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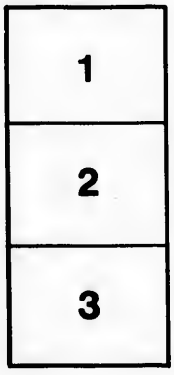
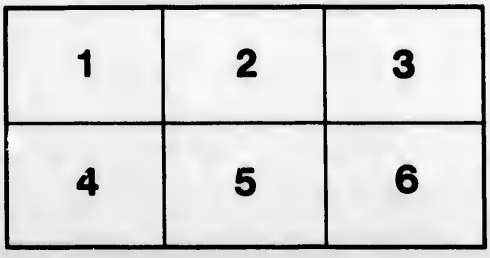




BULLETIN
OF THE
ILLINOIS STATE LABORATORY
OF
NATURAL HISTORY.

VOLUME II.

ERRATA.

Page 5. Third line of table, second column, for 39, read 38; sixth line, second column, for 121, read 120.

Page 9. Seventeenth line, for conjunction, read *conjugation.*

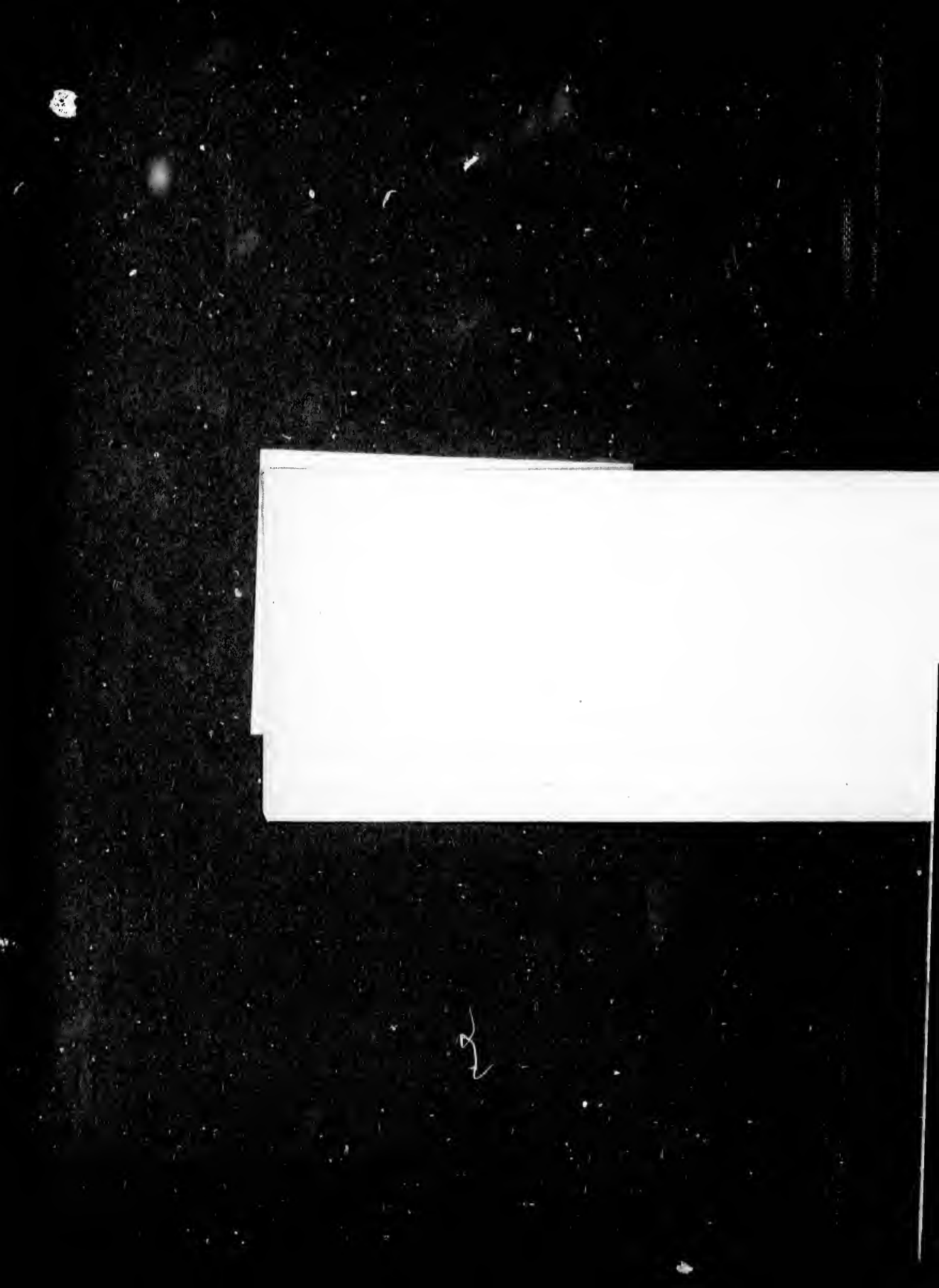
Page 21. Thirteenth line, for Ricciaceæ, read *Ricciaceæ.*

Page 67. Seventeenth line from bottom, for F. fraligifolia, read *F. fragilifolia.*

3. Most of our public and college libraries contain little or no literature on this subject.

4. Many of the species described as new by American writers are not represented in any American collection.

When we add to the above the inherent complexity of the group, we begin to see some of the difficulties in the way of study. It is to relieve in part these difficulties, and to stimulate a more complete collection of *Hepaticæ*, particularly in unexplored portions of our country, that the present compilation has been made. That it is at best an imperfect representation of our hepatic flora is painfully apparent to its writer, but it is hoped that it may serve as a stimulus to more work in this



BULLETIN
OF THE
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VOLUME II.

