum aureum this is unquestionably the most magnificent of North American Ferns. The root-stock is very large, and sometimes rises a few inches from the ground, in the manner of a tree-fern with a very short caudex. Unlike our two other species of Woodwardia radicans, var. spinulosa, Fee, Gen. Fil., p. 207.


Eaton, Ferns of the South-West, p. 328.


Woodwardia spinulosa, Martens & Galeotti, Syn. Fil., Mex., p. 64. — Fee, 8me Mém., p. 122.


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Woodwardia spinulosa, Martens & Galeotti, Syn. Fil., Mex., p. 64. — Fee, 8me Mém., p. 122.


Blechnum radicans, LINNÆUS, Mantissa, p. 307.
wardia, which have slender and creeping root-stocks, and scattered or even distant stalks, this one has the stalks clustered about the end of the root-stock, and the fronds standing in a crown or circle, the root-stock, with its chaff and clustered stalks resembling that of Aspidium marginale, but twice as large. The root-stock and the bases of the stalks are heavily covered with large lanceolate bright-brown chaffy scales, some of them fully an inch long. They are entire on the edges, destitute of midnerve, and mainly composed of narrowly-linear cells, those towards the base being short and broad, much as in the leaves of many kinds of moss. The stalk is nearly semiterete, becoming deeply furrowed on the flattened (anterior) side when dried, a foot or more long and nearly half an inch thick at the base in large plants, greenish-brown, becoming deep-dull-brown in herbarium specimens; when mature chaffy only at the base. The section shows a tough exterior sheath and four or more interior fibro-vascular bundles, two strap-shaped bundles at the sides, and several smaller ones at the back. Milde mentions only the lateral bundles, but a specimen from Madeira shows six others.

The fronds are said by Brackenridge and Brewer to be three or four feet high. Mrs. Cooper writes from Santa Barbara as follows:—“Our grand Woodwardia radicans grows close beside living streams in somewhat shaded localities, and in favored situations it attains the height of eight or ten feet. The young fronds are of a light tender green, while the older ones are of a rich dark color, and grow from
five to twenty or more in a tuft." Milde says of the European fern:—"A most splendid plant. The fronds curve over in an arch, and take root from chaffy buds near the apex. It grows in moist forests of the evergreen region, in shady laurel-groves, by streams and springs, and among shaded rocks to the elevation of four thousand feet above the sea."

These chaffy buds usually occur singly on the rachis at the base of one of the upper pinnæ. They are sometimes nearly an inch in diameter, covered with brown chaffy scales, and often emit slender roots. A section of a large one from Madeira shows that it is a bud on the rachis developed into a short rhizoma, with several rudimentary fronds coiled up and hidden in the chaff. The fact that no instance of the formation of this bud on an American plant has as yet been

1 The fact that a stalk may produce a rhizome, noticed at page 341 of the first volume of this work, though perhaps more evident in the case of Dicksonia pilosisiosa than in other ferns, is by no means unknown. In Sach's Text-Book (English version, p. 351) several instances are given of the same thing, as Pteris aquilina, which often produces a shoot from the back of the leaf-stalk close to the base, and Aspidium Filix-mas, which produces buds a short distance above the base, oftenest on one side of the stalk. The slender stolons of Onoclea Struthiopteris are said to be formed in a similar way, and Acrostichum aureum and Woodwardia radicans seem to do a like thing. The formation of prolificous buds on the stalk of Asplenium fragile, on the rachis of Asplenium ebeneum, the bulblets of Cystopteris bulbifera, the scaly bud of Woodwardia radicans, the terminal bud of Camptosorus rhizophyllus, the numerous little buds on the upper surface of the pinnæ of Woodwardia orientalis and of the Australian Aspidium proliferum, rightly regarded, are all manifestations of the same power which many ferns have of producing an adventitious prolificous bud from almost any part of the plant.
recorded, together with a fancied difference in the spiny teeth of the margin, and in the more or less abundantly reticulated venation, has disposed several authors to consider our fern specifically distinct from the European; but on the whole it is better either to call our plant a variety of the other, or even to wait patiently till the scaly bud shall be found, which discovery it is only reasonable to expect.

The fronds are smooth, sub-coriaceous, oblong-ovate, and have sometimes as many as fifteen or twenty pinnæ on each side. The lower pinnæ are rather distant, short-stalked and not quite so long as some of the middle ones, which are sessile. The upper pinnæ diminish rapidly in size and are more and more adnate-decurrent on the rachis, and so pass into the rather short, but acute, pinnatifid apex of the frond.

The largest pinnæ have sometimes as many as thirty segments on each side, but more commonly there are only about half that number. The midribs of the pinnæ are broadly winged, and the lanceolate acute segments are set on very obliquely, generally leaving broad sinuses between them in the lower pinnæ, and narrower and more acute sinuses in the upper ones. The segments are lanceolate from a broad base, commonly acuminate, the margin sometimes pinnately lobed or undulate, but always finely serrulate with appressed translucent, slender or even aculeate teeth. The American, and especially the Mexican specimens, have rather longer and more spinulose teeth than those from Europe and Asia.
The veins form three sets of areoles:—a series of very long and narrow areoles running along both sides of the mid-rib from the midvein of one lobe to the midvein of the next; a series of shorter areoles running along both sides of the midveins, and outside of these an irregular row of smaller oblique areoles, from which free veinlets extend to the spinulose serratures.

The sori are found filling some of the areoles of the first and second series. The indusium is attached to the veinlet forming the outer boundary of the areole, and covers the sporangia until they mature, when it is reflexed. The spores are ovoid and marked with a single vitta.

Plate LXI. — _Woodwardia radicans_, a rather small frond, from California. Fig. 2 represents two segments of the natural size from a large specimen. Fig. 3 is a spore.
ASPIDIUM ACULEATUM, Swartz.
Plate LXII.

Aspidium aculeatum, Swartz.

Prickly Shield-Fern.

Aspidium aculeatum:—Root-stock stout, ascending or erect; stalks of variable length, commonly very chaffy with broad and very narrow scales intermixed; rachis chaffy-fibrillose; fronds one to three feet long, forming a crown, subcoriaceous, oblong-lanceolate, acuminate, once or twice pinnate; primary pinnæ closely placed, short-stalked, lanceolate, or linear-lanceolate from a broad base, often curved upwards, incisely pinnatifid or again pinnate; secondary pinnæ or segments of variable shape, rhomboid-oval and adnate or sessile, or unequally triangular-ovate and auriculate on the upper side of a slightly stalked base, entire or serrate or incised, the lobes and teeth of all degrees aculeate; under surface more or less chaffy and fibrilllose; veins free; sori in two rows on the segments, nearer the midvein than the margin; indusium orbicular, attached by the depressed centre.

The following forms have been found in the United States or in British America.

Var. *Californicum*, Eaton:—Stalks rather long; frond much elongated, scarcely narrowed at the base, thinly sub-coriaceous, pinnæ very numerous, lance-linear, but slightly incised above the middle, more and more deeply cut towards the rachis, segments rhomboid-ovate, acute, serrate with incurved aculeate teeth, the lowest superior one largest, but scarcely distinct as a pinnule, and not at all auricled.—Ferns of the South-West, p. 336. — *Aspidium Californicum*, Eaton, in Proc. Am. Acad., vi., p. 555.—Baker, Syn. Fil., p. 253.


Var. *Braunii*, Doell:—Stalk very short; frond elliptical-lanceolate, tapering from the middle to both base and apex, bipinnate; pinnules

Var. scopulinum: — Stalk very short; frond narrowly lanceolate, less than a foot long, scarcely one and a half inches wide, sub-coriaceous, the chaff mostly deciduous, pinnate; pinnae numerous, seven to nine lines long, four to six lines wide at the base, ovate, rather obtuse, the lower part pinnately lobed, the upper half serrate with pointed and barely aculeate teeth, sori remote from the margins. — Aspidium Lonicchitis, Eaton, in Coulter's report in Hayden's Sixth Annual Report of the Geol. Surv. of Territories (1872), p. 788.

Hab. — Deep rocky ravines in mountainous districts. The first three varieties have been found in the canons of the Coast Ranges of California, especially in Santa Cruz and Mendocino Counties. Var. Braunii, has been found among the mountains of Northern Vermont and New Hampshire, in the Adirondack and the Catskill Mountains of New York, in Oswego County, New York, in the Ontonagon peninsula of Michigan, in New Brunswick and Canada, in British Columbia, and, according to Milde, in the island of Sitka. It was first discovered in Smugglers' Notch, Mount Mansfield, Vermont, by Frederic Pursh, prob-

I have limited myself to the necessary synonymy of this species. Very many more names might be quoted, and innumerable references given; but the notions which various botanists have held of this species and its forms are so many and so diverse, that a considerable volume would be needed to elucidate them all; and the effort would probably be but a waste of time even if it were successful.
ably in September, 1807, though he does not allude to it in his journal. There are now several stations known for it in the Green Mountains and in the Catskills, the latest one among the Catskills having been recently discovered by Misses Mary and Caroline Redfield, some fifteen miles west of Kaaterskill Clove. Var. scopulinum was collected in the Upper Teton Cañon in Eastern Idaho, and has been found in the Sierra Nevada by Mrs. E. C. Knox. Varieties lobatum, angulare and Braunii are well known European forms, and if all the plants referred to this species by Hooker really belong to it, it may be said to be distributed throughout nearly all parts of the world.

Description:—The root-stock is stout, erect or assurgent, becoming somewhat woody with age, and is in great part composed of the adherent and closely imbricated stalk-bases of former fronds. The stalk is seldom over a foot long, except in var. Californicum, in which it sometimes attains fifteen inches of length. In var. Braunii it measures only two to four inches. The fresh stalk is roundish with the anterior side flattened; it contains four or five fibro-vascular bundles arranged in a semicircle, the two lateral bundles much larger than the others. In all forms of the species the stalk is very chaffy, especially at the base, where the scales are large, ovate-acuminate, and obscurely ciliate-toothed, intermixed with much smaller and slenderer scales and fine palaceous hairs. In all our forms the chaff is rather thin, and of a clear ferruginous brown, much paler, of course, in young fronds. In some of the European forms the largest scales are darker; and in the plants of tropical regions and
the southern hemisphere, which are considered by many botanists to form several distinct species, the scales are often very rigid, and nearly black in color. The chaffiness extends along the rachis and its divisions, often abundantly, but in smaller and smaller scales, and so passes into the fibrils which are always found on the lower surface of the frond, and not rarely on the upper surface also. The fronds are in general lanceolate, in var. *Braunii* conspicuously narrowed at the base, in the other forms more or less so, or even a trifle broadest at the base in var. *angulare*. The pinnae are numerous, and are usually lanceolate from a base which is widened on the upper side. The degree of incision varies much in the different forms, as indicated in the characters assigned to the several varieties here recognized. Var. *Californicum* has much the look of *A. munitum*, though with more deeply incised pinnae; but between it and var. *lobatum* there occur so many intermediate forms, that I can no longer consider it specifically distinct. In var. *lobatum* I include, as did Kunze and Milde, the forms which have been considered typical *aculeatum* and var. *lobatum* by many authors, for the difference is only that usually seen between the fronds of mature and younger plants. The former, again, passes by insensible gradations into Willdenow's *A. angulare*, in which the greater part of the pinnules are distinctly auricled and rest on short foot-stalks. I have some doubt about the plant here named var. *scopulinum*, as it differs more from all the rest than any of them do from each other. It has a little the habit of
A. mohrioides, but, though the specimens I have seen are old, they still keep in a degree the aculeate points of the present species.

The sori are mostly near the midveins, and have the orbicular and peltate indusia of the section Polystichum. The margin of the indusium is more or less repand-toothed, or, in the Californian plants, conspicuously ciliate. The spores are ovoid and univittate.

Plate LXII.—Aspidium aculeatum. Fig. 1 is var. Braunii, from Vermont. Figs. 2, 3 and 4, the details from the same. Fig. 5 is a pinna of var. lobatum; Fig. 6, of var. Californicum; Fig. 7, of var. angulare; Fig. 8, four pinnæ of var. scopulinum.

1 Aspidium mohrioides, Bory, has recently been discovered in a valley some thirty miles west of Mount Shasta, in California, by Mr. J. G. Lemmon. At first I believed it to be a distinct species, and proposed to name it after its discoverer, a gentleman whose own modesty has been the innocent reason why some Californian fern was not long ago named in his honor. It is a South Chilian and Patagonian fern, and it is very remarkable that it should occur in California. It will be figured in the last part of the present work.
Plate LXIII.—Fig. 1-4.

NEPHROLEPIS EXALTATA, SCHOTT.

Tall Nephrolepis.

Nephrolepis exaltata:—Root-stock very short, sending out numerous very long and slender stolons or runners; stalks a few inches to over a foot long, chaffy with narrow scales when young, at length nearly smooth; fronds two to six feet long, two to four inches wide, linear, often somewhat pendent, simply pinnate; pinnae very many, chartaceous, smooth or sparingly hirsute beneath, sessile, articulated to the rachis, oblong-linear and slightly falcate, auriculate on the upper side of the truncate or sub-cordate base, crenulately-denticulate, obtuse or acute; veins free, mostly once forked near the midvein, the veinlets oblique, straight, enlarged at the tip; fertile pinnae soriferous at the tips of the superior forks of the veins; indusia firm, round-reniform, and attached at the sinus, or merely curved and attached by the concave base, the free margin being directed towards the apex of the pinna.


Many nominal species of *Nephrolepis* are referred to *N. exaltata* in *Species Filicium*, among them *N. hirsutula*, Presl, a form with hirsute-pubescent pinnæ.

Hab.—On decomposing vegetable matter and on the trunks of trees, particularly the Cabbage Palmetto. South Florida, Dr. Cooper, Dr. Palmer, W. R. Tompkins, Dr. Garber, Capt. J. Donnell Smith, Miss Reynolds, etc., etc. It is found in Mexico, the West Indies, Central and South America, Southern Asia, China, the Pacific Islands Australia, and parts of Africa. The hirsute form is more common in India, China and Polynesia, but is found also in several parts of Tropical America.

**Description:**—The genus *Nephrolepis* was proposed, in 1834, by H. W. Schott for those species of *Nephrodium* or *Aspidium* which had a reniform indusium obliquely affixed by its emarginate base to the side of the enlarged tip of the fertile vein. He gives excellent analytical drawings of *N. exaltata*, and mentions "*N. pectinata, biserrata*, etc." as also examples of his genus. In the *Tentamen Pteridographiae*, of Presl, two years later, the genus is admitted and over a score of species referred to it. A new distinctive character
is also indicated:—"Pinnæ truly articulated to the rachis, and easily separating from it." Fée divided the species into two genera, *Nephrolepis* and *Lepidocaulon*, assigning to the former the species with a broadly reniform indusium somewhat laterally attached to the receptacle, and to the latter those with a round-reniform indusium, affixed by the centre; but since specimens are very common in which both forms of indusium occur on the same pinna, it is clearly impossible to make the special form of the indusium a generic character. A peculiarity in the genus, which escaped the observation of many of the earlier pteridologists, is the indefinite growth of the frond. According to the observations of Mettenius, there is no necessary limit to the apical development of the frond in mature plants. What he has to say on the subject is translated below.¹

¹ "The rhizoma of all the cultivated species is raised erect from the soil, without reaching any great height, and is covered with the gradually decaying leaf-stalks.

In all the cultivated species, just below the points where the fronds are inserted on the rhizoma, there originate filiform runners, which either produce buds somewhere on their course above-ground, or develop tubers at the end which enters the soil, and thus contribute to the multiplication of the plant. The fronds are characterized by the perennial indefinite growth of the leaf-stalk [rachis], and the consequent unlimited periodical production of pinnae at the uninjured circinate apex, long after the older pinnae have fruited or fallen off. Only in the earliest fronds of plants grown from spores (and also in *N. platyotis* and *N. davallioides*, after the formation of fertile pinnae) does the development of the frond terminate with a gradual diminution of the size of the pinnae, whilst the highest rudimentary side-pinna blends with the proper terminal segment. In *N. exaltata* the oldest fronds continue to develop at the apex, and the growth of the frond is limited only by some injury happening to the apex. The limit of the yearly increase of the frond is always indicated by the smaller size of the segments." [Fil. Hort. Lips., p. 99]
The root-stock, though seldom over a few inches long, is erect and very woody. It produces a crown of many fronds, and emits from just below the insertion of nearly every stalk, as Mettenius has indicated, a long and slender runner. These runners are rather rigid, less than a line in thickness, but often over two feet long. They root freely, and produce many lateral buds, from which new plants arise, very much as new strawberry-plants are produced from the lateral buds of runners. In this way there is often formed a large mass of the plant, as was found by Dr. Garber in the low hummocks of Southwestern Florida.

The stalk is rigid, terete, dark-brown, shining, but more or less chaffy, and the section discloses a very strong exterior sheath of sclerenchyma, and three rather slender fibro-vascular threads buried in the internal mass of brown parenchyma. The runners have but one fibro-vascular thread.

The chaff of the root-stock, like that found on the runners and on the stalks when young, consists of very slender ferruginous scales, nearly entire in the Florida specimens, but in exotic plants sometimes conspicuously ciliate. The rachis is more or less chaffy-fibrillose, especially along the upper side.

The fronds have no definite length, as they continue to grow indefinitely from the apex, and may sometimes reach a length of six or eight feet before the growth is arrested by some accidental injury. Among many specimens in my collection, I find only one (from Venezuela, collected by Fendler) in which the frond has a proper pinnatifid apex. This frond
is about three feet long and three inches wide, and is in full fruit.

The pinnae are lanceolate or oblong-linear, sessile and articulated to the rachis, leaving a minute elliptical scar when they finally drop off. The base is usually cordate and auricled, especially on the upper side, the auricles obtuse and covering the lower surface of the rachis. The apex of the pinnae is either acute or obtuse, and the margin is crenulate-serrate. The veins are mostly once forked near the midrib, the branches running obliquely almost to the margin, and their apices enlarged and thickened. The position of these thickened apices is commonly marked on the upper surface of the frond by the presence of a minute round white scale. By the use of dilute hydrochloric acid the white calcareous matter may be dissolved out, and only a delicate cellular film remains. Similar calcareous dots have been observed on the fronds of Polypodium Phyllitidis and many other ferns. Many of the pinnae are fertile, the sori being produced on the thickened apices of the upper veinlet of each pair. The indusia vary much in shape, being now round-reniform, and attached near the centre, much as in section Nephrodium of Aspidium, and now merely arched, and attached by a broad hollow base to the superior side of the incrassated apex of the fertile veinlet. Both forms may often be seen on the same pinna.

The sporangia have a ring of about fourteen or fifteen joints, and the spores are ovoid.

Hooker and Baker reduce the species of Nephrolepis to
seven, *N. cordifolia, exaltata, acuta, ramosa, altescandens, floccigera* and *davallioides*. The fourth and fifth of these have a slender wide-creeping root-stock; the rest have a root-stock much like that of our species.

Concerning the affinities of the genus there has been some diversity of opinion. Mettenius placed it in *Davallieæ*; Hooker in *Aspidieæ*. Fée placed part of it in each of these two tribes. The character of the indusium, when fully developed, is clearly Aspidioid, and I see no sufficient reason for removing the genus to *Davallieæ*.

Plate LXIII., Fig. 1–4.—*Nephrolepis exaltata*, from Indian River, Florida. The beginning only of the runners is represented. Fig. 2 is a pinna, slightly enlarged; Fig. 3 is an indusium, and Fig. 4, a spore.
Plate LXIII.—Fig. 5–8.

**POLYPODIUM PLUMULA, H. B. K.**

**Plume Polypody.**

**Polyodium Plumula:**—Root-stock rather short, chaffy; stalks clustered, one to four inches long, slender, wiry, blackened, ferruginous-puberulent and slightly chaffy, as is the midrib; fronds three to fifteen inches long, three-fourths to two and a half inches wide, curled to one side when dry, narrowly linear-lanceolate, tapering to both ends, pinnatifid almost to the midrib; segments very numerous, spreading, five to fifteen lines long, scarcely one line wide, linear from a base slightly dilated on the upper side, entire, obtuse, somewhat puberulent; midvein blackish; veins concolorous, obscure, mostly once forked, the superior veinlet soriferous; sori minute, half-way between the midvein and the margin; spores ovoid reniform, yellowish, the surface minutely pustulated.


Polypodium pulchrum, Martens & Galeotti, Syn. Fil., Mex., p. 41, t. 8, Fig. 2. (This is kept distinct by Fournier, who has seen the original specimens, but is referred to P. elasticum by Baker. Fournier gives several synonymes of P. Plumula, which I have been unable to verify.)

Hab.—Almost always on the trunks of living trees, the root-stocks covered with mosses and lichens. Tampa Bay. Dr. M. C. Leavenworth. Near Enterprise, Mr. C. E. Faxon. Indian River, Mr. Whitney. Fourteen miles west of St. Augustine, Miss Reynolds. Along the Corkscrew River, Dr. Garber. Near Lake Astachula, Captain J. Donnell Smith. Mexico to Venezuela and Brazil.

Description:—The root-stock is about two lines in diameter, and rarely over two inches long. The growing end and the bases of the stalks are covered with dark-brown lanceolate slender-pointed scales, destitute of midnerve, and obscurely ciliate-toothed. The stalks grow in a double row from the upper side of the root-stock, and, when fallen away, leave little raised concave scars on the root-stock, being articulated at the base, as are all the true Polypodia. The stalks are fuscos-black, terete, rigid, about two-thirds of a line thick and four inches long in the largest plants, and much slenderer and shorter in plants of smaller growth. A section shows the outer sheath of hard tissue to be very thick and firm, and discloses a central somewhat triangular fibro-vascular bundle. A very slight herbaceous line extends down each side of the stalk for some little distance below the lowest
segments. In young fronds the stalk and the midrib are ferruginous-puberulent and sparingly paleaceous, but older ones become gradually smoother; more or less of this roughness, however, adheres permanently to the midrib.

The fronds are narrowly linear-lanceolate in outline, and are gradually contracted towards both base and apex. The lowest segments are distinct, and do not pass into mere enlargements of the descending herbaceous lines. The frond terminates in an apical segment, which is seldom so long as to be fairly caudate. The ratio of the length of the fronds to their breadth is usually about ten to one, but is sometimes as low as six to one. The fronds are nearly erect when fresh; but when dry from the heat of the sun, or when dried for preservation, they show a very decided curvature, either backwards or to one side; at the same time the segments coil up nearly to the midrib, showing only the under surface. This habit is plainly seen in the specimens gathered by Captain Smith, and is commented on by Miss Reynolds in her article in the Botanical Gazette. When moistened again the curvatures disappear, just as the infolding of the segments of *Polypodium incanum* disappears when the dried fronds of that fern are moistened.

The segments are very numerous, a frond fifteen inches long having over ninety of them on each side. They are rarely over a line wide for most of their length, but at the base are dilated, on the upper side especially, to nearly twice that width. They are thus, except near the midrib, separated
from each other by a space equal to their own width. The texture is chartaceous, and the surfaces, especially the lower surface, are sparingly chaffy-fibrillose. The margin is entire and slightly ciliate. The apex is obtuse.

