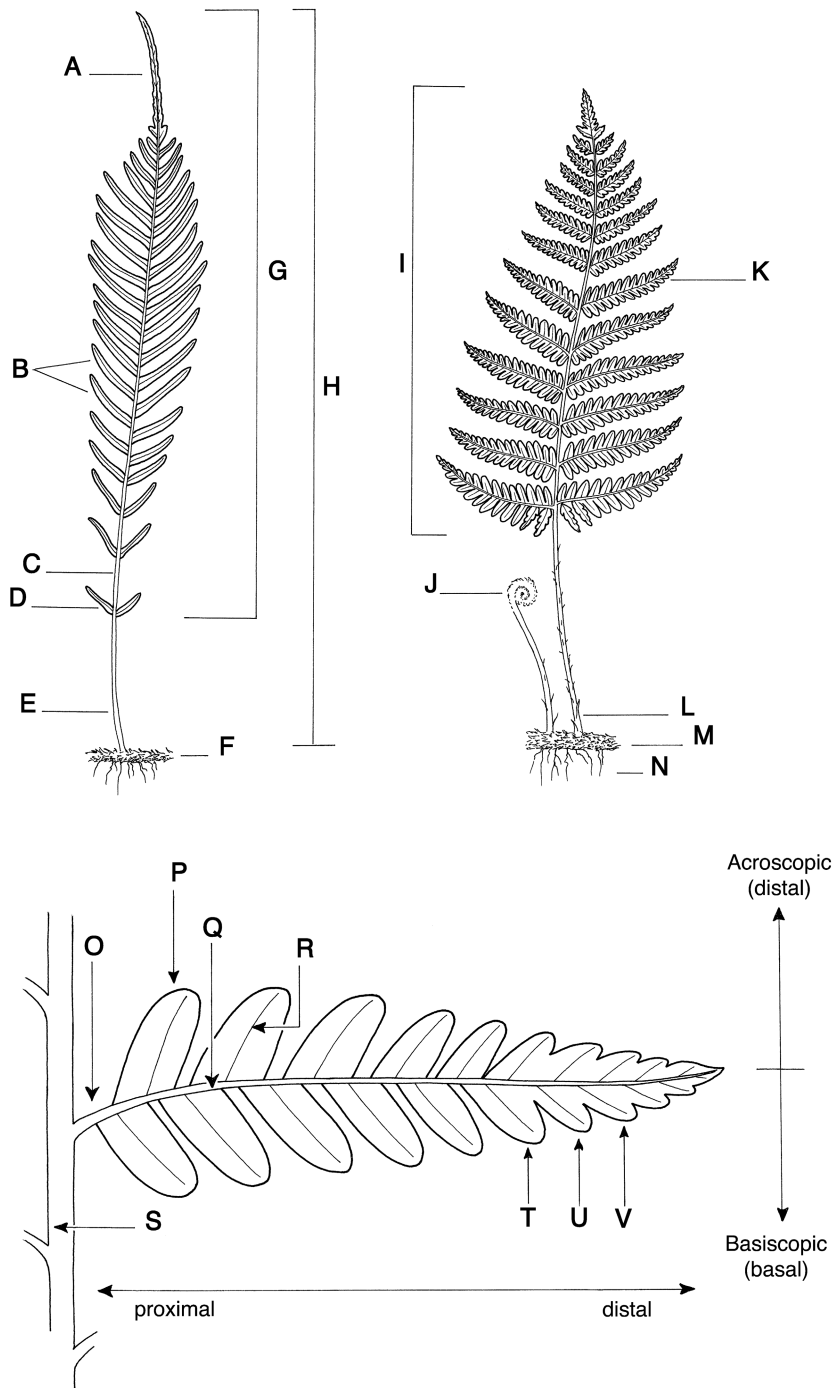


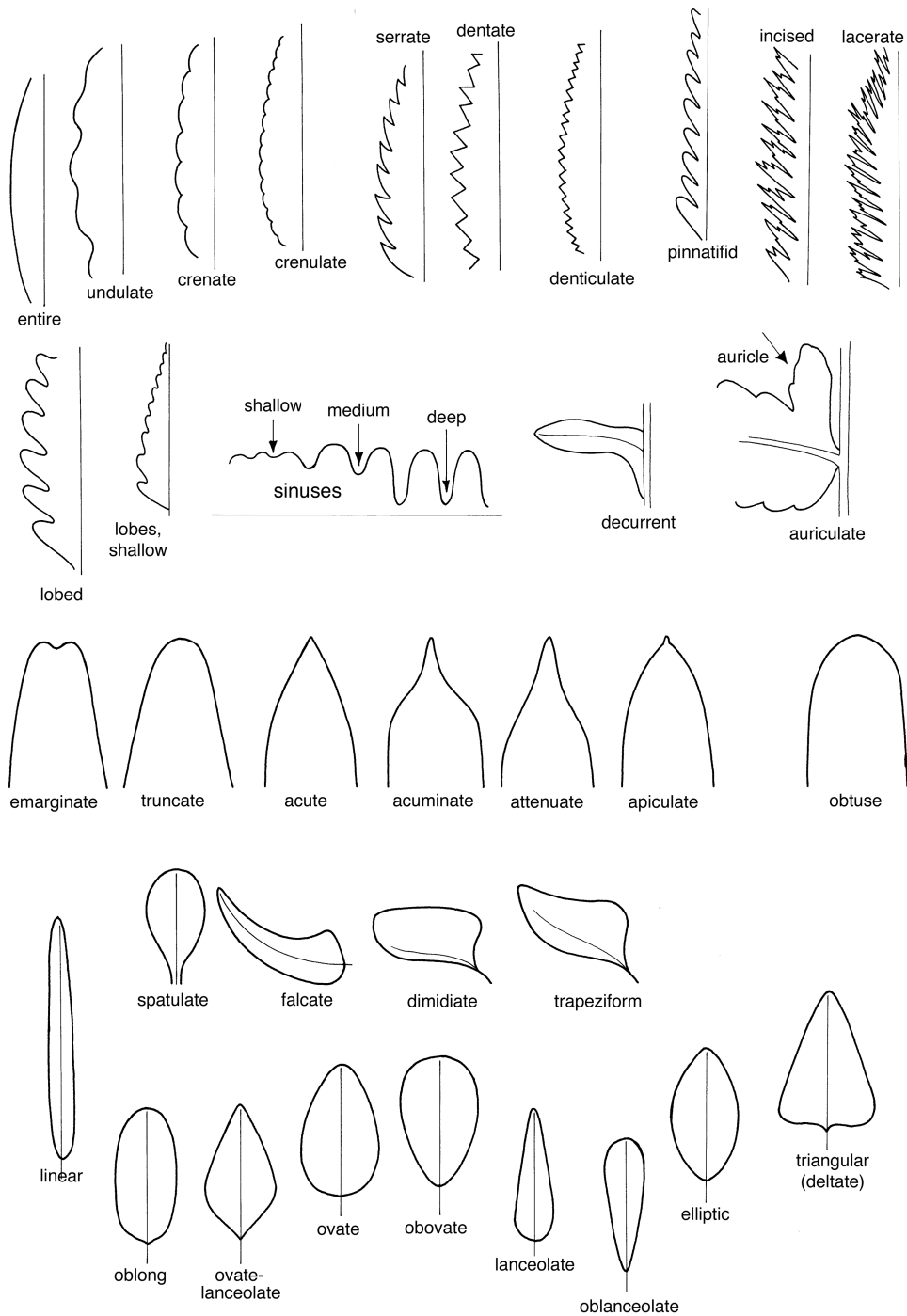
## Key to the Genera of Leptosporangiate and Eusporangiate Ferns (Polypodiopsida) as Found in Michigan