ARTICLE I.—*Descriptive Catalogue of the North American Hepaticæ, North of Mexico.* By LUCIEN M. UNDERWOOD, PH.D.

PREFATORY NOTE

The study of the *Hepaticæ* is attended with much difficulty for several reasons, among which may be named the following:

1. These plants are very largely neglected by collectors.

2. The literature on the subject is rare and inaccessible. Sullivant's work on the *Hepaticæ*, which seems to have been published in a limited edition, is now a rarity, and can hardly be obtained at any price.

3. Most of our public and college libraries contain little or no literature on this subject.

4. Many of the species described as new by American writers are not represented in any American collection.

When we add to the above the inherent complexity of the group, we begin to see some of the difficulties in the way of study. It is to relieve in part these difficulties, and to stimulate a more complete collection of *Hepaticæ*, particularly in unexplored portions of our country, that the present compilation has been made. That it is at best an imperfect representation of our hepatic flora is painfully apparent to its writer, but it is hoped that it may serve as a stimulus to more work in this

direction, and lay in store material for a more critical examination of this group in the future.

It was the intention of Mr. Austin, of New Jersey, to publish a monograph of this group, but by his death his critical knowledge of the *Hepaticæ* is lost to the world. His private collection, even, has crossed the ocean and is practically lost to Americans. Some of Mr. Austin's work was left in manuscript form, and all that he left is now in the writer's possession. Much of it consists of mere fragments or notes on a few species. A notable exception to this is the genus *Riccia,* on which his notes and descriptions are very complete; the account of that genus given here may be regarded as a condensation of Mr. Austin's manuscript notes. On the *Jungermaniaceæ*, the largest and most difficult order, Mr. Austin left almost nothing in manuscript.

In the preparation of this compilation the writer has made use of every available means for making it complete and authentic. Many thanks are due kind-hearted botanists for assistance; especial mention is due the following. To Prof. S. A. Forbes, for the loan of hepatic collections in the possession of the State Laboratory; to Prof. Sereno Watson for the generous loan of the manuscript on the Californian *Hepaticæ*, originally prepared for the "Botany of California," but not published; to Prof. Watson and the other authorities at Cambridge for access to the extensive libraries and collections; to Dr. H. A. Bolander and others for generous contributions of specimens particularly from the Pacific coast.

No attempt has been made to publish new species, the writer believing that too many have already been described from insufficient data, and considering it far more necessary to set in order those already published.

It is hoped that persons receiving this work will aid the further and critical study of this group by communicating specimens of all the forms found in their own localities.

SYRACUSE, N. Y., *November 10, 1883.*

INTRODUCTORY

General Characters. The HEPATICÆ include quite diverse forms of vegetation, judging from the outward habit of the plants composing the group, yet all are more or less intimately related in their essential, that is, their reproductive characters. The lower forms consist of a mere expansion of tissue with no differentiation of stem and leaves. These thalloid forms are quite frequently confused with certain forms of lichens, but can be easily distinguished by the fact that while the lichen is usually rather dry and crustaceous or leathery, the hepatic is more loosely cellular or spongy in texture, and presents a moist or somewhat juicy appearance under pressure. Some of the aquatic forms have also been mistaken for algæ. The higher forms of Hepaticæ are more moss-like in general appearance, consisting of a stem and leaves usually closely creeping over some substance, which may be the ground itself, rotten wood, living trees, or rocks. These higher forms are sometimes confused with the true mosses (*Musci*), but can usually be distinguished by having the leaves two-ranked, while the mosses proper have them in several or many ranks. The more technical differences will be made apparent at a later paragraph.

Habits of Growth. The Hepaticæ are as various in their habits of growth as they are diverse in their external appearance. They may be looked for in almost any situation, though certain conditions seem most favorable for continued and thrifty growth. Some may be found on the ground in ditches or in moist places, others grow on rocks or stones by brooks or rivulets, while others still are found on rotten logs or stumps in forest or swamp. Some species are found among other mosses, notably the *Sphagna* of swamps and peat-bogs.

some grow on the bark of living trees, a few on the stems or leaves of herbaceous plants, while at least one American species is found growing over lichens. Some grow in cultivated, even trodden ground, and a very few are aquatic in pools or ponds.

Size. The variation in size is often considerable; a few forms of *Lejeunia* are so small as to be almost invisible to the unaided eye: this condition, however, is not common, and most will measure from a few millimetres to several centimetres in length. All forms are small and inconspicuous, and rarely are the species so crowded or numerous as to form a conspicuous portion of the earth's vegetation.

