18. TRICHÓMANES, L. Filmy Fern.

Sporangia with a transverse entire ring, sessile on a cylindrical receptacle which is produced from the end of a vein and enclosed in a funnel-form or cup-shaped involucre of the same substance with the frond. Fronds very thin and pellucid, often consisting of a single layer of cells. (An ancient Greek name for some fern.)

1. **T. radicans,** Swartz. Fronds very delicate, oblong-lanceolate in outline (4–8′ long, 6–18″ wide), bipinnatifid; rhachis narrowly winged; pinnæ triangular-ovate, the divisions toothed or again lobed; involucres tubular-funnel-shaped, margined, the mouth truncate; receptacle often much exserted. — On moist and dripping sandstone cliffs, Ky., and southward; rare. — Though the fronds are so very delicate, yet they survive for several years; they begin to fruit the second or third year, and thereafter the receptacle continues to grow and to produce new sporangia at its base. (Eu.)

19. SCHIZÆA, Smith. (Pl. 20.)

Sporangia large, ovoid, striate-rayed at the apex, opening by a longitudinal cleft, naked, vertically sessile in a double row along the single vein of the narrow divisions of the pinnate (or radiate) fertile appendages to the slender and simply linear, or (in foreign species) fan-shaped or dichotomously many-cleft fronds (whence the name, from *σχίζω, to split*).

1. **S. pusilla,** Pursh. Sterile fronds linear, very slender, flattened and tortuous; the fertile ones equally slender (½″ wide), but taller (3–4′ high), and bearing at the top the fertile appendage, consisting of about 5 pairs of crowded pinnæ (each 1–1½″ long). — Low grounds, pine barrens of N. J.; very local. Sept. (Also in Nova Scotia and Newf.)

20. LYGÒDIUM, Swartz. Climbing Fern. (Pl. 20.)

Fronds twining or climbing, bearing stalked and variously lobed (or compound) divisions in pairs, with mostly free veins; the fructification on separate contracted divisions or spike-like lobes, one side of which is covered with a double row of imbricated hooded scale-like indusia, fixed by a broad base to short oblique veinlets. Sporangia much as in Schizæa, but oblique, fixed to the veinlet by the inner side next the base, one or rarely two covered by each indusium. (Name from *λυγώδης, flexible.*)

1. **L. palmàtum,** Swartz. Very smooth; stalks slender, flexile and twining (1–3° long), from slender running rootstocks; the short alternate branches or petioles 2-forked; each fork bearing a round-heart-shaped palmately 4–7-lobed frondlet; fertile frondlets above, contracted and several times forked, forming a terminal panicle. — Low moist thickets and open woods, Mass. to Va., Ky., and sparingly southward; rare. Sept.

21. OSMÚNDA, L. Flowering Fern. (Pl. 20.)

Fertile fronds or fertile portions of the frond destitute of chlorophyll, very much contracted, and bearing on the margins of the narrow rhachis-like divisions short-pedicelled and naked sporangia; these are globular, thin and reticulated, large, opening by a longitudinal cleft into two valves, and bearing near the apex a small patch of thickened oblong cells, the rudiment of a transverse ring. — Fronds tall and upright, growing in large crowns from thickened rootstocks, once or twice pinnate; veins forking and free. Spores green. (*Osmunder*, a Saxon name of the Celtic divinity, Thor.)

* *Sterile fronds truly bipinnate.*

1. **O. regàlis,** L. (Flowering Fern.) Very smooth, pale green (2–5° high); sterile pinnules 13–25, varying from oblong-oval to lance-oblong, finely serrulate, especially toward the apex, otherwise entire, or crenately lobed toward the rounded, oblique and truncate, or even cordate and semi-auriculate base, sessile or short-stalked (1–2′ long); the fertile racemose-panicled at the summit of the frond. — Swamps and wet woods; common. The cordate pinnules sometimes found here are commoner in Europe. May, June. (Eu.)