1. Plants aquatic or partially so; small and free-floating or clover-shaped and rooted in shallow water or mud (2).
1. Plants terrestrial on soil, rock, or rooted in moist or wet soil; not free-floating and not ordinarily rooted in shallow water or mud (3).
- 2(1). Plants free-floating on quiet water surfaces; fronds 2-lobed, imbricate, tiny—about 0.5–1.5 mm long; whole plant resembles a cedar branchlet; sori borne in leaf axils on undersurface of plants. . . . . *Azolla*
2. Plants growing in water or rooted in mud, sometimes becoming stranded; blades resembling a 4-leaf clover, with 4 equal pinnae at tips of stipes, each less than 2 cm long; sori borne in hardened sporocarps at bases of stipes. . . . . *Marsilea*
- 3(1). Fronds long, climbing, vinelike, and twining; pinnae palmately lobed, fertile and sterile pinnae very different (dimorphic); sporangia borne in tight clusters at tips of pinna lobes. . . . . *Lygodium*
3. Fronds of various shapes but not vinelike; fertile and sterile blades the same or different; sporangia may or may not be borne in tight cluster of pinna lobes (4).
- 4(3). Fronds simple, linear, strap-shaped, or undivided long triangular hastate; sori long-linear along veins . . . . *Asplenium* (in part) (*A. rhizophyllum*, *A. scolopendrium*)
4. Fronds various shapes from ternate to 1-pinnate to 3-pinnate; sori of various types (5).
- 5(4). Fronds fan-shaped; rachises divided into 2 equal parts curving away from each other; pinnae or pinnules trapezoidal or dimidiate (unequally sided, the basicopic side narrower and lower margin closer to midvein); sori linear under false indusia formed by leaf margins folding . . . . *Adiantum*
5. Fronds of various shapes but not fan-shaped; rachises not divided; pinnae and pinnules mostly not trapezoidal; sori various in size, shape, and location (6).
- 6(5). Sporangia borne on very different, separate erect spikes arising separately from sterile fronds arising at ground level or on very different flaccid fertile pinnae in the middle or at tips of fronds; fertile regions green in early spring, turning brown and wilting in early summer or becoming dark, hardened, and persistent over winter (7).
6. Sporangia borne in sori on undersurface of blades, pinnae, or pinnules, not on separate spikes or separate pinnae; sterile and fertile blades alike or fertile blades with narrower pinnae and pinnules; fertile and sterile blades share same seasonal variation in color and wilting (9).
- 7(6). Sterile fronds 1-pinnate-pinnatifid, fertile fronds 30–60 cm long with all pinnae shorter, narrower, and flaccid, green in early spring, soon turning brown, dying, and wilting; or sterile fronds and lower parts of fertile fronds fully 2-pinnate with several much smaller, darker fertile pinnae found at