The midveins of the segments are black, prominent on the lower surface, and slightly depressed on the upper. The veins are of the same green color as the frond, and are difficult to see, except by soaking a piece of the frond in hot water. They diverge from the midvein at an angle of about sixty degrees, and presently fork into two diverging veinlets, of which the lower one is slightly curved, and extends nearly to the margin of the segment, rarely forking again near the end. The upper veinlet reaches only about half-way to the margin, and is soriferous at its tip in the fertile fronds. There are sometimes as many as twenty-four of these forking veins along each side of the midvein.

The sori are minute, round, and placed at nearly equal distances from the midvein and the margin. The sporangia are few to each sorus, and have a ring of fourteen or fifteen articulations. The spores are yellowish, translucent, ovoid or reniform in shape, and have a minutely blistered or pustulate surface. The single vitta along the concave side is sometimes so broad as to form a kind of wing.

This fern is closely related to _P. pectinatum_, which is figured on our forty-second plate, but on the whole is a smaller plant, and has more numerous and narrower segments, and simpler veinlets. The outline of the whole frond is narrower.
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The two species, as they occur in Florida, may be compared thus:—

<table>
<thead>
<tr>
<th>P. pectinatum</th>
<th>P. Plumula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-grown fronds two to three feet long, three to six times longer than broad.</td>
<td>Full-grown fronds ten to fifteen inches long, six to ten times longer than broad.</td>
</tr>
<tr>
<td>Segments one and a half to three or four inches long, two to four lines broad, much dilated on both sides of the base.</td>
<td>Segments one-half to one and a half inches long, and rarely more than a line wide, dilated chiefly on the upper side of the base.</td>
</tr>
<tr>
<td>Midrib purplish.</td>
<td>Midrib black.</td>
</tr>
<tr>
<td>Veins dark colored near the base.</td>
<td>Veins greenish at the base.</td>
</tr>
<tr>
<td>Veinlets three or four to each vein.</td>
<td>Veinlets mostly two from each vein.</td>
</tr>
<tr>
<td>Sori rather large, often oval.</td>
<td>Sori small and round.</td>
</tr>
<tr>
<td>HAB. — Usually growing in the earth, often in clayey soil.</td>
<td>HAB. — Usually on living trees, rarely on fallen logs, or even on the face of calcareous rock (J. D. Smith).</td>
</tr>
</tbody>
</table>

Miss Reynolds, Dr. Garber and Captain Smith have all compared the two living plants in their native habitats, and all agree in considering them distinct species. Captain Smith writes that *P. Plumula*, is "easily distinguished from *P. pectinatum* by habit as well as by its place of growth, the pinnae, when dry, being strongly involute, even circinate." The specimens collected by him growing in banks of red clay and sand, on the southern shore of Lake Astachula, I refer to *P. pectinatum*, chiefly on account of their broader outline and more numerous veinlets.

From *P. taxifolium*, of Linnaeus, as this species is understood by Mr. Baker, *P. Plumula* differs in having forked
veins, the veins in the other being always simple. Specimens marked *P. taxifolium*, and distributed from the Kew herbarium (No. 924) have, however, forked veins, and belong rather to *P. Plumula*. The only plant I have of genuine *P. taxifolium* is Fée's *P. l’Herminieri*, from Guadeloupe.

Whether the Mexican *P. pulchrum* is distinct from *P. Plumula* or not, must be left to others to decide: in the few specimens I have seen, no specific difference is discernible.

With this species the account of our North American *Polypodia* is completed. There are nine species in all: four of them, *P. pectinatum*, *Plumula aureum* and *Phyllitidis*, are tropical species which enter our limits only in Florida; one, *P. incanum*, is a tropical species which comes as far north as West Virginia and Indiana; one, *P. vulgare*, is a plant of the north-temperate zone generally, and three species, *P. Scouleri*, *P. Californicum* and *P. falcatum*, the last doubtfully distinct, are found only on our Pacific Coast.

Plate LXIII., Fig. 5-8.—*Polypodium Plumula*, from Indian River, Florida. Fig. 6 is an enlarged drawing of a pinna, showing the simply forked veins. Fig. 7 is a minute scale from the midrib, magnified. Fig. 8 is a spore.
PTERIS CRETICA, LINNAEUS.

Cretan Brake.

PTERIS CRETICA: — Root-stock creeping, the advancing end sending up numerous fronds; stalks often eighteen inches long, slender, sparingly chaffy at the base, otherwise smooth, stramineous when dry; fronds coriaceo-membranaceous, smooth, a few inches to nearly a foot long, ovate, ternate, quinate or pinnate; the lower pinnae two-or three-parted, sessile, the upper ones decurrent, terminal one elongated; sterile ones lanceolate or linear-lanceolate, narrowly cartilaginous-margined and finely serrate; fertile fronds taller than the sterile, the pinnae longer and narrower, entire or spinulose-serrate at the acuminate apex; veins straight, simple or forked; involucre narrow, continuous, entire.

Pteris triphylla, Martens & Galeotti, Syn. Fil. Mex., p. 51, t. 14, Fig. 1.
Pteris trifoliata, Fée, 8me Mém., p. 114.

Hab. — "Shady woods, Middle and East Florida," Dr. Chapman. Edges of limestone sinks or chasms, near Ocala, Florida, Mr. W. H. Shockley, Captain J. Donnell Smith. Mexico, Guatemala, Italy, Crete, Corsica; from the Ural Mountains to Arabia, the Himalayas and Japan; Abyssinia, and in the Philippine, Fiji and Hawaiian Islands (Synopsis Filicum).

Description: — The root-stock creeps just beneath the surface of the ground, and is several inches in length, by nearly a quarter of an inch in thickness. It is thickly covered by the short adherent bases of old stalks, which are found on all sides of it. The roots are long and slender, branching, and emitting abundant slender fibres.

The fronds borne by each root-stock are very numerous, those produced early in the season smaller and sterile, while those of later growth are taller, larger and more generally fertile. The fronds of one year remain green until after those of the succeeding year are developed. The stalks are about half a line in diameter, and often over a foot long, sometimes nearly two feet long. In the dried specimens they are stramineous, and deeply furrowed on the anterior side, but in the living plant they are greenish, and the furrow is much shallower. They are somewhat rigid, erect, and smooth except for a little mostly deciduous chaff near the base. This chaff consists of delicate little amber-brown lanceolate-acuminate
scales, destitute of midnerve, the cells arranged in a somewhat clathrate or lattice-like way, especially those of the very slender point. The section of the stalk shows two obliquely-placed strap-like fibro-vascular bundles.

The fronds of very young plants, and some of the earlier fronds of mature plants, consist of only three pinnae, all sessile at nearly the same point. The middle pinna is twice or three times as long as the side ones, and measures anywhere from one to five or six inches in length, and from three to six lines in width. Such fronds are commonly, but not always, sterile. *Pteris triphylla*, of Martens & Galeotti, a name altered to *trifoliata* by Fée, was founded on plants with such fronds, but is not deserving of being considered even a variety of the species. This form is found among the specimens of all those persons who have gathered the species in Florida. In the next degree of composition the two side pinnae are parted almost to the very base, rendering the frond quinate, but with the middle pinna, as before, decidedly the longest. From this condition the fronds pass by stages to the most complex form observed among the Florida specimens, in which the lowest pinnae are three-parted, the second, third and perhaps fourth, or even fifth, pair simple, the upper side of the base sessile, the lower side more and more decurrent on the midrib, and the terminal pinna distinct or nearly so, and usually the longest of all.

In the sterile frond the pinnae and pinnules are linear-lanceolate, tapering from near the middle to both base and
apex, and strongly serrated throughout. The texture is thin but firm, chartaceous, or coriaceo-membranaceous as described by Hooker. The veins are about one-third of a line apart, and leave the midvein nearly at a right angle. Many of them are simple, and others, mixed in irregularly with the simple ones, fork either near the base, or half way to the margin. The very edge is semi-translucent and sub-cartilaginous, the acute serratures partaking of this character. In this firm and semi-translucent edge is perhaps the readiest distinction between this fern and the nearly related *Pteris serrulata*, which, though long a garden fern of unknown origin, has now for some years been considered a native of China, but has recently been discovered wild, and apparently native, near Mobile, and has also been growing without cultivation, on the walls of the college at Charleston, South Carolina, for many years.

The fertile fronds of *Pteris Cretica* have linear pinnae three to six or eight inches long, and three or four, rarely five or six, lines wide, nearly linear in shape, the margin entire, and bordered with a delicate continuous recurved involucre, and the apex for the distance of an inch or more very sharply spinulose-serrate.

The sporangia are borne on a continuous marginal veinlike receptacle, and are covered by the involucre until near maturity. The ring of the sporangia consists of about twenty-one joints. The spores are roundish-tetrahedral, plainly trivittate, and have a faintly sculptured surface.
This fern receives its specific name from the island of Crete. Whether it was first discovered there I cannot determine: Swartz says "Europa australis, Oriens;" Willdenow indicates Switzerland, Italy, Corsica, Crete and Arabia. A very full list of Old-World localities may be seen in Hooker's *Species Filicum*, where there is also a var. *stenophylla*, in which the fronds are digitate or sub-pinnate, and the few pinnae entire or nearly so. This form occurs in Northern India, and in the Philippines, and is figured by Hooker and Greville (*Ic. Fil.*, t. 130). Another variety is noticed in *Synopsis Filicum*, var. *melanocaulon*, having a dark-colored stalk and scarcely visible venation: this form was found long ago in the Philippines by Cuming, and is described and figured as a species by Fée (*7me Mém. p. 31, t. xix, fig. 1*). A common form in cultivation is var. *albo-lineata*, in which there is a broad whitish stripe on the upper surface along the middle of each pinna. The pale color is apparently due to a partial deficiency of chlorophyll in the cells just beneath the epidermal layer, and also to a paler color in what chlorophyll there actually is there. This form has been figured in Curtis's Botanical Magazine (t. 5194), and in one or two other places. Mr. Baker reports that it has been found in Brazil by Dr. Glaziou.

*Pteris pellucida*, *P. Hookeriana* and *P. dactyliina*, all East Indian ferns, are closely allied to *P. Cretica*, and by some authors are regarded as doubtfully distinct from it.
In *Pteris Cretica* two or three pairs of pinnae are sometimes bi-partite or tri-partite, and rarely the inferior segment of the lowest pinna is again compound; but none of these forms have been observed in Florida specimens.

Plate LXIV.—*Pteris Cretica*, from one of Capt. Smith's Florida plants. Fig. 2 is a portion of a pinna magnified eight diameters, and showing the venation, indusium, sporangia, etc. Fig. 3 is a spore.
PHEGOPTERIS HEXAGONOPTERA.
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Plate LXV.

PHEGOPTERIS HEXAGONOPTERA, Fée.

Hexagon Beech-Fern.

Phegopteris hexagonoptera:—Root-stock creeping, slender, elongated, softly paleaceous; stalks scattered, slender, stramineous, ten to twenty inches high; fronds triangular, seven to twelve inches long and rather broader than long, thinly herbaceous, slightly hairy and often finely glandular beneath, usually twice pinnatifid; pinnae sessile, lanceolate, pinnatifid into numerous oblong obtuse segments, those of the very large lowest pinnae elongated and pinnately lobed, the rest entire or crenately toothed; basal segments adnate to the main rachis, and forming a series of polygonal narrowly connected wings along its sides; veins pinnately arranged, simple or forked; sori rather small, rounded, placed just below the tips of the veinlets and either near or remote from the margin of the segments; sporangia sparingly pilose; spores bean-shaped.


Polypodium Phegopteris, var. majus, Hooker, Fl. Bor.-Am., ii., p. 258.

Hab.—Moist woodlands, from Canada to Florida, and westward to Iowa, Arkansas and Louisiana, not one of our commonest ferns, but abundant in favorable localities, more particularly in the Middle and Southern States. It has not been found outside of North America.

Description:—The root-stock is sometimes nearly a foot long, and creeps just beneath the surface of the ground. It is about two lines in thickness. The newer portion is moderately paleaceous, the scales being ovate, very delicate, and distantly ciliate with straight unicellular hairs. The root-stock is somewhat fleshy, and contains about five interior fibro-vascular bundles.

The stalks are from half an inch to an inch apart. They are continuous with the root-stock, and not articulated at the base, as in Polypodium. For an inch or two at the base they bear a few thin chaffy ciliate scales, like those of the root-stock. In the living plant they are erect, green in color, and terete, but in dried specimens they turn to a light straw-color, and are more or less furrowed. Their height is from
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a few inches to nearly two feet. At the very base they contain two obliquely placed strap-like fibro-vascular bundles, which presently unite and form a single one. A section of this has the form of a V.

The frond, when pressed, forms almost a perfect equilateral triangle in general outline, a large one being from ten to twelve inches broad from tip to tip of the lowest pinnæ, and about the same from these lower angles to the apex. In living plants the two lowest pinnæ stand obliquely forward, and are not in the general plane of the frond. The pinnæ are lanceolate in shape, all the larger ones being broadest in the middle and narrowed towards both the base and the apex, which is acuminate. The upper pinnæ gradually become smaller, and lose this lanceolate form, being no broader in the middle than at the base. The uppermost pinnæ pass into mere segments or lobes of the apex of the frond. The principal pinnæ are pinnatifid into very numerous oblong obtuse segments or lobes, the middle ones of the lowest pinnæ an inch or two long, and pinnately lobed, the rest gradually shorter and merely crenately serrate or even entire. The basal lobes are adnate to the main rachis, and form an irregular wing along both sides of it. The inferior basal lobes, in fact, grow rather from the rachis than from the midribs of the pinnæ, but those on the upper sides of the pinnæ receive their midveins from the axils of the midribs. The wings thus formed have suggested the specific name *hexagonoptera*; but it is very seldom that they form anything like a true
hexagon. It rarely happens that the wing is interrupted between the first and second pairs of pinnae.

The fronds are thinly herbaceous in texture, slightly hairy on both surfaces, but more so on the under surface, where there are also found a few minute ciliate scales along the midribs and principal veins.

The veins are pinnately arranged and free. Fertile fronds bear sori on every segment. The sori are rather small, round and naked, and are borne on the back of the veinlets just below the apex. The lower veinlets of each segment or lobe bear their sori quite remote from the margin, while the upper veinlets bear theirs near the margin. The sporangia have a ring of about fifteen articulations. On many, perhaps all, of the sporangia, there are a very few (2–4) unicellular hairs, which are found on the sides of the sporangium near the end, but not on the ring. Mettenius says there is one bristle-like and one gland-tipped hair each side of the ring; but my observations tend to show that the hairs may be all slender or all gland-tipped, and that in many sporangia they are entirely lacking. When the sporangia have been boiled on a glass slide they show the modified cellules of the side opposite the ring with great distinctness, and the two transversely elongated cellules which separate when the sporangium opens are especially worth examination. The spores are bean-shaped, amber-colored, and marked with a single vitta.

This fern is so closely related to *P. polypodioides* that it is often difficult to decide to which species a given specimen
should be referred. In general the plant here described is much larger than the other, and has fronds much more broadly triangular. The lowest pinnæ in *P. hexagonoptera* are decidedly longer and broader than the next lower pair, while in *P. polypodioides* the difference between the lowest pinnæ and the next is very little; in fact the lowest pinnæ are sometimes even shorter than the next ones. *P. hexagonoptera* is more southern in its range than *P. polypodioides*, for it is not a common plant in Canada, but extends to the Gulf of Mexico, while *P. polypodioides* is found far beyond the Arctic Circle, but does not occur, I believe, south of Pennsylvania and Ohio. Nothing like our present fern is found in Europe, where the other species is common enough.

The genus *Phegopteris* was proposed in 1851 by Fée, and distinguished from *Polypodium* by having the sori dorsal on the veins, and not at the enlarged apices of the veins. He also pointed out a difference in the general habit and in the number of vascular bundles in the stalk. The genus was accepted by Mettenius, who added to it the species having anastomosing veins, which had been excluded by Fée. He discovered other distinctions from *Polypodium* in the want of an articulation at the base of the stalk, and in the acute and not enlarged tips of the veinlets. In all these characters, with the sole exception of uncovered sori, *Phegopteris* is absolutely identical with *Aspidium*; and since there are many species in which the indusium is said by one author to be present,
and by another author to be deficient, and some species in which the indusium, though discernible, is almost lacking, there is every propriety in referring Phegopteris to the tribe Aspidieae. One recent author has even united the two genera.

Plate LXV.—Phegopteris hexagonoptera, from New Haven, Connecticut. Fig. 2 is an enlarged segment of the lowest pinna, showing the venation, and the dorsal position of the sori. Fig. 3 is a sorus, and Fig. 4, a spore.
Plate LXVI.

Aspidium cristatum, Swartz.

Crested Wood-Fern.

Aspidium cristatum:— Root-stock stout, creeping, chaffy and bearing numerous up-curved stalk-bases; stalks a few inches to over a foot long, chaffy, especially near the base, with large ovate pointed thinnish scales; fronds firmly membranaceous, nearly erect, smooth, nearly evergreen, linear-oblong or oblong lanceolate in outline, slightly narrowed towards the base, a foot to a foot and a half long, the fertile ones taller than the sterile, pinnate; pinnæ two to three inches long, triangular-oblong, or the lowest ones triangular-ovate, from a somewhat cordate base, deeply pinnatifid; divisions from six to ten pairs, oblong, very obtuse, finely serrate or cut-toothed, but scarcely aristate, those next the rachis largest and more deeply cut; veins of the living plant conspicuously impressed from above, mostly forked; sori as near the midvein as the margin; indusium rather large, smooth and naked, round-reniform, the sinus not very deep.

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Polypodium Callipteris, Ehrhart, "Beitr., iii., p. 77."


Var. Clintonianum, D. C. Eaton:—Fronds in every way much larger, two and a half to four feet high; pinnæ oblong-lanceolate, broadest at their base, four to six inches long, one to two inches wide; their divisions more numerous, either crowded or somewhat distant, linear-oblong, obtuse, serrate or cut-toothed, the basal ones sometimes pinnately lobed; sori near the midvein, indusium orbicular-reniform with a shallow sinus, smooth and naked.—Gray's Manual, ed. v., p. 665.

Var. Clintonianum has been noticed in Canada, New England, New York, New Jersey, Ohio and Wisconsin. A.
cristatum is found also in middle and northern Europe, from the British Islands to the Ural Mountains and the Caucasus. In the United States it is less abundant than A. marginale and A. Thelypteris, but more common than A. Goldianum.

Description:—The root-stock creeps just beneath the surface of the ground, and may attain a length of five or six inches. Its own thickness is not over three or four lines, but the apparent diameter is made considerably larger by the fleshy adherent bases of the stalks, which remain a long time undecayed. It is chaffy with large thin light-brown ovate scales, which also cover the young stalk, and are more or less persistent on the lower part of the stalk.

There is a marked difference between the fertile and the sterile fronds, the latter being much shorter than the former, and remaining green through the winter, long after the fertile ones have withered. The stalks of the sterile fronds are also much shorter than the others. The stalks are rounded at the back, and have a narrow but rather deep anterior furrow: when dried lateral furrows are also formed. There are two large round anterior-lateral fibro-vascular bundles, and from one to three smaller posterior ones, the number varying according to the thickness of the stalk.

The fronds vary in length from a few inches to a foot and a half in the common form, but are sometimes fully twice as large in the variety. They are usually from four to six times as long as they are broad, being linear-oblong or oblong-lanceolate in outline, and consist of from twelve to eighteen pinnæ on each
side, the lower ones slightly diminishing in length, more distant and mostly opposite, the upper ones either alternate or opposite. Most of the pinnæ have very short stalks; the lower ones are broadly ovate-triangular, the higher ones gradually narrower at the base, and so becoming ovate-oblong. In the sterile fronds the pinnæ are pinnately lobed about two-thirds of the way to the midrib; in the fertile fronds they are pinnatifid to within half a line of the midrib. The number of lobes on each side is usually about eight pairs, the higher ones gradually passing into mere teeth of the short and only sub-acute apex of the pinnæ. The lobes are oblong, and mostly serrated with short incurved barely mucronate teeth. The basal lobes are incised-serrate, the teeth being again serrated. The apex of the lobes is rounded and obtuse: in the form called Aspidium Lanceastriense the lobes are shorter and more triangular, and consequently less obtuse. A character which can be seen only in the living fronds is noticed by Moore: it is that the stalks of the pinnæ are twisted just enough to turn the upper surface of the pinnæ towards the apex of the frond. This condition may be seen in very many kinds of ferns, but is especially evident in the fertile fronds of the present species.

The fronds are dark-green and somewhat lustrous above, paler beneath, and perfectly smooth, save for a little chaff which commonly persists along the rachis. The texture is firmly herbaceous.

The veins are marked on the upper surface by impressed lines, which almost disappear in dried specimens.
They are pinnately arranged on the midvein. The lowest superior veinlet is often simple, but nearly as often forked, the lower branch sometimes again forking. The rest of the veins are mostly once forked. Most of the veinlets terminate in the teeth, and are slightly enlarged at the apex. The superior veinlets of the several veins bear sori about midway of their length, the number of sori being often ten or twelve on the basal lobes, and from four to eight on all but the uppermost of the others.

The indusium is at first rather large, flat, orbicular-reniform, the sinus not very deep, and the surface and margin without hairs or glands. As the fruit matures the indusia commonly become a good deal shrivelled, or even fall off. The sporangia have about fifteen articulations in the ring. The spores do not ripen until late in the season, and are bean-shaped, the surface so rough as to be almost muricate.

Var. *Clintonianum* differs chiefly in its much greater size, and consequently larger and more numerous pinnæ and lobes. It does not occur in Europe, and in America it has often been mistaken for *A. Goldianum*, from which it differs evidently in having the fertile and sterile fronds unlike, in the narrower outline of the fertile fronds, and especially in having all the pinnæ broadest at the base instead of in the middle. In both forms of *A. cristatum* the lobes of the pinnæ are commonly closely placed, though in some large specimens.
of the variety most of them are separated by a sinus half as
broad as the lobes themselves.

Both the typical form of this species and the variety are
easily cultivated in a somewhat moist and shaded place, but
will do best if they be afforded a soil largely mixed with peat.

LXVI.—*Aspidium cristatum*. Fig. 1 represents a fertile frond of
the typical form, from near Boston. Fig. 2 is an enlarged pinnule.
Fig. 3, an indusium. Fig. 4, a spore. Fig. 5 is a section of the
stalk. Fig. 6 is a pinna from the middle of a frond of var. *Clin-
tonianum*. Fig. 7 is a pinna of the same, enlarged. Fig. 8, an indu-
sium. Fig. 9, a spore.
Plate LXVII.

ASPIDIUM FLORIDANUM, D. C. Eaton.

Florida Wood-Fern.

ASPIDIUM FLORIDANUM:—Root-stock stout, creeping, very chaffy with large thin ferruginous-brown scales; stalks nearly a foot long, rather stout, discolored and chaffy near the base, stramineous and less chaffy upwards; fronds standing in a crown, firmly membranaceous or subcoriaceous, the fertile and sterile unlike; sterile fronds lower, lanceolate-oblong, pinnate, the pinnae lanceolate from a broad base, pinnatifid rather more than half-way to the midrib, lower ones shorter, broader and more deeply lobed, segments close-placed, oblong, obtuse, obscurely crenulate-toothed; fertile fronds two to three feet long, lanceolate, tapering both ways from the middle, pinnate; lower pinnae sterile, triangular-lanceolate, deeply pinnatifid like those of the sterile frond; upper pinnae fertile, longer and narrower, pinnate with usually distant oblong or sub-falcate obtuse crenulate-toothed pinnules, which are sessile on a narrowly winged secondary rachis, or the lower ones barely stalked; lowest superior veins twice forked, the rest once forked; sori rather large, half-way between the midvein and the margin; indusium round-reniform, smooth.