Time for Collecting. The hepatics should be collected for preservation and study when in fruit, if this be possible, and this condition occurs at different seasons in the various species; some bear fruit in late autumn, some in early spring, some in midsummer; in short, there is scarcely any season of the year, even winter, that will not find some form in fruit, yet the period from October to May may include the larger number of species for the cool temperate regions of America. Many species have never been found in fruit, and possibly never produce fruit, so it will be advisable to collect all species whether in fruit or not, for otherwise these less known forms may be neglected.

Geographic Distribution. Too little is known at present regarding the range of our native species to arrive at definite conclusions regarding distribution, yet certain preliminary features may be noted with even our present knowledge. Of the 231 species described in this paper 111 are common to North America and Europe. We may tabulate our species in five chief groups or natural divisions:

I. Boreal: including those species found on the summits of the higher mountains of the Atlantic States as well as the Rocky Mountains of the West, and the colder portions of Canada, Labrador and Greenland; most of the species of this province are common to the colder portions of the Old World.

II. Medial: including those species inhabiting that portion of the United States and Canada east of the Rocky Mountains not already included in I; more than one-half the species

we have in common with England and the lower latitudes of Continental Europe.

III. AUSTRAL: including the forms found in the southern border states from Texas or New Mexico to Florida, some forms being common to Mexico or the West Indies, or both, and a few found in Europe.

IV. OCCIDENTAL: including the Pacific border region from Lower California to British Columbia, and possibly to Alaska, including also the species of the Sierra Nevadas.

V. COSMOPOLITAN: including species more or less common to all portions of our territory, all of which are also common to Europe.

The above divisions are, of course, merely tentative, and may be considerably modified by a further knowledge of the distribution of individual species. (See Appendix A.)

Our species may be summed up as follows:

DIVISION.	Number of Species.	Peculiar to America.	In common with Europe.
I. BOREAL.....	38	10	28
II. MEDIAL	99	45	54
III. AUSTRAL	46	39	8
IV. OCCIDENTAL	34	27	7
V. COSMOPOLITAN	14	....	14
TOTAL	231	121	111

ESSENTIAL CHARACTERS

From this brief outline or introduction to the more general characters of the hepatics, we must now consider the special or characteristic habits of the group and its subdivisions. As the plants of this group all manifest two distinct phases in their cycle of growth or life history, it will become

necessary to consider each separately, as the *sexual phase*, and the *sporogony phase*.

Sexual Phase. All HEPATICÆ, in common with the MUSCI (Mosses), manifest what is called an "alternation of generations,"* which distinguishes them for the most part from the lower forms of plant life, and connects them with the ferns and their allies. The first phase is developed from the spore, either directly or indirectly, and produces the sexual organs by which the second or spore producing phase is orignated. As the sexual phase is the form in which the plant is most likely to be seen, and furnishes the most distinctive generic and specific characters, a detailed account of the various parts and organs will be first given.

Vegetation. Two principal forms of vegetation are commonly found in this group of plants, namely, the *thallose*,† consisting merely of an expanded or flattened mass of tissue, without distinction of stem and leaves; and the *foliaceous*, with well marked stem and leaves. These two forms, however, are only the extremes of a somewhat regularly graded series of forms. The entire series may be characterized as follows:

1. Forms consisting of a true thallus. *(Anthoceros, Aneura.)*

2. Thalloid stems, usually with scales underneath, which may correspond to leaves. *(Marchantia, Blasia.)*

3. Pseudo-foliaceous forms, in which the thallus is lobed, the lobes assuming leaf-like forms. *(Fossombronia.)*

4. Typical foliaceous forms. *(Jungermania, Frullania.)*

The vegetation in all Hepaticæ is bilateral, that is, differently developed on the upper and under sides. The under side, deprived of the light, differs in internal structure from the upper, and there frequently results a corresponding difference in the external appearance. Most are of some shade of green, the darker more common, but varying to brownish-green and even fuscous; some of the thallose forms are purplish beneath,

* I have hitherto pointed out the misapplication of this term, which must eventually give place to one more exact and scientific. Compare: *Our Native Ferns and Their Allies*, p. 35, note.

† *Frondose* is an older term, but the term *frond* has an entirely different signification, and is appropriately applied to the ferns; the above term is moreover more expressive and exact.

and this frequently extends to the upper margins, and more rarely to the entire upper surface. Some species of *Riccia* are whitish, or even milky white, above.

True roots are never present, but root-hairs, consisting ordinarily of a single cell, are usually abundantly produced on the under surface of the thallus, or, in the foliaceous forms, may proceed from definite points of the leaves *(Radula)*, or the amphigastria *(Frullania, Madotheca)*, or, as in most, from the under side of the stem, or from both stem and leaves *(Jungermania crenulata)*. In those forms that live on dry rocks and the bark of trees, the root-hairs are short and fascicled, and are sometimes provided with a sucker-like development at the end. The cell composing the root-hair is usually, in the thallose forms, granulose or papillose on the inner surface of its wall.