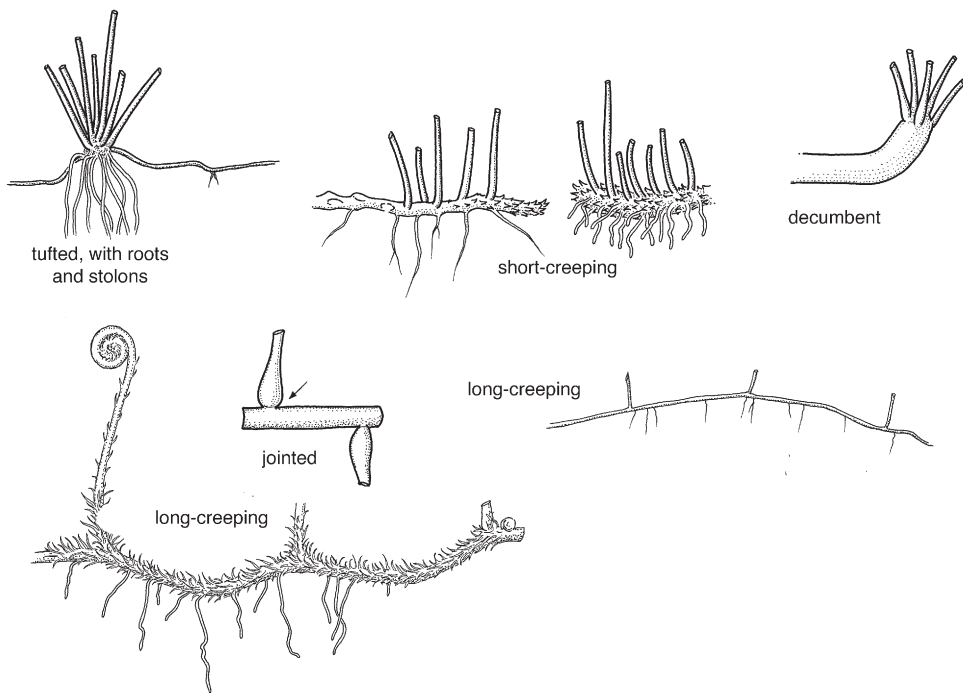
- tips of fronds; or sterile fronds and upper and lower divisions of fertile frond 1-pinnate-pinnatifid with much smaller, darker fertile pinnae between fertile parts not persisting through winter. . . . . *Osmunda*
7. Sterile blades pinnatifid to 1-pinnate-pinnatifid; sterile and fertile pinnae arising separately from ground; fertile blades shorter, hard, dark, and persisting through winter (8).
- 8(7). Sterile blades 1-pinnate-pinnatifid throughout, rachises not winged, veins free. . . . . *Matteuccia*
8. Sterile blades pinnatifid, rachises winged, the lowest pinnae sometimes free, veins netted . . . . . *Onoclea*
- 9(6). Sori linear or slightly curved along veins, or parallel to costae, or in continuous bands along margins of pinnae under a false indusium (10).
9. Sori round or nearly so, along veins from costae toward margin or near margins of pinnae or pinnules (17).
- 10(6). Sori long-linear along veins; cross section of stipe bases reveals 2 back to back, C-shaped vascular bundles uniting to form an X-shape higher up stipe; scales clathrate. . . . . *Asplenium* (in part) (*A. platyneuron*, *A. ruta-muraria*, *A. trichomanes*, *A. viride*)
10. Sori short- or long-linear along veins, pinna, or pinnule margins or along costae of pinna or pinnule midribs; cross section at stipe bases reveals 2 straplike, parallel vascular bundles; scales nonclathrate (11).
- 11(10). Sori linear or j-shaped along veins that extend from midribs toward margins (12).
11. Sori linear along margins of pinnules or along areolar veins near and parallel to midrib (14). . . . . *Asplenium*, *Athyrium*, *Cryptogramma*, *Deparia*, *Homalosorus*, *Pellaea*, *Pteridium*
- 12(11). Blades 1-pinnate; pinna margins entire; fertile fronds narrower and with much narrower pinnae. . . . . *Homalosorus* (*H. pycnocarpos*)
12. Blades 1-pinnate-pinnatifid to 2-pinnate-pinnatisect; sterile and fertile fronds the same shape or nearly so (13).
- 13(12). Grooves of pinna costae shallow, not continuous with grooves of rachises; blades 1-pinnate pinnatifid; sori linear. . . . . *Deparia* (*D. acrostichoides*)
13. Grooves of pinna costae deep, continuous with grooves of rachises; blades 1-pinnate-pinnatisect to 2-pinnate-pinnatifid; sori linear or J-shaped hooked over vein tips . . . . . *Athyrium* (*A. filix-femina*)
- 14(11). Sori short-linear in single chainlike rows on anastomosing areolar veins on each side of, and parallel to, costae, and sometimes along midribs; veins joining to form a single row of areoles near and on both sides of midribs, then free and branching to margins . . . . . *Woodwardia*
14. Sori short- to long-linear; along pinna or pinnule margins; veins free, not forming areolae near costae (15).
- 15(14). Fronds 35–180 cm long, 20–50 cm wide; well separated, growing in large colonies on long, creeping underground rhizomes; sterile and fertile fronds the same; blades broadly triangular; growing in loose soil in open areas; stipes straw-colored to green or brown. . . . . *Pteridium*
15. Sterile fronds 3–50 cm long, 2–20 cm wide; fronds clustered in small tufts



**Fronds Anatomy:** A. Frond tip (apex). B. Pinnae. C. Rachis. D. Basal pinna. E. Stipe. F. Rhizome. G. Blade. H. Frond. I. Blade. J. Crozier. K. Pinna. L. Stipe. M. Rhizome. N. Roots. O. Pinna stalk. P. Pinnule. Q. Costa. R. Costule. S. Rachis. T-V: Ultimate segments.