*Aspidium Filix-mas*, var. *elongatum*, Hooker, Sp. Fil., iv., p. 117 (as to our plant only).

HAB.—Wet woods, Florida to Louisiana. It was collected many years ago in Florida by Mr. S. B. Buckley, and was described by Hooker from his specimens. I saw it on Amelia Island in 1857, and Mr. C. E. Faxon collected it on the same island a few years later. Miss Reynolds reports it near St. Augustine, and Mr. Curtiss found it at Jacksonville. Dr. Garber collected it in Levy and Hillsborough Counties, and considers the latter its southern limit. Mr. C. Moir has favored me with a large frond from Louisiana.

DESCRIPTION:—The root-stock is creeping, fleshy, rather stout, very chaffy with large thin brown scales, and covered with the persistent fleshy bases of upcurved stalks. The stalks of the largest fertile fronds are rather more than a foot long, and those of the sterile fronds somewhat shorter. As with most ferns growing in wet places the lower part of the stalk is most frequently somewhat blackened. The base of the stalk is very chaffy, the chaff consisting of large but thinnish scales, while the upper part of the stalk and the rachis has but a few much smaller scales. The stalk of the living frond is rounded at the back, and more or less fur
rowed in front: when dried the furrow becomes much deeper.
The cross-section shows a firm exterior sheath and about seven interior fibro-vascular bundles, a large rounded one each side of the furrow, and four or five much smaller ones arranged in a semicircle near the back of the stalk.

The fertile and the sterile fronds are unlike, the sterile ones being much shorter than the others, and of a comparatively broader outline. One collected by Dr. Garber has a rather slender stalk seven inches long:—the frond itself is nine inches long, and four inches and a half wide in the middle, decreasing to three inches wide at the base. There are about twelve distinct pinnæ on each side, besides the apical segments. The lowest pinnæ are three-fourths of an inch wide at the base, triangular-ovate in shape, and pinnatifid almost to the midrib into a few closely-placed oblong segments. The rest of the pinnæ are successively narrower and less deeply lobed, the uppermost mostly crenate-toothed. The upper surface is deep-green and smooth; the lower surface a little paler.

The fertile fronds are more than twice as long as the others, and are lanceolate in outline. There are nearly thirty distinct pinnæ on each side, those in the middle of the frond three to five inches long and half an inch to an inch broad at the base. The lower pinnæ are sterile and successively shorter and broader at the base, the lowest ones being about two inches long and an inch and a quarter broad. The upper pinnæ are fertile, and decrease gradually in length and breadth
to the apex of the frond. The sterile pinnae are pinnatifid, while the fertile ones are pinnate, the usually distant pinnules being oblong, obtuse, slightly toothed, and adnate to a narrowly winged secondary rachis, or the lower ones supported on a short and wing-margined stalk.

The sori are rather large, and are placed about midway between the midvein and the margin. The indusium is round-reniform, perfectly smooth, and rather rigid. The spores are dark-brown, bean-shaped and very rough on the surface.

The manifest relationship of this fern is to *A. cristatum*, a form of which I formerly considered it, and I am by no means sure that this opinion is not correct. It has a similar root-stock, similar scales and closely similar sterile fronds; and it is only in the fertile portion of the fruiting fronds that any considerable difference appears.

*A. Floridanum* proves hardy in the botanical garden at Cambridge, and, as seen there, its resemblance to *A. cristatum* is greater than in herbarium specimens from Florida.

*A. Ludovicianum* is unknown to me. It was placed in § *Polystichum* by Kunze.

The plate represents a fertile frond with the root-stock, collected near Fernandina, Florida, by Mr. C. E. Faxon. Fig. 2 is a fertile pinnaule, enlarged. Fig. 3 is an indusium; Fig. 4, a spore; and Fig. 5, a section of the stalk.
PLATE LXVIII.

ASPIDIUM SPINULOSUM, Swartz.

Spinulose or Common Wood-Fern.

ASPIDIUM SPINULOSUM: — Root-stock stout, assurgent, chaffy, covered with imbricated stalk-bases; stalks a span to a foot and a half long, chaffy, the scales rather large, ovate, pointed, ferruginous, brown or brown with a dark central spot; fronds one to three feet long, all alike, forming a crown, firmly membranaceous, half-evergreen, ovate to ovate-oblong, twice to thrice pinnate; primary pinnae mostly short-stalked, the lowest pair triangular-ovate or triangular-lanceolate, broad-est on the lower side, rather remote from the next pair, the remaining pinnae gradually narrower in outline and less distant; secondary rachises very narrowly wing-margined; pinnules oblong, sub-acute, pinnate or pinnately incised with oblong obtuse spinulose-serrate lobes; sori rather small, borne on the back of the free veins or either apical or dorsal on the veinlets; indusium flat, delicate, round-reniform, either smooth or glandular.


Aspidium dilatatum Torrey, Fl. New York, ii., p. 496.

The forms of this species are very many, the limits by no means agreed upon, and the synonymy inextricably complicated and uncertain. The following appear to be the chief American varieties.


Var. intermedium, D. C. Eaton:—Scales tawny, fronds oblong-ovate, twice or frequently thrice pinnate; pinnae spreading obliquely, oblong-lanceolate, the lowest pair broadest and more triangular, having the inferior pinnules moderately elongated, the basal ones a little
FERNS OF NORTH AMERICA.


FERNS OF NORTH AMERICA.


Hab.—In shady woods, often in springy places and along shaded rivulets, from Newfoundland to Oregon and North-West America, and extending southward to North Carolina, Tennessee and Arkansas. The typical form, our var. vulgare, has been seen in Newfoundland, New Brunswick, Canada, New England, the Middle States, Kentucky, about Lake Superior, and westward to British Columbia. Var. intermedium has nearly the same range, but extends to Tennessee and probably to Arkansas, and is not reported from Newfoundland. It is the common form of the species in the northern United States. Var. dilatatum is found on the higher mountains of New England, and extends along the Appalachian chain to North Carolina: it is known in Newfoundland, New Brunswick, Canada, and thence westward to Oregon, British Columbia and Alaska. In New England and New York it seems to pass in less mountainous districts into both the other forms. Aspidium spinulosum, in several forms, is common in Europe and northern Asia, and is credited to the Cape of Good Hope also. Var. intermedium seems to be exclusively North American.

Description:—The root-stock is either creeping or assurgent, or even occasionally erect. It may sometimes be found six or eight inches long, but is usually much shorter. It has an actual diameter of about a quarter of an inch, but as the fleshy bases of the stalk are adherent and continuous with it, and persist unwithered for at least a year after the fronds have gone, the thickness of the whole is considerably greater.
When the root-stock is erect, the stalk bases are loosely imbricated on all sides of it, but when it is assurgent or creeping, the stalk-bases of the lower side are curved upwards towards the light. The root-stock consists mainly of greenish parenchymatous cells filled with starch. The fibro-vascular bundles are very slender, few in number, and placed in an irregular circle.

The stalks are from a span to sometimes nearly two feet long, rather slender, rounded at the back, channelled in front, and lightly furrowed along the sides. They are dark-fuscous at the base, but above the base are greenish, or slightly brownish along the back. When young they are very chaffy, especially near the base, but the chaff gradually wears away, and at length very little of it remains. The character of the chaff varies in different specimens, and to some extent in the varieties. In European examples of var. *dilatatum* the scales have a very conspicuous dark central spot or stripe. This is sometimes lacking in European specimens, and generally so in North American. I notice a little of it in Oregon plants, and Milde speaks of the stalk of American examples as being "*paleis ferrugineis medio atri vestitus*." In the typical *A. spinulosum*, which I follow Koch in naming var. *vulgare*, and in var. *intermedium*, the scales are concolorous, either pale-ferruginous or fuscous-brown. The largest scales are seldom more than half an inch long. They are ovate, acuminate, entire, and composed of narrow linear slightly sinuous cellules. The section of the stalk discloses
two roundish fibro-vascular bundles near the anterior side, and three or four smaller ones near the back.

The fronds always form a crown, and vary from three or four to perhaps eight or ten from a single root-stock. The root-stocks often branch, probably by the formation of adventitious buds at the base of the stalks, and thus a single plant may develop into a large cluster, sending up numerous fronds of all sizes.

The fronds of newly formed root-stocks, whether grown from spores or derived from older plants by proliferous development, are, of course, smaller than those of well-established plants, but are generally also broader at the base, being deltoid-ovate, while the fronds of older plants are either narrowly or broadly ovate, but not deltoid, except in some forms of var. dilatatum.

Var. vulgare has fronds usually about twelve or fifteen inches long, and four to seven inches broad in the middle, the shape being oblong-ovate. The texture is firmly membranaceous, and the color light-green, sometimes inclining to yellowish-green. The pinnæ diverge from the rachis at an angle of from forty-five to sixty degrees. The lowest pinnæ are separated from the next pair by an interval of one and a half to two inches, and are triangular-ovate in shape, the pinnules on the lower side being twice as long as the corresponding ones on the upper side, and the basal ones longest of all. The second pair of pinnæ are a trifle narrower and commonly a little longer than the lowest, and the third pair
still narrower, and perhaps a little longer yet. Successive pinnae are gradually narrower, and less triangular in outline. At about the fifth pair they begin to grow shorter as well as narrower, and so rapidly decrease towards the acute and slightly acuminate apex of the frond. The secondary rachises are very narrowly winged. The pinnules are oblong or oblong-ovate, sub-acute, and set on rather obliquely. They are usually incisely lobed, but sometimes more deeply cut, into oblong lobes which are spinulose-toothed at the apex, and often somewhat so on the sides also. The veins are always free. There are a midvein and from five to seven veins in each lobe, the first vein being always on the superior side. These veins are either simple, or they bear a single short veinlet on the upper side half-way between the midvein and the margin. The sori are seated astride on the middle of the vein, if it be truly simple, but if it be bent at an angle as if trying to branch, the sorus is directed towards the course the branch would take:—if the branch be actually formed, the sorus is seated on it, either near the apex or some distance below it according to the length of the branch. I do not find any good distinction between this variety and the next in the position of the sori, as indicated by Mr. Davenport. The lower surface of the frond is smooth and without glands, as is also the indusium, though most European authors note more or less frequently occurring exceptions to this rule. The spores are slightly reniform, and minutely verrucose.
This plant is usually considered the type of the species; it is very common in Europe, less so in America. It is well represented on Plate xxi of Moore's Nature Printed British Ferns, and on Plate 18 of Hooker's British Ferns. Being obliged to give it some distinctive name as a variety, I have selected what seems to be the oldest, that used by Koch, who, however, placed the species in Polystichum.

Var. intermedium has fronds a little broader in outline than those of var. vulgare, and often larger; measuring not unfrequently twenty-two inches long and nine inches broad. The color is dark-green. The pinnæ diverge from the rachis at an angle of from sixty to ninety degrees, being usually more spreading than in the type of the species. The lowest ones are sometimes nearly three inches distant from the next; they are triangular-ovate in outline, and have the pinnules of the lower side much longer than those on the upper side. The first or basal pinnule is generally a little shorter than the second one, a point noticed by Milde, but apparently hitherto overlooked by American authors. Successive pinnæ are a little narrower and longer, the longest ones being commonly those just below the middle of the frond. The secondary rachises are very narrowly winged. The pinnæ are usually fairly bipinnatifid, being one degree more compound.

Milde has as sub-varieties, exaltatum, with dark-green glabrous fronds, elevatum, with narrower yellowish-green and somewhat glandular fronds, and Amurense, with broadly ovate fronds chaffy beneath with little bullate scales. He says that towards the north of Europe the true spinulosum becomes scarce and passes gradually into var. dilatatum.
than in var. *vulgare*, though there are fronds in which they are only once pinnatifid. The secondary pinnae are usually distinctly stalked, and are spreading like the primary ones. The tertiary pinnae, or segments, are oblong-ovate, obtuse, and spinulosely toothed on the sides and at the apex. The under surface of the rachises and pinnules are minutely glandular with unicellular cylindrical or capitate glands. The venation is the same as in var. *vulgare*, and I see no difference in the position of the sori, which are dorsal if on the veins, or either dorsal or sub-apical if they are formed on branches of the veins. The indusium is sprinkled on the surface and at the margin with stalked and sessile glands.

Mr. Davenport has endeavored to elevate this variety to the rank of a species, under the name of *Aspidium Americanum*, rejecting the name of *intermedium* because Willdenow's description "does not contain a word in regard to the glandular indusiums and under surface, while, on the other hand, his description of *A. spinulosum* does, thus exactly reversing the usual arrangement." To the first objection it may be replied that neither does Willdenow speak of the glandular lower surface and indusia of *A. rigidum*, where the glands are much more conspicuous; to the second that *A. spinulosum* is often glandular in European specimens. Willdenow had no American examples of the true *spinulosum*. Milde, who had examined the specimens of *intermedium* sent by Muhlenberg to Willdenow, says it is "nothing but a common form of *A. spinulosum*." But our *intermedium* he refers to his
A. spinulosum genuinum, indicating the fact that the basal pinnules are shorter than the next. Dr. Gray also examined the Willdenovian specimens of *intermedium*, and his notes show that he recognized in them what we now call var. *intermedium*. Willdenow's words "pinnulis pinnatifido-incisis" also point towards var. *intermedium*; since *A. spinulosum* he says: "pinnulis inciso-dentatis." It is therefore right to keep for this form the time-honored name of *intermedium*; and to consider it a variety of *A. spinulosum*, because neither in the form and details of the frond, the position of the sori, nor the glandulosity of the surface and indusia can any specific distinction be fairly discovered.

Var. *dilatatum* has dark-green deltoid-ovate or broadly ovate fronds often considerably larger than in the other forms: Milde gives three feet as the extreme length, but such fronds are rarely preserved for herbarium specimens. The pinnæ diverge from the rachis at from sixty to eighty degrees. The lowest ones are frequently but not invariably longest, but always broadest: in one example from Mount Mansfield they are eight or nine inches long, and five inches wide at the base. They are broadly triangular, nearly twice pinnate, the secondary rachis wingless and the tertiary very narrowly winged, and the inferior basal pinnules are over three inches long. The inferior basal pinnules are longer than the next ones in this form, but the superior basal pinnules are shorter than the next. The pinnules generally are so deeply pinnatifid as to render the frond
almost tripinnate, and the frond has a generous breadth which distinguishes the variety from those already described. The sori are either apical, sub-terminal or medial, seated on the lowest anterior veins or on short veinlets derived from them, the position varying according to the size of the pinnules. In American specimens the indusium is smooth, so far as I have observed, and the spores are irregularly winged or cristate. In the plant of Europe the indusium is said to be usually glandular. In writing the *Synopsis Filicum*, Swartz at first united this form with *A. spinulosum*, but in the addenda he separated the two, in which he was followed for a long time by most writers. I do not know that the first edition of the British Flora (1830) is the earliest publication in which *A. dilatatum* is made a variety of *A. spinulosum*, but it is the earliest that I can find.

Var. *dumetorum* (*Aspidium dumetorum*, Smith) is a form of var. *dilatatum* having dwarfish deltoid-ovate compactly bipinnate fronds and large pinnules, the inferior basal ones of the lowest pinnæ not much elongated. It is found in mountainous parts of Europe; but I have seen nothing exactly corresponding to it in America. It seems to be only var. *dilatatum* dwarfed and compacted by exposure to the sun, and will probably be found ere long in northern New England or Canada. Other European sub-varieties are mentioned by Moore and Milde, and the student is referred to their writings for descriptions or figures of them.

Var. *Boottii*, Gray, has been variously referred to *A.*
spinulosum and to \textit{A. cristatum}, but, as its claims to specific are considered good by several able botanists, it will be separately figured and described in the following pages of this work.

Plate LXVIII.—\textit{Aspidium spinulosum} var. \textit{intermedium}, from a plant collected near Boston by Mr. Faxon. The drawing does not show the peculiarity above indicated of having the inferior basal pinnules a trifle smaller than the next ones. Fig. 2 is an enlarged pinnule. Fig. 3, the indusium. Fig. 4, the smooth indusium of var. \textit{vulgare}. Fig. 5, a spore, less plainly muriculate than I have usually seen. Fig. 6, a section of the stalk.
Plate LXIX.

ASPIDIUM BOOTTII, TUCKERMAN.

Boott's Wood-Fern.

Aspidium Boottii: — Root-stock stout, creeping or as- surgent, covered with persistent up-curved stalk-bases; stalks about a foot long, more or less chaffy with large thin pale- brown scales; fronds one to two and a half feet long, firmly membranaceous, oblong-lanceolate or elongated-lanceolate in outline, somewhat narrowed towards the base, nearly twice pinnate, the sterile ones shorter and slightly less compound than the fertile, pinnae numerous, pointed, the lower ones triangular-lanceolate, broadest at the base, the upper ones lanceolate from a broad base; pinnules many pairs, oblong-ovate, mostly constricted at the base, and confluent on the narrowly winged secondary rachis, sharply serrate with spinulose teeth, the lower ones cut-lobed or pinnatifid; sori midway between the midvein and the margin, medial or sub-apical on the lowest superior branch of each vein; indusium round-reniform, minutely glandular.

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Aspidium spinulosum, var. Bootii, Gray, Manual, ed. ii., p. 598.—


Lastrea uliginosa, Newman, in “Phytologist, iii., p. 679.”


Lastrea cristata, var. uliginosa, Moore, Nat. Pr. Brit. Ferns, t. xx.

Cur., xxvi. ii., p. 532. tt. 41, 42, 43.


Hab.—Wet places in woods, often in alder-thickets near streamlets or ponds. Discovered near Lowell, Massachusetts, by Mr. William Boot as early as 1843, and since found by several collectors near Fresh Pond, Cambridge, in Middlesex County, near Amherst and near Pelham, all in the same State. Mr. Frost has it near Brattleboro; I have found it in more than one place in Connecticut; it occurs in central and southern New York, and Mr. A. Commons has sent it from the vicinity of Wilmington, Delaware. It is known to occur in England, in Continental Europe, and in Siberia.

Description:—In the structure of the root-stock, and in its mode of growth there is nothing to distinguish this fern

Mr. Moore’s character reads thus:—“Fronds various, early fertile ones tall, erect, narrow, linear-lanceolate, bipinnate below with oblong-acute adnate inciso-serrate or lobed pinnules having aristate incurved teeth; barren ones shorter, with oblong bluntish pinnules, adnate or decurrent; later fertile ones broader, with oblong bluntish crenato-serrate pinnules; anterior and posterior basal pinnules of the lowest pinna nearly equal in size.”—Mr. Moore’s plate well represents the three kinds of fronds he describes, all taken from a plant brought by Mr. John Lloyd from Oxton bog, Nottinghamshire.
from *Aspidium cristatum* or *A. spinulosum*. The stalks are chaffy when young with ovate ferruginous shining scales, most of which drop off as the season advances. The section of the stalk shows about five roundish fibro-vascular bundles, the two anterior ones largest, and with a slight furrow between them, which deepens as the fronds wither, or when they are dried for preservation.

The fronds grow in a circle or crown, several from the apex of the root-stock, and stand fully three feet high in the largest plants. They are of a deep herbaceous green, moderately firm in texture, smooth above, and provided with a few scattered minute chaffy scales on the lower surface. The early fronds are usually tall, narrowly oblong-lanceolate and fertile, the lowest pinnae broadest at the very base, and having the superior basal pinnules but little smaller than those on the inferior side. These larger pinnules are seldom over an inch long. The next few pairs of pinnae are gradually a little longer and narrower, becoming more oblong-lanceolate in shape. The pinnules are mostly distinct, oblong-ovate, acutish, adnate to a narrowly winged secondary rachis, and pinnatifid-toothed with short spinulosely serrate lobes, the upper pinnules of course more and more confluent and only simply serrate. The sori are rather numerous, not large, and either medial or sub-terminal on the veinlets a little nearer the midvein than the margin. The indusium is dotted with minute stalked glands, and a very few similar glands may be detected on the lower surface of
the frond. Many sporangia are imperfectly formed, and the spores are very rare: — both Mr. Faxon and I have searched many fronds, and found very few spores, which however were ovoid-reniform and minutely roughened. Milde’s experience is similar, and he thereupon argues the possibility of this fern being a hybrid, though in his latest writings he considers it a variety of *A. cristatum*.¹

Soon after the early fertile fronds, at the same time, but from small side-branches of the root-stock, are produced much smaller sterile fronds, the segments of which are less distinct, more confluent, and less deeply toothed. Later in the season, another set of fronds is produced, intermediate in size and outline, but with pinnatifid pinnae and oblong obtuse confluent segments more like the fertile fronds of *A. cristatum*. These fronds may be either fertile or sterile. The spring fronds decay in the late autumn, but those of the late growth remain green till late in the winter. All this is clearly pointed out by Mr. Moore, and my own observations confirm his remarks.

¹ "It is remarkable that the spores of the numerous specimens I have examined were either colorless and without contents, or black, as if carbonized, and that the sporangium itself was often filled with only a shapeless dusty mass." (Nov. Acta. Acad. Nat. Cur. xxvi., ii., p. 536)— "Of this plant I have seen so many specimens, that I may justly contend that it is in very truth intermediate between *A. cristatum* and *A. spinulosum*, so that the first passes gradually into the second, and no absolute distinctions may be found between *A. cristatum* and *A. spinulosum*." (Fil. Eur. et Atl., p. 131.)
Hooker, in "British Ferns," has referred *A. Boottii* to *Nephrodium remotum, Aspidium remotum* of A. Braun. In "Species Filicum" it is not noticed, and in "Synopsis Filicum" it is made a variety of *N. spinulosum*. Mr. Davenport is disposed to consider *A. remotum* and *A. Boottii* as identical, although Milde kept them apart and apparently had no suspicion of their identity. Mr. Davenport remarks that a specimen in the herbarium at Cambridge, marked *A. remotum* probably by Braun himself, is so like *A. Boottii* that "if detached from its sheet and sent out for that fern it would be generally received without question." I have only a cultivated specimen of *A. remotum* from the Leipsic garden, sent me several years ago by Dr. Mettenius. In this frond the pinnæ and pinnules are much like those of *A. Boottii*, but the frond is scarcely narrowed at the base, and the large indusia are wholly glandless. Milde says of *A. remotum*;—"The illustrious Braun now considers this plant a form of *A. Filix-mas*; nevertheless I venture to defend the old opinion and consider it a hybrid between *A. Filix-mas* and *A. spinulosum*. If *A. remotum* were really nothing but a form of *A. Filix-mas*, it is hard to understand why this form is not more frequently observed in Germany, where *A. Filix-mas* is so very common. In Silesia, where *A. Filix-mas* is a common plant, I have hitherto in vain sought for *A. remotum*. But *A. remotum* is perfectly intermediate between *A. Filix-mas* and *A. spinulosum*.

If hybridity among ferns be admitted, then it would ap-
pear that Milde is right in making *A. Böttii* and *A. remotum* both hybrids of *A. spinulosum*, the one with *A. cristatum*, the other with *A. Filix-mas*.