* * *Sterile fronds once pinnate; pinnæ deeply pinnatifid; the lobes entire.*

2. **O. Claytoniàna,** L. (Pl. 20, fig. 1–3.) Clothed with loose wool when young, soon smooth; *fertile fronds taller than the sterile* (2–4° high); pinnæ oblong-lanceolate, with oblong obtuse divisions; *some* (2–5 *pairs*) *of the middle pinnæ fertile*, these entirely pinnate; sporangia greenish, turning brown. — Low grounds, common. May. — Fruiting as it unfolds.

3. **O. cinnamòmea,** L. (Cinnamon Fern.) Clothed with rusty wool when young; *sterile fronds tallest* (at length 3–5° high), smooth when full grown, the lanceolate pinnæ pinnatifid into broadly oblong obtuse divisions; *fertile fronds separate*, appearing earlier from the same rootstock and soon withering (1–2° high), contracted, twice pinnate, covered with the cinnamon-colored sporangia. — Var. frondòsa is a rare occasional state, in which some of the fronds are sterile below and more sparsely fertile at their summit, or rarely in the middle. — Swamps and low copses, everywhere. May.

Order 132. OPHIOGLOSSÀCEÆ. (Adder's-Tongue Family.)

Leafy and often somewhat fleshy plants; the leaves (*fronds*) simple or branched, often fern-like in appearance, erect in vernation, developed from underground buds formed either inside the base of the old stalk or by the side of it, and bearing in special spikes or panicles rather large subcoriaceous bivalvular sporangia formed from the main tissue of the fruiting branches. Prothallus underground, not green, monœcious. — A small order, separated from Ferns on account of the different nature of the sporangia, the erect vernation, etc.

1. **Botrychium.** Sporangia in pinnate or compound spikes, distinct. Veins free.
2. **Ophioglossum.** Sporangia cohering in a simple spike. Veins reticulated.

1. BOTRÝCHIUM, Swartz. Moonwort. (Pl. 20.)

Rootstock very short, erect, with clustered fleshy roots (which are full of starch, in very minute, irregular granules!); the base of the naked stalk containing the bud for the next year's frond; frond with an anterior fertile and a posterior sterile segment; the former mostly 1–3-pinnate, the contracted divisions bearing a double row of sessile naked sporangia; these are distinct, rather coriaceous, not reticulated, globular, without a ring, and open trans-

versely into two valves. Sterile segment of the frond ternately or pinnately divided or compound; veins all free. Spores copious, sulphur-color. (Name a diminutive of *βότρυς, a cluster of grapes*, from the appearance of the fructification.)

§ 1. BOTRYCHIUM proper. *Base of the stalk containing the bud completely closed; sterile segment more or less fleshy; the cells of the epidermis straight.*

* *Sterile portion of the frond sessile or nearly so at or above the middle of the plant. Plants small.*

1. **B. Lunària,** Swartz. *Sterile segment* nearly sessile, borne near the middle of the plant, *oblong, simply pinnate with* 5–15 *lunate or fan-shaped* very obtuse crenate, incised or nearly entire, *fleshy divisions*, more or less excised at the base on the lower or on both sides, the veins radiating from the base and repeatedly forking; fertile segment panicled, 2–3-pinnate. — N. Eng. to Lake Superior, and northward; rare. — Very fleshy, 4–10′ high. (Eu.)

2. **B. simplex,** Hitchcock. Fronds small (2–4′, rarely 5–6′ high), *the sterile segment short-petioled from near the middle of the plant, thickish* and fleshy, simple and roundish, or *pinnately* 3–7-*lobed;* the lobes roundish-obovate, nearly entire, decurrent on the broad and flat indeterminate rhachis; *the veins all forking from the base;* fertile segment simple or 1–2-pinnate. — Maine to N. Y., Minn., and northward; rare. (Eu.)

3. **B. lanceolàtum,** Angstroem. Fronds small (3–10′ high); *the sterile segment closely sessile at the top of the* long and slender common *stalk*, scarcely fleshy, *triangular, ternately twice pinnatifid; the acute lobes* lanceolate, incised or toothed; veinlets forking from a *continuous midvein;* fertile part 2–3-pinnate. — N. Eng. and N. J. to Ohio and Lake Superior. July–Aug. (Eu.)

