the valves. Antheridia 3–20, in the axils of small saccate leaves, which are scarcely imbricate or crowded into terminal heads. (Name from σκαπάνιον, *a shovel*, from the form of the perianth.)

* *Leaf-lobes somewhat equal.*

1. **S. subalpina,** Dumort. Leaves equidistant, imbricate, cleft nearly to the middle, the roundish obtuse lobes denticulate on the outer margin; perianth much exceeding the involucral leaves, obovate from a narrow base, denticulate. — Mountains of N. Eng. (*Oakes, Austin*); L. Superior (*Gillman, Macoun*). (Eu.)

2. **S. glaucocéphala,** Aust. Stems short, cespitose, creeping or ascending, subsimple, with numerous offshoots; leaf-lobes broadly ovate, entire, mostly obtuse and apiculate; involucral leaves sometimes denticulate; perianth small, subcuneate, entire. (Jungermannia glaucocephala, *Tayl.*; S. Peckii, *Aust.*) — On rotten wood, N. Eng. to N. Y. and Canada.

* * *Lower lobe about twice the size of the upper, except near the summit.*

+– *Leaves broader than long; upper lobes rounded or blunt.*

3. **S. undulàta,** Dumort. (Pl. 24.) Ascending or erect, slightly branched; leaves lax, spreading, entire or ciliate-denticulate, the lobes round-trapezoidal, equal at the summit of the stem; perianth oblong-incurved, nearly entire, twice as long as the outer involucre. — In woods, damp meadows, and rills; common, especially in mountain districts. — Var. PURPÙREA, Nees; a form with long lax stems and rose-colored or purplish leaves. (Eu.)

4. **S. irrígua,** Dumort. Creeping; leaves somewhat rigid, repand, deeply lobed; lobes rounded, submucronate, the lower appressed, the upper convex with incurved apex; perianth ovate, denticulate. (S. compacta, var. irrigua, *Aust.*) — Wet places, N. J., Catskill Mts., mountains of N. Eng., and northward. (Eu.)

+– +– *Leaves longer than broad; upper lobes more or less acute.*

5. **S. nemoròsa,** Dumort. Rather stout, flexuose, creeping at base, leaves rather distant, decurrent on both sides, ciliate-dentate, the lower lobe obovate, obtuse, slightly convex, the upper cordate, acute, concave; perianth densely ciliate; capsule large, roundish-ovate, reddish-brown. (S. breviflora, *Tayl.*) — On rocks, etc., in swamps and rills; common and variable. (Eu.)

6. **S. Oakèsii,** Aust. Leaves obovate, somewhat spreading, often deflexed, closely complicate, convex, the lower lobe coarsely dentate, and with deep purple spur-like teeth on the keel, the upper roundish and less dentate; perianth usually dentate. — White Mts. (*Oakes, Austin*).

* * * *Lower lobes 3–4 times the size of the upper.*

7. **S. exsécta,** Aust. Ascending; leaves subcomplicate, entire, the lower lobe ovate, acute or bidentate, concave, the upper small and tooth-like; involucral leaves 3–5-cleft; perianth oblong, obtuse, plicate. (Jungermannia exsecta, *Schmidel.*) — High mountains, far northward; rare. — Perhaps better retained in Jungermannia. (Eu.)

8. **S. umbròsa,** Dumort. Stems short, decumbent, slightly branched; leaf-lobes ovate, acute, serrate; perianth incurved, naked at the mouth. — White Mts.; rare. — The tips of the shoots are frequently covered with a dark mass of gemmæ. (Eu.)

16. DIPLOPHÝLLUM, Dumort. (Pl. 25.)

Leaves rather narrow, complicate-bilobed, the lobes subequal or the upper smaller, the lower succubous; underleaves none. Fruit terminal. Involucral leaves few. Perianth cylindrical, scarcely or not at all compressed, pluriplicate, denticulate. (Name from διπλός, *double*, and φύλλον, *leaf*, on account of the folded 2-lobed leaves.)

1. **D. álbicans,** Dumort., var. **taxifòlium,** Nees. Stems ascending, almost rootless; leaves closely folded, subdenticulate, with a rudimentary pellucid line near the base or none, the lobes obtuse or acutish, the lower oblong-scymitar-shaped, the upper smaller, subovate; perianth ovate, plicate. (Jungermannia albicans and J. obtusifolia of *Sulliv.*; not of *L.* and *Hook.*) — Under rocks in mountain ravines and on the ground. (Eu.) — The typical form occurs in N. Scotia, distinguished by a broad pellucid median line in both lobes.

17. GEÓCALYX, Nees. (Pl. 23.)

Leaves succubous, bidentate; underleaves 2-cleft, with linear divisions. Fruit lateral, pendent. Involucre simple, fleshy, saccate, oblong, truncate, attached to the stem by one side of the mouth. Calyptra membranous, partly adnate to the involucre. Capsule oblong. Elaters free. Antheridia in the axils of small leaves on spike-like lateral branches. (Name from γέα, *the earth*, and κάλυξ, *a cup*, from the subterranean involucres.)

1. **G. gravèolens,** Nees. Leaves ovate-quadrate, 2-toothed, light green; underleaves oval-lanceolate, cleft to the middle. — On the ground, and rotten logs; not rare. (Eu.)

18. LOPHOCÓLEA, Dumort. (Pl. 23.)

Leaves succubous, dorsally decurrent, obliquely ovate-oblong, broadly truncate or bidentate; underleaves smaller, more or less quadrate, bifid or with 4–8 capillary lobes. Dicœcious or monœcious. Fruit terminal on the main stem or primary branches. Involucral leaves 2–4, large, often spinulose; perianth triangular-prismatic, 3-lobed, ciliate or laciniate. Calyptra short, obovate, at length lacerate above. Capsule oblong-globose. Antheridia mostly solitary in or near the base of ordinary leaves. (Name from λόφος, *a crest*, and κολεός, *a sheath*, from the crested perianth.)

