Subclass II. CELLULAR ACROGENS, or BRYOPHYTES.

Plants composed of cellular tissue only. Antheridia or archegonia, or both, formed upon the stem or branches of the plant itself, which is developed from the germinating spore usually with the intervention of a filiform or conferva-like prothallus. — Divided into the *Musci*, or Mosses, and the *Hepaticæ*.

Division I. HEPÁTICÆ.[1] (Liverworts.)

Plants usually procumbent, consisting of a simple thallus, a thalloid stem, or a leafy axis; leaves when present 2-ranked, with uniform leaf-cells and no midvein; thalloid forms with or without a midvein, smooth or scurfy or scaly beneath and usually with numerous rootlets. Sexual reproduction by antheridia and archegonia, which are immersed in the thallus, or sessile or pedicelled upon it, or borne on a peduncled receptacle. The fertilized archegonium develops into a capsule (*sporogonium*) closely invested by a calyptra, which ruptures above as the ripened capsule (containing numerous spores and usually elaters) pushes upward. It is also commonly surrounded by a usually double involucre, the inner (often called *perianth*) more or less tubular, the outer tubular or more often foliaceous, sometimes wholly wanting. Propagation is also effected by offshoots (*innovations*), runners (*flagella*), or by *gemmæ*, which appear at the margin of the leaves or on the surface of the thallus, often in special receptacles.

Order 137. JUNGERMANNIÀCEÆ. Scale-Mosses.

Plant-body a leafy axis or rarely thallose. Capsule borne on a slender often elongated pedicel, splitting at maturity into 4 valves. Elaters mixed with the spores, mostly bispiral (unispiral in n. 1 – 3, 32, and 33, 1 – 3-spiral in n. 5 and 28). Antheridia and archegonia dicœcious or monœcious, in the latter case either mingled in the same inflorescence, or separated upon the same branch, with the antheridia naked in the axils of the lower leaves, or on separate parts of the same plant. Leaves

[1] Elaborated for this edition by Prof. L. M. Underwood, of Syracuse, N. Y.

2-ranked, incubous (i. e. the apex of each leaf lying on the base of the next above), or succubous (i. e. the apex of each leaf lying under the base of the next above), or sometimes transverse, with frequently a third row of rudimentary leaves beneath the stem.

Artificial Key to the Genera.

§ 1. Plant-body a leafy axis.

* Leaves complicate-bilobed (i. e. folded together) or with a small basal lobe.

+– Lower lobe smaller than the upper.

↔ Root-hairs borne on the stems or underleaves.

1. **Frullania.** Lower lobe mostly saccate, more or less remote from the stem. Branches intra-axillary, the leaves on either side free.
2. **Jubula.** Lower lobe saccate; branches lateral, a basal leaf borne partly on the stem, partly on the branch.
3. **Lejeunea.** Lower lobe incurved, more or less inflated.
5. **Porella.** Lower lobe ligulate. Perianth triangular, the third or odd angle ventral.

↔ ↔ Root-hairs rising from the lower lobes.

4. **Radula.** Perianth compressed. Underleaves none.

+– +– Upper lobe smaller than the lower, or the two somewhat equal.

↔ Leaves succubous as to their lower lobes.

15. **Scapania.** Involucral leaves 2; perianth dorsally compressed, the mouth truncate, bilabiate, decurved.
16. **Diplophyllum.** Involucral leaves few; perianth erect, round, the mouth denticulate.

↔ ↔ Leaves transverse.

25. **Marsupella.** Perianth tubular or somewhat compressed. (Compare also Jungermannia § Sphenolobus.)

* * Leaves palmately 3 – 4- (or many-) cleft.

+– Divisions numerous, capillary. Plants large, usually in conspicuous mats.

6. **Ptilidium.** Leaves palmatifid with ciliate margins.
7. **Trichocolea.** Leaves setaceously multifid.

+– +– Leaves 3 – 4-cleft or parted; plants small, mostly inconspicuous.

10. **Lepidozia.** Leaf-divisions two cells wide or more.
11. **Blepharostoma.** Leaf-divisions only one cell wide.

* * * Leaves entire, emarginate, or 2 – 3-toothed or -lobed.

+– Leaves closely imbricate on short julaceous stems.

27. **Gymnomitrium.** Involucre double, the inner shorter.

+– +– Leaves deeply bilobed.

8. **Herberta.** Underleaves large. Perianth fusiform on an elongated branch.
12. **Cephalozia.** Underleaves mostly wanting; perianth mostly triangular on a short branch.

+– +– +– Leaves incubous, mostly plane or depressed.

9. **Bazzania.** Leaves mostly 2 – 3-toothed. Perianth fusiform on a short branch.
14. **Kantia.** Leaves mostly entire. Perianth fleshy, pendulous, subterranean.

+– +– +– +– Leaves succubous or transverse.

↔ Underleaves entire or nearly so.