For the form here described the specific name *Böttii* is several years older than *uliginosum*, for though the *Aspidium spinulosum* var. *uliginosum* of Braun was published in 1843, yet Milde positively asserts that the plant so named belongs to the true *A. spinulosum*, and in no way to Newman's var. *uliginosum*, the date of which is somewhere between 1849 and 1851.

Plate LXIX. *Aspidium Böttii*, a rather small fertile frond from near Boston. Fig. 2 is a fertile pinnule from one of the middle pinnæ, and Fig. 3 is a sterile pinnule from one of the lower pinnæ, both somewhat enlarged. Fig. 4, an indusium, Fig. 5, a spore, and Fig. 6, a section of the stalk.
ASPIDIUM LATENS, Swartz.
Plates LXX.

Aspidium Patens, Swartz.

Spreading Wood-Fern.

Aspidium patens:—Root-stock rather stout, creeping, scaly with thinnish fuscos-brown lanceolate scales; stalks clustered, brownish-stramineous, chaffy at the base, rather slender, a few inches to over a foot long, fronds usually longer than the stalks, membranaceous or chartaceous, softly pubescent beneath, ovate-oblong in outline, caudate-acuminate, pinnate; pinnae closely-placed, linear-acuminate, three to six inches long or longer, five to seven lines wide, the lowest pair scarcely or not at all smaller, but somewhat deflexed, all pinnately incised one-half to three-fourths of the way to the midrib; segments very numerous, crowded, obliquely oblong, acutish, basal ones longest; veins very evident, simple, the lowest ones of adjoining segments curved and meeting at the sinus, or sometimes uniting and sending out to the sinus a short free veinlet; sori about midway between the midvein and the margin; indusia round-reniform, very pubescent.


*Polypodium patens*, Aiton; Swartz, Fl. Ind. Occ., p. 1673.


*Lastrea patens*, Presl, Tent. Pterid., p. 75.

*Aspidium nymphale*, Foster, "Prodr., n. 442."—Schkuhr, Krypt. Gew., p. 36, t. 34.


**Hab.**—Low shady woods, Florida to South Carolina and westward near the Gulf of Mexico to Alabama, Louisiana and Texas. Also in several canons near Santa Barbara, California, Mrs. Cooper, Dr. Rothrock, Mr. Lemmon, etc. A specimen is in the herbarium at Kew, marked “San Francisco, Calif. Dr. Sinclair,” and the same station is reported in the Botany of Captain Beechey’s voyage, but no one has found the fern near that city in many years, and it may be considered probable that there is some error in the locality as given with specimen. It is a common fern throughout tropical America, and plants not distinguishable from it are found in South Africa and the islands of the Pacific Ocean.

**Description.**—The root-stock is a few inches long and creeping. It is slenderer than that of *Aspidium cristatum*, but not cord-like as in *A. Thelypteris*. It bears the up-curved bases of numerous stalks, and is moderately chaffy with small lanceolate fuscous-brown ciliated scales; a few similar scales are found near the base of the stalk.

The stalk varies from a few inches to over a foot in
length in the North American specimens, and is over two feet long in some from tropical America. It is stramineous, but darker at the base, roundish-quadrangular, with a furrow on the anterior side, and, when dried, with lateral furrows also. The surface is softly pubescent. There are two strap-shaped fibro-vascular bundles near the base of the stalk, but near the frond the two are united into a single U-shaped bundle. The structure of the bundle is not unlike that of *A. Thelypteris*, but here the interior projections, as I have observed them, are four in number, the two lateral ones being visible in the separate bundles of the lower part of the stalk.

The fronds vary very much in size, but the largest I have seen from North America are not over two feet long and one foot wide. In the tropics the size is often considerably greater. The texture is thin, but not without a certain degree of firmness. Both surfaces are pubescent with fine white sharp-pointed unicellular hairs. Large fronds have as many as twenty-two to twenty-seven pinnae on each side, besides the long pinnatifid and acuminate apex. The lower pinnae are slightly deflexed, but are scarcely shorter than the others. The middle pinnae are spreading, or curved upwards, and the upper ones are oblique to the rachis. The pinnae are from three to six inches long, or longer in some exotic specimens, narrowly linear and slenderly acuminate, being rarely more than half an inch wide at the base, and keeping nearly this width for more than half their length. The lowest ones are sometimes a little narrowed at the base.
The pinnae are incised more than half way to the midrib into very numerous obliquely-oblong, sub-acute, often curved segments.

The veins are simple, and usually from seven to ten pairs to each segment. The lowest ones of adjoining segments are curved and either extend to the bottom of the sinus separating the segments, or unite between the bottom of the sinus and the midrib, and send out a ray to the sinus. As I find all intermediate conditions in the disposition of the veins I am unable to separate the specimens into two species. The sori are rather small and are placed on the back of the veins about midway between the midvein and the margins, or sometimes nearer the margins than the midvein. The indusia are round-reniform and pubescent with hairs like those of the frond. The bean-shaped spores are very dark-brown, and have a verrucose surface.

Plate LXX.—Aspidium patens. The principal figure is from a frond collected near Mobile, Alabama, by Mr. Charles Mohr. Fig. 2 is a portion of a pinna, enlarged and showing the venation, etc. Fig. 3 is an indusium, and Fig. 4, a spore. Fig. 5 is a pinna from a Florida specimen, sent by Dr. Chapman, showing the anastomosing basal veins. Fig. 6 is an enlarged portion of the same.

1 Mettenius has this note:—"Specimina boreali-americana, rhizomate destituta, molliter hirsuta, nervis conniventibus vel arcum Goniopteridis formantibus, ex specimen completis describenda erunt." But I am persuaded that all are forms of one species.
Woodsia Oregana, D. C. Eaton.

Oregon Woodsia.

Woodsia Oregana:—Root-stocks short, creeping, chaffy, forming large tufts or patches; stalks two to four inches high, not jointed, bright-ferruginous near the base, paler and stramineous upwards; fronds lanceolate-oblong, four to six inches long, pinnate, smooth, the fertile ones tallest; pinnae triangular-oblong, obtuse or acutish, pinnatifid; segments oblong or ovate, obtuse, toothed or crenate, the teeth often reflexed and covering the submarginal sori; indusium very minute, divided almost to the centre into a few beaded hairs.


Hab.—Growing in dense patches in the crevices of rocks, often where it is much exposed to the sun; from Oregon and British Columbia eastward to Lake Winnipeg and the Keweenaw Peninsula of Michigan, and southward to Wyoming, Utah, Colorado and Arizona. It has recently been found in California by Mr. J. C. Lemmon, forming
“masses around lava-rocks in high plateaus along the Pitt River.” I have seen it on the top of red quartzite rocks at Paradise Camp, in Big Cottonwood Cañon, Wasatch Mountains, Utah.

**Description:**—The root-stocks form an entangled mass so closely packed that it is difficult to separate a single root-stock for examination. They are, however, rather slender, covered with adherent stalk-bases, and chaffy near the growing end. The chaff, which is also found on the lower part of the young stalks, consists of ovate-acuminate obscurely denticulate light-brown scales. The scales are composed of rhomboid-linear cells, usually all of them empty, but in a few of the scales some of the cells in the median line contain a dark reddish-brown coloring matter, and occasionally the number of the colored cells is so great as to form a very evident midnerve.

The stalks are rather slender, greenish or stramineous near the frond, but bright-brown near the base. The section is nearly round, but slightly flattened anteriorly. At the very base the outer sclerenchymatous sheath is well developed, and the fibro-vascular bundles are two in number, widely separated and enclosed in rings of sclerenchyma buried in starchy tissue. Higher up, the exterior sheath becomes very thin, and the two bundles approach each other and unite, forming a figure which reminds one of the expanded wings of a sea-bird.

The fronds are about the size and shape of those of *W. Ilvensis*, being from three to six inches long, rarely over
an inch wide, and lanceolate-oblong or linear-lanceolate in outline. They are broadest in the middle, from which they are narrowed to a somewhat acute apex, and grow slightly narrower to the base. The lower pairs of pinnae are increasingly distant. The pinnae are triangular-oblong, the lower ones broader than the middle ones. The uppermost gradually diminish, so that the last below the apex is only about a line long. The principal pinnae are pinnatifid, or even pinnate, into a few oblong obtuse more or less crenately toothed lobes. The whole frond and rachis are perfectly smooth and glabrous, though in some immature specimens a very minute glandulosity may be detected by very close examination. The ends of the lobes are often slightly reflexed, partly covering the sori, thus in some degree imitating the appearance of a Cheilanthes, for a species of which genus the plant has sometimes been mistaken. The veins are pinnated from a midvein, and either simple or forked, bearing the sori near their extremities. The sori are minute at first; but the sporangia, as they mature, often nearly cover the lower surface of the frond. The indusium is best examined in specimens taken when the sporangia are about half developed. It is saucer-like, and placed beneath the sorus, as in the rest of the genus. It is very minute, and extremely delicate, and consists of an inconspicuous central portion from which radiate a few articulated cilia composed of a single series of nearly globular cells.

The sporangia are sub-globose, and have a ring of about
eighteen articulations. The spores are ovoid and minutely muricated, or sometimes apparently wing-margined, though it is difficult to say whether the wing is not partly an optical effect.

In its general form this fern has a good deal of resemblance to small forms of *W. obtusa*, to which it was referred by Sir J. W. Hooker. The rudimentary indusium, however, clearly separates it from that species. In the "British Ferns" of the same author, mention is made of specimens of *W. hyperborea* collected at the Dalles of the Columbia River by Major Raines of the United States Army. These are a part of the specimens on which the present species was founded, and on account of which it received its specific name of *Oregana*. It has not the imperfectly articulated stalk seen in the original species of *Woodsia* described by Robert Brown, and the indusium, though patterned like that of *W. Ilvensis* and *hyperborea*, is far less conspicuous.

Plate LXI., Fig. 1-4.—*Woodsia Oregana*, from the Utah specimens. Fig. 2 is an enlarged pinna. Fig. 3, a sorus. Fig. 4, a spore.
WOODSIA OBTUSA, Torrey.

Obtuse-leaved Woodsia.

WOODSIA OBTUSA:—Root-stock short; stalks stramineous, chaffy when young, two to six inches long; fronds eight to fifteen inches long, broadly lanceolate, membranaceous, minutely glandular, pinnate or nearly bipinnate; pinnæ rather remote, short-stalked, obtuse, the lower ones triangular-ovate, middle ones longer and narrower in outline, all pinnately parted; segments oblong, obtuse, crenately toothed, the lower ones pinnately incised with toothed lobes; veins pinnated and forking, free; sori dorsal and subterminal on the veinlets, nearer the margin than the midvein; indusium at first subglobose, afterwards splitting into a few spreading concave toothed lobes.

Polypodium obtusum, Sprengel, Anleitung, p. 92; Engl. version, p. 102.—
Hypopeltis obtusa, Torrey, Compendium, p. 380.
Cystopteris obtusa, Presl, Tent. Pterid., p. 93.
Woodsia Perriniana, Hooker & Greville, Ic. Fil., t. lxviii.
Alsophila Perriniana, Sprengel, Syst. Veg., iv., p. 125.
Physematium Perrinianum, Presl, Tent. Pterid., p. 66.—Kunze, Analecta
Pteridogr., p. 43.—Link, Fil. Hort. Berol., p. 44.
Cystopteris Perriniana, Link, "Hort. Berol., ii., p. 131."

Hab.—On rocks and stony hillsides, not rare; from New England
to Wisconsin, and southward to Georgia, central Alabama, Arkansas and
Indian Territory. It reappears in British Columbia, where Dr. Lyall
found it on the Galton Mountains, but is not known in the eastern
provinces of Canada. In Synopsis Filicum several South American
varieties are indicated, the W. incisa, Peruviana, and crenata of authors,
but I have not examined them, and have no opinion of my own to
offer concerning them. The species does not occur in the eastern
hemisphere.

Description.—This species of Woodsia forms tufts or
patches, though of less extent than some of the others.
The root-stock is one or two inches long, creeping, covered
with the remains of old stalks, and moderately chaffy. The
chaffiness consists of little ovate-acuminate nearly entire
scales, most of them thin in texture and pale in color. As
in *W. Oregana* some of the median cells are often dark-colored, and even so densely as to form a midnerve. The stalks are several to each root-stock: they are commonly four or five inches long, roundish, but flattened or even slightly furrowed in front, green with a dark-brown or blackish base in the living plant, but bright brownish-straw-color when dry. There are two oblique strap-shaped fibro-vascular bundles in the base of the stalk, which unite higher up and form one which has something the shape of the two forewings of a butterfly. The stalk is chaffy when young, and a little of the chaff remains till the fronds wither, which they do at the earliest frost of autumn.

The fronds are commonly six or eight inches long and two or three inches broad, but occasionally measure full fifteen inches in length by four in the greatest breadth, which is near the middle. They are rather delicately herbaceous in texture, and minutely glandular, particularly on the lower surface and along the rachis. The pinnae are rather distant and very short-stalked, triangular-ovate or triangular-lanceolate, and usually obtuse. They are pinnatifid into oblong-oval obtuse segments, the larger ones of which are contracted at the base and often pinnatifid, and the smaller ones adnate to the midrib of the pinna and crenate or crenately toothed. The veins are pinnately arranged on the midveins, and are either simple or forked. They are always free, but not very conspicuous.

The sori are placed on the veins, mostly just below the
apex, and, consequently are rather nearer the margin than the midvein. The indusium is attached beneath the sporangia, and at first nearly or quite encloses them, as in a subglobose pouch; but as the sporangia mature it splits into from four to six irregular and jagged lobes, which extend out beyond the sporangia. It is very delicate in texture, and, in a perfectly ripe frond, is very difficult to find. It is very badly represented in Schkuhr's plate 43b, but is well shown in the drawing published by Hooker & Greville. The ring has sixteen to eighteen joints. The spores are dark-colored, ovoid and narrowly wing-margined.

The genus *Woodsia*, as characterized by Robert Brown, was limited to the species in which the indusium is divided nearly to the centre into ciliary processes; and the present species was placed by different authors in five or six different genera, before it was finally referred to *Woodsia*, in which it is one of the few species constituting the section *Physematium*, having a pouch-like indusium which splits into radiating lobes. The specific name *Perriniana* was founded on an error, which is explained in Dr. Torrey's Flora of New York. Specimens sent by him from New York were placed by Sprengel in a West-Indian collection made by Perrin. It is strange, however, that Sprengel failed to recognize his own *Polypodium obtusum*.

The specimen figured was collected near Boston, by Mr. Faxon. The details are a portion of a pinna, a sorus and a spore.
WOODSIA SCOPULINA, D. C. Eaton.

Rocky-Mountain Woodsia.

Woodsia scopulina:—Root-stocks short, creeping, chaffy, forming large tufts or patches; stalks two to four inches high, not jointed, bright-ferruginous near the base, paler and stramineous upwards, puberulent, like the rachis and the under surface of the frond, with minute jointed hairs and stalked glands; fronds lanceolate-oblong, four to eight inches long pinnate; pinnae numerous, eight to fifteen lines long, oblong-ovate, sub-acute, deeply pinnatifid with five to eight pairs of short ovate or oblong obtuse crenulate or toothed divisions; sori sub-marginal; indusium very delicate, deeply cleft into narrow segments which terminate in short hairs composed of irregular cylindrical cells.


Hab.—Growing in dense masses on rocks and in crevices, from Oregon to Mono Pass, California (Bolander), and extending eastward to Dacotah, Minnesota and Colorado.
DESCRIPTION: — This species of Woodsia is so much like *W. Oregana* that unless the specimens are in good condition it is very difficult to distinguish one plant from the other. The general habit is the same; the scales of the root-stock and of the lower part of the stalk are precisely alike, and the color of the stalks is similar. In *W. scopulina* the stalks and the lower surface of the frond are finely but not densely pubescent with slender jointed hairs, as well as minutely glandular with stalked glands. The fronds are often apparently bipinnate, but the secondary rachises are narrowly winged. The most important distinction is in the indusium, which is not always in condition to admit of satisfactory examination. It is deeply and irregularly cleft into laciniae, and these are narrowed into rather short articulated hairs, or cilia, the cells of which are irregularly cylindrical rather than globular. The whole indusium is larger and more evident than that of *W. Oregana*, but far less so than in *W. obtusa*, of which Mr. Baker thinks the present fern "scarcely more than a variety."

The largest specimens are from Minnesota and Colorado.

Plate LXXI, Fig. 9-12. — *Woodsia scopulina*, from Mono Pass, collected by Bolander. Fig. 10 is part of a pinna somewhat enlarged. Fig. 11 is an indusium, the sporangia having been removed, and Fig. 12 is a spore.
ONOGLEA SENSIBILIS, L.
FERNS OF NORTH AMERICA.

PLATE LXXII.

ONOCLEA SENSIBILIS, LINNÆUS.

Sensitive Fern.

Onoclea sensibilis:—Root-stock creeping, elongated; stalks scattered, nearly chaffless, a few inches to over a foot high; fronds dimorphous; sterile ones triangular-ovate, foliaceous, smooth, quickly withering when plucked, deeply pinnatifid into several oblong-lanceolate entire or sinuate or sinuately pinnatifid segments, the lowest pair sometimes distinct, the rest connected by a wing which widens upwards; the veins reticulated and forming narrow paracostal areoles, and, outside of these, copious oblong or hexagonal meshes; fertile fronds shorter, contracted, rigid, closely bipinnate; the pinnules rolled up into berry-like bodies; veins free, simple or forked, soriferous on the back; sporangia borne on an elevated receptacle, half surrounded by a very delicate somewhat hood-like indusium attached at the base of the receptacle.

Ferns of North America.


Osmunda frondibus pinnatis foliis superioribus basi coadunatis, omnibus lanceolatis, pinnato-sinuatis, Linnaeus, Hort. Cliff., p. 472.— Gronovius, Fl. Virginica, p. 196; ed. ii., p. 163.— (Other ancient names are repeated by Linnaeus and Willdenow.)

Hab.— Wet meadows and thickets, from New-Brunswick to the Saskatchewan, extending southward through Dacotah, Kansas, and Arkansas to Louisiana, and eastward to St. Augustine, Florida, one of our commonest and most abundant ferns, often occupying large portions of land to the partial exclusion of other plants. Not found in western America or in Europe, but occurring in Japan, Manchuria and eastern Siberia.

Description:— The root-stock is about one-third of an inch thick, and irregularly roundish in section. It creeps widely below the surface of the ground, rooting freely and often forking, so that in cultivation it is very difficult to confine the plant to one spot. The root-stock contains six or eight roundish or flattened fibro-vascular bundles arranged in a circle near the outer surface. It bears no chaff. The stalks are scattered along its length, the apex being covered with the
thickened stalk-bases of next year's fronds, and the stalks for the present year rising a few inches back of the apex.

The fronds are truly dimorphous, the fertile ones being so unlike the sterile, that no one who is unacquainted with the plant would suppose they had anything to do with each other.

The sterile fronds vary in length from one or two inches to fifteen or eighteen, and are supported on stalks usually rather longer still, so that, while the smallest plants may be concealed in the grass, the tallest ones are often fully three feet high. The bases of the stalks are flattened, discolored and very sparingly chaffy; the upper part is green in the living plant, brownish-stramineous when dried, smooth and naked, rounded at the back, and slightly furrowed in front. It contains two obliquely-placed strap-shaped fibro-vascular bundles, which unite below the base of the frond and form one having a U-shaped section. The outline of the sterile fronds is triangular or triangular-ovate. The midrib is winged, either from the very base, or from the second pair of segments; the wing at its lower extremity very narrow, but gradually widening towards the apex, so that its greatest width is but little less than that of the terminal segment. The number of segments in the smallest fronds is two or three on each side; in the largest fronds twelve or thirteen on each side. The lowest segments are rather more than half as long as the whole frond; the next segments usually a little smaller, but sometimes a little longer than the first pair, and the remaining ones rapidly decreasing. The segments are broadly
lanceolate or oblong-lanceolate, narrowed at the base, especially the lower ones, and either rounded or subacute at the apex. The sinuses between them are rounded, and are gradually narrowed towards the apex of the frond. The segments are very minutely serrulate on the edges; the smallest ones otherwise entire, and the larger ones either with sinuous margins or, in large fronds, deeply sinuous-pinnatifid. The texture is herbaceous, the surfaces perfectly smooth, the color of the upper surface grass-green, of the lower surface paler and slightly glaucescent. The fronds wilt very soon after plucking them, and in wilting there is a slight disposition to fold the segments together, face to face, for which reason the plant has received the name of "Sensitive-Fern." The first frost of autumn destroys the sterile fronds; and a late frost in May or June does the same. The midribs are prominent, and the veins conspicuous; the latter being copiously reticulated into areoles which enclose no free veinlets. Along the sides of the midribs and mid-veins are very long and narrow areoles, and outside of these are obliquely-placed oblong areoles in several irregular rows.

The fertile fronds are not very common, and a young botanist may search in vain for them for a long time. They stand only about half as high as the sterile fronds, and are very rigid. They are nearly black in color: in winter they dry up, but remain erect through the next summer, so that a fruiting plant often has fertile fronds standing of two years' growth. The frond is only a few (usually four to six) inches long,
and consists of from four to ten pairs of appressed fleshy or cartilaginous pinnae, which are divided into a double row of sub-globose bead-like segments or pinnules; the whole looking like a small and narrow but dense cluster of diminutive grapes. Each pinnule has its edges so much recurved that the whole forms a sort of pouch, apparently filled with sporangia.

Mr. Faxon has made a careful study of the sori, and has very kindly furnished the account given below.

The articulations of the sporangia are said by Fée to be twenty-eight to thirty-two, and more numerous than in any other fern. I have counted only thirty at most, and more frequently only twenty-eight. The spores are ovoid and very dark-colored.

Var. obtusilobata, Torrey, Fl. New York, ii., p. 499, t. clx (Onoclea obtusilobata, Schkuhr), is not a permanent variation of the species, but is based on a not infrequent condition of the plant, in which the pinnae of some of the foliaceous fronds become deeply pinnatifid into obovate segments, which have mostly free veins and imperfectly developed sori. The indusia

In O. sensibilis the sori are borne on the middle of the vein, and consist of a tough cylindrical receptacle, three or four diameters in height, bearing sporangia thickly all over its surface, and covered when young by a delicate hood-like indusium, attached half-way or more around the base of the receptacle on the inferior side, and having the crenulate-margined opening toward the apex of the segment. At an early stage the blackberry-shaped sorus is almost entirely covered by the indusium, which resembles a closely drawn cowl, but with the growth of the sporangia it is thrown back, or rent, and soon disappears, the sori becoming confluent. The receptacle is very persistent, and may be seen, covered with the stalks of the sporangia, in the dried last-year's fertile fronds, which are always found where the plant grows.\(^1\)
appear as little whitish scales on the back of the veins. It occurs in almost all places where the plant is common, is often produced from root-stocks which bear also normal fronds, and presents all gradations from the usual sterile frond to the proper fertile one. _Ragiopteris onocleoides_ of Presl is founded on a young fertile frond of this species placed with a sterile one of what Milde judges to be a monstrous form of _Aspidium Filix-mas_. Maximowicz describes a var. _interrupta_, from the Amoor region, in which the fertile frond nearly equals the sterile, and has elongated pinnae, with remote segments. This condition is also sometimes seen in American specimens, and is hardly a true variety.