* *Underleaves mostly bifid (or 3–4-cleft in* n. 1*); divisions mostly entire.*

1. **L. bidentàta,** Dumort. Stems 1–2′ long, procumbent, sparsely branching; leaves pale green, ovate-triangular, acutely 2-toothed, the teeth oblique with a lunulate sinus; monœcious; perianth oblong-triangular, laciniate; antheridia 2–3 in a cluster, axillary. — On rocks in shady rills; not common. (Eu.)

2. **L. Austìni,** Lindb. Creeping; leaves uniformly deeply lobed, the lobes and usually the sinus acute; underleaves comparatively small, the lobes subulate; cells small; monœcious; antheridia solitary in the upper axils. (L. minor, *Aust.*; not *Nees.*) — On roots of trees in woods (*Austin*). Imperfectly known.

3. **L. Macoùnii,** Aust. Stems very short, prostrate, ascending at the apex, densely radiculose; leaves suberect, ovate-subquadrate, 2-lobed with ob-

ruse lobes and sinus, or retuse or often entire; underleaves light pink, deeply bifid, the setaceous lobes spreading-incurved; monœcious; involucral leaves somewhat oblong, repandly 2–4-toothed at the apex; perianth subobovate, slightly angled. — On logs, Little Falls, N. Y. (*Austin*); Ont. (*Macoun*).

4. **L. minor,** Nees. Diffusely branching; leaves pale green, oval-subquadrate, expanded, convex, slightly rigid, equally and acutely bifid with a lunate sinus; underleaves ½ as large, deeply bifid, the lanceolate lobes acuminate; diœcious; involucral leaves like the cauline; perianth obtusely triangular-plicate at the apex. (L. crocata, *Aust.*; not *Nees.*) — On the ground and dry rocks in limestone regions (*Austin*). (Eu.)

* * *Divisions of the underleaves more or less dentate.*

5. **L. heterophýlla,** Nees. (Pl. 23.) Stems short, creeping or ascending, much branched; leaves ovate-subquadrate, entire, retuse and bidentate on the same stem; underleaves large, 2–3-cleft; involucral leaves lobed and dentate; perianth terminal, the mouth crested. — On the ground and rotten logs in woods and swamps; very common. (Eu.)

6. **L. Hàllii,** Aust. Creeping, very slightly rooting; leaves subvertical, oblong, cleft nearly to the middle with obtuse sinus and erect mostly obtuse lobes; lower underleaves small, subequally 2-parted with an obtuse sinus, the upper ones larger, with a single tooth on each side or palmately 3–4-parted, the apical sublanceolate and narrowly bifid. — On the ground, Ill. (*Hall*).

19. CHILOSCÝPHUS, Corda. (Pl. 23.)

Leaves succubous, dorsally decurrent, mostly rounded and entire; underleaves rooting at the base, usually deeply 2-cleft. Fruit terminal on a very short lateral branch. Involucral leaves 2–6, the outer smaller, the inner variously cut; perianth small, obconic or campanulate, 3-angled and 3-lobed only at the apex, the lobes usually spinose. Calyptra fleshy, subglobose or clavate Capsule oblong-globose. Antheridia in the saccate bases of stem-leaves. (Name from χεῖλος, *a lip*, and σκύφος, *a bowl*, from the form of the perianth.)

* *Underleaves 4-parted.*

1. **C. ascéndens,** Hook. & Wils. (Pl. 23.) Prostrate; leaves large, pale green, ascending, roundish-oblong, slightly emarginate; involucral leaves two, 2-cleft; perianth 2–3-lobed, the lobes long and irregularly lacerate-toothed. — On rotten logs; rather common.

* * *Underleaves bifid.*

2. **C. palléscens,** Dumort. Procumbent, creeping; leaves flattened, ovate-subquadrate, obtuse or retuse; underleaves ovate, distant, free; involucral leaves two, 2-toothed; perianth deeply trifid, the lobes spinose-dentate, mostly shorter than the conspicuous calyptra. — Mountains of N. Eng. (*Oakes*).

3. **C. polyánthos,** Corda. Procumbent, creeping; leaves subascending, ovate-subquadrate, truncate or subretuse; underleaves ovate-oblong, distant, free; involucral leaves 2, slightly 2-toothed; perianth 3-lobed, the short lobes nearly entire, shorter than the calyptra. — Var. RIVULÀRIS, Nees. Larger, more branching, succulent; leaves mostly rounded above; underleaves often divided in halves or wanting. — On the ground among mosses or on rotten logs, common; the variety in shaded rills or still ponds. (Eu.)

20. PLAGIOCHÌLA, Dumort. (Pl. 24.)

Leaves large, succubous, rounded or truncate above, dentate or spinose or rarely entire, the dorsal margin reflexed; underleaves usually none. Diœcious or monœcious. Fruit terminal, or axillary by the growth of offshoots. Involucral leaves larger than the cauline; perianth laterally compressed, erect or decurved, obliquely truncate and bilabiate, the lobes entire or ciliate-dentate. Capsule thick, oval. Elaters attached to the middle of the valves. Antheridia oval, 2–3 in the axils of spicate leaves. (Name from πλάγιος, *oblique*, and χεῖλος, *lip*, from the form of the perianth.)

* *Underleaves 2–3-cleft, fugacious.*

1. **P. porelloides,** Lindenb. Branches ascending; leaves subimbricate, convex-gibbous, round-obovate, the uppermost repand-denticulate, the rest entire, the dorsal margin reflexed; perianth terminal, oblong-ovate, the mouth compressed, denticulate. — Among mosses in swamps and river-bottoms; common.

2. **P. interrúpta,** Dumort. (Pl. 24.) Prostrate, horizontally branched, copiously rooting; leaves imbricate, horizontal, oval, entire or slightly repand; underleaves lanceolate; perianth terminal, broadly obconic, the mouth compressed, repand-crenulate. (P. macrostoma, *Sulliv.*) — Moist banks and decayed logs, N. Eng., Ohio, and northward. (Eu.)