Thallus. The thallus is usually dichotomously branched, less frequently somewhat pinnately branched, and in rare cases simple. In some forms it is conspicuously reticulate on the upper surface, and is further marked with large whitish pores *(Conocephalus)*.

Leaves. In the foliaceous forms the leaves are usually two-ranked *(distichous)*, with frequently a rudimentary row on the ventral surface, known as the *amphigastria* (Gr. *amphi*, about, and *gastrion*, diminutive of *gaster*, belly). Both leaves and amphigastria may be entire, serrate, dentate, or variously lobed, cleft or divided. When one of the lobes is much inflated *(Frullania)* it is termed an *auricle*. The amphigastria usually differ from the leaves more or less in size and shape, though in rare cases they are similar, and the leaves thus become apparently three-ranked.*

Asexual Reproduction. This occurs among the hepatics under three forms; viz: (1). By innovations. (2). By gemmæ. (3). By runners.

In nearly all hepatics, except those that are annuals, the growth is continuous and indefinite from the apex of the stems or branches by a process of renewal, while the older portion

* Is it possible that the 3-ranked condition is the typical form, and that the amphigastria represent the abortive condition resulting from their position on the ventral surface? If so, this would be a marked example of retrograde development.

gradually dies away; the branches thus become independent plants by a sort of compulsory self-division. By this method large areas become covered with a single species without the production of spores.

Gemmæ (Lat. *gemma,* a bud) are variously produced in different genera. In some *(Madotheca)* they are simply cells detached from the margin of the leaves; in others *(Marchantia)* they are produced in broad cup-shaped receptacles on the upper side of the thallus, looking like miniature bird's nests with their included eggs; in other genera the receptacle may be flask-shaped *(Blasia),* or crescent-shaped *(Lunularia).* The last-named species may be seen in almost any greenhouse, where it has been introduced from Europe, and the crescent-shaped gemmæ cups are found on nearly every plant. Many species produce no gemmæ.

Less commonly the Hepaticæ multiply by runners, a peculiar form of which is termed a *flagellum* (Lat. a lash). Tubers, so called, were once supposed to form a fourth method of reproduction, but these "endogenous gemmæ" have been found to be produced from filaments of *Nostoc.* They are most common in some species of *Anthoceros.*

Sexual Organs. Two kinds are present, known respectively as *archegonia* (Gr. *archa,* beginning, and *gonos,* seed), analogous to pistils, and *antheridia* (Lat. *anthera,* an anther, and Gr. *eidos,* form), analogous to stamens. The relative position of these organs on the plant varies greatly in different genera. When the sexual organs are in the same cluster the term *synœcious* (Gr. *sun,* together, and *oikia,* house) is used; this form, however, rarely, if ever, occurs among the hepatics. When the antheridia are situated in the axils of bracts near the archegonia, or when (as in *Fossombronia)* both organs are naked on the dorsal surface of the same stem, the relation is said to be *paroecious* (Gr. *para,* beside, and *oikia).* When the antheridia occur in a separate receptacle on the same plant as the archegonia, the plant is *monœcious;* the same arrangement, but with the sexes on separate plants, is the *diœcious* relation. In some species one or more relations exist, apparently without special reason.

Antheridium. The male organ is usually globose or oval

and raised on a pedicle in the foliaceous species; in the thallose species it may be sessile on the surface of the thallus *(Sphærocarpus)*, immersed in it *(Fimbriaria, Pellia)*, or in a sessile or pedunculate disc-like receptacle, sometimes called an *androcephalum (Marchantia, Asterella)*. The antheridia collectively are sometimes referred to as the *andræcium*.

The antheridia contain a large number of small bodies suspended in a mucus, which consist essentially of spirally curved slender threads, provided at the end with cilia for purposes of motion; these are the antherozoids (Lat. *anthera*, anther, Gr. *zoon*, an animal, and *eidos*, form), and are analogous to pollen.

Archegonium. The female organ is a flask-shaped body which, when mature, has an orifice at the apex opening into the interior, where is found a globular cell known as the *oosphere* (Gr. *oon*, an egg, and *sphairos*, a sphere).

The process of fertilization consists of a union or conjunction of the antherozoid produced from the male organ, and the oosphere produced by the female, an end made possible by the motile power of the former. The fertilized oosphere developes into the "alternate generation," or sporogony phase.

In most of the true Liverworts (MARCHANTIACEÆ) the archegonia are situated on the under side of a usually pedunculed receptacle, which, as it bears the so-called fruit, is known as the *carpocephalum* (Gr. *karpos*, fruit, *kephale*, head).

Involucres. Immediately surrounding the archegonia, and usually formed after fertilization takes place, is a tubular or somewhat prismatic organ, which may be called the *inner involucre;** surrounding this is the *outer involucre*,* which is

* I have used the above terms at the suggestion of Dr. Gray, notwithstanding the different use of writers in both Europe and America. American writers have largely followed Nees von Esenbeck, in *Synopsis Hepaticarum* (1844), while recent European writers have revived the nomenclature of Dumortier, used as early as the publication of *Syllogé Jungermanniidearum* (1831), and perhaps earlier. It would seem that a rearrangement of terms, adjusted to both *Musci* and *Hepaticæ*, might profitably be made. That no error be made by those referring to other writers, the following comparison is given:—

Inner involucre (as above) = colesula (*Dumortier, Lindberg*) = perianth (*Nees von Esenbeck, Sullivant, Austin*) = perichætium (*Ekart*).