In an article on “The late Extinct Floras of North America,” which appeared in Vol. ix of the Annals of the New York Lyceum of Natural History, in April, 1868, Professor Newberry describes certain fossil specimens of ferns occurring in Miocene argillaceous limestone at Fort Union, Dacotah, and refers them with little hesitation to this species. I have not seen the specimens, but, as similar venation and not very dissimilar fronds are seen in Woodwardia and Pteris, one may perhaps doubt the absolute certainty of the identification.

Plate LXXII.—_Onoclea sensibilis_; a plant from near Boston. Fig. 2 is a fertile pinnule laid open and showing the sori, the sporangia removed from one receptacle, and the indusium from another. Fig. 3 is a young sorus and its indusium. Fig. 4, a spore. Fig. 5, a portion of a sterile frond, to show the venation. Fig. 6, section of stipe. Fig. 7, the var. _obiusilobata._
CONGLEA STRUTHIOPTERIS. Hoffmann.
ONOCLEA STRUTHIOPTERIS, Hoffmann.

Ostrich-Fern.

Onoclea Struthiopteris:—Caudex short, thick, erect, emitting slender subterranean stolons; stalks stout, a few inches to a foot long, chaffy at the base; fronds standing in a vase-like crown, dimorphous; sterile ones one to ten feet high, herbaceo-membranaceous, broadly lanceolate, narrowed from the middle to the base, abruptly short-acuminate, pinnate; pinnæ very many, sessile, the lowest ones sinuate and deflexed, the rest three to eight inches long, five to nine lines wide, linear-lanceolate, acuminate, deeply pinnatifid into numerous close-placed oblong obtuse entire segments provided with a midvein and several simple veinlets on each side; fertile fronds in the middle of the crown or vase, much shorter than the sterile, rigid, contracted, narrowed at the base, pinnate; pinnæ one to two inches long, crowded, obliquely ascending, linear, obtuse, sub-entire or pinnately lobed, the lobes one or two lines long and broad, the margins much recurved, and the whole pinna forming a somewhat articulated pod-like body; veinlets of the fertile segments few, soriferous on the back; receptacle elevated; indusium very delicate, lacerate-toothed, half surrounding the sorus; sporangia at length confluent and filling the fertile pinnæ.

Onoclea nodulosa, Schkuhr, Krypt. Gew., p. 97, t. 104 (Perhaps also of Michaux, but this is still uncertain).


Struthiopteris, the genus only, Willdenow, in Berl. Mag., 1809, p. 160.

Hab.—Low grounds, especially in fine alluvial soil subject to the overflow of rivers; from the Saskatchewan and Lake Winnipeg to New Brunswick, and southward to Pennsylvania and Illinois. Mentioned by Alexander Braun as coming from Arkansas. From Lapland to Sicily, and eastward to the Amoor region, Sachalin and Kamtschatha. Not known in the western parts of either Europe or America.

Description:—The ostrich-fern is one of our finest ferns, being surpassed in grandeur only by Acrostichum aureum, Woodwardia radicans, and perhaps Osmunda regalis. The
The plant is propagated chiefly by long and slender stolons, bearing appressed rudimentary stalk-bases. These stolons are said by Sachs to originate from buds formed on the stalks near the base: they run underground for several inches or a foot, and at the end rise to the surface and there thicken into a short erect caudex, covered by imbricating stalk-bases, and throwing up from the apex a grand vase-like circle of foliage, which is often higher than a man’s head, and sometimes extends above his utmost reach.

The stalks are seldom over a foot long: they are flattened, blackish, and chaffy at the base, but above ground they are green, drying dull-brown, somewhat four-sided, and deeply channelled in front, when dried furrowed on the sides also. They contain two flattened fibro-vascular bundles. The stalks of the sterile fronds are rather longer than the others, but more rigid, and remain erect till the second year.

The sterile fronds are oblong-lanceolate in outline, gradually narrowed to the base from near the middle and abruptly short acuminate. The pinnae are usually of nearly equal breadth from the base to beyond the middle. They are pinnatifid to within a line of the midrib into numerous oblong and obtuse segments, the veins of which are free, simple and pinnately arranged on a midvein.

The fertile fronds are produced late in the summer, and are contracted, much shorter than the others, and very rigid. The pinnae are sometimes nearly entire, and in other examples pinnately lobed. The margins are very much recurved,
so that the pinnae are pod-like, and either sub-cylindrical or somewhat moniliform. The venation is free, and the sori are dorsal on the veins. Mr. Faxon writes: “The indusium can be detected only when the fertile frond is very young, and appears as a very delicate, lacerate membrane, attached at the base of the receptacle, and serving to separate the sorus from its neighbors. I have not found it in any case hood-like as in *O. sensibilis*. The sori are quickly confluent, and all trace of the indusium is soon lost. The membranaceous edge of the transformed fertile pinna is attached near the bases of the inferior sori and a fold is usually found pressed against the sori as seen in the drawing (Fig. 3). This is usually ruptured, so as to leave a portion attached at the base of the sorus, and must not be mistaken for the true indusium, which is within.”

The sporangia have twenty-six or twenty-eight articulations of the ring. The spores are dark-colored and ovoid.

Imperfectly fertile fronds are often found, which are analogous to the “*obtusilobata*” condition of *O. sensibilis*.

Plate LXXIII.—*Onoclea Struthiopteris*, about half the natural size of a small plant. Fig. 2 is part of a fertile pinna with one side laid open to show the venation and the sori. Fig. 3 is a cross section of the same, showing on one side a sorus with its indusium, and on the other a denuded receptacle, the indusium showing in section only. Fig. 4, an indusium. Fig. 5, part of a sterile pinna. Fig. 6, a section of the stalk. Fig. 7, a spore.
POTHOLÆNA PARRYI

Taxon, del.

Plate LXXIV.
Plate LXXIV.—Fig. 1-4.

PELLÆA ASPERA, Baker.

Rough Cliff-Brake.

PELLÆA ASPERA:—Root-stock rather short, ascending, chaffy with appressed linear-acuminate entire brown scales mostly with a darker midnerve; stalks clustered, rather slender, rigid, two to four inches long, black, but with a pale-ash-colored scurfy pubescence; fronds sub-coriaceous, oblong-lanceolate, four to six inches long, bipinnate; pinnæ deltoid-ovate; pinnules next the main rachis often somewhat lobed, the rest oblong, slightly auriculate on one or both sides, all of them having the upper surface roughened with harsh, short, simple or forked whitish hairs; involucre pale, continuous, minutely crenulate-denticulate.


Hab.—Texas and New Mexico. Near the Rio Grande, A. Schott. Near the Santa Rita Copper mines and along the San Pedro, Bigelow. First collected by CHARLES WRIGHT in 1849. It has not been collected by any one in more than twenty years and is very rare in herbaria.
Description:—This comparatively little-known fern is one of those ambiguous species which might find its place in either Cheilanthes or Pellea with about equal propriety. Hooker, who gave the earliest account of it, and illustrated it with an excellent figure, placed it in the former genus, and in his section "Pteridoideae," and next to Ch. canescens and Ch. candata, species scarcely known to himself at that time. Baker, in continuing Synopsis Filicum, removed it to Pellea, together with Cheilanthes Alabamensis and Ch. intramarginalis, probably because of the continuous involucres.

The root-stock, in the specimen available for the present description, is about the thickness of a crow's quill, and scarcely more than an inch long. Near the growing end it is forked into two short nearly equal branches. It is covered with very narrow long-pointed entire scales of a ferruginous color, most of them so thickened and deeply colored along the middle as to form a very decided midnerve.

The stalks are a few inches long and about half a line thick, blackened, and covered at the very base with brownish chaff, which is replaced along the rest of the stalk and the rachis with fine pale-cinereous appressed paleaceous hairs. The stalk-section is round, and shows a thick outer sclerenchymatous sheath and a somewhat butterfly-shaped central fibro-vascular bundle.

The fronds are lanceolate or oblong-lanceolate in outline, rather wider in the middle than at the base, and gradually
narrowed to an acute apex. The texture is subcoriaceous, and the color, when fresh, probably a rather pale shade of green. The secondary rachises are a little scaly as well as paleaceous-pubescent. The pinnae are short-stalked, triangular-ovate or triangular-lanceolate in outline, the largest ones about an inch long and half an inch wide, and composed of three or four pairs of pinnules besides the terminal one. The basal pinnules are often three-lobed or broadly hastate, and obscurely petiolulate, the rest sessile by a broad base, oblong-ovate, two or three lines long, and often slightly auricled on one or both sides of the base, the uppermost ones not separated but confluent with the triangular-ovate terminal segment. The whole upper surface is harsh and roughened with minute tubercles which are tipped with short, rigid, simple or forked or three-branched whitish hairs. Hooker says:—"This has a good deal the habit and general appearance of Cheilanthes canescens of Kunze, and has as much claim to be placed in the genus as that species, the continuous involucre being however that of Pteris or Allosorus [Pellaea.] Our plant is much more delicate and graceful, the stipes and main rachises ebeneous, the primary, pinnae again truly pinnate. But the remarkable character exists in the transversely waved margin of the fertile pinnae and segments, and the harsh, rigid, simple or bi- and sometimes tri-partite white hairs seen on the ridges, especially, of the undulations. It is assuredly a very distinct and new species." The transverse undulations are not always very clear, and are possibly due to contraction
between the veinlets in drying, but the hair-tipped tubercles are found even more abundantly on the recurved margins of the fertile pinnules than near the midvein, and are a very remarkable characteristic of the species. The very edge of the recurved margin is thin and white-cartilaginous, sparingly hairy, and minutely denticulate or crenulate. The under surface of the pinnules is paler than the upper surface, and bears a few minute appressed hairs.

*Pellaea rigida*, from Mexico, with very different fronds, is roughened in a very similar way.

The sporangia have a ring of about twenty articulations. The spores are subglobose and faintly trivittate.

Plate LXXIV., Fig. 1-4.—*Pellaea aspera*. Fig. 2 is an enlarged portion of a pinna. Fig. 3, a portion of a pinnule, seen from the under side, still more enlarged. Fig. 4 is a spore.
Notoholæna Parryi, D. C. Eaton.

Parry’s Notoholæna.

Notoholæna Parryi: — Root-stocks short, tufted, thickly covered with linear-acuminate entire chaffy scales mostly having a distinct blackish midnerve; stalks clustered, slender, two to five inches long, dark-brown or blackish, minutely striated, hirsute-pubescent with spreading articulated whitish hairs; fronds about as long as the stalks, oblong-lanceolate, tripinnate; lower pinnæ distant, ovate, a little shorter and broader than the middle ones; ultimate segments crowded, roundish-ovate, half a line to a line long, crenately incised, densely covered above with entangled white articulated hairs, and beneath with a still heavier similar tomentum of a pale-brown color; ends of the lobes very slightly recurved; veins sparingly forked, bearing at their ends a few blackish sporangia, which at length project beyond the margin of the segments.


Hab.—Crevices of basaltic rocks near St. George, Utah, Drs. Parry and Palmer. Valley of the Colorado, Arizona, Palmer. Marengo Pass, San Bernardino County, California, Parry. Eastern Slope of San
Jacinto Mountains, San Diego County, Wm. Stout. Specimens exist in the collection of plants made in California by Dr. Bigelow, while engaged in Lieut. Whipple's survey for a Railroad route to the Pacific Ocean, but are not referred to in the Botany of his Report.

Description:—This little woolly fern grows in dense tufts, probably in very dry and exposed places among the rocks, where it has to endure great heat and long-continued drought. The root-stocks are evidently combined into masses of considerable extent. When disentangled, a root-stock is found to be scarcely an inch long, and, with its covering of stalk-bases and chaff, about two lines in thickness. The chaff, which is also found on the bases of the stalks, consists of very narrow entire slender-pointed rather rigid scales, in general of a light cinnamon-brown, but nearly always provided with a very narrow, but definite, midnerve of so dark a hue as to be almost black. This midnerve is frequently somewhat interrupted, and never extends quite to the apex of the scale.

The stalks are clustered, very slender, terete, wiry, blackish-brown, very minutely striated, and pubescent with spreading pointed white hairs having one or two joints near the middle. Mixed with these hairs are some that are shorter and appressed; also a few sessile glands. Microscopic examination of the stalk shows a heavy outer sheath of blackish sclerenchyma, and a central fibro-vascular bundle, somewhat V-shaped in its section. After the pinnae have fallen from

1 The specimens were detected in Prof. Gray's herbarium by Mr. Davenport, who obtained permission to detach a little portion for my examination.
the rachis, or the fronds from the stalks, the latter remain on the root-stock for a year or two before they fall off or decay.

The fronds are oblong-lanceolate or oblong-ovate in outline, from very small in young plants up to five inches long in the largest I have seen. Their general color is greenish-white above and ferruginous-white beneath, the whiteness being due to the heavy covering of slender-pointed entangled hairs which cover both surfaces, but the lower surface more thickly. This wool is much coarser and longer than in *N. Newberryi*, and considerably coarser than in *Cheilanthes lanuginosa*, to which the present fern bears a very close resemblance, and for which it was at first mistaken. In a frond of full size there are seven or eight pairs of pinnae, the lowest ones nine or ten lines long, five or six lines broad, and distant from the next pair by an interval of a full inch. Succeeding pinnae are nearer together, rather narrower and longer, and the upper ones, again are smaller and smaller, and crowded very closely together.

The pinnae are twice pinnate, the pinnules set very close together, and scarcely visible through the woolly covering. When denuded of this they are found to be very small, usually less than a line long, roundish-ovate, and crenately-incised or crenate. The upper ones are less distinct, and the uppermost are confluent with the terminal segment. They have the outer margin very slightly recurved, but never enough so to cover the sporangia, which are placed, three or
four together, on the ends of the sparingly forked or simple veinlets.

The sporangia are very dark-colored, and have a ring of about twenty joints. The spores are globose, and probably trivittate, but the vittae have not yet been detected.

The hairs of the surface are usually composed of three cells, which are fifteen to twenty diameters long, terete, dilated at the articulations, and those of the lower surface of the frond containing a little pale-brown endochrome, which settles mostly in the ends of the cells. The terminal cell is acute at the free extremity.

The upper surface of <i>Cheilanthes lanuginosa</i> is scantily furnished with whitish webby hairs, and is never hirsute-tomentose as in our present fern.

Plate LXXIV., Fig. 5-9.—<i>Notholcena Parryi</i>, from Dr. Parry's Utah specimens. Fig. 6 is a pinnule denuded and magnified about eight diameters. Fig. 7, a part of the same, more magnified. Fig. 8, a spore. Fig. 9, some of the tomentum, highly magnified, and showing the nodes perhaps a trifle larger than I have described them.
Plate LXXIV. — Fig. 10-15.

CHEILANTHIES LINDHEIMERI, Hooker.

Lindheimer's Lip-Fern.

Cheilanthes Lindheimeri: — Root-stock slender, elongated, chaffy with rather thin ovate ferruginous-brown scales, the darker midnerve broad, but not well-defined; stalks scattered, four to seven inches long, wiry blackish-brown, polished, at first bearing pale delicate linear-lanceolate slender-pointed scales and minute paleaceous hairs; fronds three to five inches long, ovate-lanceolate, three to four times pinnate; primary pinnæ ovate-oblong, mostly closely placed; ultimate pinnules roundish, bead-like, one-fourth of a line long, very much crowded, sometimes lobed, the unchanged margin much incurved; upper surface of frond white-tomentose, lower surface very chaffy with delicate pale-ferruginous ciliated scales, those of the ultimate pinnules more and more ciliate and passing into entangled branched hairs.


Hab.—Western Texas, New Mexico and Arizona, probably in crevices of exposed rocks, F. Lindheimer, Wright, King, Palmer, Rothrock. Also in the Sierra Madre of Mexico (Seemann), and near San Luis Potosi, Parry & Palmer, No. 999.

Description:—This little fern has a slender root-stock about one line in thickness, and several inches long. It is covered with appressed or slightly spreading chaffy scales which are a little more than a line in length, ovate, acute, ciliate at the apex when whole, ferruginous-brown in color, and provided with a rather broad but not well-defined mid-nerve or central space in which the cells are filled with a deep-resinous-colored coloring matter.

The stalks are slender, terete, wiry, nearly black, and at length shining. They bear a few ferruginous scales at the base, but for the greater part of their length are, when young, chaffy with very thin and pale linear-lanceolate slender-pointed denticulated scales mixed with minute palaceous hairs. A transverse section shows that the exterior sheath of sclerenchymatous tissue is very thick and hard, and that the solitary fibro-vascular bundle, as in many of the related species, is transversely oval with a deep indentation on the anterior side, or, as termed in previous parts of this work, butterfly-shaped.

The fronds are about as long as the stalks, and ovate-lanceolate in general shape. One of the largest seen measures
a little over four inches in length and about an inch and a half in breadth. Such fronds are fully quadripinnate. The primary pinnae are placed closer together than in *C. Fendleri*, are ovate-oblong in shape, nearly sessile, and diverge from the rachis at an angle of about sixty degrees. The secondary and tertiary pinnae and the ultimate pinnules are compacted very densely; the latter are very minute, mostly about one-fourth of a line in diameter, rounded, sub-sessile, and either entire or so deeply lobed as to be almost divided into three similarly rounded or slightly pyriform segments. The outer margin is so revolute as to make them almost pouch-like. The veins are forked and only two or three to a pinnule. The whole under surface of the frond is densely clothed with imbricated ferruginous scales, which are very delicate in texture, ovate with very long and slender acuminations, and ciliate with long and curling hairs, especially at the base. On the pinnules these scales become very narrow, and at last have no perceptible central portion, but consist of slender branching hairs which are much entangled and constitute a heavy tomentum. The upper surface is webby with similarly branching white and exceedingly delicate hairs, having no evident articulations. When the frond is very old this webbiness partly wears off, while the color of the scales of the lower surface gradually becomes much deeper.

The sporangia are very few to each pinnule, and are entirely hidden beneath the scaly and woolly covering. The ring is composed of about twenty joints. The spores are very
large, dark-colored and quite globular. Mr. Faxon has observed the three radiating vittae which are found throughout the genus.

*Cheilanthes Lindheimeri* differs from *Ch. myriophylla* in having a very slender root-stock, and the covering of the frond more decidedly tomentose, especially on the upper surface. The pinnules, too, are smaller and more densely crowded. *C. Fendleri*, which has also a slender root-stock, has no tomentum, and the pinnules are not at all crowded.

Presl proposed a sub-genus of *Cheilanthes* for the species with minute concave or vesiculiform pinnules, giving it the name of *Physapteris*, and enumerating three species, *C. lenticera*, *myriophylla* and *scariosa*. Some years afterwards Fée made a genus of the same group, calling it *Myriopteris*, and dividing it into two sections, *Eumyriopteris*, for the species with a proper involucrum, and *Cheilanthastrum*, for those having a recurved margin in place of an involucrum. Fournier keeps Fée's genus *Myriopteris*, but says nothing about the two sections. It is a very difficult group, for the species are all much alike, and the earlier authors failed to indicate the most distinctive points of difference.

Plate LXXIV., Fig. 10–15.—*Cheilanthes Lindheimeri*, from a specimen collected by Lindheimer himself. Fig. 11 is a secondary pinna, enlarged, and having the scaly and tomentose covering mostly removed. Fig. 12, a pinnule, almost denuded. Fig. 13, a spore. Fig. 14, a scale from the lower surface. Fig. 15, entangled hairs from the upper surface.
ASPIDIUM JUGLANDIFOLIUM. Kunze.

PHEGOMETERIS POLYPODICIDES. Fée.
PLATE LXXV.—Fig. 1-4.

PHEGOPTERIS POLYPODIOIDES, Fee.

Common Beech-Fern.

PHEGOPTERIS POLYPODIOIDES:—Root-stock creeping, slender, elongated, at first softly paleaceous; stalks scattered, slender, stramineous, two to twelve inches high; fronds triangular, three to eight inches long, about two-thirds as broad at the base, thinly herbaceous, slightly hairy on both surfaces and scantily paleaceous on the midribs, beneath twice pinnatifid; pinnae sessile, linear-lanceolate, acuminate, pinnatifid half or two-thirds of the way to the midrib into numerous closely placed oblong obtuse entire or obscurely crenulate segments, lower pinnae separate and turned obliquely downwards and forwards; basal segments of the rest adnate to the main rachis, and forming a series of polygonal and usually narrowly connected wings along its sides; sori rather small, rounded, placed near the tips of the veinlets mostly near the margin of the segments; sporangia sparingly pilose.

FERNS OF NORTH AMERICA.


_Polystichum Phegopteris_, ROTH, "Fl Germ., iii., p. 72."


Hab.—Damp woods and hillsides, commonest in the mountainous parts of New England and the Middle States, the range in America extending to Newfoundland, Labrador and Greenland in the East, and to the Saskatchewan, Sitka, Alaska and Unalaska in the North-West, but not known in the United States west of the one hundredth meridian.1 Iceland, Europe and northern Asia to Mantchooria, Kamtschatka and Japan.

Description:—The root-stock of this fern is only about one line in thickness, but is often a foot long, or even longer. It creeps just beneath the surface of the ground,

1 While correcting the proof I am informed that it has just been discovered near San José, California, but there is not now time to investigate the accuracy of the report.
or in the crevices of mossy rocks, and throws up fronds usually about an inch apart. The newer portion bears a few very thin ovate scales; and the fronds for the next year's growth are seen closely coiled up a few inches in advance of the fronds of the present year.

The stalks are very slender, variable in length, and somewhat hairy. When very young they bear lanceolate long-pointed scales, which usually have one or two needle-pointed marginal hairs near the apex. The stalks are green when fresh, brownish-stramineous when dry. They contain two oval fibro-vascular bundles which unite into one trough-like bundle some distance below the base of the frond.

The frond is triangular in outline, more or less acuminate, and usually considerably longer than broad. It is slightly hairy above, and more so beneath, with appressed or spreading acute unicellular shining hairs. Along the midribs, both primary and secondary, are scattered delicate pale-ferruginous scales, ciliated with spreading slender-pointed hairs. The two lowest pinnae are somewhat deflexed and turned obliquely forwards. These are lanceolate or broadly lanceolate in shape, somewhat narrowed towards the base, and are commonly not connected with the next pair, the basal segments being free from the rachis or general midrib. The remaining pinnae have the basal lobes nearly or quite as long as the middle ones, adnate to the rachis, and connected with each other by a narrow wing, or else plainly confluent, so that the rachis is bordered nearly throughout its length by an irregular
wing-like border. The lobes of the pinnæ are placed close together, and are oblong, rounded at the apex, and set obliquely on the secondary midribs. They are either entire or crenately-toothed. The veins are pinnately arranged, the lower ones forked, the upper ones simple.

The sori are seated in the veinlets a short distance below the acute apices, and consequently near the margin of the segments. They are rather small, roundish or slightly oblong, and are usually seen on all the pinnæ of a fertile frond. The sporangia have about fourteen articulations. In many sporangia one or two slender-pointed hairs are borne near the top, reminding one of the similar hairs of the scales of the young stalk. The spores are ovoid, univittate, smooth and yellowish.

This fern is taken as the type of the genus *Phegopteris*, which, as explained on page 151 of this volume, is abundantly distinct from *Polypodium*, though, perhaps, not sufficiently so from *Aspidium*.