4. **B. matricariæfòlium,** Braun. Fronds small (3–10′ high); *the sterile segment nearly sessile at the top of the* long and slender *common stalk*, moderately fleshy, *ovate or triangular*, varying from pinnate to bipinnatifid; *the lobes oblong-ovate and obtuse; midvein dissipated* into forking veinlets; fertile part 2–3-pinnate. — Same range as the last. June, July. (Eu.)

** *Sterile portion of the frond long-stalked; the common stalk short in proportion to the size of the plant. Plants usually larger.*

5. **B. ternàtum,** Swartz. (Pl. 20.) *Plant very fleshy* (4–16′ high), sparsely hairy; *sterile segment long-petioled* from near the base of the plant, broadly triangular, *ternate and variously decompound with stalked divisions;* ultimate segments varying from roundish-reniform and sub-entire to ovate-lanceolate and doubly incised; fertile segment erect, 2–4-pinnate. — The following varieties pass into each other: — Var. AUSTRÀLE; frond ample; ultimate segments rhomboid-ovate with a denticulate margin. — Var. INTERMÈDIUM; frond of moderate size; ultimate segments as in var. australe. (B. lunarioides, of last ed.) — Var. RUTÆFÒLIUM; frond small; ultimate segments few, ovate and semicordate. — Var. LUNARIOÌDES; frond small; ultimate segments roundish-reniform. — Var. OBLÌQUUM; frond moderate; ultimate segments obliquely lanceolate, denticulate or toothed. — Var. DISSÉCTUM; segments dissected into innumerable narrow lobes or teeth. — Pastures and hillsides, sometimes in dry woods, rather common, especially vars. intermedium and obliquum. — Var. rutæfolium occurs in Europe.

§ 2. OSMUNDÓPTERIS. *Base of the stalk containing the bud open along one side; sterile segment membranaceous; the cells of the epidermis flexuous.*

6. **B. Virginiànum,** Swartz. *Fronds tall and ample; sterile segment sessile above the middle of the plant,* broadly triangular, thin and membranaceous, *ternate;* the short-stalked *primary divisions once or twice pinnate,* and then once or twice pinnatifid; the oblong lobes cut-toothed toward the apex; *veins forking from a midvein;* fertile part 2–3-pinnate. — Rich woods; common. — Plant 1–2° high, or often reduced to a few inches, in which case it is B. gracile, *Pursh.* June, July. (Eu.)

2. OPHIOGLÓSSUM, L. ADDER'S-TONGUE. (Pl. 20.)

Rootstock erect, fleshy and sometimes tuberous, with slender fleshy roots which are sometimes proliferous; bud placed by the side of the base of the stalk; fronds with anterior and posterior segments as in Botrychium, but the coriaceous sporangia connate and coherent in two ranks on the edges of a simple spike. Sterile segment fleshy, simple in our species; the veins reticulated. Spores copious, sulphur-yellow. (Name from *ὄφις, a serpent,* and *γλῶσσα, tongue.*)

1. **O. vulgàtum,** L. Fronds from a slender rootstock (2–12′ high), mostly solitary; sterile segment sessile near the middle of the plant, ovate or elliptical (1–3′ long); midvein indistinct or none; veins forming small meshes enclosed in larger ones. — Bogs and pastures; not common. July. (Eu.)

ORDER 133. LYCOPODIÀCEÆ. (CLUB-MOSS FAMILY.)

Low plants, usually of moss-like aspect, with elongated and often much branched stems covered with small lanceolate or subulate, rarely oblong or rounded, persistent entire leaves; the sporangia 1–3-celled, solitary in the axils of the leaves, or on their upper surface, when ripe opening into two or three valves, and shedding the numerous yellow spores, which are all of one kind. — The Order, as here defined, consists mainly of the large genus

1. LYCOPÒDIUM, L. CLUB-MOSS. (Pl. 21.)

Spore-cases coriaceous, flattened, usually kidney-shaped, 1-celled, 2-valved, mostly by a transverse line round the margin, discharging the subtile spores in the form of a copious sulphur-colored inflammable powder. — Perennials, with evergreen one-nerved leaves, imbricated or crowded in 4–16 ranks. (Name compounded of *λύκος, a wolf,* and *πούς, foot,* from no obvious resemblance.)