Outer involucre (as above) or simply *involucre* = perichætium (*Dumortier, Lindberg*) = involucre (*Nees von Esenbeck, Sullivant, Austin*) = calyx (*Ekart*).

tubular *(gamophyllous)*, or composed of separate leaves of peculiar shape, then called *involucral leaves (polyphyllous)*. In *Fossombronia* the archegonia are naked on the dorsal surface of the thallus, there being no involucres, and in several genera either the outer or inner involucre may be absent.

Sporogony Phase. The so-called "fructification," or "asexual generation," is properly neither, but merely a phase or stage of growth in the life-history of the plant, as the caterpillar is a mere phase in the life-history of a butterfly. It may be called the *sporogony phase* (Gr. *sporos,* seed, and *goneia*, generation). This varies slightly in the various orders, but essentially consists of a *capsule* containing the *spores* and, with the exception of the Order RICCIACEÆ, *elaters,* whose function is to aid in distributing or scattering the spores. The capsule, with its appendages, constitutes the *sporogonium*, and consists of an elongate, two-valved, projecting pod in *Anthoceros;* a thin-walled ball sessile on the thallus or sunken in its tissue in *Riccia;* a short-stalked ball in *Marchantia*, and a more or less long-stalked ball in *Jungermania*, the four named genera each forming the type of an order. In *Targionia* the capsule is situated in a bivalved receptacle beneath the apex of the thallus. Altho the sporogonium appears like an outgrowth of the mature sexual plant, it nowhere unites with the surrounding vegetative structure, even when its pedicel penetrates into its tissue.

Calyptra. In the course of the development of the sporogonium the lower portion, which has become considerably expanded, separates into two portions, the outer called the *calyptra* (Lat. a covering for the head), which is ultimately of a thin and delicate texture, and closely invests the capsule formed of the inner portion. The upper portion of the archegonium not expanding, forms a blunt point, which crowns the calyptra, and is called the *style*.

Spores. The product of this phase is the spores, which are developed in fours in a sort of globular utriculus, which disappears when the spores mature and allows the spores to separate. In some of the RICCIACEÆ the spores remain united and form a *coccus* or berry.

The surface of the spores may be smooth, reticulate, papillose or granulose. The spores on germinating produce the sexual phase.

Elaters. Enclosed in the capsule with the spores are certain thread-like bodies formed of a single cell, and containing from one to four spiral (rarely annular) bands in their walls. These are the *elaters*, and probably aid in scattering the spores when the capsule matures and its valves separate. In *Anthoceros* they are often of peculiar shape, simple or jointed, and usually without distinct fibres.

In the last named genus occurs another organ known as the *columella*, which is found in no other group of *Hepaticæ*, but reappears as a constant organ in the true mosses.

CLASSIFICATION

General Relations. The hepatics form a part of a natural group of plants which stands about midway between the highest and lowest forms of vegetable life. Indeed, in them are mingled forms representing the two vegetative types — the one *thallophytic*, with merely a plant body without true foliage — the other *cormophytic*, having the differentiation of stem and leaves more or less complete.

In the seven recognized divisions of the vegetable kingdom the *Bryophyta*, to which the hepatics belong, is placed fifth in a lineal classification, as follows:—

I. Protophyta.—Bacteria, yeast plant, etc.
II. Zygospora.—Diatoms, desmids, moulds, etc.
III. Oospora.—Many freshwater and marine algæ.
IV. Carpospora.—Red algæ, *Chara*, lichens, mushrooms, many parasitic fungi.
V. Bryophyta.—Hepaticæ, mosses.
VI. Pteridophyta.—Ferns and their allies.
VII. Phanerogamia.—Flowering plants.

A lineal classification, however, does not properly present the natural position or inter-relations of the Hepaticæ and other groups, and indeed the affinities of the lower groups are too imperfectly understood to represent even a tolerable natural,

that is to say, *genetic* relationship. A creditable attempt is made by Prof. Bessey in his excellent Botany (p. 568) to arrange the primary divisions with reference to descent. It was a fancy of Mr. Austin, expressed in his MSS., as well as hinted in his publications,* that the hepatics were only a higher development of some form of freshwater algæ, and that the ferns, in turn, were a higher development of the hepatics. In a generalized sense this is likely to prove nearer the realm of fact than that of fancy. Unfortunately few of the earlier forms have been preserved in a fossil state to offer a clue to the affinities of primordial types.

Relation to Mosses. Whatever be the origin of the members of this group, or however the earlier representatives may have been allied to lower forms, the hepatics with the true mosses *(Musci)* at present form a somewhat specialized group, clearly marked in their methods of growth as well as in their reproductive characters. These two were early associated together in a sub-class known as "Cellular Aerogens," but are now more explicitly and appropriately named the *Bryophyta* (Gr. *bruon*, moss, *phuton*, plant), i. e., mosses and their allies.