13. **Odontoschisma.** Involucral leaves numerous, small, incised, those of the stem rounded or retuse.
21. **Mylia.** Involucral leaves 2, connate at base. Large.
22. **Harpanthus.** Involucral leaves few, smaller than the semi-vertical emarginate stem-leaves. Small.

24. **Jungermannia.** Involucral leaves few, mostly larger than the entire or bidentate stem-leaves. Medium-sized or large.

++ ++ Underleaves 2–4-cleft, -parted, or -divided.

17. **Geocalyx.** Involucre fleshy, saccate, pendent. Leaves bidentate; underleaves 2-cleft.

18. **Lophocolea.** Fruit terminal on the main stem or a primary branch. Involucral leaves distinct.

19. **Chiloscyphus.** Fruit on a short lateral branch. Involucral leaves distinct. (See also Jungermannia.)

++ ++ ++ Underleaves mostly wanting.

a. Leaves entire or barely retuse.

23. **Liochlæna.** Involucral leaves distinct, like those of the stem; perianth truncate-depressed at the apex.

26. **Nardia.** Involucral leaves connate at base and adnate to the perianth.

b. Leaves bidentate or bilobed, rarely 3-lobed.

12. **Cephalozia.** Branches all from beneath. Perianth on a short branch, mostly trigonal with the odd angle beneath.

24. **Jungermannia.** Simple or branching laterally. Perianth terminal, mostly laterally compressed.

c. Leaves mostly spinulose or dentate.

20. **Plagiochila.** Involucral leaves large; perianth laterally compressed.

§ 2. Plant-body pseudo-foliaceous with succubous leaf-like lobes.

28. **Fossombronia.** Perianth large, campanulate.

§ 3. Plant-body a thallus.

* Thallus with a distinct costa.

29. **Pallavicinia.** Thallus 3–6″ wide, mostly simple, the margins sinuate or undulate. Perianth tubular, at length dorsal.

30. **Blasia.** Thallus 3–6″ wide, lobed, dichotomous, or radiate, the margins pinnatifid-sinuate.

32. **Metzgeria.** Thallus narrow (1–2″), ciliate at the margins or on one or both sides.

* * Thallus with an inconspicuous costa or none.

33. **Aneura.** Thallus rather narrow, mostly palmately or pinnately lobed. Sporogonium rising from the under side near the margin.

31. **Pellia.** Thallus wider, mostly simple or forked. Sporogonium rising from the upper surface.

1. FRULLÀNIA, Raddi. (Pl. 24.)

Leaves incubous, complicate-bilobed, the lower lobe usually inflated, helmet- or club-shaped; underleaves bifid, rarely entire, with basal rootlets. Dicœcious or moncœcious. Fruit terminal on the branches. Involucral leaves 2 or 4, larger than the stem-leaves; perianth 3–4-angled, mucronate. Calyptra pyriform, fleshy. Capsule globose, the lower third solid. Elaters truncate at each end, unispiral, adherent to the valves. Spores large, reddish, minutely muricate. Antheridia most often on a short branch, globose-oblong or cylindric. Archegonia 2–4, long-styled. (Named for *Leonardo Frullani*, an Italian Minister of State.)

§ 1. TRACHYCÓLEA. *Perianth triangular in section, rough with tubercles or scales, or villous; lower leaf-lobe helmet-shaped, truncate at base.*

* *Lower leaf-lobe about three fourths the size of the upper.*

1. **F. Oakesiàna,** Aust. Stems widely branching; fertile branches short; leaves obliquely orbicular, loosely imbricate, the lower lobe rotund, contiguous to the stem; underleaves ovate-rotund or subobovate, little wider than the stem, bifid; involucral leaves more or less connate, equally bilobed, the lobes entire, obtuse; perianth small, subobovate-pyriform, smooth or 1–7-nerved or alate both sides. — White Mts., on stunted spruce and birch trees.

* * *Lower leaf-lobe much smaller than the upper.*

+– *Underleaves scarcely wider than the stem, ovate, bifid, the divisions entire, acute; perianth* 1*-carinate or smooth, except in* n. 2; *stems creeping.*

2. **F. Virgínica,** Lehm. Stems short, irregularly branching; leaves crowded, ovate, entire, somewhat concave, the lower lobes sometimes expanded into a lanceolate lamina; underleaves round-ovate, bifid, twice the width of the stem; perianth compressed-pyriform, tuberculate, 2–4-carinate dorsally, 4-carinate ventrally. — On bark of trees, rarely on rocks; common.

3. **F. Eboracénsis,** Lehm. Branches clustered; leaves loose, imbricate on the branches, round-ovate, entire; perianth pyriform, slightly compressed and repand, smooth, obscurely carinate beneath and gibbous toward the apex. (F. saxatilis, *Lindenb.*) — On trees and rocks; common northward.