* * *Underleaves wanting.*

3. **P. spinulòsa,** Dumort. Creeping, branches ascending; leaves remote, obliquely spreading, obovate-cuneate, the dorsal margin reflexed, entire, the ventral and apex spinulose-toothed; perianth rounded, at length oblong, the mouth spinulose. — Shaded rocks in mountain regions; rare. (Eu.)

4. **P. asplenoides,** Dumort. Branched, creeping or ascending; leaves subimbricate, obliquely spreading, round-obovate, entire or denticulate, the dorsal margin reflexed; perianth much exceeding the involucral leaves, oblong, dilated at the truncate or ciliate apex. — In rocky rivulets; common. (Eu.)

21. MÝLIA, S. F. Gray. (Pl. 25.)

Leaves succubous, semi-vertical, circular, or ovate and pointed; underleaves subulate. Diœcious. Fruit terminal or pseudaxillary. Involucral leaves 2, clasping; perianth ovate-oblong, laterally compressed above a subterete base, the apex at length bilabiate, denticulate. Capsule ovate, coriaceous. Elaters free. Antheridia 2 in the axils of bracts clustered near the apex of distinct branches. (Name from *Mylius*, an early botanist.)

1. **M. Taylòri,** S. F. Gray. Stems erect, nearly simple, radiculose; leaves large, convex, orbicular, entire, purplish; cells large; underleaves lance-subulate, entire or subdentate; perianth terminal, oval; calyptra finally long-exserted. (Jungermannia Taylori, *Hook.*) — Wet rocks, high mountains of N. Eng. and N. Y. (Eu.)

22. HARPÁNTHUS, Nees. (Pl. 23.)

Leaves succubous, semi-vertical, ovate, emarginate; underleaves connate with the leaves, ovate or lanceolate, 1-toothed at base. Diœcious. Fruit on short shoots from the axils of the underleaves, finally sublateral. Involucral

leaves 2 or 4. Perianth terete, the lower half thickened. Calyptra fleshy, confluent with the perianth for ⅔ its length. Capsule oval. Antheridia 1 or 2 in the axils of bracts terminal on slender branches. (Name from ἄρπη, *a sickle*, and ἄνθος, *flower*.)

1. **H. scutàtus,** Spruce. Stems filiform, decumbent, usually simple; leaves smaller at the base and apex of the stems, roundish-ovate, concave, sharply bidentate, the apex lunate or acute; underleaves large, acuminate involucral leaves two, 2–3-cleft, the upper adnate to the perianth; perianth ovate, becoming obovate, obscurely 3–4-plicate, splitting above on one side; capsule deep brown. (Jungermannia scutata, *Weber.*) — On rotten logs in damp places; common. (Eu.)

H. Flotovìànus, Nees. (Pl. 23.) Stems flexuous, procumbent, mostly unbranched; leaves ovate-orbicular, horizontal, the apex contracted and emarginate with a shallow sinus; underleaves large, ovate or lanceolate, obliquely inserted, entire or more often toothed on one or both sides near the middle; dicœcious; perianth subcylindric, slightly sickle-shaped, the mouth pointed at first, notched on one side and finally crenulate; antheridia elliptic, single in the base of swollen leaves. (Pleuranthe olivacea, *Tayl.*) — "North America" (*Drummond*), but not collected recently; certainly extralimital.

23. LIOCHLÆNA, Nees. (Pl. 25.)

Leaves succubous, ovate-oblong, entire or slightly retuse; underleaves none. Dicœcious or monœcious. Involucral leaves 2 or 4, like the cauline; perianth pyriform, becoming cylindric, incurved, abruptly rounded at the summit, the minute orifice prominently ciliolate. Capsule oblong, long-exserted. Elaters attached to the middle of the valves. Spores minute, globose. An theridia in the axils of ordinary leaves. Archegonia 5–12. (Name from λεῖος, *smooth*, and χλαῖνα, *a cloak*, referring to the perianth.)

1. **L. lanceolàta,** Nees. Closely creeping, branched; leaves sometimes decurrent; involucral leaves vertical; perianth at right angles with the stem; monœcious. — On banks and rotten logs; not rare. (Eu.)

24. JUNGERMÁNNIA, Micheli. (Pl. 25.)

Leaves succubous, rarely subtransverse, entire, lobed or dentate, the margins never recurved; underleaves present or none. Dicœcious or monœcious. Fruit terminal. Involucral leaves 4 or fewer, like the cauline or more incised, free; perianth laterally compressed or terete, usually 3–10-carinate, the usually small mouth entire or toothed. Calyptra oval-pyriform. Capsule globose or oblong, rarely cylindric. Spores minute, smooth or roughish. Archegonia 8–70. (Named for *L. Jungermann*, a German botanist of the 17th century.)

§ 1. JUNGERMANNIA proper. *Leaves orbicular or ovate, entire or barely retuse; underleaves none (very small in* n. 1).

1. **J. Schràderi,** Martius. (Pl. 25.) Creeping, flexuous; leaves round-elliptic, entire, ascending; underleaves broadly subulate, not apparent on old stems; involucral leaves large, elongated, the inner smaller and more or less laciniate; perianth oval-obovate, ascending. — On the ground and rotten logs; common. (Eu.)

2. **J. sphærocárpa,** Hook. Stems creeping, the tips ascending, subsimple, greenish; leaves semi-vertical, rather rigid, orbicular, obliquely spreading, decurrent dorsally, pale green; involucral leaves separate; perianth exserted, obovate-oblong, the mouth 4-cleft; capsule globose. — Mountains of N. Eng. (*Austin*); rare. (Eu.)

3. **J. pùmila,** With. Stems creeping, the tips somewhat ascending, subsimple, rooting, pale; leaves ascending, ovate, obtuse, concave, entire; involucral leaves like the cauline, erect; perianth terminal, fusiform, plicate above and denticulate; capsule oval. — On shaded rocks along rivulets, Closter, N. J. (*Austin*). (Eu.)