§ 1. *Spore-cases in the axils of the ordinary (dark green and shining, rigid, lanceolate, about* 8-*ranked) leaves.*

1. **L. Selàgo,** L. Stems erect and rigid, dichotomous, forming a level-topped cluster (3–6′ high); *leaves uniform,* crowded, ascending, glossy, pointed, entire or denticulate; sporangia in the axils of unaltered leaves. — Mountain-tops, Maine to Lake Superior, and northward. — The leaves of this and the next species often bear little gemmæ, with the lower bracts pointed, and the 2–3 uppermost broadly obovate and fleshy, as figured in 1768 by Dillenius. These gemmæ fall to the ground and their axis grows into the stem of a new plant,

as specimens collected in 1854 show very plainly. (For their true nature see Sachs' Lehrbuch, Engl. trans., p. 411.)

2. **L. lucídulum,** Michx. Stems assurgent, less rigid, dichotomous (6–12′ long); leaves pointed, toothed, at first spreading, then deflexed, arranged in alternate zones of shorter and longer leaves, the shorter leaves more frequently bearing sporangia in their axils; proliferous gemmæ usually abundant. — Cold, damp woods; common northward. Aug.

§ 2. *Spore-cases only in the axils of the upper (bracteal) leaves, thus forming a spike.*

* *Leaves of the creeping sterile and of the upright fertile stems or branches and those of the simple spike nearly alike, many-ranked.*

3. **L. inundàtum,** L. *Dwarf;* creeping sterile stems forking, flaccid; the fertile solitary (1–4′ high), bearing a short thick spike; *leaves lanceolate or lance-awl-shaped, acute,* soft, spreading, *mostly entire,* those of the prostrate stems curving upward. — Var. BIGELÒVII, Tuckerm., has fertile stems 5–7′ high, its leaves more awl-shaped and pointed, sparser and more upright, often somewhat teeth-bearing. — Sandy bogs, northward, not common; the var., eastern New Eng. to N. J., and southward. Aug. (Eu.)

4. **L. alopecuroides,** L. *Stems stout,* very densely leafy throughout; the sterile branches recurved-procumbent and creeping; the fertile of the same thickness, 6–20′ high; *leaves narrowly linear-awl-shaped, spinulose-pointed, spreading, conspicuously bristle-toothed below the middle; those of the cylindrical spike with long setaceous tips.* — Pine-barren swamps, N. J. to Va., and southward. Aug., Sept. — Stems, including the dense leaves, ½′ thick; the comose spike, with its longer spreading leaves, ¾–1′ thick.

* * *Leaves (bracts) of the catkin-like spike scale-like, imbricated, yellowish, ovate or heart-shaped, very different from those of the sterile stems and branches.*

+– *Spikes sessile (i. e. branches equally leafy to the top), single.*

5. **L. annótinum,** L. Much branched; *stems prostrate and creeping* (1–4° long); *the ascending branches similar* (5–8′ high), sparingly forked, the sterile ones making yearly growths from the summit; *leaves equal, spreading,* in about 5 ranks, rigid, lanceolate, pointed, minutely serrulate (pale green); spike solitary, oblong-cylindrical, thick. — Var. PÚNGENS, Spring, is a reduced sub-alpine or mountain form, with shorter and more rigid-pointed erectish leaves. — Woods; common northward; the var. on the White Mountains, with intermediate forms around the base. July. (Eu.)

6. **L. obscùrum,** L. Rootstock cord-like, subterranean, bearing scattered, erect, tree-like stems dividing at the summit into several densely dichotomous spreading branches; leaves linear-lanceolate, decurrent, entire, acute, 6-ranked, those of the two upper and two lower ranks smaller and appressed, the lateral ones incurved-spreading; spikes 1–10, erect, mostly sessile; bracts scarious-margined, broadly ovate, abruptly apiculate. — Var. DENDROÍDEUM (L. dendroideum, *Michx.*) has all the leaves alike and incurved spreading. — Moist woods. Aug. — Remarkable for its tree-like appearance.