The distinguishing characteristics of the two allied groups may be brought out more clearly by the following parallel arrangement:—

Hepaticæ.	Musci.
1. *Plant body* varying (in different species) from a thallus to a leafy axis.	1. *Plant body* always a leafy axis.
2. *Stems* bilateral, consisting of an upper and a lower side distinct in appearance and structure.	2. *Stems* not bilateral, uniformly developed.
3. *Leaves* 2-ranked, often with rudiments of a third *(amphigastria)*, never with a midvein.	3. *Leaves* 3-many (sometimes 2-), ranked usually with a midvein.
4. *Root hairs* unicellular.	4. *Root hairs* usually composed of a row of cells.

* Bulletin Torrey Botanical Club, VI, 306.

Hepaticæ.	Musci.
5. *Calyptra* remaining below at the base of the capsule which ruptures its upper portion.	5. *Calyptra* ruptured at the base by the capsule, which it covers as a cap.
6. *Capsule* maturing before rupturing the calyptra, opening by 2 or 4 valves, or irregularly; or indehiscent, never by a special lid.	6. *Capsule* maturing after rupturing the calyptra, opening by a special lid *(operculum)*.
7. *Columella* wanting (except in *Anthocerotaceæ*).	7. *Columella* always present (at least at an early stage of development).
8. *Elaters* mixed with the spores (except in *Ricciaceæ*).	8. *Elaters* never present.

In other characters the two groups closely resemble each other.

Subdivisions. The hepatics, varying so much in their characters, may be arranged in four or five well-marked groups, four of which it would seem should rank as *orders,* notwithstanding the rearrangement of recent European writers.*

These four are all largely represented among our forms and each is of somewhat general distribution. Their characters may be arranged in tabular form for convenience of comparison:

* Compare S. O. Lindberg *Genera Europæa Hepaticarum secundum novam dispositionem naturalem.* In Acta Soc. Fenn. X. That Lindberg's classification may be more widely known in this country a tabulated outline will be found in Appendix B.

	Ricciaceæ.	Marchantiaceæ.	Anthocerotaceæ.	Jungermaniaceæ.
Plant Body	A thallus dichotomously branching, usually scaly beneath.	A thallus dichotomously or radiately branching, scaly beneath.	A thallus irregularly branching.	In a few forms a thallus variously branching; in most a leafy axis with two rows of leaves and sometimes a rudimentary third row beneath.
Epidermis	Usually distinct, eporose.	Well marked, usually porose.	Wanting.	Wanting (leaves composed of a single layer of cells.)
Capsule	Spherical, immersed in thallus or sessile on its surface, *indehiscent.*	Spherical, short-stalked, opening irregularly or by imperfect valves, frequently pendent from under surface of a receptacle (*carpocephalum*).	Elongate, two-valved at maturity.	Usually spherical and long-stalked, opening by four valves.
Elaters	Wanting.	Present, with spiral fibres.	Present, lacking spiral fibres.	Present, with spiral fibres.
Columella	Wanting.	Wanting.	Present.	Wanting.
Number of American Genera	3	13	2	32

Popular names have been only rarely applied to the hepatics because of their humble and inconspicuous position in the vegetable world, yet the *Ricciaceæ* are sometimes known as Crystalworts, the *Marchantiaceæ* as Liverworts, the *Anthocerotaceæ* as Horned Liverworts, or simply Hornworts, and the *Jungermaniaceæ* as Scale Mosses. The old name of the common *Marchantia polymorpha*—Liverwort—given since it was supposed to be a specific for liver troubles, because the thallus bore a faint resemblance to the liver—has been latterly adopted for the entire order, and in a Latin form *(Hepaticæ)* for the entire group. Thus does the language of ignorant superstition become the adopted language of science.

BIBLIOGRAPHY

The works consulted in the preparation of this paper, not including various general works on Botany, are given below. The list is believed to contain all American works, as well as papers and notes in American periodical literature. Notices of any omissions in this particular would be thankfully received. The only works hitherto professing to describe the American species of any considerable area are those by Schweinitz (1821) and Sullivant (1856). It is hoped that a critical work, figuring the rarer American forms, may follow this introductory paper in due course of time.

AUSTIN (Coe F.) Characters of some new Hepaticæ (mostly North American) together with Notes on a few imperfectly described Species. In Pro. Phil. Acad., Dec. 1869 (Vol. —, pp. 218–234). Describes 39 new species as follows: from the U. S. 24; from Sandwich Is. 9; from Japan 3; from Mauritius 2; from Nepal 1.

———New Hepaticæ. In Bull. Torr. Bot. Club, Mar. 1872 (Vol. III, pp. 9–18). Describes 17 new species as follows: from the U. S. 15; from Europe 1; from Fiji Is. 1.

Number of American Genera	3	13	2	32
	Wanting.	Wanting.	Present.	Wanting.