4. **F. Pennsylvánica,** Steph. Stems dichotomous; leaves imbricate, flat, ovate, mucronate or rarely obtuse, entire; lower lobe marginal, large, round-cucullate; underleaves broadly ovate, deeply parted, the divisions long-acuminate; dicœcious; antheridial spikes on short lateral branches, elongated; lobes of the involucral leaves acuminate, much narrowed at base, and the large underleaves carinate-concave, deeply parted, their apiculate divisions entire or toothed. — Shaded rocks, Stony Creek, Carbon Co., Penn. (*Rau*). Known only from the original description.

5. **F. saxícola,** Aust. Stems numerous, widely branching; leaves orbicular, scarcely oblique, flat; lower lobe near the stem, small, or rarely larger and round-galeate; underleaves scarcely wider than the stem, subovate, bifid; perianth broadly oblong, bowl-shaped with very short mouth, papillose, abruptly broad-carinate beneath, 1–many-nerved each side of the keel, 2-angled. — Sloping dry trap rocks, Closter, N. J. (*Austin*).

+– +– *Underleaves* 2–3 *times wider than the stem, round or subquadrate, bifid, the divisions blunt or truncate.*

++ *Leaves lax, rather distant; lower lobe mostly expanded, ovate-lanceolate.*

6. **F. æolòtis,** Nees. Procumbent, irregularly branched or subpinnate; leaves semi-vertical, subsquarrose, obliquely cordate, the lower lobe expanded; underleaves ovate, acutely bifid, the upper margin angular-dentate or entire; sporogonium unknown. — On trees and rocks, chiefly in mountain regions.

++ ++ *Leaves close-imbricate; lower lobe galeate, seldom expanded except on terminal leaves.*

7. **F. squarròsa,** Nees. Decumbent, pinnately branching, the short fertile branch lateral; leaves subvertical, suborbicular, obtuse, entire; lower lobe obovate-cucullate or galeate, subappressed; underleaves cordate or rounded, sinuate-subdentate, slightly bifid; perianth oblong, triquetrous, convex dorsally, strongly keeled ventrally. — On rocks and trees, N. Y. to Ohio, and southward; rather common.

8. **F. plàna,** Sulliv. Procumbent, widely branching or subpinnate; leaves orbicular, subimbricate; lower lobe very small, as broad as long, close to the stem; underleaves rather large, flat, rounded, slightly bifid; moncœ-

cious; perianth oblong-oval or subobovate, triquetrous, dorsally sulcate, acutely keeled ventrally; antheridial spikes globose. — Shaded rocks, N. Y. and N. J. to E. Tenn.

9. **F. dilatàta,** Nees. Loosely and widely pinnate; leaves round, entire, opaque; lower lobe subrounded, cucullate, close to the stem; underleaves subquadrate, toothed at the anterior angles; involucral leaves with 2 or 3 entire lobes; perianth tuberculate, retuse. — Rocks and trunks of trees; rather common. (Eu.)

§ 2. THYOPSIÉLLA. *Perianth smooth; leaves semicordate at base (marked by a central moniliform row of cells, or sometimes in* n. 12 *by a few scattered large cells); lower lobe near the stem (except in* n. 11*), cylindric-saccate, mostly erect; underleaves round-oval, the margin entire, recurved; diœcious.*

* *Leaves orbicular.*

10. **F. Asagrayàna,** Mont. (Pl. 24.) Creeping, simply pinnate; leaves concave, obtuse, decurved; lower lobe oblong-clavate, emarginate at base; underleaves oblong, flat, 2-cleft, the sinus obtuse; involucral leaves unequally 2-cleft, the dorsal segment oblong, pointed, nearly entire, the ventral subulate; perianth pyriform, 3-sided, obtusely keeled beneath. (F. Grayana of authors.) — Rocks and bark of coniferous trees; frequent.

11. **F. Tamarísci,** Nees. Bipinnately branching, somewhat rigid; leaves obtuse, mucronately acute or subacuminate, decurved, entire; lower lobe distant from the stem, oval or oblong; underleaves quadrate-ovate or obovate, emarginate, the margin revolute; involucral leaves bifid, serrulate; perianth oblong, sulcate dorsally, obtusely keeled ventrally. — N. Eng. and southward; rare. (Eu.)

* * *Leaves oblong from a narrowed base.*

12. **F. fragilifòlia,** Tayl. Procumbent, subpinnate, the alternate flattened branches subremote; leaves subimbricate, ascending, recurved, entire; lower lobe oblong-galeate; underleaves round-obovate, flat, appressed, bifid, the margins entire or angled; perianth obovate-cordate, concave dorsally, keeled ventrally; involucral leaves subequally lobed, obtusely few-toothed. (F. polysticta, *Mont.* F. Sullivantiæ, *Aust.*) — On trees in a cedar swamp, Urbana, Ohio (*Sullivant*). (Eu.)

2. JÙBULA, Dumort. (Pl. 25.)

Characters nearly as in Frullania. Leaves large and flat, an axillary one at the base of each branch without a lower lobe. Calyptra turnip-shaped, abruptly globose above. Monœcious, with 2 antheridia in each leaf of a spike-like branch, and the archegonia mostly solitary. (Name from *juba*, a mane, alluding to the persistent elaters.)