§ 2. LOPHÒZIA. *Leaves roundish or subquadrate, bidentate, bifid, or sometimes 3–5-cleft; underleaves none, or small and mostly 2-parted; perianth usually strongly plicate.*

* *Underleaves present.*

+ *Leaves bifid or 2-lobed.*

4. **J. Gillmàni,** Aust. Stems short, densely cespitose, prostrate, strongly radiculose; leaves vertical, round-ovate, subconcave, bifid, the lower leaves with usually acute sinus and lobes, the upper much larger with rounded lobes and obtuse sinus; underleaves entire or the broader bifid; perianth without involucral leaves, dorsal, sessile, obovate, subgibbous, ciliate, at length much incised. — In a sandstone cave, Traine Island, L. Superior (*Gillman*).

5. **J. Wattiàna,** Aust. Stems rather thick, 2–4″ long, fragile, subflexuose, strongly radiculose; leaves subvertical or spreading, subovate, concave, emarginately 2-lobed, the lobes acute or the upper obtuse; underleaves somewhat obsolete, hair-like or subulate, incurved; involucral leaves little larger, less deeply lobed; perianth terminal, small, ovate-gourd-shaped, whitish, ciliate. — On the ground, northern shore of L. Superior (*Macoun*).

+ + *Leaves 3–5-cleft.*

6. **J. barbàta,** Schreb. (Pl. 25.) Procumbent, sparingly branched; leaves roundish-quadrate, with obtuse, acute, or mucronulate lobes and obtuse undulate sinuses; underleaves broad, entire or 2-toothed, sometimes obsolete; perianth ovate, plicate-angled toward the apex, denticulate. — On rocks in mountain regions; common. (Eu.)

Var. **attenuàta,** Martius. Ascending, with numerous offshoots; stem-leaves semi-vertical, obliquely spreading, roundish, acutely 2–4-toothed, those of the shoots closely imbricate, premorsely 2–4-denticulate; involucral leaves two, 3-toothed; perianth oblong. — In similar localities. (Eu.)

7. **J. setifórmis,** Ehrh. Erect or ascending, dichotomous; leaves toothed at base, 3–4-cleft, the lobes ovate-oblong, acute, channelled; underleaves ciliate-dentate at base, deeply bifid, the divisions lanceolate, acuminate; involucral leaves more toothed than the cauline; perianth terminal, oval, plicate. — Alpine summits of N. H. (*Oakes*). (Eu.)

* * *Underleaves wanting.*

+ *Leaves 2-toothed; involucral leaves 2–4-cleft.*

8. **J. alpéstris,** Schleich. Stems creeping, crowded, bifid-branching, the ends ascending; leaves semi-vertical, ovate-subquadrate, obliquely toothed, the teeth unequal, acute or mucronulate, distant; involucral leaves wider, 2–3-cleft; perianth twice as long, oblong, smooth, the mouth complicate; capsule oval. — Alpine region of N. H. (*Oakes*). (Eu.)

9. **J. ventricòsa,** Dicks. Stems dense, close-creeping, branching from beneath; leaves semi-vertical, subquadrate, mostly flat, broadly and acutely emarginate-bidentate, often bearing globules; involucral leaves larger, round, erect-spreading, 3–4-cleft, subdentate; perianth ovate, inflated, narrowly complicate above; capsule oval. — On the ground and rotten wood in the mountains, and far northward; common. (Eu.)

10. **J. Wallrothiàna,** Nees. Minute, blackish; stems creeping, strongly rooting, subsimple; leaves clasping, semi-vertical, closely imbricate, ovate-quadrate, concave, obtusely bidentate with an obtuse sinus, or acute in the upper leaves; involucral leaves larger, erect, connate at base, 3-toothed, wavy-plicate; perianth oval-cylindric, plicate and subdentate, pellucid, reddish below. — On coarse sand in the White Mts. (*Oakes*). (Eu.)

\+ + *Leaves bifid or 2-lobed, the ventral lobe often inflexed or subcomplicate; involucral leaves merely toothed, except in* n. 11.

11. **J. làxa,** Lindb. Widely creeping, mostly simple, usually purplish-black; leaves imbricate, or distant on the erect fertile stems, 2–3-lobed, the lobes obtuse, wavy; cells very large, lax; involucral leaves 2, wide, short, cristate-undulate, obtusely many-lobed; perianth exserted, long-clavate, subplicate above, minutely ciliate. (J. polita, *Aust.*; not *Nees.*) — Among Sphagnum near Closter, N. J. (*Austin*).

12. **J. excisa,** Dicks. Stems closely creeping, short, subsimple, rather rigid; leaves semi-vertical, erect-spreading, pellucid, roundish, with straight acute lobes and deep obtuse sinus; involucral leaves erect, quadrate, usually 4–5-toothed; perianth erect, oblong, pale, banded and spotted with pink, plicate above, irregularly denticulate. — Sterile grounds in open woods; common. (Eu.)

Var. **crìspa,** Hook. Leaves round-quadrate, closely imbricate, deeply and obtusely 2–3-cleft; involucral leaves 3–4-cleft, connate at base, subserrate. (J. intermedia, *Lindenb.*) — In crevices of rocks, N. Y. and N. J. (*Austin*). (Eu.)

13. **J. incisa,** Schrad. Stems thick, rooting, closely creeping or ascending; leaves crowded, semi-vertical, complicate, subquadrate, 2–6-cleft, the acute lobes unequal, more or less spinulose-dentate; involucral leaves similar, more plicate and dentate, free; perianth short, oval or obovate, plicate above, denticulate. — On rotten wood in the mountains, and northward. (Eu.)

§ 3. SPHENÓLOBUS. *Leaves 2-lobed, subtransverse, complicate-concave; underleaves none; involucral leaves 2–3-cleft.* (Verging toward Marsupella on one side and Diplophyllum on the other.)

14. **J. Michaùxii,** Weber. Stems ascending, flexuous by repeated innovations below the summit; leaves crowded, subvertical, erect-spreading, subsaccate at base, subquadrate, bifid with straight acute lobes and a narrow sinus; involucral leaves similar, the outer serrulate, the inner smaller; perianth ovate-subclavate, obtuse, plicate above, fringed. — Fallen trunks, mountains of N. Y. and N. Eng.; common. (Eu.)