From *P. hexagonoptera* this species is distinguished by its usually smaller size, narrower outline, and the more nearly entire segments of the pinna. But, as in many other analogous cases of relationship, it is sometimes difficult to decide to which of the two species a specimen ought to be referred.

Plate LXXV, Fig. 1-4.—*Phegopteris polypodioides*. Fig. 2 is a segment, enlarged about eight diameters. Fig. 3 is a sorus. Fig. 4, a spore.
Platte LXXV. — Fig. 5–8.


Walnut-leaved Shield-Fern.

Aspidium juglandifolium: — Root-stock short, erect, very chaffy with large ovate dark-brown scales; stalks a few inches to a foot long, very chaffy when young; fronds four to twelve inches long (much larger in tropical America), coriaceous, smooth and shining above, sparingly chaffy beneath, pinnate, or the earliest ones simple; pinnae short-stalked, ovate-oblong or broadly lanceolate, the terminal ones distinct and often the largest, the lateral ones one to eight or ten on each side, two to six inches long, one or two inches broad, obtusely cuneate or truncate or sub-cordate, serrate with rather distant incurved teeth, acute at the apex; veins pinnately branched, veinlets few in each group, nearly parallel, either free or uniting towards the margin; sori rather large, scattered in two or more irregular rows between the midrib and the margin; indusium orbicular, peltate, somewhat toothed around the edge.


Cyrtomium juglandifolium and C. nobile, Moore, Index, p. 277.


Cyrtomium nobile, Moore, Index, p. 277.

Aspidium pumilum, Martens & Galeotti, Syn. Fil. Mex., p. 64, t. 17, fig. 1.

Phanerophlebia pumila, Fée, Gen Fil., p. 282.


Hab.—Western Texas, at Van Horn's Wells and the Huecco Tanks, collected by the botanists of the Mexican Boundary Survey. Mexico to Venezuela.

Description:—The few fronds brought home from the survey of the Mexican Boundary about twenty-five years ago are the only specimens known to have been collected anywhere within the limits covered by this work. The region
which includes the two stations above named lies between the Rio Pecos and the Rio Grande, and here a number of Mexican and tropical American types find their northern limit.

In Venezuela this fern attains a height of three feet, but in Mexico it is commonly of lower stature, and the Texas specimens are not above a foot long, stalk included.

The root-stock is erect and somewhat woody. It is covered with large ovate dark-brown ciliated scales, which in the larger plants have a still darker and denser central spot. The stalks are from a few inches to a foot long, or even longer. When young they are very chaffy with narrower scales than those of the root-stock, but this covering gradually wears off. The stalks are channelled in front, and contain two lateral strap-like fibro-vascular bundles, besides several smaller threads at the back.

The fronds are coriaceous in texture, and everywhere bordered by a narrow cartilaginous edge, which is extended into acute and incurved teeth especially towards the ends of the pinnae. The upper surface is smooth and shining, and the lower surface bears a few little scattered chaffy scales. The Texas fronds have six or seven pinnae on each side, besides a separate terminal pinna a little larger than any of the others.

Specimens from farther south sometimes have as many as twelve pinnae on each side, and sometimes only one; indeed a frond is not rarely seen perfectly simple. The plant selected for our illustration is from Chiapas in southern Mexico, and
shows gradations from a simple frond to those with one pinna on one side and two on the other.

The venation is so variable that two genera were proposed by Fée, one for the specimens with free veins, and one for those with anastomosing veins. Even the careful Mettenius, who, more than any other botanist, demonstrated the futility of founding genera upon differences of venation, admitted two species, *Aspidium juglandifolium* and *A. nobile*, the first with anastomosing veins, the second with free veins. In the Texas fronds the veins are nearly all free, very few anastomosing near the margin. The Chiapas plants have the venation very irregular, partly anastomosing and partly free. Other specimens show a like variability, even on the same pinna, and abundantly justify Hooker in referring all the forms to one species.

The sori are dorsal on the veins, and form a row each side of the midrib, and a little distance from it. Outside of each of these rows is a second row less complete, and outside of this are often found a few scattered sori. The indusium is orbicular and peltate, as in the section *Polystichum*, but owing to the occasional and sometimes regular reticulation of the veinlets, the species is referred to the section *Cyrtomium*, in which *Aspidium falcatum*, *A. caducum*, and two or three other species are also placed in *Synopsis Filicum*.

Plate LXXV., Fig. 5–8.—*Aspidium juglandifolium*, from Chiapas, Mexico, collected by Ghiesbreght. Fig. 6 is an enlarged portion of a pinna, showing the variable venation. Fig. 7 is an indusium, and Fig. 8 is a spore.
Plate LXXVI.

Asplenium Filix-fœmina, Bernhardi.

Lady-Fern.

Asplenium Filix-fœmina:—Root-stock rather stout, creeping or assurgent, covered with the blackened imbricating bases of former stalks; stalks clustered, a few inches to a foot long, chaffy at the base, greenish or brownish-stramineous, or even light purple upwards; fronds one to three feet long, forming a crown, softly membranaceous, oblong-lanceolate, acuminate, more or less narrowed at the base, twice or sometimes thrice pinnate; primary pinnae numerous, short-stalked, oblong-lanceolate from a broad base, acuminate; pinnules adnate to the narrowly winged secondary rachis, ovate-oblong and doubly serrate, or elongated and pinnately incised with cut-toothed segments; veins forked or pinnated, the lowest superior veinlet of each group commonly soriferous; sori near the midrib or midvein; indusium short, variously curved, often crossing the fertile veinlet and continued down on the other side, usually lacerate-ciliate on the free edge.

FERNS OF NORTH AMERICA.


Nephrodium Filix-femina, Michaux, Fl. Bor.-Am., ii., p. 268.
Nephrodium asplenioides, Michaux, Fl. Bor-Am., ii., p. 268.
Athyrium asplenioides, Desvaux, "Prodr., p. 266."—Moore, Index, p. 179.
Asplenium Athyrium, Sprengel, Anleitung, p. 113, Engl. Version, p. 124. (The synonymy might be extended to very great length, as may be seen by any one consulting the works of Hooker, Moore and Mettenius, above referred to.)
The so-called varieties of this fern are almost innumerable, but all pass into one another by various gradations. The chief forms occurring in North America are the following.

Var. *exile*: — Fronds three to six inches high, lanceolate, pinnate; pinnæ oblong-lanceolate, deeply cut into oblong laciniae which are two- to three-toothed at the end.—Ferns of the South-West, p. 330.

Var. *angustum*: — Fronds one to three feet high, rather rigid, narrow in outline, nearly bipinnate; pinnæ obliquely ascending or curved upwards, narrowly lanceolate; segments oblong, crowded, crenated or serrate; sori usually abundant, straight or curved.—Ferns of the South-West, p. 330.—Aspidium *angustum*, Willdenow.—Asplenium *Felix-femina*, var. Michauxii, Mettenius, Asplenium, p. 199.—Eaton, in King's Report, Botany, p. 396.—Athyrium *asplenioideis*, var. *angustum*, Moore, Index, p. 179.

Var. *latifolium*, Hooker: — Fronds two to three feet high, oblong-lanceolate in outline, nearly bipinnate; pinnæ three to four inches long, oblong linear, having a narrowly winged secondary rachis; pinnules broadly ovate and foliaceous, obtuse, simply or doubly serrate; sori nearer the midvein than the margin; indusia often curved, the basal ones frequently horseshoe-shaped.—Sp. Fil., iii., p. 218.—Eaton, Ferns of the South-West, p. 330.—Athyrium *Felix-femina*, var. *latifolium*, Moore, Nat. Pr. Brit Ferns, t. xxxi, B.

Var. *commune*: — Frond ample, delicate, two to four feet high, broadly oblong-ovate, twice pinnate, pinnæ elongated, four to eight inches long; pinnules oblong-lanceolate, pointed, more or less pinnately incised and serrate, distinct or confluent on the secondary rachis by a very narrow and inconspicuous wing; sori short; indusium straight or curved or horseshoe-shaped.—Ferns of the South-West, p. 331.—Athyrium *Felix-femina*, var. *ovatum*, Moore, l. c., t. xxxii.—The fully developed normal form of the species, passing into all the others by insensible differences.
Var. *cyclosorum*, Ruprecht:—Fronds very large, often five feet high, and eighteen to twenty inches broad; the secondary pinnæ or pinnules often nearly an inch and a half long, oblong-lanceolate, pinnately incised, or nearly again pinnate; sori short, roundish; indusium very short.—Dist. Crypt. Vasc., p. 41; also var. *Sitchense* of the same author.—Eaton, Ferns of the South-West, p. 331.—*Athyrium Filix-femina*, var. *cyclosorum*, Moore, Index, p. 183.

Other forms, as var. *laciniatum* (Moore; Davenport, Catal. p. 24) with small fronds and laciniated segments, and var. *cristatum* (Wollaston) with multifid apices of frond and pinnæ, are sometimes found, but, though they may be permanent in cultivation, they are to be considered aberrant monstrosities rather than varieties.

**Hab.**—Moist shady woods and hillsides, sometimes in sunny places as along roadsides and under walls, common in most parts of the United States and British America, and extending nearly throughout the North Temperate Zone. Var. *latifolium* and var. *cyclosorum* are more common on the Pacific coast, but are not unknown in the Eastern States and in Europe.

**Description:**—The root-stock is creeping or oblique, rarely erect, and is covered with the adherent and blackened bases of old stalks, the whole mass being nearly an inch thick in large plants, and several inches long.

The fronds stand in a crown, and the stalks of the standing fronds are clustered at the apex of the root-stock. At first the stalks and the young fronds are covered with blackish fuscous or sometimes lighter colored ovate-acuminate scales, but most of these soon wear off, a few only remaining at the base of the stalk. The stalks contain two strap-like
fibro-vascular bundles, which unite into one U-shaped bundle below the base of the frond. In living plants the stalks are oftenest green, but very frequently the color is a beautiful brownish pink, or almost red. This color is not peculiar to any one variety, and is found oftenest in plants growing in the shade.

The fronds vary in length from four or five inches to nearly as many feet, from narrowly lanceolate to broadly ovate in outline, and from pinnate with pinnatifid pinnæ to nearly quadripinnate in composition. The texture is rather thinly herbaceous, and they do not endure the frosts of autumn. Very generally the lower pairs of pinnæ are shorter than the middle ones, sometimes very much shorter, so that the frond tapers from the middle to a very narrow base. The frond itself and the primary pinnæ are acuminate, and in the most highly developed form the pinnules are pointed. The pinnules are always serrated, if not incised, the teeth usually acute, and often slightly incurved.

The veins are pinnately arranged; the veinlets simple or forked. The indusia are normally confined to the upper side of the fertile veinlets; they often cross the veinlet and continue some little distance down the lower side, thus becoming horse-shoe-shaped or hippocrepiform. Frequently they are but slightly recurved, and commonly all the forms of the indusium may be found on one frond. The indusium is very tender, and usually laciniately fringed. The spores are bean-shaped, yellowish and smooth.
Various attempts have been made to separate specifically the North American forms from the European, but the opinion of Hooker, Mettenius and Milde that all belong to one species is undoubtedly correct.

The Lady-fern takes kindly to cultivation, and is often seen in the dooryards of our half-rural towns.

Plate LXXVI. _Asplenium Filix-femina_, a plant from New Haven, having the stalks and rachises bright brownish pink. Fig. 2 is an enlarged portion of a pinnule. Fig. 3, an indusium less recurved than we sometimes see them. Fig. 4, a spore. Fig. 5 is a pinnule of var. _commune_; Fig. 6, a pinna of var. _latifolium_; Fig. 7, two pinnae of var. _angustum_; Fig. 8, two pinnules of var. _cylindrorum_; Fig 9, a frond of var. _exile._
Plate LXXVII.

ADIANUM TENERUM, SWARTZ.

Brittle Maidenhair.

Adiantum tenerum:—Root-stock rather stout, creeping, knotted; stalks often a foot long, erect, wiry, terete, smooth, nearly black and very lustrous, as are all the divisions of the rachis; fronds as long as the stalks, broadly deltoid-ovate in outline, thrice or four times pinnate at the base; pinnae of every degree stalked, the lower primary ones having very long stalks; ultimate pinnules usually eight to ten lines long, smooth, membranaceous but elastic, rhomboid, the base cuneate or obtuse-angled and articulated to the disk-like apex of the ultimate petiole, the upper and outer margins more or less lobed, and in the sterile fronds denticate, the veinlets extending to the points of the teeth; fertile fronds having the ends of the lobes recurved and forming numerous short-oblong or somewhat lunate or often slightly two-lobed involucres.

FERNS OF NORTH AMERICA.


Hab.—Banks of Halifax River, Florida, Mr. S. N. Chamberlin, Miss M. C. Reynolds, May, 1877. Sides of 'sinks' in limestone near Ocala, Florida, Mr. W. H. Shockley and Mr. Christian Beh (March, 1878), and gathered abundantly near the same place, by Capt. J. Donnell Smith, in April, 1879. A common fern in the West Indies, Bermuda, Mexico, Venezuela and some parts of South America. Plants from Florida referred to this species by Dr. Chapman are *A. Capillus-Veneris*, and the name was given by Dr. Torrey in Emory's notes of a Military Reconnoissance, p. 155, to specimens of *A. Capillus-Veneris* and *A. emarginatum*.

Description:—The root-stock is creeping, and about as thick as a goose-quill, but owing to the many short nodose lateral branches which it often bears, it appears much thicker. It is covered with fuscous-brown ovate-acuminate ciliated chaff intermixed with narrow chaffy hairs.

The stalks are often a foot long, and sometimes exceed this measure by several inches. They are erect, terete, rigid, smooth, almost if not quite black in color, and have as fine a polish as is ever seen in ferns. The largest ones are a line and a half thick near the base. The fibro-vascular bundles are two at the base of the stalk, but they presently unite into one showing in its section the form of a V. All the
branches of the rachis have the same ebony-like color and polish.

The largest fronds are over a foot long, and nearly as broad at the base as they are long; so that the outline is broadly triangular. The lower primary pinnae have a stalk from two to four or five inches long, and the stalks of the rest of the pinnae and pinnules are successively shorter, those of the ultimate pinnules being from one to three lines long. The second primary pinna is very often rather larger than the first, but the rest of the pinnae rapidly diminish and become simpler, so that the ninth or tenth pinna is reduced to a single pinnule. All the pinnae and pinnules are strictly alternate, and the arrangement of the frond is anadromous throughout, the first pinnule being always on the upper side of the rachis of the pinna to which it belongs.

The ultimate pinnules are in general rhomboid, though many of them, especially the terminal ones, have the outer and upper margins rounded into one continuous curve. They vary in length from three or four lines to nearly an inch. The base is an angle of from about sixty to one hundred and thirty degrees, but oftenest about a right angle. The outer and upper margins are lobed, usually slightly, but sometimes to a depth of two or three lines. In the sterile fronds the lobes are denticulate, the veinlets extending to the points of the teeth. In the fertile fronds the ends of the lobes are recurved to form the fruiting involucres, which are from four to twelve to a pinnule, short, transversely oblong, or somewhat crescent-shaped, and often slightly two-lobed.
The great peculiarity, which distinguishes this Maidenhair and its ally, *A. fragile*, from the rest of the pyramidal-fronded *Adianta*, is the very conspicuous disk-like enlargement of the apices of the ultimate divisions of the rachis, the pinnules being articulated to these disks, and very readily falling from them when the frond is old or not carefully dried.

Miss Reynolds was the first to gather this fern in Florida, though mistaking it for *A. Capillus-Veneris*, and she expressly noticed that "last year's fronds were all gone, or rather the pinnae had dropped, leaving the shining black wiry stems standing upright, and spreading out their slim fingers, while the baby fronds were coming up all around them. Some were old enough to be well fruited, while others were very tender and of a lovely pink color." The locality was pointed out to her by Mr. Chamberlin, who had known of it for a long time, "in rich hummock-land, where wild oranges and other trees made a constant shade." ¹

*Adiantum Farleyense*, Moore, is a variety of this species, originating, it is said, in the island of Bermuda. The pinnules are very large, fan-shaped and deeply lobed on the rounded outer margin.

Plate LXXVII.— *Adiantum tenerum*, from Florida. Fig. 2, is an enlarged pinnule, showing the articulation. Fig. 5, a fruiting lobe, the indusium opened. Fig. 4, a trivittate spore.

PTERIS LONGIFOLIA, LINNÆUS.

Long-leaved Brake.

PTERIS LONGIFOLIA: — Root-stock rather short, somewhat woody, knotted, chaffy with soft narrow scales; stalks clustered, stramineous, nearly smooth, a few inches to over a foot long; fronds as long as the stalks or longer, lanceolate in outline, narrowed at base, pinnate; pinnæ numerous, chartaceous, smooth, linear, sub-sessile by a truncate or subcordate base, obtuse or acuminate, minutely denticulate, the terminal one often the longest and usually distinct from the nearest ones; veins very numerous, once or twice forked, free; fertile fronds with narrower pinnæ, the whitish involucre erose-denticulate and continuous along the sides of the pinnæ; sporangia accompanied by slender jointed paraphyses.

FERNS OF NORTH AMERICA.


*Lonchitis non ramosa longissimis angustis et ad basim auriculatis foliis*, Plumier, Fil. Amer., p. 52, t. 69. (Other references and synonymy may be found in the works of Agardh, Hooker and Milde here quoted.)

Hab.—Key West, C. J. Lyons, 1857; crevices of rocky ledges in the open pine-barrens at Miami, Florida, Dr. Garber. West Indies, Mexico and Venezuela, and in tropical and sub-tropical regions all round the world, including southern Australia, Syria and the Mediterranean countries of Europe.

Description:—The root-stock is creeping, but rather short, stout and woody. It is covered with fine and delicate amber-brown chaffy scales, which are also found on the lower part of the stalks, and sometimes, though not in our Florida specimens, follow the stalk and rachis to the apex of the frond, as in some examples from Santo Domingo, Chiapas and the Pacific Islands. The stalks of fully developed plants are often a foot long, and sometimes longer. Their color is stramineous or brownish stramineous in dried specimens. They are erect and very strong, having a very thick outer
sclerenchymatous sheath. There is a furrow or channel down the anterior side, and the back is rounded. The section of the fibro-vascular bundle is horseshoe-shaped, as it is said to be in all the related species of the genus, being very different from that of the common Bracken of the northern states.

The frond is lanceolate in outline, being often longer than the stalk. Dr. Garber's specimens from Florida have from seven to thirteen inches of stalk, and from seventeen to twenty-three inches of frond. A fine specimen from Cuba, collected by Mr. Wright, has twenty-eight inches of stalk and forty of frond.

The largest of the Florida fronds has forty-two pinnae on each side. Other plants have sometimes a still greater number, and sometimes very few, even so few as five or six on each side.

The longest pinnae are usually near the middle of the frond, being about three inches long in the specimens from Florida, and five or six inches long in some from elsewhere. The terminal pinna is very variable; sometimes it is much the longest of all, and sometimes it is shorter than the average. From the middle of the frond to the base the pinnae grow shorter and shorter, so that the lowest ones are often only a few lines long. The pinnae are nearly sessile, the base commonly truncate, but sometimes sub-cordate, or even doubly auricled. The apex is oftenest acuminate but not rarely obtuse. Sterile fronds have pinnae three to six lines wide, and minutely denticulate on the semi-transparent carti-
laginous margin. The veins are very numerous and once or twice forked. Fertile fronds have narrower pinnæ and a continuous whitish erosely denticulate involucre occupying both margins. The sporangia are accompanied by numerous articulated hairs or paraphyses, which Milde says are in place of a true indusium. The spores are somewhat three-cornered, faintly trivittate, and have raised reticulating ridges over the whole surface.

Agardh describes six varieties of this fern, the differences being mostly in the base of the pinnæ, whether subcordate or auriculate, in the smooth or paleaceous stalk and rachis, and in the more or less serrate sterile pinnæ; forms which have been described by various authors as species, but which afford no constant distinctions:—indeed, as Agardh remarks, the several forms do not come from different places, but the most different grow together in any native land of the species.

*Pteris longifolia* has been cultivated at Kew since 1770, and is now one of the commonest species seen in the conservatories of tropical ferns.

Plate LXXVIII.—Fig. 1–4. *Pteris longifolia*, from Florida. Fig. 2 is an enlarged portion of a fertile pinna. Fig. 3 is a smaller part of the same still more magnified, so as to show the sporangia and the paraphyses seated on the marginal receptacle. Fig. 4 is a spore.
Plate LXXVIII.—Fig. 5-7.

PTERIS SERRULATA, LINNÆUS, FIL.

Serrulate or Chinese Brake.

PTERIS SERRULATA:—Root-stock creeping, rather stout; stalks densely clustered, slender, smooth, stramineous, a few inches to a foot long; fronds membranaceous, smooth, ovate in outline, six to fifteen inches long, bipinnatifid; rachis winged often to the base of the frond; pinnae lanceolate or linear, the terminal one very much elongated, the next lower pairs simple, the lowest ones once or even twice pinnatisect with a few distant segments, the terminal ones always longest; margins of the sterile fronds sharply serrate but not cartilaginous; involucres whitish, very long and continuous, the edge entire; sporangia without paraphyses.

Hab.—Shaded banks of rivulets in forests near Mobile, Alabama, C. Mohr. Walls in the City of Charleston, South Carolina, Professor Lewis R. Gibbes. China, Japan and Natal Colony.

Description:—In many respects this fern is so like Pteris Cretica that a full description is not needed. It has the same habit of growth, and fronds of about the same stature. The pinnae and pinnules of the sterile fronds are shorter and broader than in the fertile. The terminal pinna is commonly longer than all the frond beside. The terminal segments of the lower pinnae are also much elongated. The pinnae are so far decurrent on the rachis that the latter is winged from the top nearly or quite to the base. The sterile pinnae are sharply and irregularly serrate; the fertile ones serrate only towards their apices. The pinnae have not the narrow cartilaginous edge seen in Pteris Cretica.

Mr. Mohr thinks the plant native in the station he discovered, but as it is otherwise known only in the far East, it is possible at least, that it may be introduced. It is well established in Charleston.

Plate LXXVIII.—Fig. 5–7. The drawing is taken from a plant kindly furnished by Professor Gibbes. The details are a part of a pinna and a spore.
Plate LXXIX.—Fig. 1–7.

CHEILANTHES FENDLERI, Hooker.

Fendler’s Lip-fern.

Cheilanthes Fendleri:—Root-stock creeping, very slender and cord-like, covered with delicate bright-brown ovate-lanceolate scales nearly destitute of midnerve; stalks dark-brown, mostly scattered, two to five inches long, chaffy at the base like the root-stock, but upwards with very narrow pale-brown scales; fronds ovate-lanceolate, three to six inches long, tripinnate; scales of the primary rachis like those of the stalk, those of the secondary and tertiary rachises larger, broadly ovate, entire or nearly so, bright-brown but white-margined, imbricated and overlapping the very minute bead-like rounded and entire or obovate and 2–3 lobed, more or less crowded ultimate segments; these are naked above, and beneath commonly bear at their centre a single broad scale; herbaceous involucre formed of the much recurved outer margin.


FERNS OF NORTH AMERICA.

Hab.—Crevices of rocks, from Colorado to western Texas, New Mexico and Arizona. Fournier says it occurs in the Valley of Mexico and in Columbia. The Californian plants formerly referred to this species I now consider all forms of *C. myriophylla*.