1. **J. Hutchínsiæ,** Dumort., var. **Sullivántii,** Spruce. Subdichotomously branching; leaves dark olive-green, subimbricate, obliquely ovate, acute, entire or subrepand; lower lobe saccate, rather remote from the stem, not spurred as in the European form; underleaves roundish, serrate or entire; involucral leaves bifid, serrate; perianth triangular-obpyriform. (Frullania Hutchinsiæ, *Nees*, in part.) — Wet rocks, N. Eng. to S. C.; more common in the mountains.

3. LEJEÙNEA, Libert. (Pl. 24.)

Leaves decurrent at the folds, the lower lobe incurved and ventricose; underleaves usually present, entire or bifid. Archegonium with a slender persistent style, solitary on a usually very short branch; the perianth free from the involucral leaves, oval or oblong, terete or angular, variously carinate, cristate, or ciliate. Capsule globose, 4-cleft to the middle, the valves recurved. Spores large (40 – 50 μ broad), globose or oblong, tuberculate. Antheridia at the base of ordinary leaves or in the axils of the leaves of a spike-like branch. — Otherwise as Frullania. (Named for *A.-L.-S. Lejeune*, a French botanist.)

* *Underleaves entire.*

1. **L. clypeàta,** Sulliv. (Pl. 24.) Stems procumbent, somewhat pinnately branched, $\frac{3}{4}$ – 1′ long; leaves whitish-green, round-ovate, cellular-crenulate, deflexed; lower lobe flat, oblong-quadrate; underleaves round-quadrate; monœcious; involucral leaves larger than those of the stem, the perianth round-obovate, 2 – 3-carinate dorsally, 1-carinate ventrally, the keels rough. (L. calyculata, *Tayl.*) — On rocks and trees; common south and westward.

* * *Underleaves bifid; leaves entire.*

2. **L. serpyllifòlia,** Libert, var. **Americàna,** Lindb. Stems long, somewhat branching, pale, pellucid and fragile; leaves rather remote, flat, opening from a basilar sac, scarcely decurved, obliquely roundish-ovate, obtuse, often slightly repand; underleaves about half as large, round-oval with a broad obtuse sinus and acute lobes; monœcious; the obovate-clavate perianth on a lateral branch. (L. cavifolia, *Aust.*) — On cedars, etc., Catskill Mts. (*Cleve*), Belleville, Ont. (*Macoun*), and southward; rather common.

3. **L. lùcens,** Tayl. Whitish, filiform, pinnately branched; leaves remote, rarely subimbricate, obliquely ovate-triangular, rounded or obtuse, semi-cordate at base; lower lobe ovoid, acute or apiculate; underleaves $\frac{1}{2}$ as large as the lateral, round-oval, deeply bifid, the lobes broad-subulate; diœcious; involucral leaves rather longer, with lanceolate lobes; perianth scarcely emersed, broadly pyriform, 5-carinate. (L. cucullata, *Sulliv.*; not *Nees.*) — Near Cincinnati; moist rocks, Alleghany Mts. and southward (*Sullivant*). Minute and flaccid.

* * * *Underleaves obsolete; leaves muriculate-denticulate.*

4. **L. calcàrea,** Libert. Very minute; stems slender, loosely branching; leaves ovate, falcate-decurved, sinuate-complicate at base; monœcious; involucral leaves bifid, the divisions entire; perianth on a very short lateral branch, pyriform-clavate, acutely 5-angled, the margin echinate-muriculate. (L. echinata, *Tayl.*) — On rocks and roots of trees; rather common. (Eu.)

4. RÁDULA, Dumort. (Pl. 24.)

Leaves large, complicate-bilobed, incubous; lower lobe small, bearing root-hairs; underleaves none. Diœcious, rarely monœcious. Fruit usually terminal. Involucral leaves 2, slightly smaller than the cauline, 2-lobed; perianth tubular, compressed or nearly terete, truncate, entire or crenate. Calyptra pyriform, persistent. Capsule oval-cylindric. Elaters slender, free. Spores large, globose, minutely tuberculate. Antheridia in the ventricose bases of

spicate leaves. (*Radula*, a scraper or spatula, in allusion to the form of the perianth.)

* *Lower lobe subquadrate, barely incumbent on the stem.*

1. **R. complanàta,** Dumort. Creeping, widely subpinnately branching; leaves imbricate, spreading, rounded, the lower lobe obtuse or acute; monœcious; perianth obconic, compressed, the mouth entire, truncate; antheridia in the bases of 2–3 pairs of strongly imbricate tumid leaves. — On rocks and roots of trees; common. (Eu.)

2. **R. obcónica,** Sulliv. (Pl. 24.) Smaller, indeterminately branched; leaves somewhat remote, round-obovate, convex; monœcious; perianth clavate-obconic, obliquely truncate; antheridia axillary on short lateral branches rising near the terminal involucre. — On trees in cedar swamps, N. J. to Ohio.