L. ALPÌNUM, L., or its var. SABINÆFÒLIUM, occurs from Labrador to Washington, and is to be expected in northern Maine and Minn. It has slender branches with rigid nearly appressed leaves.

+– +– *Spikes peduncled, i. e. the leaves minute on the fertile branches.*

++ *Leaves homogeneous and equal, many-ranked; stems terete.*

7. **L. clavàtum,** L. (COMMON CLUB-MOSS.) Stems creeping extensively, with similar ascending short and very leafy branches; the fertile terminated by a slender peduncle (4–6′ long), bearing about 2–3 (rarely 1 or 4) linear-cylindrical spikes; leaves linear-awl-shaped, incurved-spreading (light green), tipped, as also the bracts, with a fine bristle. — Dry woods; common, especially northward. July. (Eu.)

++ ++ *Leaves of two forms, few-ranked; stems or branches flattened.*

8. **L. Caroliniànum,** L. (Pl. 21.) Sterile stems and their few short branches *entirely creeping* (leafless and rooting on the under side), thickly clothed with broadly lanceolate acute and somewhat oblique 1-nerved *lateral leaves widely spreading in* 2 *ranks,* and a shorter intermediate row appressed on the upper side; also sending up a slender simple peduncle (2–4′ high, clothed merely with small bract-like and appressed awl-shaped leaves), *bearing a single cylindrical spike.* — Wet pine-barrens, N. J. to Va., and southward.

9. **L. complanàtum,** L. (GROUND-PINE.) Stems extensively creeping (often subterranean), the erect or *ascending branches several times forked above;* bushy *branchlets crowded, flattened,* fan-like and spreading, *all clothed with minute imbricated-appressed awl-shaped leaves in* 4 *ranks,* with decurrent-united bases, the lateral rows with somewhat spreading tooth-like tips, those of the upper and under rows smaller, narrower, wholly appressed; peduncle slender, *bearing* 2–4 *cylindrical spikes.* — Var. CHAMÆCYPARÍSSUS has narrower, more erect and bushy branches, and the leaves less distinctly dimorphous. — Woods and thickets; common, especially northward. (Eu.)

ORDER 134. SELAGINELLÀCEÆ.

Leafy plants, terrestrial or rooted in mud, never very large; the stems branching or short and corm-like; the leaves small and 4–6-rowed, or subulate and elongated; sporangia one-celled, solitary, axillary or borne on the upper surface of the leaf at its base and enwrapped in its margins, some containing large spores (*macrospores*) and others small spores (*microspores*). The macrospores are in the shape of a low triangular pyramid with a hemispherical base, and marked with elevated ribs along the angles. In germination they develop a minute prothallus which bears archegonia to be fertilized by antherozoids developed from the microspores.

1. **Selaginella.** Terrestrial; stems slender; leaves small; sporangia minute and axillary.
2. **Isoetes.** Aquatic or growing in mud; stems corm-like; leaves elongated and rush-like; sporangia very large, enwrapped by the dilated bases of the leaves.

1. SELAGINÉLLA, Beauv. (Pl. 21.)

Fructification of two kinds, namely, of minute and oblong or globular spore-cases, containing reddish or orange-colored powdery microspores; and of mostly 2-valved tumid larger ones, filled by 3 or 4 (rarely 1–6) much larger globose-angular macrospores; the former usually in the upper and the latter in the lower axils of the leafy 4-ranked sessile spike, but sometimes the two kinds

are on opposite sides all along the spike. (Name a diminutive of *Selago*, an ancient name of a Lycopodium, from which this genus is separated, and which the plants greatly resemble in habit and foliage.)

* *Leaves all alike and uniformly imbricated; those of the spike similar.*

1. **S. spinòsa,** Beauv. *Sterile stems prostrate* or creeping, small and slender; *the fertile thicker, ascending, simple* (1–3′ high); *leaves lanceolate, acute, spreading, sparsely spinulose-ciliate.* (S. selaginoides, *Link.*) — Wet places, N. H. (*Pursh*), Mich., Lake Superior, Colorado, and northward; rare. — Leaves larger on the fertile stems, yellowish-green. (Eu.)