———Hepaticæ Boreali-Americanæ Exsiccatæ. 1873. Specimens of 176 species and varieties of American Hepaticæ (Nos. 1–150 with 26 interpolated numbers). The tickets of the specimens were also published in pamphlet form.

———Sandwich Island Hepaticæ. In Bull. Torr. Bot. Club, Mar. and Apr. 1874 (Vol. V, pp. 14–18.) Two lists, one of 24, the other of 34 species, with descriptions of 13 new species.

———New Hepaticæ. In Bull. Torr. Bot. Club, Mar. 1875 (Vol. VI, pp. 17–21). Describes 13 new species as follows: from the U. S. 11; from Cuba 1; from Africa 1.

———Notes on the Anthocerotaceæ of North America, with descriptions of several new species. In Bull. Torr. Bot. Club, Apr. 1875 (Vol. VI, pp. 25–29). Describes 9 new species.

———Notes on the Genus Pellia. In Bull. Torr. Bot. Club, Apr. 1875 (Vol. VI, pp. 29–30).

———New Hepaticæ. In Bull. Torr. Bot. Club, July 1875 (Vol. VI, pp. 46–47). Describes 3 new species, 1 each from California, Lower California and Van Dieman's Land.

———Notes and Criticisms on Hepaticæ Americanæ Exsiccatæ. In Bull. Torr. Bot. Club, Apr. 1876 (Vol. VI, p. 85.) The notes are on Nos. 6, 15, 19, 20, 26, 27, 29, 29b, 30, 31 and 35.

———Notes on Hepaticology. In Bot. Bulletin (now Bot. Gazette), May and June 1876 (Vol. I, pp. 31–32, 35–36). Describes 11 new species as follows: from the U. S. 5; from Sandwish Is. 4; from Cuba 1; from Jamaica 1.

———New Hepaticæ. In Bull. Torr. Bot. Club, June 1877 (Vol. VI, pp. 157–158). Describes 4 new species, 3 from the U. S. and 1 from Mexico.

———Notes. In Bot. Gazette, Oct. 1877 (Vol. II, p. 142). *Lejeunia biseriata?* changed to *Erpodium biseriatum?*

———List of 15 species of Hepaticæ from Colorado and the Southwest. In Vol. VI, Botany; U. S. Geog. Surveys west of the 100th meridian. 1877.

———Notes on Hepaticology. In Bot. Gazette, Jan. 1878 (Vol. III, pp. 6–7). Describes 2 new species, 1 each from Ohio and Sandwich Is.

———Notes on Hepaticology. In Bull. Torr. Bot. Club, Apr. 1879 (Vol. VI, pp. 301–306). Describes 10 new species as follows: from the U. S. 5; from Sandwich Is. 3; from Japan, Chili and Australia, each 1.*

BEARDSLEE (Henry C.) List of Hepaticæ growing in Ohio. In Bot. Bulletin (now Bot. Gazette) Apr. 1876 (Vol. 1, p. 22). A nominal list of 61 Species.

———Same. In "Catalogue of the Plants of Ohio." 1874.

BOLANDER (Henry N.) List of 30 species of Hepaticæ growing in California. In "A Catalogue of the Plants growing in the Vicinity of San Francisco," 1870.

BORY DE SAINT VINCENT et MONTAGNE (C.) Sur un Nouveau Genre de la Famille des Hepatiques. In Annals Sciences Naturelles, Apr. 1844.

BRENDEL (Friedrich). Flora Peoriana: Die Vegetation im Clima von Mittel-Illinois. Budapest, 1882. List of 19 species of *Hepaticæ* growing in the vicinity of Peoria, Illinois.

DUMORTIER (Barth. Car.) Sylloge Jungermannidearum Europæ Indigenarum, 1831.

———Recueil d'observations sur les Jungermanniacees, 1835.

———Hepaticæ Europæ, 1874. The European Manual of the Hepaticæ, describing, with synoptic tables, all the recognized species of Europe.

EKART (Tobia P.) Synopsis Jungermanniarum in Germania Vicinisque Terris Hucusque Cognitarum, 1832. Illustrated with 116 well-executed figures showing the microscopic characters of the order *Jungermaniaceæ*.

* It may be of interest to summarize the work of Mr. Austin in the Hepaticæ as by him, more than any other American botanist, has the subject of this perplexing but interesting group been brought to its present condition. Total number of new species described 122, distributed as follows: United States, Canada and British Columbia, 74; Sandwich Islands 30; Japan 4; Mauritius, Mexico and Cuba, each 2; Jamaica, Chili, Europe, Africa, Australia, Van Dieman's Land, Figi Islands and Nepal, each 1.

GOTTSCHE (Carl M.) Ueber die Fructification der Jungermanniæ Geocalyceæ, 1844.

———De Mexikanske Levermosser. 1863.

HITCHCOCK (Edward). List of 24 species of Hepaticæ growing in Massachusetts. In "Catalogue of Plants growing without cultivation in Massachusetts." Report on Geol. etc., of Mass. 1834.

HOOKER (William Jackson). British Jungermanniæ. 1816. This magnificent volume is most valuable on account of the 88 accurately figured and colored plates which it contains.