Description:—The root-stock is slender, creeping and elongated. Its scales are somewhat spreading, thin, ferruginous-brown, and destitute of midnerve. The stalks are scattered, dark-brown, wiry, and, though at first somewhat chaffy, are at last nearly smooth. The ultimate pinnules or segments are beaded, round, nearly sessile, entire, or often three-lobed, especially the terminal ones or those of the very rare sterile fronds. The segments are about half a line broad. The scales which copiously cover the lower surface are broadly ovate, pointed, composed of sinuous cellules, and are entire or very sparingly ciliate at the base.

This fern is closely allied to *C. myriophylla*, and imperfect specimens, destitute of root-stock and badly preserved, are not easily distinguished from equally poor examples of that species. The principal differences between the several species of this group will be indicated under *C. myriophylla*.

Plate LXXIX. Fig. 1-7.—*Cheilanthes Fendleri*, from Arizona specimens collected by Dr. Palmer. Fig. 2 is a part of a pinna enlarged, seen from above. Fig. 3, a pinnule seen from beneath. Fig. 4, the same denuded. Fig. 5, an ultimate segment partly laid open. Fig. 6, a scale from a Colorado specimen. Fig. 7, a spore.
Plate LXXIX.—Fig. 8-15.

CHEILANTHES MYRIOPHYLLA, Desvaux.

Elegant Lip-Fern.

Cheilanthes myriophylla:—Root-stock short, usually ascending, often nodose, covered with closely imbricating narrow dark-brown rigid scales; stalks clustered, two to six inches high, wiry, castaneous, covered with partly deciduous palacinereous narrow appressed scales and paleaceous hairs; fronds three to eight inches long, ovate-oblong or oblong-lanceolate, smooth and green or deciduously pilose above, three to four times pinnate; rachises and midribs densely covered beneath with pale-brown or ferruginous ovate or ovate-lanceolate ciliated scales; pinnæ deltoid-ovate, narrower upwards; ultimate segments minute (half a line broad), roundish or roundish-pyriform, crowded, innumerable, sometimes (especially in the sterile fronds) three-lobed or parted, covered beneath with ovate scales having few or many long tortuous cilia passing into branched and entangled hairs, the unchanged margin of the segments much incurved.

Ferns of North America.


*Cheilanthes paleacea*, Martens & Galeotti, Syn. Fil., Mex., p. 76, t. 21, fig. 2.

*Myriopteris paleacea*, Fée, Gen. Fil., p. 149; 8me Mém., p. 115; 9me Mém., p. 10.

Hab.—In crevices of rocks and on exposed rocks, mostly at elevations of from 3000 to 5000 feet, from western Texas through New Mexico, Arizona and Nevada to California, extending southward to Peru and Chili.

Description:—The slight diversities which this little fern presents in the longer or shorter root-stock, the broader or narrower fronds, the more or less ciliated scales of the frond and the rounded or pyriform or incisely lobed ultimate segments, have caused authors to found several supposed species on what is believed to be but one kind of fern.

The scaly-fronded species of *Cheilanthes*, § Physapteris, are probably only five, of which *C. myriophylla*, *C. Fendleri*, *C.
Clevelandii, and C. Lindheimeri occur in our southwestern States and Territories, some of them extending to South America, and one, C. scariosa, Presl, is found in the mountains of Peru, and, it is said, in those of Mexico. C. scariosa and C. myriophylla have usually a short and condensed, often nodose root-stock, and consequently clustered fronds: the other three have more or less elongated and cord-like root-stocks, the fronds more or less scattered along its length. All have thrice or four times pinnated fronds, the ultimate segments very numerous, usually crowded, bead-like and roundish or roundish-ovate with recurved margins in the fertile fronds, but flattened, larger, and generally lobed in the sterile fronds, which are far less common than the others.

The scales of the root-stock are closely appressed and have a dark and strong midnerve in C. myriophylla, C. Lindheimeri and C. Clevelandii: they are dark and narrowly lanceolate in C. scariosa, and paler, more ovate and not so closely appressed in C. Fendleri.

In C. Fendleri the scales of the frond are entire, or very sparingly ciliate at the base; in C. myriophylla they are ciliate with comparatively few long and slender hairs, which are more abundant in C. Clevelandii. In C. scariosa the scales cover both surfaces, and are very large, ovate-lanceolate, and erosely ciliate-denticulate, and in C. Lindheimeri they are mostly replaced by an entangled tomentum. C. Lindheimeri is tomentose on the upper surface; C. myriophylla sometimes sparingly hairy on the upper surface, but oftener smooth,
and *C. Clevelandii* and *C. Fendleri* have the upper surface always smooth, though in both *C. Clevelandii* and *C. myriophylla* the cilia of the scales often curl over the upper surface of the pinnules and simulate pubescence there.

In all these plants the scales are at first whitish, often silvery-white, and it is only as the fronds mature that the scales turn gradually to various shades of brown.

The specimens brought by Mr. Stout from Cajon Pass and San Jacinto mountain in California have a slenderer root-stock and less ciliated scales than the commoner form, but on careful study and comparison I can find no good reason for considering them specifically distinct.

Many specimens of this fern, including all the California plants and some from western Texas (*C. Wright*, No. 2126) have passed heretofore for *C. Fendleri*.

Kuhn quotes Mettenius as saying that Desvaux's specimens of *C. elegans*, and *C. myriophylla* are precisely alike. He prefers the name *elegans*, as being more commonly used in gardens.

Plate LXXIX.—Fig. 8-15. *Cheilanthes myriophylla*, from California. Fig. 11 is part of a pinna, enlarged. Fig. 12, a pinnule seen from beneath. Fig 13, the same with the scales removed, and showing a few scattered hairs (which are often wanting). Fig. 14, an ultimate segment denuded and partly opened. Figs. 8, 9, 15, scales from different specimens. Fig. 16, a spore.
CHEILANTHES GRACILLIMA, D. C. EATON.
Lace-Fern.

Cheilanthes gracillima:—Root-stocks creeping and assurgent, forming a dense entangled mass, chaffy with appressed rigid narrow dark-brown scales; stalks slender, two to eight inches long, dark-brown, at first sparingly chaffy, soon smooth and shining; fronds usually one to four inches long, linear-oblong, bipinnate or sometimes partly tripinnate; primary and secondary rachises bearing delicate narrow bright-brown scales ciliated at the base; pinnae many pairs, crowded, three to six lines long; ultimate pinnules crowded, oblong-oval, about one line long, at first webby above, soon smooth, beneath heavily covered with matted ferruginous wool; involucres yellowish-brown, formed of the continuously recurved margin.


Cheilanthes vestita, Brackenridge, Fil. of U. S. Expl. Exped., p. 91, not of Swartz.

Hab.—Growing in dense masses among rocks, mostly at elevations of from 6000 to 8000 feet, from the Yosemite Valley to Oregon. Also
in British Columbia near the Pend d'Oreille River, Dr. Lyall. First collected on the Sacramento River, California, and on the banks of streams in Oregon, by Brackenridge, but first described from a few little specimens collected in the Cascade Mountains of Oregon by Dr. Newberry.

**Description.**—The species most closely related to this fern is *C. Eatoni*, from which it differs by the narrower and usually less compound fronds, larger and more oval pinnules, and their nearly or quite smooth upper surface.

The scales of the root-stocks are very narrow, slender-pointed, and ferruginous-brown with a darker midnerve, which does not extend to the base of the scales. The scales which occur rather sparingly along the rachises are long and narrow, and elegantly ciliated at the base. The tomentum, which is very dense, is nearly white in very young fronds, but deep chestnut-brown in mature ones. It seems to be composed of scales which are so deeply ciliated as to leave no undivided central portion.

The pinnules are oblong-oval, nearly twice as long as they are broad. Some of them are partly lobed at the base, as if the frond were becoming tripinnate, and, indeed the largest fronds are partly tripinnate.

The involucre is herbaceous, and continuous round the margin of the pinnules.

*The plant figured was collected in Plumas County, California, by Mrs. R. M. Austin. The details are a pinna seen from above, a pinnule from beneath, the same denuded and a spore.*
Plate LXXX.—Fig. 1-3.

Asplenium dentatum, Linnaeus.

Toothed Spleenwort.

Asplenium dentatum:—Root-stock short, erect; stalks tufted, one to five inches long, dark-brown at the base, becoming green higher up, those of the fertile fronds tallest; fronds as long as the stalks, oblong or linear-oblong, thin-herbaceous, smooth, simply pinnate; rachis green, flattish; pinnae few, distant, moderately long-stalked, half an inch long, or less, ovate-rhomboid or rounded-ovate, cuneate on the lower side of the base, truncate on the upper, obtuse, crenately lobed or crenate, those of the sterile fronds rounder; veins few, simple or forked; sori four to eight on a pinna, nearer the midvein than the margin, oblong, the lowest superior one often diplazioid; indusium pale, the edge slightly erose.


Trichomanes latifolium dentatum, Plumier, Fil. Amer., p. 58, t. 101, C.

Description:—Dr. Garber says of this fern; "Like the other small species of the genus it grows out of the crevices of limerock, and sometimes by the close grouping of the little tufts, covers the entire face of shaded rocks; but instead of being found on the sides of rocky ledges like the northern species it is restricted to rocky sides of depressions, or rock-holes, lower than the surrounding surface."

The root-stocks are nearly erect though short. The fronds are somewhat dimorphous, the sterile ones being both smaller and on shorter stalks than the fertile ones. The upper part of the stalk and the flattened rachis are green, much as in A. viride. The pinnæ are from four to ten on each side, the terminal one obtuse, and often as large as any of the others. They are roundish-ovate in the sterile fronds, ovate-oblong or slightly rhomboid-ovate in the fertile fronds. They are crenated or even crenately lobed. The veins are few, and the sori near the midvein. The superior basal sorus is often double, a common thing in most Asplenium.

Plate LXXX.—Fig. 1-3. Asplenium dentatum from Florida. Fig. 2 is an enlarged fertile pinnule. Fig. 3, a spore, wing-margined and covered with netted ridges.
FERNS OF NORTH AMERICA.

- Plate LXXX.—Fig. 4-9.

ASPIDIUM MOHRIOIDES, Bory.

Falkland Islands Shield-Fern.

Aspidium mohrioides:—Root-stock rather stout, short, erect or ascending, very chaffy; stalks clustered, one to six inches long, very chaffy with large ovate-acuminate scales intermixed with smaller ones and paleaceous hairs; fronds coriaceous or sub-coriaceous, at first chaffy, four to twelve inches long, oblong lanceolate, sub-acute, narrowed slightly from the middle to the base, pinnate; pinnae numerous, six to eighteen lines long, crowded, usually imbricated, ovate or ovate-lanceolate, obtuse, pinnately lobed with crenately toothed segments, or in very large fronds again pinnate with crenated ovate-trapezioid obtuse pinnules, the teeth obtuse or barely pointed, never mucronate; sori on the upper pinnae; indusia orbicular, fixed by the centre, smooth, very large and often imbricated.


Hab.—Mountains of northern California, at an elevation of 8000 feet, J. G. Lemmon, July, 1879. First discovered about 1824 by the botanists of Duperry's voyage of the Coquille at the Falkland Islands. Afterwards collected by Darwin, J. D. Hooker and others, at the same locality, and now known from several places in the mountains of Chili, from Port Famine, on the Straits of Magellan (Capt. King), from Orange Harbor, Tierra del Fuego (U. S. Expl. Exped.), and lastly from Marion Island, one of the Prince Edward group, where it was found by the Challenger Expedition.

Description:—Mr. Lemmon writes that this fern grows in loose and moist granitic soil, the root-stocks hidden under rocks, and a great many plants in one cluster. "It is very abundant on the side of a little valley at the headwaters of the South Fork of the Sacramento, and along the southern sloping side of Mount Eddy, which rises on the northern side of this valley."

That a fern known heretofore only from the regions adjacent to the extreme southern end of South America should occur in the mountains of Northern California, is remarkable. But it should be remembered that among phænogamous plants there are many instances of very closely allied plants occurring in both Chili and California, and, among Ferns, Pellea andromedæfolia is both Californian and Chilian, while several other species are common to Arizona and Chili, most of them occurring at many intermediate points also.
The present fern belongs to the section *Polystichum* of the genus *Aspidium*, having round involucres centrally affixed in the middle of the sorus to the back of the fertile vein.

The root-stocks and the lower part of the stalks are very chaffy, the scales being ovate or ovate-lanceolate, acuminate, and commonly finely ciliate along the upper part of the margins. In the Port Famine plant they are much narrower, and the color is very dark, but in the Orange Harbor specimens, and in those figured by Bory, they are more brownish, and the shape is the same as in Mr. Lemmon's specimens.

The stalks are clustered around the apex of the root-stock, as they are in *A. munitum* and *A. aculeatum*, and are at first covered with chaff, large and small scales intermixed, clear to the frond, which is itself also chaffy when young; but in mature fronds much of this chaffiness is lost, so that in *Synopsis Filicum* a part of the character given is "both surfaces naked." The Californian plants vary in height from four inches to about a foot. The Patagonian plants are from three inches to a foot and a half high. In general the frond is two or three times as long as the stalk.

The fronds are rather thick in texture. Their general outline is narrowly oblong-lanceolate, tapering slightly to the base from near the middle, and sub-acute at the apex. The pinnæ are rounded-ovate, and crenately toothed, or slightly three-lobed in the very smallest plants; pinnately incised with crenately toothed lobes in plants a little larger, such
as that which serves for our figure, and again pinnate with rhomboid-ovate incised and toothed pinnae in still larger plants. The teeth are generally obtuse, and if pointed are still muticous or destitute of the mucronate or spinulose point which is always seen in *A. aculeatum* and our other common species of this section.

The sori are abundant on the upper pinnae, and are placed mostly near the midveins of the lobes. The indusia are very large, orbicular, nearly entire, and often slightly wrinkled on the surface. They often lap over each other a little, so as to be slightly imbricated. The spores are ovoid and have an uneven surface.

The form of *Aspidium aculeatum* to which the name of var. *scopulinum* was given at page 125 of this volume is almost as much like *A. mohrioides* as it is like *A. aculeatum*, but as it has the lobes of the pinnae somewhat aculeate it is better to leave it with the latter species.

The specific name *mohrioides* refers to the considerable resemblance the fronds of this species have to those of *Mohria thurifraga*, a schizæaceous fern of South Africa.

Plate LXXX.—Fig. 4–9. *Aspidium mohrioides*, from California, a small specimen. Fig. 5 is an enlarged pinna. Fig. 6 is a pinnule, one of the indusia removed and more magnified at Fig. 7. Fig. 8 is a spore, and Fig. 9, a scale from the rachis, both more or less magnified.
Plate LXXX.—Fig. 10-14.

**CERATOPTERIS THALICTROIDES, Brongniart.**

Floating Fern.

*Ceratopteris thalictroides:*—Plant aquatic, annual; stalks thick, succulent, full of air vesicles; fronds flaccid, half-succulent, often proliferous from the surface or the edges; the earliest sterile ones floating, ovate, simple or three-lobed; later ones larger and more compound, the largest of them a foot long, erect, ovate in outline, twice or thrice pinnate with ample triangular-ovate divisions which are adnate to a winged midrib; veins finely reticulated into oblong-hexagonal meshes, the areoles pellucid-dotted; fertile fronds taller than the sterile, decompound with very numerous narrowly linear confluent segments; margins recurved and concealing the sub-globose sessile sporangia scattered on longitudinal veins or receptacles; ring of sporangia very broad, sometimes nearly complete, often much reduced or even wanting.


_Acrostichum thalictroides_, Linnaeus, Sp. PL, p. 1527.

*Pteris thalictroides*, Swartz, Syn. Fil., p. 98.—Willdenow, Sp. PL, v.,
p. 378.


_Ellobocarpus oleraceus* and _E. cornutus_, Kaulfuss, Enum. Fil., p. 148.

_Acrostichum siliquosum_, Linnaeus, Sp. PL, p. 1527.

_Parkeria pteridoides_, Hooker, "Exot. Flora, t. 137 and 231."—Hooker &
Greville, Ic. Fil., t. xcvii.


Nearly a score of additional names are given in Moore's _Index
Filicum_, and several more in Hooker's _Species Filicum_.

_HAB._—Floating on the waters of Prairie Creek in South Florida,
Dr. A. P. Garber, July, 1878. Head waters of the St. John's River,
Florida, A. H. Curtiss, October, 1879. Quiet and slowly moving waters
throughout the tropics; Mexico and the West Indies to Brazil; Africa,
southern Asia, Australia, etc.

_DESCRIPTION._—Mr. Curtiss, who has made a large col-
lection of specimens of this most peculiar fern, states that the
plant, where he found it, "somewhere in the vast inundated
prairie region north of the Everglades, was floating free (ex-
actly like _Pistia_ and _Azolla_) in water ten feet deep. The
fronds are arranged in rosettes, each having roots of its own.
The young ones are central, of the usual crosier shape, and
the spongy stipes bear a few hyaline, cup-shaped scales."

The plant is an annual, growing from the spore, form-
ing its prothallus, with the antheridoia and archegonia, producing its embryo, and growing first into a plantlet with minute obovate fronds, and soon into a mature plant, buoyed up by the spongy leaf-stalks and minutely vesiculose fronds, and later sending up into the air fully developed sterile and fertile fronds, and at last dying, and contributing its proportion of decaying vegetable matter to its native lagoons.

Its whole life history has been described, and illustrated by Dr. L. Kny, Director of the Institute of Vegetable Physiology in Berlin. He states that he has been able to examine living plants only of Ceratopteris thalictroides, and apparently considers that there is a second species of the genus, following the opinion of Mettenius, and contrary to the final judgment of Hooker, who himself formerly proposed Parkeria pteridoides as a distinct genus.

The floating fronds of this fern vary from simple and minute, to deltoid-ovate fronds several inches long, ternately compound, but with all the ample ovate-triangular or oblong segments confluent on broadly winged and more or less inflated midribs. The larger erect sterile fronds have triangular-lanceolate segments often an inch long and half an inch wide. The veins are everywhere reticulated into little oblong-hexagonal meshes, and when held up to the light appear pellucid-punctate, from an internal stratum of large cells filled with air.

The fertile fronds are three or four times pinnate, and are divided into narrow linear or horn-like segments, the margins
recurved so as almost to meet at the midvein. The veins are reticulated into long and narrow areoles (as they are also in the stalks), and the sporangia are seated on the longitudinal veins of the both lamina and the recurved portion. The sporangia are sub-globose, solitary, and sessile. Their walls are extremely thin and delicate. The wing is so variable that its different forms have given rise to several species and at least two genera. It is very broad but not at all prominent: sometimes it is nearly complete, and at other times it is reduced to a few cells. In the Florida specimens I have counted about twenty-two joints. The spores are globose-tetrahedral, and are curiously marked: on the apex are three short radiating lines; below them the three rounded sides are marked with somewhat parallel lines. In germination the exospore opens upwards from the three apical-lines; the endospore rises in the form of a conical papilla, with its generating-cell at the apex, while within the exospore the cells still go on dividing. On account of this and other peculiarities in its early growth Dr. Kny considers that the plant forms a good sub-order of equal rank with Polypodiaceae, Osmundaceae, etc.

Plate LXXX.—Fig. 10–14. *Ceratopteris thalictroides*, from Florida. Fig. 11 is a part of a fertile segment enlarged, and partly laid open to show the venation and the position of the sporangia. Fig. 12 is a sporangium. Fig. 13 and 14 are spores in different positions copied from Kny.
Ferns of North America.

Plate LXXX.—Fig. 15-17.

Asplenium Firmum, Kunze.

Firm-leaved Spleenwort.

Asplenium firmum:—Root-stock short, erect, sparingly chaffy; stalks clustered, nearly naked, two to six inches long, dark at the base, greener upwards, marked by two narrow herbaceous lines descending from the lowest pinnæ; fronds four to eight inches long, two to four inches broad, oblong-ovate, acuminate, broadest at the base, firmly membranaceous or sub-coriaceous, smooth, pinnate; pinnæ five to twenty on each side, the uppermost sessile and coalescing with the pinna-tifid apex, one to two inches long, half an inch wide, the rest short-stalked, varying from oval to rhomboid-lanceolate, obtuse or acuminate, crenate or serrate, the base cut away obliquely on the lower side and parallel with the rachis on the upper, but not auricled; veins mostly once forked, the upper ones simple; sori two or three lines long, mostly simple and placed on the upper branch of each vein; indusium fuscous, entire.

Asplenium abscissum, Baker, Syn. Fil., ed. ii., p. 203, and possibly of Willdenow, but this is very doubtful.

Asplenium polymorphum, Martens & Galeotti, Syn. Fil. Mex., p. 56, t. 15, fig. 2.

Asplenium salicifolium, Fournier, Pl. Mex., Crypt., p. 106.

Hab.—In sinks or chasms in limerock, near Ocala, Florida, W. H. Shockley, J. Donnell Smith. Mexico and the West Indies to Peru.

Description:—The fronds are firmly membranaceous, rather than sub-coriaceous. They are ovate or triangular ovate in outline, with a long pinnatifid and acuminate apex. The upper pinnæ are adnate to the rachis and more or less decurrent at the base, forming a narrow wing on the rachis. The inferior pinnæ have short stalks, and have the upper side of the base closely parallel to the rachis, while the lower side is cut away obliquely. The pinnæ are usually acuminate, but not always so. The sori are oblong, and placed about midway between the midvein and the margin. Sometimes the lowest one on the upper side of the base is diplazioid. The spores are oval, and covered with reticulating ridges.

Asplenium abscissum of Willdenow is sometimes considered to be this fern, and sometimes A. latum. It may have been made up of both. Fournier identifies this fern with A. salicifolium of Linnæus, which is contrary to the usually received opinion.

Plate LXXX.—Fig. 15–17: Asplenium firmum, from Florida. Fig. 16 is half of a principal pinnæ, somewhat enlarged, and Fig. 17 is a spore.
Plate LXXXI.—Fig. 1-4.

OPHIOGLOSSUM VULGATUM, LINNÆUS.

Common Adder’s-tongue.

OPHIOGLOSSUM VULGATUM:—Root-stock slender, erect; fronds mostly solitary, two to twelve inches high; sterile segments fleshy, sessile near the middle of the plant; ovate or elliptical, one to three inches long; midvein indistinct or none, the veins forming large areoles enclosing smaller ones and a few free veinlets; fertile spike an inch long or more, apiculate, commonly, long-stalked and overtopping the sterile segment.


HAB.—Commonest in low meadows, but sometimes on dry hillsides; Canada and New England to Texas and Arizona. Also in Unalaska, Europe, Western Asia, Madeira and the Azores.
Description:—The common Adders-tongue has an erect or sometimes creeping root-stock nearly two lines thick and sometimes one or two inches long. The roots are fleshy about half a line in diameter, and extend horizontally from the root-stock often to a distance of several inches. Occasionally one of them forms an adventitious bud and produces a new plant at some little distance from the old one. The frond for the year grows from just below the apex of the root-stock. At the base of the stalk is a short stipule-like sheath, which encloses a pointed bud, standing on the apex of the root-stock. This bud contains the undeveloped frond for the next year’s growth, and, according to Hofmeister, even the rudiments of the frond for another year may be detected within the same bud. The fronds of successive years face in opposite directions. In O. vulgatum but one frond is commonly produced each year. Sometimes, however, a second frond is borne, and in var. polyphyllum, Al. Braun, two or three fronds are commonly found together on one root-stock.