15. **J. minùta,** Crantz. Rootless; leaves cleft $\frac{1}{4}$–$\frac{1}{2}$ their length, the lobes ovate, subequal, acute or obtuse, entire, or gemmiparous ones subdentate; involucral leaves trifid; perianth oval-oblong or subcylindric. — On rocks in high mountain regions, and northward. (Eu.)

16. **J. Hellerìana,** Nees. (Pl. 25.) Creeping, entangled; leaves spreading, subascending, cleft $\frac{1}{3}$–$\frac{1}{2}$ their length, the lobes equal, acute, entire or serrate; involucral leaves 2–3-cleft, spinulose-serrate; perianth ovate, the mouth contracted. — On rotten wood, N. Y., N. Eng., and northward. (Eu.)

§ 4. GYMNOCÓLEA. *Leaves 2-lobed; underleaves none; involucral leaves like the cauline; perianth pedunculate, denticulate.*

17. **J. inflàta,** Huds. (Pl. 25.) Procumbent or ascending, loosely radiculose, branching; leaves semi-vertical, roundish-elliptic, inequilateral, the sinus and unequal lobes obtuse; perianth terminal or at length dorsal, oval or pyriform, smooth, the mouth connivent; capsule oblong. — On sterile ground and rocks, N. J. (*Austin*), and northward in the mountains. (Eu.)

25. MARSUPÉLLA, Dumort. (Pl. 23.)

Stems dorsally compressed, with rootlets at the base and often producing somewhat leafless runners. Leaves transverse, complicate-bilobed; involucral leaves 2 or 4, connate with the perianth. Perianth tubular or oval, subcompressed parallel to the base of the leaves. Elaters free. Spores round, rufous (in our species). Antheridia mostly terminal. (Name a diminutive of *marsupium*, a pouch, from the form of the perianth.)

1. **M. sphacelàta,** Dumort. Stems erect, subflexuous, pale brown; leaves rather distant, concave, obovate to obcordate, somewhat clasping, the sinus narrow; dicœcious; involucral leaves larger than the cauline, cordate; perianth free at the apex, with 4–5 broad acute teeth; antheridia 1–3, in short terminal spikes. — Wet rocks, mountains of N. Eng. to N. J., and southward. (Eu.)

2. **M. emarginàta,** Dumort. (Pl. 23.) Stems simple or innovating at the summit, rigid, somewhat thickened upward; leaves usually broader than long, round-cordate or subquadrate, lobes obtuse or mucronate, sinus acute; dicœcious; involucral leaves 4–8, usually larger, more deeply and acutely emarginate; perianth urceolate, the closed apex splitting into 4–5 triangular lobes; antheridia 2–3, oval, axillary in terminal spikes. (Sarcoscyphus Ehrharti, *Corda.*) — On wet rocks, chiefly in mountain rivulets, N. Y. and N. Eng. Floating forms are longer with distant leaves. (Eu.)

3. **M. adùsta,** Spruce. Stems minute, clavate; leaves (5–8 pairs) imbricate, round or broadly ovate from a sheathing base, acutely lobed with angular sinus; monœcious; perianth included, campanulate, crenate becoming irregularly lobed; spores punctate; antheridia 1 or 2, oval, in the axils of the lower involucral leaves. (Gymnomitrium adustum, *Nees.*) — Alpine region of the White Mts. (*Oakes, Austin*). (Eu.)

26. NÁRDIA, S. F. Gray. (Pl. 25.)

Stems laterally compressed, usually without runners. Leaves succubous, subconcave or flat, the apex rounded, rarely retuse or bidentate; underleaves none (in our species). Monœcious or dicœcious. Involucral leaves 2–4 pairs, connate at base. Perianth subcompressed laterally, connate with the involucral leaves. Antheridia terminal on somewhat spike-like stems. (Named for *S. Nardi*, an Italian abbot.)

§ 1. EÙCALYX. *Perianth connate at base with the inner involucral leaves, somewhat surpassing them, 3 – 8-carinate, the mouth constricted.*

1. **N. hyalina,** Carring. Creeping, with ascending tips, the branches dichotomous-fastigiate, with claret-colored rootlets; leaves loosely imbricate, decurrent, roundish, repand-undulate; monœcious or dicœcious; involucral leaves broader, appressed, one connate with the lower third of the perianth, which is somewhat exserted, obovate, plicate with acute rough angles, rostellate, at length 4-cleft; capsule round-ovate. (Jungermannia hyalina, *Lyell.*) — On banks in woods, Closter, N. J. (*Austin*), Ohio (*Lesquereux*). (Eu.)

2. **N. crenulàta,** Lindb. (Pl. 25.) Prostrate, branching; leaves orbicular, entire, larger toward the involucre and with large marginal cells; dicœcious; involucral leaves 2, rarely 3, adnate to the base of the perianth, which is flattened or terete, more or less regularly 4 – 5-plicate, the angles smooth; mouth much contracted, toothed. (Jungermannia crenulata, *Smith.*) — On the ground in old fields, N. Y. and southward. (Eu.)

3. **N. crenulifórmis,** Lindb. Densely cespitose; fertile stems creeping, thickened upward, with numerous purple rootlets, the sterile subascending, attenuate upward; leaves subdecurrent, obliquely spreading, orbicular, concave, entire or nearly so; perianth small, subobovate, more or less connate with the involucral leaves, not exserted or slightly so, rooting at base, triquetrous above, becoming 4 – 7-plicate; calyptra often violet-purple; capsule oval-globose. (Jungermannia crenuliformis, *Aust.*) — On rocks in rivulets, Closter, N. J. (*Austin*), Coshocton Co., Ohio (*Sullivant*).

4. **N. biformis,** Lindb. Densely cespitose, much branched, innovating from beneath; rootlets numerous; leaves scarcely imbricate, alternate, spreading, obliquely semicircular or broadly ovate, retuse or entire, decurrent dorsally; cells large, hyaline; branch-leaves half as large, ovate or obovate, scarcely decurrent; dicœcious; antheridia solitary; fruit unknown. (Jungermannia biformis, *Aust.*) — On steep wet rocks, Delaware Water Gap, N. J. (*Austin*).