2. **S. rupéstris,** Spring. (Pl. 21, fig. 1–4.) *Much branched in close tufts* (1–3′ high); *leaves densely appressed-imbricated, linear-lanceolate,* convex and with a grooved keel, *minutely ciliate, bristle-tipped;* those of the strongly quadrangular spike rather broader. — Dry and exposed rocks; very common. — Grayish-green in aspect, resembling a rigid Moss. Very variable farther west and south. (Eu.)

* * *Leaves shorter above and below, stipule-like; the lateral larger, 2-ranked*

3. **S. àpus,** Spring. Stems tufted and prostrate, creeping, much branched, flaccid; leaves pellucid-membranaceous, the larger spreading horizontally, ovate, oblique, mostly obtuse, the smaller appressed, taper-pointed; those of the short spikes nearly similar; larger spore-cases copious at the lower part of the spike. — Low, shady places; not rare, especially southward. — A delicate little plant, resembling a Moss or Jungermannia.

2. ISÒETES, L. Quillwort. (Pl. 21.)

Stem or trunk a fleshy more or less depressed corm, rooting just above its 2-lobed (or in many foreign species 3-lobed) base, above covered with the dilated and imbricated bases of the awl-shaped or linear somewhat quadrangular leaves, which include four air-tubes, intercepted by cross partitions. Sporangia pretty large, orbicular or ovoid, plano-convex, very thin, sessile in the axils of the leaves, and united at the back with their excavated bases (the thin edges of the excavation folding round partly cover them, forming the *velum*), traversed internally by transverse threads; those of the outer leaves filled with large spherical macrospores, their whitish crustaceous integument marked by one circular, and on the upper surface by three radiating elevated lines (circumscribing a lower hemisphere, and three upper segments which open valve-like in germination); those of the inner leaves filled with very minute and powdery grayish microspores; these are always obliquely oblong and triangular. — Mostly small aquatics, grass-like or rush-like in aspect, some always submerged, others amphibious, a few living in merely moist soil, maturing their fruit in late summer and early autumn, except n. 7 and some forms of n. 6.

This genus is left essentially as it was elaborated for the 5th edition by the late Dr. George Engelmann. The present editor has added to the range of a few species, and given var. robusta of n. 3.

* *Growing under water, only accidentally or in very dry seasons out of water; leaves without stomata (except in forms of* n. 3) *and peripherical bast-bundles.*

1. **I. lacústris,** L. (Pl. 21, fig. 1–5.) Leaves (10–25 in number, 2–6′ long) dark green, rigid; sporangium ovoid or circular, the upper third, or less, covered by the velum, the free part pale and unspotted; both kinds of spores the largest of our species; macrospores (0.32–0.38″ wide) covered with short and twisted crested ridges, which often anastomose; microspores (0.017–0.020″ long) smooth. — Mountain lakes, Penn., N. Y., and New Eng. to Lake Superior, and northward, often with n. 3. (Eu.)

2. **I. Tuckermàni,** Braun. Leaves (10–30, 2–3′ long) very slender, awl-shaped, olive-green, the outer recurved; sporangium ovoid or circular, the upper third covered by the velum, the free part sometimes brownish-spotted; macrospores (0.22–0.28″ wide) on the upper segments covered with parallel and anastomosing ridges, the lower half reticulated; microspores (0.013–0.015″ long) smooth or very delicately papillose. — Mystic and other ponds near Boston, together with the next (*Tuckerman, W. Boott*).

3. **I. echinóspora,** Durieu. Leaves slender, awl-shaped; sporangium ovoid or circular; macrospores (0.20–0.25″ wide) beset all over with small entire and obtuse or slightly forked spinules. (Eu.) — In this European form, the leaves are very slenderly attenuated (3–4′ long), the upper margin of the sporangium only is covered with the narrow velum, the free part is unspotted, and the slightly papillose microspores are larger (0.015–0.016″ long).