* * *Lower lobe small, rounded, more or less transversely adnate.*

3. **R. tènax,** Lindb. Stems brownish-green, rigid, tenacious; leaves remote, scarcely decurrent, obliquely elliptic-ovate, opaque, the cells round and strongly chlorophyllose; dicœcious; the antheridial spike lateral below the keel of a leaf, long, linear, somewhat obtuse. (R. pallens, *Sulliv.*; not *Gottsche.*) — On rotten trunks, in the Catskill Mts., and southward, especially in the mountains.

5. PORÉLLA, Dill. (Pl. 24.)

Leaves large, incubous, complicate-bilobed; lower lobe ligulate, suberect; underleaves similar, decurrent at base, the apex entire. Dicœcious. Fruit on a short lateral branch. Involucral leaves usually 4, 2-lobed, the margin ciliate or denticulate; perianth somewhat oval, compressed, bilabiate, incised or entire. Calyptra globose, persistent. Capsule globose, reddish, short-stalked. Elaters very numerous, 2–3-spiral, free. Spores large, rough. Antheridia solitary in the saccate bases of leaves, crowded in short spikes. (Name a diminutive of *porus*, an opening.)

* *Leaves more or less remote; stems bipinnate.*

1. **P. pinnàta,** L. Stems irregularly pinnate, fastigiate at the ends; leaves scarcely incubous, ovate-oblong, the rounded apex sometimes slightly decurved; lower lobe minute, flat, oblong, obtuse, as long but not half as wide as the flat, entire, ovate-rectangular, scarcely decurrent underleaves. (Madotheca Porella, *Nees.*) — On rocks and trees subject to inundation; common. (Eu.)

* * *Leaves mostly closely imbricate; stems mostly simply pinnate (or bipinnate in* n. 2).

2. **P. platyphýlla,** Lindb. (Pl. 24.) Yellowish or fuscous-green; stems irregularly pinnate, often fastigiate at the ends; leaves obliquely ovate, more or less concave at base and the rounded upper margin curved upward and undulate, mostly entire; lower lobe obliquely ovate, the margin strongly recurved, with an acute tooth at base; underleaves semicircular, with strongly reflexed margins. (Madotheca platyphylla, *Dumort.*) — On rocks and trees; common eastward. (Eu.)

3. **P. Thùja,** Lindb. Fuscous-green or blackish, somewhat regularly pinnate; leaves convex, closely appressed, obliquely round-ovate, the rounded apex decurved, more or less denticulate; lower lobe oblong, obtuse, with an acute tooth at base, longer but narrower than the quadrate underleaves, both with strongly recurved sparsely denticulate margins. (Madotheca Thuja, *Dumort.*) — On rocks and trees; more common westward. (Eu.)

4. **P. dentàta,** Lindb. Mostly fuscous-green, irregularly pinnate or subdichotomous; leaves more remote on the branches, obliquely round-ovate, the rounded summit slightly decurved, more or less denticulate; lower lobe decurrent, twisted, obliquely ovate, acute, with recurved undulate denticulate margin and a large acute tooth at base; underleaves twice as wide as the lower lobes, quadrate-oval, the undulate reflexed margin dentate, especially near the base. (Madotheca rivularis, *Nees.*) — Shaded rocks, Yellow Springs, Ohio (*Sullivant*). (Eu.)

5. **P. Sullivántii,** Underw. Stems strongly decurved at the ends in drying; leaves suberect, the straight ventral margin strongly involute toward the apex; cells large, punctate-stelliform; perianth broadly keeled beneath, the keel 2-angled. (Madotheca Sullivantii, *Aust.*) — Alleghany Mts. (*Sullivant*); rare.

6. PTILÍDIUM, Nees. (Pl. 24.)

Leaves incubous, complicate-bilobed, each lobe divided and lacerately ciliate; underleaves 4–5-lobed, ciliate. Dicœcious. Fruit terminating short branches. Involucral leaves 2–4, 4-cleft; perianth terete, obovate, the mouth connivent, plicate, denticulate. Calyptra pyriform, coriaceous. Capsule ovate. Spores globose. Antheridia in the base of closely imbricated leaves. (Name a diminutive of πτίλον, *a feather*, from the fringed foliage.)

1. **P. ciliàre,** Nees. Stems crowded, subpinnate; fringes of the foliage long-setaceous. (Blepharozia ciliaris, *Dumort.*) — On rotten logs and stumps; common. (Eu.)

7. TRICHOCÓLEA, Dumort. (Pl. 24.)

Leaves succubous, 4–5-divided, and with the underleaves setaceously fringed. Dicœcious. Fruit terminal, or axillary from the growth of innovations. Involucral leaves coalescent into an oblong truncate hairy tube, blended in our species with the calyptra; perianth none. Capsule oblong, its pedicel bulbous at base. Elaters free. Antheridia large, in the axils of leaves on terminal branches. (Name from θρίξ, *hair*, and κολεός, *a sheath*, from the hairy involucre.)