§ 2. CHASCÓSTOMA. *Perianth exserted, subcampanulate and open, deeply laciniate, connate with the involucral leaves.*

5. **N. fossombronioides,** Lindb. Stems densely cespitose, ascending; rootlets numerous, purple; leaves 2-ranked, subvertical, spreading-subrecurved, rooting, closely imbricate, orbicular, clasping by a slightly cordate base, subventricose, undulate-repand, the apex uniplicate and slightly emarginate; monœcious; perianth very large, 6 – 10-plicate, the lobes entire; calyptra violet; capsule short-oval. (Jungermannia fossombronioides, *Aust.*) — On rocks in a rivulet, Closter, N. J. (*Austin*), and southward.

27. GYMNOMÍTRIUM, Corda. (Pl. 23.)

Leaves closely imbricated, 2-ranked on fascicled ascending julaceous stems, emarginate-bidentate; underleaves none. Dicœcious. Involucre double, the inner shorter, of 2 or more dentate and deeply cleft leaves. Calyptra short, campanulate. Capsule globose, the valves at length reflexed. Elaters caducous. Antheridia in the axils of leaves, oval, stipitate. (Name from γυμνός, *naked*, and μιτρίον, *a little cap.*)

1. **G. concinnàtum,** Corda. Stems simple or imbricately branching, thickened at the apex; leaves ovate, bifid, with a narrow scarious margin.

(Cesia concinnata, *S. F. Gray.*) — Alpine regions of the White Mts. (*Oakes*). — Grayish or silvery-olive. (Eu.)

28. FOSSOMBRÒNIA, Raddi. (Pl. 23.)

Stems thalloid, with large subquadrate succubous leaves; underleaves none. Dicœcious or monœcious. Fruit terminal or by innovation dorsal on the main stem. Involucral leaves 5 – 6 (in our species), small, subulate, adnate. Perianth open-campanulate or obpyramidal, crenate-lobed. Calyptra free, subglobose. Capsule short-pedicelled, globose, irregularly valved. Elaters very short, 1 – 3- (mostly 2-) spiral, free. Spores large, very rough. Antheridia 2 – 3, short-pedicelled, naked. Perfect archegonia 2 – 3. (Named for *V. Fossombroni*, an Italian Minister of State.)

* *Plant large or of medium size; stems mostly simple.*

1. **F. pusilla,** Dumort. (Pl. 23.) Stems 6 – 10″ long; leaves retuse, entire or irregularly indented; perianth obconic, dentate; elaters short and thick; spores brown, depressed-globose-tetrahedral, 40 μ broad, crested, the slender crests pellucid, rarely becoming confluent. — On damp ground. Its occurrence in America is doubtful. (Eu.)

2. **F. Dumortièri,** Lindb. Cespitose, greenish or brownish-yellow; stems 3 – 6″ long, 1″ wide, shortly bifurcate; rootlets copious, purple; leaves numerous, smaller toward each end of the stem; monœcious; perianth large, broadly obpyramidal; calyptra nearly as long; elaters scanty; spores globose-tetrahedral yellowish-brown, regularly pitted. — White Mts. (*Farlow*), N. J. (*Austin*), and perhaps elsewhere; confused with n. 1.

3. **F. angulòsa,** Raddi. Stems narrowly forked at the apex; leaves horizontal, subquadrate, the upper undulate-lobed; dicœcious; perianth dilated-conic, crenate; spores brownish-yellow, globose-tetrahedral, not depressed, 30 μ broad, deeply reticulated, the reticulations large, 5 – 6-angled. — Brackish meadows, common; fruiting in early spring. (Eu.)

* * *Plant minute; stems forked or fastigiately divided.*

4. **F. crístula,** Aust. Stems 1 – 2″ long; leaves whitish, quadrate or round-obovate, subentire, strongly crisped-undulate; capsule immersed on a short pedicel; elaters short, more or less diverse, with a single narrow annular and spiral fibre; spores pale fuscous, more or less tuberculate. — On moist sand in unfrequented paths, Batsto, N. J. (*Austin*).

29. PALLAVICÍNIA, S. F. Gray. (Pl. 22.)

Thallus with a distinct costa. Fruit arising from the costa, at first terminal, becoming dorsal. Dicœcious. Involucre cup-shaped, short-lacerate. Perianth long-tubular, denticulate. Calyptra irregularly lacerate. Capsule slender-cylindric. Elaters slender, free. Spores minute. Antheridia dorsal, covered with minute fimbriate scales. (Named for *L. Pallavicini*, Archbishop of Genoa.)

1. **P. Lyéllii,** S. F. Gray. Thallus thin, 1 – 4′ long, 3 – 5″ wide, simple or bifid, the margin entire, slightly crenate or serrate; cells large, oblong-hexagonal; perianth erect, fleshy (5 cells thick below), the somewhat constricted mouth lobate-ciliolate; pedicel long, exceeding the thallus; capsule cylindric,

five times as long as broad. (Steetzia Lyellii, *Lehm.*) — Among mosses in swamps and on dripping rocks; common, especially southward. (Eu.)

30. BLÀSIA, Micheli. (Pl. 23.)

Thallus simple or forked or stellate, with sinuous margins. Dicœcious. Fruit from an oval cavity in the costa. Involucre mostly none. Calyptra obovate. Capsule oval-globose. Antheridia immersed in the thallus, covered with dentate scales. Gemmæ globose, issuing by a slender ascending tube from large flask-shaped receptacles which are immersed in the thallus. (Named for *Blasius Biagi*, a monk of Valombrosa and companion of Micheli.)

1. **B. pusílla,** L. Thallus ¼–1½′ long, 2–3″ wide, narrowly obovate, the margins pinnatifid-sinuous. — Wet banks; common. (Eu.)