Var. **Braùnii,** Engelm. Leaves (15–30 in number, 3–6′ long) dark and often olive-green, straight or commonly recurved, half or two thirds of the sporangium covered by the velum, the free part often with light brown spots; macrospores as in the type; microspores smaller (0.013–0.014″ long), smooth. (I. Braunii, *Durieu.*) — Ponds and lakes, New Eng. to N. Y., Penn., Mich., and northward, often with the two preceding. — Frequently with a few stomata, especially in Niagara specimens.

Var. **robústa,** Engelm. Stouter; leaves (25–70, 5–8′ long) with abundant stomata all over their surface; velum covering about one half of the large spotted sporangium; macrospores 0.18–0.27″ wide. — Lake Champlain, north end of Isle La Motte (*Pringle*).

Var. **muricàta,** Engelm. Leaves (15–30, 6–10′ long) straight or flaccid, bright green; about one half of the almost circular sporangium covered by the velum, unspotted; macrospores (0.22–0.27″ wide) with shorter and blunter spinules; microspores as in the last variety, or rarely spinulose. (I. muricata, *Durieu.*) — In some ponds north of Boston (*W. Boott*).

Var. **Boóttii,** Engelm. Leaves (12–20, 4–5′ high) awl-shaped, stiffly erect, bright green, with stomata; sporangium as in the last; macrospores as in the type, but a little smaller and with very slender spinules. (I. Boottii, *Braun,* in litt.) — Pond in Woburn, near Boston, partly out of water (*W. Boott*).

* * *Growing partly out of water, either by the pond drying up or by the receding of the ebb tide; leaves with stomata, and in* n. 6 *and* 7 *with four or more peripherical bast-bundles.*

4. **I. saccharàta,** Engelm. Leaves (10–15, 2–3′ long) slender, olive-green, curved; sporangium small, ovoid, only the upper edge covered by the velum, nearly unspotted; macrospores (0.20–0.22″ wide) minutely tuberculate; microspores (0.012″ long) papillose. — On Wicomico and Nanticoke Rivers, eastern shore of Maryland, between high and low tide (*Canby*).

5. **I. ripària,** Engelm. Leaves (15–30, 4–8′ long) slender, deep green, erect; sporangium mostly oblong, upper margin to one third covered by the

velum, the free part spotted; macrospores very variable in size (0.22–0.30″ wide), the upper segments covered by short crested ridges, which on the lower hemisphere run together forming a network; microspores larger than in any other species except n. 1 (0.013–0.016″ long), mostly somewhat tuberculated. — Gravelly banks of the Delaware, from above Philadelphia to Wilmington, between flood and ebb tide; margins of ponds, Lake Saltonstall, Conn. (*Setchell*), and northward. — Distinguished from the nearly allied I. lacustris by the stomata of the leaves, the spotted sporangium, the smaller size of the macrospores and their reticulation on the lower half.

6. **I. Engelmánni,** Braun. Leaves long (25–100, 9–20′ long), light green, erect or at last prostrate, flat on the upper side; sporangium mostly oblong, unspotted, the velum very narrow; macrospores (0.19–0.24″ wide) covered all over with a coarse honeycomb-like network; microspores (0.012–0.014″ long) mostly smooth. — Shallow ponds and ditches, from Mass. (near Boston, *W. Boott, H. Mann*) and Meriden, Conn. (*F. W. Hall*), to Penn. and Del. and (probably through the Middle States) to Mo. — By far the largest of our species, often mature in July.

Var. **grácilis,** Engelm. Leaves few (8–12 only, 9–12′ long) and very slender; both kinds of spores nearly as in the type. — Southern New Eng. (Westville, Conn., *Setchell*) and N. J. (*Ennis*); entirely submersed!

Var. **válida,** Engelm. Trunk large and stout (often 1–2′ wide); leaves (50–100, even 200, 18–25′ long) with an elevated ridge on the upper side; sporangium oblong or linear-oblong (4–9″ long), ½–¾ or more covered by the velum; spores very small; macrospores 0.16–0.22″ wide; microspores 0.011–0.013″ long, spinulose. — Del. (*Canby*) and Penn. (*Porter*). Sept.