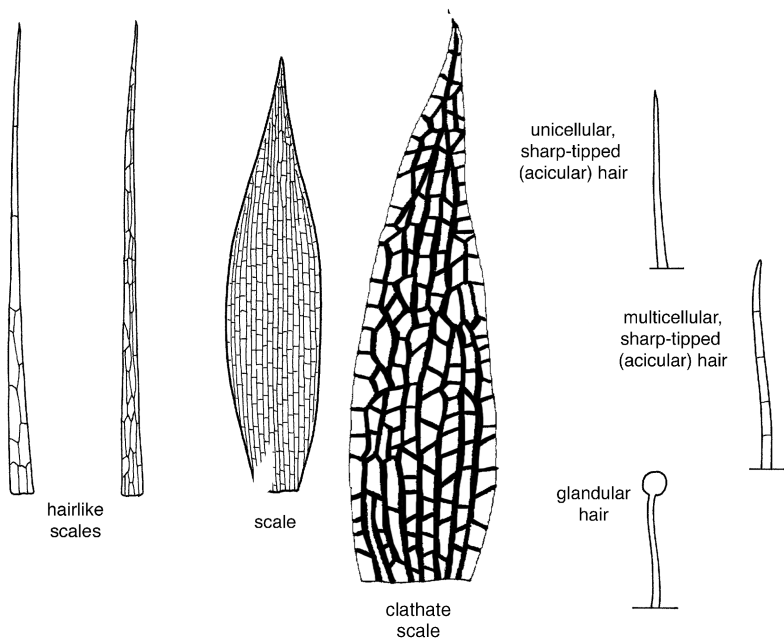


**Pinna Forms and Margins**



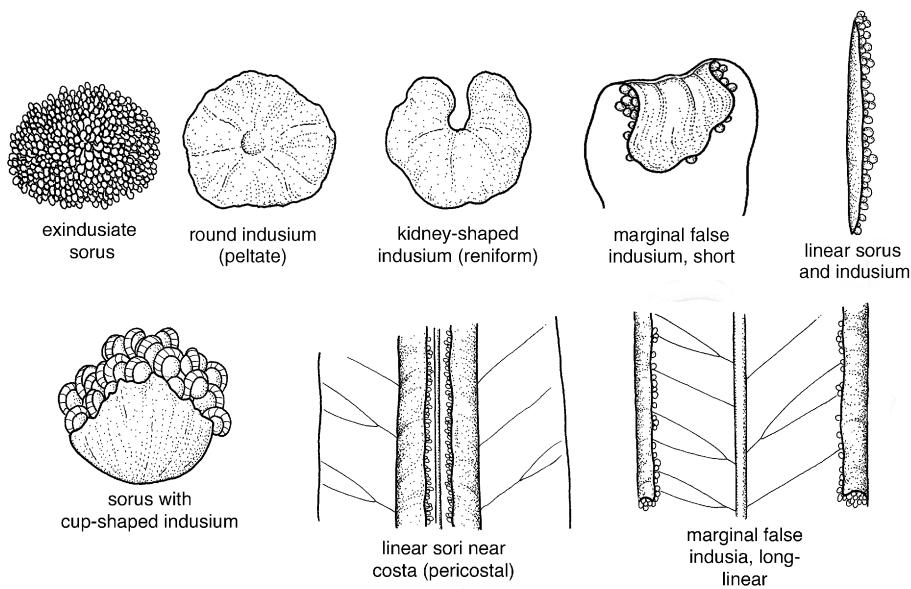
**Rhizomes**

- on short ascending to erect rhizomes; sterile blades different; usually growing on rock; stipes dark purple to black or stipes brown at base, green or straw-colored distally (16).
- 16(15). Stipes dark, shiny, brown to dark purple to black; fronds somewhat dimorphic or not; sterile and fertile pinnae linear-oblong to oblong-lanceolate . . . . . *Pellaea*
16. Stipes brown at base, green or straw-colored distally; fronds strongly dimorphic; fertile fronds obviously longer than the sterile, narrow, elongate, usually with revolute pinnules; sterile pinnules oblong- to fan-shaped, fertile pinnules narrow, elongate . . . . . *Cryptogramma*
- 17(9). Blades deeply pinnatifid; rhizome long-creeping; indusia lacking. . . . . *Polypodium*
17. Fronds 1-pinnate to 3-pinnate; rhizomes erect; short- or long-creeping; indusia present or absent (18).
- 18(17). Blades 1-pinnate, pinna margins sharply toothed with long, stiff, bristlelike projections; indusia peltate; pinnae eared at base; sterile and fertile pinnae same size or fertile pinnae near frond tips much smaller . . . . *Polystichum*
18. Blades 1-pinnate-pinnatifid to 3-pinnate-pinnatifid; pinna margins with or without fine teeth; indusia of various types; sterile and fertile fronds same size or different, fertile pinnae near frond tips not smaller (19).



**Scales and Hairs**

- 19(18). Indusia absent; fronds ternate or broadly triangular with winged rachises (20).
- 19. Indusia of various types present; fronds not ternate or broadly triangular; rachises not winged (21).
- 20(19). Fronds ternate; rachises not winged; stipes 1.5 to 3 times length of blade; costae grooved adaxially; lacking small, white, sharply pointed (acicular) hairs. . . . . *Gymnocarpium*
- 20. Fronds broadly triangular; rachises winged; stipes 1 to 1.5 length of blade; costae not grooved adaxially; small, white, sharply pointed (acicular) hairs on undersurface of pinnae and rachis . . . . . *Phegopteris*