31. PÉLLIA, Raddi. (Pl. 23.)

Thallus with a broad indeterminate costa. Monœcious or dicœcious. Fructification dorsal near the end of the thallus. Involucre short, cup-shaped, lacerate-dentate. Calyptra membranous, oval, longer or shorter than the involucre. Capsule globose. Elaters long, free. Antheridia globose, immersed in the costa. (Named for *A. L. Pelli*, an Italian botanist.)

* *Monœcious.*

1. **P. epiphýlla,** Raddi. (Pl. 23.) Thallus oblong, lobed and sinuate, somewhat fleshy, much thickened in the middle; capsule exserted. — On the ground in wet places; not uncommon eastward. (Eu.)

* * *Dicœcious.*

2. **P. endiviæfòlia,** Dumort. Thallus flat, green or purplish, broadly linear, dichotomous, the margin mostly undulate or crisped. — On the ground and in ditches; common, but often confused with n. 1. (Eu.)

3. **P. calycìna,** Nees. Thallus dichotomous, proliferous, the early divisions linear-oblong, the margins ascending and remotely sinuate, the later divisions linear-palmatifid, coarsely nerved; cells large, hexagonal; involucre ciliate-fringed or lacerate; calyptra smooth, included. — Wet limestones and shales. (Eu.)

32. METZGÈRIA, Raddi. (Pl. 23.)

Thallus linear, dichotomous, with well defined costa. Dicœcious. Fructification arising from the under side of the costa. Involucre 1-leaved, scale-like, at length ventricose. Calyptra clavate or pyriform, fleshy. Capsule short-pedicelled. Elaters unispiral, some remaining attached to the tips of the valves. Spores minute, mostly smooth. Antheridia globose, enclosed in a scale on the under surface of the costa. (Named for *J. Metzger*, a German botanist.)

* *Densely villous throughout.*

1. **M. pubéscens,** Raddi. Thallus 1–2′ long, 1″ wide, alternately pinnate or somewhat decompound, the short linear branches of uniform width, flat, the margin undulate; hairs longer beneath, single or in twos and threes near the margin, irregularly curved; midrib nearly without cortical layer, with 6–10 (mostly 8) rows of very uniform peripheral cells; dicœcious. — In mountain regions, eastward. (Eu.)

* * *Hairy on the margins and midrib beneath, smooth above; diœcious* (n. 4 *monœcious*).

2. **M. myriópoda,** Lindb. Thallus elongated (2′ long, ½″ wide), dichotomous, the long linear branches of uniform width, convex above, the reflexed margins not undulate; midrib densely pilose beneath; hairs rather long, straight or nodding, the marginal mostly in clusters of 3–6, some with discoid tips; midrib covered above with 2 rows of enlarged cells, and beneath with 3–7 (usually 4–6) rows of smaller cells, lax and often indistinct. (M. furcata, *Sulliv.*, in part; not *Nees.*) — Shaded rocks and trees in the Alleghanies (*Sullivant*), and southward.

3. **M. hamàta,** Lindb. Like the last; thallus much elongated (4′ long, 1–1½″ wide); hairs very long, divaricate and hooked-deflexed, the marginal in twos, rarely with discoid tips; midrib covered above and below with two rows of enlarged lax cells. (M. furcata, *Sulliv.*, in part.) — Alleghany Mts. (*Sullivant*).

4. **M. conjugàta,** Lindb. Thallus 1½′ long, ½–1″ wide, usually dichotomous, the short branches irregular in width, convex above, the margins more or less undulate; hairs rather long, straight, divaricate, the marginal usually in twos, very often disk-bearing; midribs covered above with 2, below with 3–6 rows of enlarged lax cells. — On shaded rocks and trunks of trees, central N. Y., and southward. (Eu.)

33. ANEÙRA, Dumort. (Pl. 23.)

Thallus fleshy, prostrate or assurgent from a creeping base; costa obscure. Dicœcious or monœcious. Fructification arising from the under side near the margin. Involucre cup-shaped, short and lacerate, or none. Calyptra large, fleshy, more or less clavate. Capsule large, oblong-cylindric. Elaters unispiral, in part adherent to the tips of the valves. Spores minute, smooth or minutely roughened. Antheridia immersed in the surface of receptacles proceeding from the margin of the thallus. (Name from α- privative, and νεῦρον, *a nerve.*)

* *Thallus narrow (about 1″ wide), palmately divided.*

1. **A. látifrons,** Lindb. Thallus cespitose, ascending or erect, usually dark green, 6–9″ long, mostly pellucid; branches linear, obtuse and emarginate, plano-convex; cells large, oblong-rhombic; monœcious; archegonia 3–10, short, conic; calyptra white, verrucose, pyriform-clavate; capsule oval, brown; spores 12½–14½ μ broad, globose, minutely and densely papillose; antheridia globose. (A. palmata of authors; not *Dumort.*) — On rotten logs; common.

* * *Thallus narrow (about 1″ wide), pinnate or bipinnate.*

2. **A. multífida,** Dumort. Thallus prostrate, brownish-green, pinnately divided, the primary portion biconvex, somewhat rigid, the branches horizontal, pectinately pinnate with narrow linear divisions; monœcious; fructification rising from the primary part or from the branches; involucre fleshy; calyptra tuberculate. — Var. MÀJOR, Nees. Primary portion and branches thick, the branches interruptedly pinnate with short obtuse divisions. — On decayed wood and moss in swamps, N. J. (*Austin*), and south in the mountains. (Eu.)

3. **A. pinnatífida,** Nees. Thallus pinnately divided or subsimple, flat or somewhat channelled; branches horizontal, the broader pinnatifid or dentate, obtuse; calyptra somewhat smooth.—On dripping rocks, Hokokus, N. J. (*Austin*), N. Haven, Conn. (*Eaton*). (Eu.)

* * * *Thallus wider (2″ or more), simple or irregularly lobed.*

4. **A. séssilis,** Spreng. Thallus decumbent, irregularly lobed, 1 – 2′ long, 3 – 5″ wide; involucre none; pedicel ¾ – 1′ long, sometimes folded upon itself and remaining within the calyptra, the capsule thus appearing sessile; antheridia on elongated receptacles. — Wooded swamps. Elongated floating forms, 5 – 6′ long, have been found in the White Mts. (*Farlow, Faxon*).