The height of the plant varies from two to three inches on dry hillsides to over a foot in damp grassy meadows. The common stalk is usually a little shorter than the peduncle of the fruiting spike; but this proportion varies much in different specimens. Sometimes the peduncle of the spike is so short that the latter scarcely rises above the apex of the sterile segment.

The sterile segment is sessile on the side of the stem, commonly about two inches long and less than an inch wide,
but sometimes twice this size. It is oblong-ovate or elliptical in shape, entire, rather obtuse, smooth and fleshy. The veins rise separately from the fibro-vascular bundles in the stalk, and are reticulated into large irregularly obovate areoles, which enclose smaller areoles, and these often enclose a free vein. There is no principal vein or midrib in this species, though in some foreign ones there is said to be a midrib, and a faint one is sometimes seen in O. nudicaule.

The fertile spike consists of a central axis containing three somewhat anastomosing fibro-vascular bundles, and from fifteen to thirty sessile sporangia on each side of it. These sporangia are connate, each one with the next above and below it, fleshy or sub-coriaceous, yellowish, entirely without ring or manifestly reticulated surface, and open by splitting horizontally when ripe. They differ, as do also those of the allied genera, Botrychium and Helminthostachys, from the sporangia of true ferns, not only in being more solid and in having no ring, but essentially in their origin; for, though as in true ferns, they belong to the leaves, they are not of the nature of trichomes, i.e., produced by transformation of single surface cells, but are from the inner tissue of the leaves, and are covered with an epidermis continuous with that of the leaf or frond.1 Equally important differences are

1 See Sach's Text-Book, as translated by Bennett, p. 381. — "The sporangia of the Ophioglossaceae are so essentially different from those of Ferns and Rhizocarps that these plants cannot, for this reason, be arranged in either of these classes; whether they differ as greatly from those of the Equisetaceae and Lycopodiaceae is yet to be proved by
observed in the nature and history of the prothallus, which is
green and above ground in true Ferns, and destitute of chlo-
rophyll and subterranean in Ophioglossaceae. While, therefore,
the latter constitute a distinct natural order, they are still so
like true Ferns in many respects, that they must still be called
Ferns; and that general name must be understood as covering
three natural orders, Filices, Marattiaceae and Ophioglossaceae.

The spores of O. vulgatum are smooth, pale-yellow, sub-
globose and trivittate.

Plate LXXXI.—Fig. 1-4. Ophioglossum vulgatum, from near
Boston. Fig. 2 is a part of a fertile spike. Fig. 3 is the upper part
of a sterile segment, where the larger areoles are less distinct than in
the lower half. Fig. 4 is a spore.

the history of their development. . . . Each sporangium is, in Botrychium, an entire lobe
of a leaf, the inner tissue of which produces the mother-cells of the spores. A longitudi-
nal section through the unripe so-called spike of O. vulgatum shows that the outer
layer of the wall of the sporangium is a continuous prolongation of the epidermis provided
with stomata and covering the whole of the fertile branch of the leaf. . . . The spherical
cavities which contain the masses of spores are imbedded in the tissue of the organ, and
are therefore entirely surrounded by its parenchyma.
Plate LXXXI.—Fig. 5-7.

**OPHIOGLOSSUM CROTALOPHOROIDES, WALTER.**

**Bulbous Adder's-tongue.**

**OPHIOGLOSSUM CROTALOPHOROIDES**: — Root-stock sub-globose, tuberous, fronds usually several from one root-stock, two to six inches high; sterile segment set below the middle of the plant, six to eighteen lines long, somewhat fleshy, broadly ovate or cordate, abruptly contracted at the base into a short petiole; midvein none, areoles not enclosed in larger ones; fertile spike three to six lines long, rather thick, apiculate, its peduncle usually twice to four times longer than the common stalk.


*Ophioglossum opacum,* Carmichael.—Hooker & Greville, Ic. Fil., t. 40.—Presl, Suppl., p. 51.
Ophioglossum vulgatum, var. crotalophoroides, Eaton, in Chapman's Flora, p. 599.

Hab.—Old fields and low sandy grounds from South Carolina and Florida to Louisiana. Dr. Garber found it at Manatee, Florida, and Professor Eugene A. Smith reports it as being abundant near Tuscaloosa, Alabama. The range extends to Chili, and possibly much farther. Pursh says, "New Jersey to Carolina," but no one in recent years has detected it in New Jersey, and it may be doubted whether it was ever found there.

Description:—The root-stock is solid and sub-globose, two to four lines thick, and furnished with a few commonly descending roots much slenderer than those of O. vulgatum. Several fronds (2 to 6) are produced in one season, some of them sterile. The sterile fronds or segments are broadly ovate or nearly round, cordate or sub-cordate at the base, and abruptly narrowed to the stalk. The areolation is more uniform than in O. vulgatum. The fertile spike is usually long stalked, and bears at the top a short and rather thick spike of sporangia. After the spores are discharged the spike bears some resemblance, in miniature, to the rattles of a rattlesnake; at least Walter must have thought so. His specific character, "frondibus subcordatis, scapo frondibus tertius longiori," describes our plant so well, that can be no doubt that his plant is the same as O. bulbosum.

Plate LXXXI.—Fig. 5-7. Ophioglossum crotalophoroides, from Fernandina, Florida, collected by Mr. Faxon. Fig. 6 is a sterile segment, slightly enlarged, showing the venation. Fig. 7 is a spore.
Ophioglossum nudicaule:—Root-stock short, slightly tuberous; fronds usually several, one to six inches high; sterile segment four to nine lines long in our plant (larger in some foreign specimens), somewhat fleshy, elliptical-ovate; acute at both ends, sub-sessile near the base of the plant; midvein sometimes present, areoles not enclosed in larger ones; fertile spike three to six lines long, apiculate, set on a long and slender peduncle.


Ophioglossum parvifolium, Hooker & Greville.—Beddome, Ferns of So. India, p. 23, t. lxxi.

Ophioglossum vulgatum, var. nudicaule, Eaton, in Chapman's Flora, p. 559.—(O. pusillum, Nuttall, Gen. p. 248, is probably a mix-
ture of this and *O. crotalophoroides*, as both species are among his specimens of *O. pusillum*. *O. ellipticum*, Hooker & Greville, is larger and perhaps distinct.)

**Hab.**—Sandy borders of ponds, fruiting in October and November. South Carolina and Georgia to southern Alabama and Florida. Mobile, C. Mohr; Apalachicola, Chapman; Levy County, Florida, Garber. Cuba, Wright, No. 1817, referred to *O. bulbosum* by Grisebach. South America, Africa, India, New Caledonia, etc.

**Description:**—With us this is usually a smaller plant than *O. crotalophoroides*. It has an indistinctly tuberous root-stock with fascicled descending roots. There are from two to six or seven fronds from one root-stock, the part of the stem which is below the sterile segment being buried in the soil. The sterile segments are rarely over an inch long, except in some doubtful foreign forms, and are elliptical, but acute at both base and apex. There is a central vein, running as far as the middle of the segment, sometimes indistinct, sometimes very plain. The areoles are irregularly oblong, and not enclosed in larger ones. The spike of sporangia rests on a slender peduncle which is commonly several times as long as the sterile segment. The spores are sub-globose, smooth and trivittate, as they are also in *O. crotalophoroides*.

Plate LXXXI.—Fig. 8-10. *Ophioglossum nudicaule*, from Dr. Chapman's Apalachicola specimens. Fig. 9 is an enlarged sterile segment. Fig. 10 is a spore.
Plate LXXXI.—Fig. 11–14.

OPHIOGLOSSUM PALMATUM, Plumier.

Palmate Adder’s-tongue.

Ophioglossum palmatum:—Root-stock short, tuberous, bearing around the top a circle of long-ciliate scales, and producing one or several fronds in a season; fronds fleshy, flaccid and somewhat pendulous, four to twelve inches long, long-stalked, cuneate at the base, sometimes entire but commonly palmately lobed; lobes two to eleven, tongue-shaped, often forked near the tip; veins anastomosing in long rhomboid or hexagonal areoles; fertile spikes one to several, borne mostly near the edges of the frond just where it narrows into the stalk, or on the upper part of the stalk itself.


Cheiroglossa palmata, Presl., Suppl., p. 57.—Fée, 11me Mém., p. 127.
Hab.—In the axils of the old leaves of the palmetto, on the banks of the Caloosahatchie, South Florida, Chapman, Oct., 1875; J. Donnell Smith, March, 1878; Garber, August, 1878. Forks of Turkey Creek, Indian River, Florida, F. A. White, May and July, 1879, always nesting in the old sheaths of leaves of the palmetto. Santo Domingo, Plumier. Mauritius, Meyrien. Southern Brazil, Tweedie, "growing in the axils of the leaves of a species of palm." Chinantla, Mexico, Galeotti. "pendent on divers trees, and more rarely on moist schistose rocks." Tovar, Venezuela, Moritz, on dead trunks. Peru, Peppig. Brazil again, Sellow. Cuba, C. Wright. Also near Manatee, Florida, Garber.

Description:—The root-stock is not very unlike that of a Trillium, being erect, a little longer than thick, about as large as a hazel-nut, profusely rooting along its sides, and producing a cluster of fronds at the top. Just below the fronds is a ring of woolly hairs, which on examination prove to be the long and entangled cilia of minute chaffy scales. This wool is ferruginous in dried specimens, but Plumier says it is "albissima." The roots are several inches long, half a line to a line thick, and dichotomously branched. Sachs is uncertain whether the branching of the roots of Ophioglossaceae is monopodial or dichotomous. Here it is certainly the latter;—in one instance a root is four times regularly dichotomous.

The number of fronds from one root-stock is said by Dr. Garber to be sometimes more than twelve, but usually there are from three to six. The stalks are from three to fifteen inches long, round, fleshy and rather tough, but gradually yielding to the weight of the frond, which is more or less
pendent according to its weight. The fibro-vascular bundles are from six to twelve, slender, and placed in a circle beneath the surface.

The frond is sometimes simple and lanceolate, a span long or less, and six to twelve lines wide; but more commonly it is fan-shaped, cuneate at the base, and deeply lobed into a variable number of tongue-shaped segments, oftenest from three to six. Two examples have eleven segments. The segments are from two to eight inches long, nearly or quite an inch broad, obtuse or acute, and often forked at the tip; one frond is forked at the middle of the stalk, and each of the divisions forked with forking segments. No two fronds are exactly alike, and in a large collection of specimens many odd shapes appear.

The veins rise from the stalk, no one larger than the others, and anastomose in elongated irregularly rhomboid or hexagonal meshes, which often contain a simple or branched veinlet entering from either the lower or the upper end of the areole.

The spikes are one or two inches long, and have peduncles a little shorter than themselves. They arise mostly from the incurved edges of the frond just where it begins to widen from the common stalk, sometimes from the stalk itself, and rarely from the anterior or upper surface of the frond, starting from a vein some distance from the margin. The peduncles contain one principal vein, and often an additional veinlet or two. Occasionally a spike or its peduncle
is forked. The spikes are manifestly appendages of the frond, as Hofmeister considers the spike of *O. vulgatum* to be, and not special fronds partly consolidated with the sterile lamina.

Dr. Garber is of the opinion that the sterile segments continue to elongate after the fruit has ripened,

The number of sporangia in one spike is usually from twenty to forty on each side.

Another peculiar species of this genus is *O. pendulum*, Linnaeus; its range being from the Mauritius to India, Australia, Polynesia, and Ecuador. In this species the frond is ribbon-like, an inch broad, and sometimes several feet long, simple or forked, sometimes twice forked near the extremity. The spike is usually solitary, and rises from the middle of the lamina not far from the base: it is much heavier than in any other species, and often several inches long. Presl made of this species the genus *Ophioderma*.

Plate LXXXI.—Fig. 11–14. *Ophioglossum palmatum*, one of Dr. Garber's specimens. Fig. 12 is a longitudinal section of a part of a fertile spike. Fig 13 shows the venation. Fig. 14 is a spore.
ADDITIONS AND CORRECTIONS.

Aspidium Oreopteris:—Root-stock short, assurgent or erect, chaffy, covered with adherent stalk-bases; stalks chaffy, very short; fronds firmly membranaceous, glandular beneath, one and a half to over three feet high, broadly lanceolate in outline, acute, tapering from the middle to a very narrow base, pinnate; lowest pinnae very short, deltoid; middle ones three to five inches long, lanceolate from a broad and nearly sessile base, pinnatifid to within a line of the midrib into numerous broadly oblong obtuse nearly entire segments; veins free, mostly forked; sori near the margin; indusia round-reniform, toothed or glandular, evanescent; spores ovoid, muriculate.—Aspidium Oreopteris, Swartz, in Schraders Journal, 1800, ii., p. 35; Syn. Fil., p. 50.—Willdenow, Sp. Pl., v., p. 247.—Mettenius, Fil. Hort. Lips., p. 92.—Lastrea Oreopteris, Presl, Tent. Pterid., p. 76.—Moore, Nat. Pr. Brit. Ferns, t. xxviii.—Nephrodium Oreopteris, Desvaux.—Hooker, Brit. Ferns, t. 14.—Aspidium montanum, Milde, Fil. Eur. et Atlant., p. 115.—Nephrodium montanum, Baker, Syn. Fil., p. 27.

Discovered on the Island of Unalaska by Mr. L. M. Turner in 1878; “abundant enough, grows four feet high in patches of many yards square in the ravines and wet places.” It is common in Europe, from England to Spain and to Russia, and occurs also in Madeira and in Asia Minor; but is not found in Siberia, nor on the North American continent.

This fern is nearer to A. Nevadense than to any other species found within our limits. It has a similar root-stock; and the fronds in both species are narrowed to the base. But A. Oreopteris is a coarse heavy-looking fern with broad pinnae and segments, while the other is slender and graceful, with narrower pinnae and much smaller segments. In A. Neva-
dense the veins are mostly simple; in _A. Oreopteris_ they are mostly forked, except in very small fronds. Specimens of this fern and of several others, collected by Mr. Turner in Unalaska, were sent to me by Dr. J. Schneck, of Mt. Carmel, Illinois, but not until all the plates for this volume were already in the hands of the lithographers.

Vol. I. Page 5.—_Lygodium palmatum_ is now known to be abundant in some parts of Tennessee and Kentucky. See Mr. Williamson’s Ferns of Kentucky, p. 129; also Bull. Torr. Club, vi., pp. 221 and 232.

Page 18.—The locality is more exactly a dense hummock near Miami, Dade County, S. E. Florida.

Page 29.—_Botrychium Lunaria_ has been found in Connecticut, by Dr. F. W. Hall. There were good specimens of it in Mr. Turner’s collection made in Unalaska.

Page 45.—_Cheilanthes Californica_ occurs as far north as Sonoma County, where Mr W. A. Stratton found it covering an immense rock of sandstone in a branch of Russian River.

Page 73.—_Aspidium Nevadense_. Also in Trinity County, Professor G. R. Kleeberger, 1879.

Page 85.—_Cheilanthes viscida_.—White-water Canon is in California, not Arizona. The name of the pass referred to in the next line is San Gorgonio.

Page 95, line 7;—for “hirsuta” read _hirsutum._

Page 104. _Aneimia adiantifolia_.—Some of Dr. Garber’s later specimens are as large and fine as one would wish to see.

Page 139, line 16;—for “Alenticum” read _Aleuticum._

Page 166.—_Woodwardia augustifolia_.—Arkansas, Dr. Engelmann.

Page 175.—_Aspidium fragrans_.—Dr. C. C. Parry, in Owen’s Geol. Survey of Wisconsin, etc., p. 621, gives an account of this fern, which he discovered growing on trap rocks at the Falls of St. Croix, in 1848.
Plate XXIV.—For “SHIZÄEA” read SCHIZÄEA.

Page 185.—Schizæa pusilla. Add to the synonymy; Schizæa filifolia, De la Pylaie, in Mém. Soc. Linn., Paris, iv. (1825), p. 424.—De la Pylaie states that he found it in low grounds growing with Arethusa, Calopogon, etc. His specimens are still preserved, and have been seen by Professor Gray. In August, 1879, the Schizæa was found by Miss Elizabeth G. Knight on the shores of Grand Lake, about twenty-three miles from Halifax, Nova Scotia. The plants were less than two inches high, the fruit immature. They were growing among the rhizomes of the royal-fern. This discovery confirms the authenticity of the Newfoundland station. See Bulletin of Torrey Botan. Club, vi., p. 361, and Botan. Gazette, v., p. 4.

Plate XXVI.—The name of the fern at the left hand is Polypodium Scouleri, Hooker, not P. vulgare.

Page 203.—Pellæa andromedaefolia, var. rubens, Eaton in Bulletin of Torrey Botan. Club, vi., p. 360, is a condition, rather than a proper variety, in which the upper surface of the frond, including the revolute margin, is colored a deep blood-red. Mrs. R. F. Bingham, of Santa Barbara, informs me that from experiments she has made, she is satisfied that the color is wholly due to the direct rays of the sun, and that when a red-fronded plant is removed to the shade the new fronds produced have not the red color. In short the color is a ripening in the sunshine like the color of many autumnal leaves and fruits.

Page 208.—The San Diego specimens are all P. andromedaefolia, some of them with larger pinnules than usual.

Page 247.—Scolopendrium vulgare.—Pursh’s original station on the Geddes farm, some five miles west of Syracuse, was rediscovered last September by the ladies of the Syracuse Botanical Club. Mr. John A. Cheatham has found the same fern on the precipitous sides of a deep chasm in limerock two miles west of the Tennessee River, and near the town of South Pittsburg, Tennessee. Both these discoveries are chronicled in the Bulletin of the Torrey Botanical Club, vi., pp. 346–348.
Page 264. — *Pteris aquilina*. Var. *caudata* is reported occurring as far north as Delaware and New Jersey. I have seen only small fragments, too scanty for certainty as to whether they are truly var. *caudata* or not. Mr. Davenport reports that var. *caudata* has been sent to him by Mr. F. A. White, from Florida, thirteen feet high! A very fragrant condition of the bracken has been noticed in Illinois by Mrs. S. T. Chapman.

Page 280. — *Asplenium parvulum*. — Greene County, Missouri, Professor E. M. Shepard. Alleghanies of Virginia, Professor Gray and Mr. Gillett.

Page 282. — *Adiantum Capillus-Veneris*. This has also been found in Missouri by Professor Shepard, and in Wythe County, Virginia, by Mr. H. Schriver.

Vol. II. Page 6. — *Pellcea Wrightiana*. — Specimens from San Bernardino Mountain in southeastern California, collected by Mr. Lemmon and Mr. W. G. Wright, are to be referred to this species. Mr. Wright states that the root-stocks form great masses under rocks, and the fronds continue to unfold long after *P. Ornithopus* has ceased its growth for the year.

Page 9, line 10, — For "oppressed" read appressed.

Page 16. — *Gymnogramme triangularis* has been sent to Halifax nurseries from British Columbia.

Page 19. — *Gymnogramme hispida*. — Specimens from San Luis Potosi, Mexico, collected by Drs. Parry & Palmer, have partly the veins free, and partly the veins reticulated as in *G. podophylla*. If the two are ultimately united it is probable that they will be found identical with *G. Ehrenbergiana* Klotsch, in Linnaea, xx., p. 411. — But more materials are needed.

Page 80, line 7 from bottom. — For "buondary" read boundary.

Page 89, line 12. — For "inches" read lines. On the next page, for "Franklin County" substitute Cumberland Mts. This (*Cheilanthes Alabamensis* and not *C. microphylla*, as stated on p. 82) is the plant that Dr. Engelmann collected at the Hot Springs in Arkansas, where it still is found, but now "principally along iron pipes which convey the water of the springs to a hotel."
FERNS OF NORTH AMERICA.

Page 95, line 12 from bottom.—For "Onodea" read Onoclea.


Page 125.—Aspidium aculeatum, var. Braunii.—"During the summer of 1878, Mr. J. P. Crosier Griffith found this fern growing freely in a rocky glen near the southwestern corner of Sullivan County, Pennsylvania."—Bulletin of Torrey Club. vi. p. 291.

Page 169.—Specimens of Aspidium spinulosum var. vulgare with glandular indusia have been detected in Dutchess County, New York, by Mr. Hoysradt.

Phegopteris calcarea:—Root-stock slender, cord-like, widely creeping, stalks scattered, slender, glandular, chaffy near the base, six to twelve inches high; fronds herbaceous, rather rigid, minutely glandular, deltoid, four to eight inches long, and about as broad at the base, ternate; primary divisions stalked, pinnate with oblong or ovate-oblong pinnæ, which are pinnately lobed or divided; lowest inferior pinna of the lateral divisions about equal to the third pinna of the middle division; lobes oblong, obtuse, crenately toothed, or if very large, pinnately lobed; veins pinnately branched, sori small, nearer the margin than the midvein.—Phegopteris calcarea, Fee, Gen. Fil., p. 243. —Mettenius, Fil. Hort. Lips., p. 83.—Phegopteris Robertiana, Al. Braun.—Milde, Fil. Eur. et. Atlant., p. 99.—Polypodium Robertianum, Hoffman.—Moore, Nat. Pr. Brit. Ferns, t. vi.—Hooker, Brit. Ferns, t. 5.—Polypodium calcareum Smith.—Willdenow, Sp. Pl., v., p. 210.

Collected in Eastern Minnesota, growing on slaty rocks on the bank of the St. Louis river, near the crossing of the Northern Pacific Railway, by Miss Ellen W. Cathcart. Formerly attributed to America, but not clearly known as American till now. It is rather common in Europe, and has been found in the Himalayan regions of Asia. It will probably be found from Lake Superior to Idaho. This fern is very closely related to the common P. Dryopteris, and is often considered a variety of it. Milde maintained that it is distinct, the principal differences being a somewhat thicker root-stock,
glandular stalk and fronds, fronds more rigid and erect, smaller pinnae on the lower side of the primary divisions, and spores more distinctly verrucose; and my own observations lead me to the same conclusion.

Page 178, line 9,—before “at” insert or.
Page 257, line 2,—for “antheridoia” read antheridia.
Page 262, line 4,—after “fleshy” add a comma.
Page 268, line 2,—for “amon” read among.

**Aspidium conterminum, Willdenow?** Root-stock stout, erect, often rising above ground, bearing a crown of fronds; fronds one to four feet long; puberulent and glandular beneath, very short-stalked, lanceolate, caudate-acuminate, much narrowed at the base, somewhat rigid, pinnate; pinnae sessile, narrowly lanceolate from a broader base, acuminate, deeply pinnatifid into oblong obliquely sub-falcate obtuse segments; veins free, simple; sori near the margin; indusium reniform minute, glandular and somewhat pilose, evanescent.—Sp. Pl. v., p. 249.—*Nephrodium conterminum*, Desvaux; Hooker, Sp. Fil., iv., p. 91.

Abundant throughout a miry swamp draining into Peace Creek, Polk Co., Florida, Captain J. Donnell Smith, March, 1880. Mexico, West Indies and South America. Captain Smith notices a small mamillate gland on the side of the rachis at the base of each pinna. This, with the very short stalk, may ultimately separate the fern from *A. conterminum.*
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