1. **T. tomentélla,** Dumort. Stems pinnately decompound, densely tufted, glaucous, 2–6′ long; leaves nearly uniform; underleaves subquadrate, as wide as the stem. — Among mosses in swamps; common. (Eu.)

T. Biddlecòmiæ, Aust., very imperfectly described from specimens collected in Urbana, Ohio, is said to be simply and rather distantly pinnate.

8. HERBÉRTA, S. F. Gray. (Pl. 24.)

Leaves large, incubous or nearly transverse, narrow, 3-ranked, the underleaves being scarcely smaller, cleft to or below the middle, the lobes acute. Dicœcious. Fruit terminal on a long branch. Involucral leaves numerous, equitant; perianth ovate-subulate or narrowly fusiform, 3-angled, deeply 6–8-

lobed. Calyptra small, obovate, deeply trifid. Capsule large, globose. Elaters free. Spores large, muriculate. Antheridia in the bases of leaves of a short terminal spike. (Named for *William Herbert*, an English botanist.)

1. **H. adúnca,** S. F. Gray. Stems long and slender, erect, brownish, nearly simple; leaves and underleaves almost alike, curved and one-sided, the lobes lanceolate. (Sendtnera juniperina, *Sulliv.*; not *Nees.*) — On rocks, Greenwood Mts., N. J., Catskill Mts., N. Y., and probably northward. (Eu.)

9. BAZZÀNIA, S. F. Gray. (Pl. 24.)

Leaves incubous, oblique, decurved, mostly truncate-tridentate; underleaves wider than the stem, mostly 3–4-toothed or crenate. Dicœcious. Fruit on a short branch from the axil of an underleaf. Involucral leaves much imbricate, concave, orbicular or ovate, incised at the apex; perianth ovate-subulate or fusiform, somewhat 3-keeled. Calyptra pyriform or cylindric-oblong. Capsule oblong. Antheridial spikes from the axils of underleaves. (Named for *M. Bazzani*, an Italian Professor of Anatomy.)

1. **B. trilobàta,** S. F. Gray. (Pl. 24.) Creeping, dichotomous, proliferous; leaves ovate, the broad apex acutely 3-toothed; underleaves roundish-quadrangular, spreading, 4–6-toothed above; perianth curved, cylindric, plicate at the narrow apex and 3-toothed. (Mastigobryum trilobatum, *Nees.* M. tridenticulatum, *Lindenb.*) — Ravines, wet woods and swamps; common and variable. (Eu.)

2. **B. defléxa,** Underw. Stems forked or alternately branched; leaves strongly deflexed, cordate-ovate or ovate-oblong, falcate, the upper margin arcuate, the narrow apex 2–3-toothed or entire; underleaves roundish-quadrate, the upper margin bifid, crenate, or entire; perianth cylindric, arcuate, plicate above and denticulate. (Mastigobryum deflexum, *Nees.*) — On rocks in the higher mountains eastward. (Eu.)

10. LEPIDÒZIA, Dumort. (Pl. 24.)

Leaves small, incubous, palmately 2–4-cleft or -parted; underleaves similar, often smaller. Dicœcious or rarely monœcious. Fruit terminal on short branches from the under side of the stem. Involucral leaves small, appressed, concave, 2–4-cleft; perianth elongated, ovate-subulate or narrowly fusiform, obtusely triangular above, entire or denticulate. Calyptra included, pyriform or oblong. Capsule oblong-cylindric. Spores minute, smooth or roughish. Antheridia large, pedicelled, solitary in the axils of 2-cleft spicate leaves. (Name from λεπίς, *a scale*, and ὄζος, *a shoot*, for the scale-like foliage.)

1. **L. réptans,** Dumort. (Pl. 24.) Creeping, pinnately compound, the branches often flagellate; leaves decurved, subquadrate, 3–4-cleft; involucral leaves ovate, truncate, unequally 4-toothed; perianth incurved, dentate. — On the ground and rotten wood, N. J., and common northward. (Eu.)

2. **L. setàcea,** Mitt. Leaves deeply 2–3-cleft or -parted, incurved, the lobes subulate, formed of a somewhat double series of cells; underleaves similar; perianth ciliate. (Jungermannia setacea, *Web.*) — On the ground and rotten wood; common. Resembling the next in its leaves, but smaller and brownish. (Eu.)

11. BLEPHARÓSTOMA, Dumort. (Pl. 25.)

Leaves transverse or slightly incubous, 3–4-parted, the divisions capillary; underleaves smaller, mostly 2–3-parted. Dicœcious or monœcious. Fruit terminal. Involucral leaves numerous, verticillate, deeply 4-cleft; perianth exserted, pyriform-cylindric, laciniate. Calyptra short, oblong, bilabiate. Capsule cylindric-oblong. Elaters large, very obtuse. Spores large, smooth. Antheridia solitary in the axils of leaf-like bracts. (Name from βλέφαρον, *an eyelid*, and στόμα, *mouth*, in allusion to the fringed orifice of the perianth.)