7. **I. melanópoda,** J. Gay. Leaves (15–50, 6–10′ long) very slender, keeled on the back, straight, bright green, usually with dark brown or black shining bases; sporangium mostly oblong, with a very narrow velum, brown or spotted; macrospores very small (0.14–0.18″ wide), smoothish, or with faint tubercles or ridges; microspores (0.010–0.012″ long) spinulose. — Shallow ponds, and wet prairies and fields, central and northern Ill. (*E. Hall, Vasey*), and westward. June, and sometimes again in Nov. — Trunk more spherical and more deeply 2-lobed, and both kinds of spores smaller than in any other of our species; leaves disappearing during the summer heat. Closely approaching the completely terrestrial species of the Mediterranean region.

Order 135. MARSILIÀCEÆ.

Perennial plants rooted in mud, having a slender creeping rhizome and either filiform or 4-parted long-petioled leaves; the somewhat crustaceous several-celled sporocarps borne on peduncles which rise from the rhizome near the leaf-stalks, or are more or less consolidated with the latter, and contain both macrospores and microspores.

1. MARSÌLIA, L. (Pl. 25.)

Submersed or emersed aquatic plants, with slender creeping rootstocks, sending up elongated petioles, which bear at the apex a whorl of four nervose-veined leaflets, and at or near their base, or sometimes on the rootstock, one

or more ovoid sporocarps. These sporocarps or fruit usually have two teeth near the base, and are 2-celled vertically, with many transverse partitions, and split or burst into 2 valves at maturity. The sporocarps have a ring along the edges of the valves, which at length swells up and bears the sausage-shaped compartments from their places. The compartments contain macrosporangia and microsporangia intermixed. (Named for *Aloysius Marsili*, an early Italian naturalist.)

1. **M. quadrifòlia,** L. Leaflets broadly obovate-cuneate, glabrous; sporocarps usually 2 or 3 on a short peduncle from near the base of the petioles, pedicelled, glabrous or somewhat hairy, the basal teeth small, obtuse, or the upper one acute. — In water, the leaflets commonly floating on the surface; Bantam Lake, Litchfield, Conn., and now introduced in many places. (Eu.)

2. **M. vestita,** Hook. & Grev. Leaflets broadly cuneate, usually hairy, entire (2–7″ long and broad); petioles 1–4′ long; peduncles free from the petiole; sporocarps solitary, short-peduncled (about 2″ long), very hairy when young; upper basal tooth of sporocarp longest, acute, straight or curved, lower tooth acute, the sinus between them rounded. (M. mucronata, *Braun.*) — In swamps which become dry in summer; Iowa and southwestward.

Order 136. SALVINIÀCEÆ.

Floating plants of small size, having a more or less elongated and sometimes branching axis, bearing apparently distichous leaves; sporocarps or conceptacles very soft and thin-walled, two or more on a common stalk, one-celled and having a central, often branched receptacle which bears either macrosporangia containing solitary macrospores, or microsporangia with numerous microspores.

1. AZÓLLA, Lam. (Pl. 21.)

Small moss-like plants, the stems pinnately branched, covered with minute 2-lobed imbricated leaves, and emitting rootlets on the under side. Conceptacles in pairs beneath the stem; the smaller ones acorn-shaped, containing at the base a single macrospore with a few corpuscles of unknown character above it; the larger ones globose, and having a basal placenta which bears many pedicellate microsporangia which contain masses of microspores.

1. **A. Caroliniàna,** Willd. Plants somewhat deltoid in outline (4–12″ broad), much branched; leaves with ovate lobes, the lower lobe reddish, the upper one green with a reddish border; macrospores with three attendant corpuscles, its surface minutely granulate; masses of microspores glochidiate. — Floating on quiet waters, from Lake Ontario westward and southward, — appearing like a reddish hepatic moss.

Salvínia nàtans, L., was said by Pursh to grow floating on the surface of small lakes in Western New York, and has more recently been said to occur in Missouri. It has oblong-oval floating leaves 4–6″ long, closely pinnately-veined, which bear conceptacles and branching plumose fibres on their under surface.