- 21(19). Blades 1-pinnate-pinnatifid; fine, white, sharp-tipped, translucent needlelike (acicular) hairs present on rachises and costae; cross section at base of stipe shows two slightly curved, linear vascular bundles that unite upward to a U-shape. . . . . *Thelypteris*
- 21. Blades 1-pinnate to 3-pinnate-pinnatifid; acicular hairs absent; cross section at base of stipe various, not with two linear vascular bundles (22).
- 22(21). Rhizomes ascending to erect; indusia above sori, round or reniform; 1-pinnate-pinnatifid to 3-pinnate-pinnatifid; glandular or not. . . . .  
 . . . . . *Dryopteris*



**Sori and Indusia**

- 22. Rhizomes ascending to erect or long-creeping subterranean; sori with cup-like or tubular indusia or ribbonlike or filamentous hairs under indusium spreading to cover it. (23).
- 23(22). Rhizomes long-creeping below soil surface; stipes and rachises hairy, scales lacking; sori marginal at vein tips in sinuses, small (less than 0.5 mm in diam.); cup-shaped circular or slightly 2-valvate cups; fronds 30–90 long (rare, Jackson County) . . . . . *Dennstaedtia*
- 23. Rhizomes decumbent to erect; sori larger than 0.5 mm; stipes and rachises scaly, with or without hairs; sori not marginal; indusia cup-shaped, attached at base, looking outward or composed of many narrow to hairlike segments attached beneath and encircling sori; fronds shorter than 50 cm long (24).
- 24(23). Indusia hoodlike (soon shriveling and absent), opening outward, attached at bases and partially overlapping sori; old stipe bases not persistent or sparsely persistent on rhizomes; fronds up to 50 cm long (*Cystopteris bulbifera* often longer) . . . . . *Cystopteris*
- 24. Indusia composed of many narrow to hairlike segments attached beneath and encircling sori; old stipe bases persist on rhizome; fronds up to 25 cm long (*Woodsia obtusa* sometimes longer) . . . . . *Woodsia*

## *Adiantum* Linnaeus Pteridaceae

### Maidenhair Ferns

See Pteridaceae in appendix I for a description of the family and a key to the Michigan genera.