1. **B. trichophýllum,** Dumort. Flaccid, branched, creeping; leaf-divisions straight, spreading, each composed of a single row of cells; perianth ovate-cylindric. (Jungermannia trichophylla, *L.*) — On the ground and rotten wood. Minute, light green. (Eu.)

12. CEPHALÒZIA, Dumort. (Pl. 23.)

Leaves mostly succubous, chiefly 2-lobed, the margins uniformly plane or subincurved; underleaves smaller, often wanting except on fruiting branches. Branches from the under side of the stem. Monœcious or dicœcious. Involucral leaves numerous, capitate, 3-ranked, usually 2-lobed; perianth long, triangular-prismatic, the constricted mouth variously dentate. Calyptra small. Capsule somewhat oblong. Elaters free. Spores minute. Antheridia in the base of inflated spicate leaves. (Name from κεφαλή, *head*, and ὄζος, *bud*, for the capitate involucre.)

§ 1. CEPHALOZIA proper. *Perianth more or less 3-angled or 3-carinate; leaf-cells large (mostly 25–50 μ broad); plants mostly medium-sized.*

* *Underleaves rarely present except on fruiting branches.*

1. **C. Virginiàna,** Spruce. Without runners, usually pale; leaves small, obliquely round-ovate, acutely 2-lobed nearly to the middle; cells quadrate-hexagonal, opaque; dicœcious, rarely monœcious; involucral leaves round-quadrate, with slender acuminate lobes; perianth large, widest above the middle, unequally ciliolate; capsule large, long-exserted; antheridial spike long. (C. catenulata of authors; not *Huebn.*) — On rotten wood or swampy ground, N. Eng. to Va., and southward.

2. **C. multifiòra,** Spruce. (Pl. 23.) Often subpinnate, without runners, pale green; leaves small, round-rhombic, decurrent, bifid ⅓ their length; cells quadrate-hexagonal, pellucid; dicœcious; inner involucral leaves 3–4 times as long as the outer; perianth linear-fusiform, 3-plaited when young, triangular only above when mature, ciliate or toothed, fleshy; calyptra fleshy, oval-globose; capsule rather short-pedicelled; spores cinnamon-color. — On the ground and rotten wood; common. (Eu.)

3. **C. pléniceps,** Underw. Stems very short, branching, densely cespitose, pale green or whitish; leaves thick, orbicular, strongly concave, subclasping but not decurrent, bifid ⅓ their length, the acute lobes incurved and strongly connivent; involucral leaves oblong, palmately 2–4-cleft, the ventral like the underleaves; perianth large, oblong-cylindric, obtusely angled, the plicate mouth denticulate. (Jungermannia pleniceps, *Aust.*) — Among Sphagnum in the White Mts. (*Oakes*).

4. **C. bicuspidàta,** Dumort. Prostrate or assurgent, cespitose, usually greenish or reddish, with runners; lower leaves small and distant, the upper larger, round-ovate, cleft nearly to the middle, the lobes ovate-lanceolate and acute, the lower lobe narrower and acuminate; cells large, pellucid; monœcious; involucral leaves about 3 pairs, the innermost nearly three times as long as the outer, cleft ½ their length; perianth four times as long as the leaves, linear-prismatic or fusiform, thin, denticulate or ciliate; capsule cylindric-oblong; spores purple. (Jungermannia bicuspidata, *L.*) — On the ground, mountains of N. Eng., N. Y., and N. J. (Eu.)

5. **C. curvifòlia,** Dumort. Slender, rarely forked, without runners, greenish, reddish, or often purple; leaves imbricate, ascending, obovate, concave, semicordate at base, lunately bifid below the middle, the lobes incurved or hooked; cells small, quadrate; monœcious or diœcious; involucral leaves complicate, the lobes subovate, spinulose-denticulate; perianth large, rose-purple, triquetrous, the wide mouth ciliate; calyptra thin; capsule oblong-globose. (Jungermannia curvifolia, *Dicks.*) — On rotten logs in swamps, etc.; common. (Eu.)

* * *Underleaves usually present; leaves rarely subimbricate.*

6. **C. flùitans,** Spruce. Stems 2 – 3′ long, loosely creeping, with short thick runners; leaves large, ovate-oblong, lobed to near the middle, the lower lobe larger, lanceolate, obtuse; cells large, mostly hexagonal; underleaves linear, appressed; diœcious; involucral leaves cleft to the middle; perianth oval-cylindric, nearly entire; calyptra short, pyriform; capsule oblong; spores small, minutely tuberculate; antheridia globose, pedicelled, solitary in the axils. — In bogs, on mosses or partly floating; rare. (Eu.)

§ 2. CEPHALOZIÉLLA. *Perianth* 3 – 6-*angled; leaf-cells small* (14 – 20 μ *broad*); *plants small, often minute; underleaves present in* n. 9.