5. **A. pínguis,** Dumort. Thallus 1 – 2′ long, decumbent or ascending, fleshy, linear-oblong, simple or slightly lobed, the margin sinuate; dicœcious; involucre short, lacerate; calyptra cylindric, smooth; capsule brownish, furrowed; antheridia in 2-lobed receptacles. — Wet banks, N. J. to Ohio, and southward. (Eu.)

Order 138. ANTHOCEROTÀCEÆ. (Horned Liverworts.)

Plant-body a thallus, irregularly branching, flaccid, without epidermis or pores, and more or less vesiculose. Involucre single, tubular. Calyptra rupturing early near the base, and borne on the apex of the capsule. Capsule dorsal, pod-like, erect or curved outward, more or less perfectly 2-valved, usually stomatose, tapering into a pedicel or often sessile with a bulbous base. Columella filiform. Elaters with or without spiral fibres. Spores flattish, more or less convex-prismatic, papillose or smooth.

1. **Anthoceros.** Capsule narrowly linear, exsertly pedicelled, 2-valved. Elaters present.
2. **Notothylas.** Capsule very short, sessile, not valved below the middle. Elaters not obvious.

1. ANTHÓCEROS, Micheli. (Pl. 22.)

Thallus dark green or blackish, usually depressed, variously lobed, with large chlorophyll-grains, frequently glandular-thickened at the apex or in lines along the middle so as to appear nerved. Monœcious or dicœcious. Capsule linear, 2-valved, exsertly pedicelled. Elaters simple or branched, often geniculate, more or less heteromorphous, the fibres wanting or indistinct. (Name from ἄνθος, *flower*, and κέρας, *horn*, from the shape of the capsule.)

1. **A. lævis,** L. (Pl. 22.) Thallus smooth, nearly flat above; dicœcious; involucre 1 – 2″ long, trumpet-shaped when dry, repand-toothed; capsule pale brown or yellowish, 1 – 1½′ long; elaters rather short, yellowish; spores yellow, nearly smooth, angular. — Wet clay banks, from Canada south and westward. (Eu.)

2. **A. punctàtus,** L. Thallus small, depressed, or often cespitose and erect, more or less glandular; monœcious; involucre rather short, oblong-linear, slightly repand, sometimes scarious at the mouth; capsule 1′ high, black; elaters fuscous, flattish, geniculate; spores black, strongly muriculate, sharply angled. — Wet banks, Canada to Mo., and southward. (Eu.)

2. NOTOTHÝLAS, Sulliv. (Pl. 22.)

Thallus orbicular, tender, laciniate and undulate or crisped, papillose-reticulate. Monœcious. Involucre sessile, continuous with the thallus, opening irregularly above. Capsule very short, oblong-globose or ovate-cylindric, pedicelled from a thickened bulb, 2-valved to the middle or rupturing irregularly. Elaters none, or fragmentary and inconspicuous. Spores subglobose, smoothish. Antheridia elliptic-globose, immersed in the thallus. (Name from νῶτος, *the back*, and θυλάς, *a bag*, from the shape and position of the involucre.)

1. **N. orbiculàris,** Sulliv. (Pl. 22.) Thallus 3 – 8″ wide; capsules 1 – 2″ long, erect or decurved, wholly included or slightly exserted, of thin and loose texture, with a suture on each side; spores light yellowish-brown. (Including N. valvata, *Sulliv.*) — Wet places, Canada to the Gulf.

2. **N. melanóspora,** Sulliv. Thallus small, depressed or sometimes cespitose, of lax texture; capsule often without sutures; spores dark brown, a half larger. — Moist ground, Ohio (*Sullivant*).

Order 139. MARCHANTIÀCEÆ. Liverworts.

Plant-body a thallus, dichotomous or subpalmately branching, usually innovating from the apex or beneath it, more or less thickened in the middle, and bearing numerous rootlets beneath and usually colored or imbricating scales. Epidermis usually more or less distinct and strongly porose above. Capsules globose, rarely oval, opening irregularly, pendent from the under side of a peduncled disk-like receptacle (*carpocephalum*). Elaters present, mostly 2-spiral.

* Thallus plainly costate, distinctly porose except in n. 6.

+– Gemmæ present on sterile stems.

1. **Marchantia.** Gemmæ in cup-shaped receptacles. Fertile receptacle 7 – 11-rayed.
8. **Lunularia.** Gemmæ in crescent-shaped receptacles. Fertile receptacle cruciform.

–+ –+ Gemmæ wanting.

++ Receptacle conic-hemispherical, 2 – 4-lobed; perianth lobed or fringed.

2. **Preissia.** Receptacle 2 – 4-lobed, with as many alternate rib-like rays. Perianth 4 – 5-lobed.
3. **Fimbriaria.** Receptacle 4-lobed. Perianth conspicuous, split into 8 – 16 fringe-like segments.

++ ++ Receptacle more or less conical; perianth none.

4. **Conocephalus.** Thallus very large, strongly areolate. Receptacle conical, membranous.
5. **Grimaldia.** Thallus small. Peduncle chaffy at base and apex. Receptacle conic-hemispheric, truncately 3 – 4-lobed.
6. **Asterella.** Thallus eporose. Receptacle conic-hemispheric, becoming flattened, acutely 4- (1 – 6-) lobed.

* * Thallus thin, ecostate or barely costate.

7. **Dumortiera.** Receptacle convex, 2 – 8-lobed. Perianth none.

1. MARCHÁNTIA, Marchant f. (Pl. 22.)

Thallus large, forking, areolate, porose, with broad diffused midrib; gemmæ in a cup-shaped receptacle. Dicœcious. Fertile receptacle peduncled from an apical sinus of the thallus, radiately lobed. Involucres alternate with the rays, membranous, lacerate, enclosing 3 – 6 1-fruited cleft perianths. Calyptra per-