**Etymology.** Greek *adiantos*, unwetted; an ancient name alluding to the water-repellent fronds. Maidenhair, a name used for obscure reasons, is applied to ferns with delicate fronds and slender black stipes (see also *Asplenium trichomanes*).

**Plants.** Monomorphic; deciduous; fronds in loose clusters in clones.

**Rhizomes.** Creeping.

**Fronds.** Stipes erect with blade horizontal to ground.

**Stipes.** Round, usually brown to purple or black, shiny, mostly glabrous except at very base, sometimes sparsely hairy or with fibrils.

**Blades.** 2-pinnate to 3-pinnate.

**Pinnae.** Elongate, tips obtuse.

**Pinnules.** Rhomboidal, trapezoidal, fan-shaped, or dimidiate, sessile to short-stalked, never adnate.

**Veins.** Free, repeatedly branching dichotomously.

**Sori.** Less than 4 mm long, short-linear, marginal along several vein tips.

**Indusial flaps.** Consisting of reflexed margins of pinnae, rectangular or U-shaped.

**Sporangia.** Distinctively borne on undersurface of the false indusia.

Chromosome #:  $x = 29, 30$

*Adiantum* is a genus of about 200 species widely distributed in tropical and temperate areas, mostly at low- to mid-elevations and in wet forests. Nine species are treated in the *Flora of North America North of Mexico*, vol. 2 (1993). One species is found in Michigan.

#### *Adiantum pedatum* Linnaeus

Maidenhair Fern, Northern Maidenhair Fern

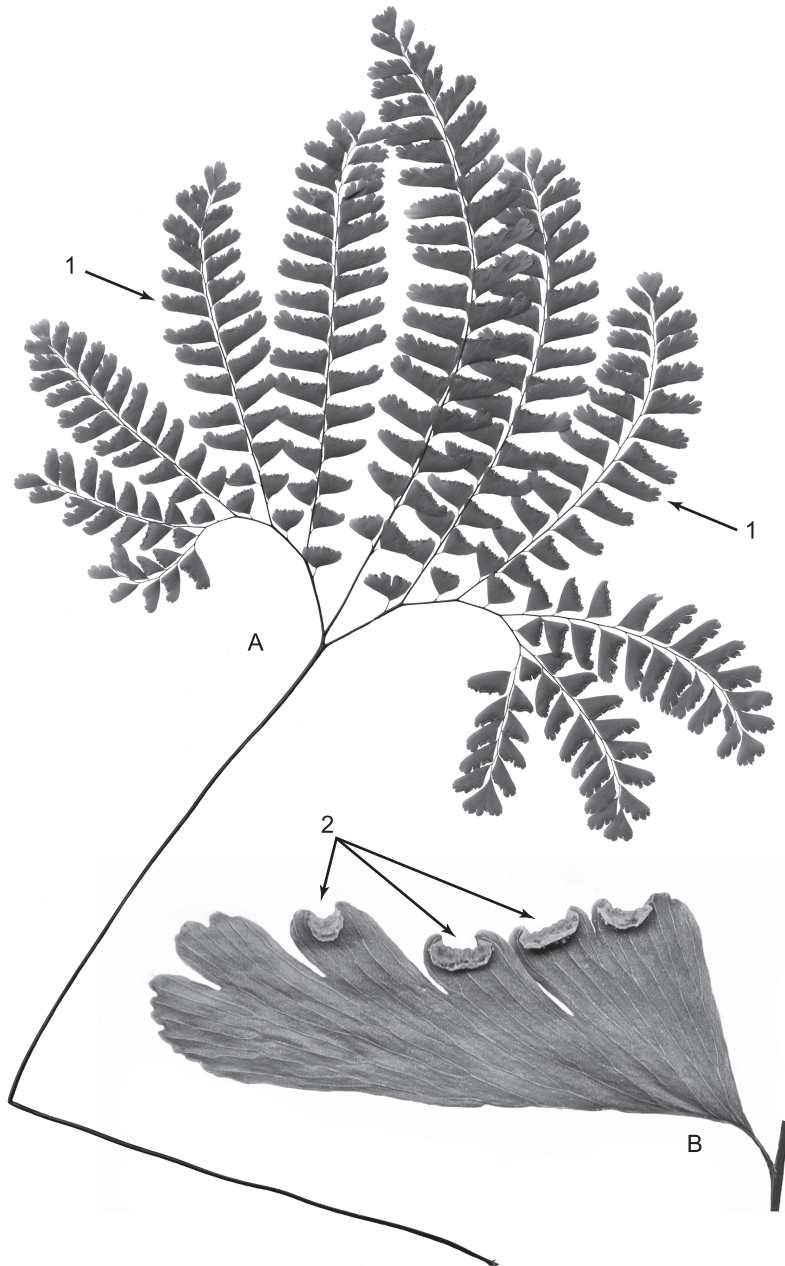
**Etymology.** Latin, *pedatum*, footlike; the frond outline resembles a bird's foot. Linnaeus used this term to describe the fronds of this fern.