7. **C. divaricàta,** Dumort. Sparingly branched, without runners; leaves very small, cuneate or round-quadrate, the ovate-triangular lobes acute; cells pellucid or subopaque; involucral leaves larger, the lobes acute, denticulate; perianth linear or narrowly fusiform, prismatic, denticulate or subentire; capsule oblong-globose, long-exserted. (Jungermannia divaricata, *Smith.*) — Dry rocks and sand, pine barrens of N. J., and northward. (Eu.)

8. **C. Macoùnii,** Aust. Slender, much branched, dark green; leaves scarcely broader than the stem, wide-spreading, bifid with a broad or lunate sinus, the broad-subulate lobes mostly acute; cells subquadrate, somewhat pellucid; diœcious; involucral leaves appressed, 2 – 3-lobed, irregularly spinulose; perianth small, whitish, obovate or ovate-fusiform, obtusely 3-angled, setulose or ciliate. — Rotten logs, mountains of N. Eng., and northward (*Austin, Macoun*).

9. **C. Sullivàntii,** Aust. Stems 3 – 6″ long, fleshy, rootlets numerous; fertile branches suberect, clavate; leaves imbricate, often narrower than the stem, subquadrate-ovate, more or less serrate, the sinus and lobes subacute; diœcious; involucral leaves 3, erect, free; perianth broadly oval or subobovate, obtusely and sparingly angled, the apex slightly plicate, the mouth connivent, dentate, sometimes narrowly scarious; capsule oval. — On rotten wood, N. J., Ohio, and Ill.; rare. Our smallest species.

13. ODONTOSCHÍSMA, Dumort. (Pl. 24.)

Leaves succubous, ovate or roundish, entire or retuse, rarely bidentate; underleaves minute, sometimes obscure or wanting. Diœcious or sometimes monœcious. Fruit terminal on a short branch from the lower side of the stem. Involucral leaves few, 3-ranked, bifid or rarely 3 – 4-cleft; perianth large, triangular-fusiform, ciliate or dentate. Calyptra membranous. Capsule cylindric-oblong. Antheridia in small whitish spikes on the under side of the stem. (Name from ὀδούς, *a tooth*, and σχίσμα, *a cleft*, alluding to the perianth.)

1. **O. Sphágni,** Dumort. (Pl. 24.) Leaves spreading or ascending, ovate, rounded or oblong, entire or retuse, subconcave; underleaves mostly wanting; perianth 3 – 6 times longer than the leaves, subulate-fusiform, laciniate or ciliate. (Sphagnœcetis communis, *Nees.*) — Among mosses, N. J. to Ill., and southward. (Eu.)

2. **O. denudàta,** Lindb. Stems densely rooting, somewhat leafless at base, flagellate, branching above; leaves spreading, broadly ovate, entire; underleaves broadly oval, entire or subdenticulate; perianth close-connivent above, at length bursting irregularly. — On rotten wood, Canada to Ohio, and south along the mountains. (Eu.)

14. KÁNTIA, S. F. Gray. (Pl. 24.)

Leaves large, incubous, flat or convex, entire or retuse; underleaves small, roundish, the apex entire, retuse or bifid. Diœcious or monœcious. Involucre pendulous, subterranean, clavate or subcylindric, fleshy, hairy, attached to the stem by one side of its mouth. Calyptra membranous, partly adnate to the involucre. Capsule cylindric, the valves spirally twisted. Spores minute, roughish. Antheridia solitary in the reduced leaves of short lateral branches. (Name from *J. Kant*, a physician at The Hague.)

1. **K. Trichómanis,** S. F. Gray. (Pl. 24.) Creeping, without ventral runners; leaves pale green, imbricate, spreading, roundish-ovate, obtuse. (Calypogeia Trichomanis, *Corda.*) — On the ground and rotten logs; very common. (Eu.) — Var. RIVULÀRIS, Aust. Leaves dusky green or blackish, more scattered, flaccid; cells large. N. J. (*Austin.*) — Var. TÉNUIS, Aust. Very slender, innovate-branching; leaves smaller, especially above, dimidiate-ovate or subfalcate, subdecurrent. Southern N. J. (*Austin*).

2. **K. Sullivàntii,** Underw. Prostrate, with ventral runners; leaves flat, subcontiguous or imbricate, obliquely round-ovate, minutely 2-toothed with a lunulate sinus, abruptly decurrent; cells large, uniform; underleaves minute, the upper orbicular, bifid, the lower twice 2-lobed, the primary lobes round-quadrate, divaricate, the secondary ovate or subulate. (Calypogeia Sullivantii, *Aust.*) — Delaware Water Gap, N. J. (*Austin*).

15. SCAPÀNIA, Dumort. (Pl. 24.)

Leaves complicate-bilobed, the upper lobe smaller, the lower succubous; margins entire or dentate or ciliate; underleaves none. Diœcious. Fruit terminal. Involucral leaves like the cauline but more equally lobed; perianth obovate, dorsally compressed, bilabiate, the mouth truncate, entire or toothed, decurved. Capsule ovate. Elaters long, attached to the middle of