**Plants.** Monomorphic, deciduous.

**Rhizomes.** Short-creeping, thick, often with attached old stipe bases; scales yellowish, margins entire.







*Adiantum pedatum*: Maidenhair fern: A. Frond. B. Pinna detail showing veins and marginal linear sori.

Informative arrows: 1. Dimidiate pinnules. 2. Marginal linear sori.

**Stipes.** 1–2 mm diam., erect, round, glabrous, dark brown or purplish-brown to black; stipe tips fork to form 2 rachises spreading in a Y-fashion.

**FronDs.** 35–75 cm long, delicate; crosiers reddish-brown when young.

**Blades.** 15–30 × 20–40 cm, 2-pinnate to 3-pinnate, semicircular, fan-shaped; formed by rachises dividing into 2 branches with several pinnae forming on the outer edge of the branches; horizontal to ground to slightly drooping.

**Pinnae.** 5–20 cm long, elongate, tips obtuse, longest pinnae closest to stipes.

**Pinnules.** 8–21 pinnule pairs, 3 times as long as wide, smaller pinnules

triangular, alternate, dimidiate, lower margin straight, acroscopic margins lobed, lobes separated by a narrow sinuses 1–2 (–3) mm deep.

**Veins.** Free, forked repeatedly.

**Sori.** 1–3 mm long, linear to slightly curved, marginal on tips of lobes, covered with elongate, green to gray, reflexed, marginal false indusia.

**Habitat.** Grows in a variety of soils, best in rich, mature, deciduous shady woods in moist, alkaline, and humus-covered soils.

**Distribution.** Eastern Canada. USA: Northeastern states extending south to northern Georgia and Oklahoma. The distribution is essentially that of the deciduous forests of eastern North America.

Some authors divide this species in North America into 3 to 4 subspecies. *Adiantum pedatum* and *A. aleuticum* (which does not occur in Michigan) are here recognized as 2 closely related species in North America.

*Adiantum pedatum* is a graceful fern with distinct fronds that is unique within the Michigan flora and easily recognized. Its silhouette alone is diagnostic. Its horizontal or drooping fan-shaped blades are borne on narrow, dark stipes and are divided into 2 equally branched rachises. Its forked rachises radiate pinna on one side only. Its pinnules are on narrow stalks, and the linear sori on their outer edges are attached to the undersurface of an in-rolled margin, forming a false indusium.

## ASPLENIUM Linnaeus      Aspleniaceae

### Spleenworts

Aspleniaceae, as recognized here, is comprised of a single, huge, extremely diverse genus, *Asplenium*. *Asplenium* contains about 700 species worldwide, mostly in the tropics. The family and generic treatments are identical and found below.

**Etymology.** Greek, *a*, not, + *splen*. In ancient Greece, the plants were believed to cure spleen diseases. The vernacular name derives from the Greek: spleenworts.

**Plants.** Small to medium-sized, terrestrial or epipetric.

**FronDs.** Monomorphic, small to medium-sized; clustered to remote.