LEHMAN (J. G. C.) Pugillus Novarum et Minus Cognitarum Stirpium. IV, V, VI, VII, VIII and X on Hepaticæ.

LEITGEB (Hubert). Untersuchungen ueber die Lebermoose, 1874-9.

LINDBERG (S. O.) Hepaticæ in Hibernia Mense Julii, 1873, lectæ. In Acta Soc. Scien. Fennicæ X, 1875, pp. 467–559.

———Monographia Metzgeriæ, 1877.

LINDENBERG (J. B. G.) Monographie des Ricciecn, 1836.

———Synopsis Hepaticarum Europæarum. 1829.

MACOUN (John). List of 67 Hepaticæ growing in British America. In Appendix to Botanist's Report — Catalogue of Plants, Geol. Survey of Canada, 1875–6.

MICHAUX (Andre). Flora Boreali Americanæ. Vol. II. Describes 13 species of Hepaticæ.

MITTEN (William). The "Bryologia" of 49th parallel of Latitude. In London Jour. Bot. Vol. VIII. 1864. List of 34 species of Hepaticæ from British North America.

NEES VON ESENBECK (Christian Gottfried). Naturgeschichte der Europäischen Lebermoose. 1833–1838. 4 Bændchen.

NEES VON ESENBECK (C. G.), **GOTTSCHE** (Carl M.), et **LINDENBERG** (J. B. G.) Synopsis Hepaticarum, 1844. The only work professing to describe the known species of the world.

PARKER (C. F.) List of 75 species of Hepaticæ growing in New Jersey. Compiled from the collections of the late C. F. Austin. In a preliminary Catalogue of the Flora of New Jersey. (Britton). 1881.

PECK (Charles H.) List of 10 species of Hepaticæ growing on the Summit of Mt. Marcy (Adirondack Mts, N. Y.) In Appendix to 7th Report on Survey of Adirondack Region of New York. 1880.

ROBINSON (John). List of species of Hepaticæ in Essex Co. (Mass.) In "Flora of Essex County," 1880.

ROTHROCK (J. T.) Flora of Alaska. In Smithsonian Report, 1867. List of 6 species of *Hepaticæ*.

RUSSELL (J. L.) Hepatic Mosses of Massachusetts. In Boston Jour. Nat. History, Vol. III.

SCHWEINITZ (Lewis David de). Specimen Floræ Americanæ Septentrionalis Cryptogamicæ sistens Mucos Hepaticos hucusque in Amer. Sept. Observatos, 1821. Describes 77 species of American Hepaticæ.

SULLIVANT (William S.) Musci Alleghanienses, 1846. Of this series Nos. 216–292—seventy-six numbers—are Hepaticæ. The tickets are also collected in book form and contain many notes on the specimens.

———Contributions to the Bryology and Hepaticology of North America. Part I (3 plates). In Memoirs Amer. Acad. (new series) III. Part II (1 plate). In same (new series) IV. Descriptions of 5 new species and notes on several others.

———Musci and Hepaticæ of the Eastern United States, 1856. Describes the Hepaticæ of the Eastern U. S., as then known; giving 3 copperplates illustrating the genera.

———Descriptions of *Musci* and *Hepaticæ* collected on the Pacific R. R. Survey. In Vol. IV of the Report. List of 7 species of *Hepaticæ*.

UNDERWOOD (Lucien Marcus). North American Hepaticæ with a preliminary list of species for additions and corrections. In Botanical Gazette, Vol. VII, No. 2 (Feb. 1882).

WARD (Lester F.) Guide to the Flora of Washington [D. C.] and Vicinity, 1881. List of 29 species of *Hepaticæ*.

WOLF (John) and **HALL** (Elihu). List of 45 species of Hepaticæ growing in Illinois. In Bulletin No. 2, Ill. State Laboratory of Natural History, 1878.

DESCRIPTIVE CATALOG

CLASS HEPATICÆ

Small moss-like or thalloid plants of a lax cellular texture, usually procumbent and emitting rootlets from beneath. Calyptra usually rupturing at the apex. Capsule irregularly dehiscent, bivalved, quadrivalved, quadridentate, or indehiscent, containing spores mixed with thin thread-like cells, usually containing one or more spiral fibres *(elaters)*. Reproductive organs of two kinds, variously situated, the matured archegonium forming the capsule. Columella rarely present. The calyptra with its enclosed capsule is usually surrounded by a tubular inner involucre, which in turn is surrounded by a tubular outward involucre or by involucral leaves. The calyptra is always present; either involucre or both may be absent.

ARTIFICIAL SYNOPSIS OF ORDERS

A
- Vegetation thallose ..... B
- Vegetation foliaceous; capsule quadrivalved or quadridentate. Order IV. JUNGERMANIACEÆ *(foliosæ* Gen. 6–32).

B
- Capsule indehiscent, elaters wanting. Order I. RICCIACEÆ.
- Capsule irregularly dehiscent, borne on the under side of a pedunculate receptacle. Order II. MARCHANTIACEÆ.
- Capsule bivalved C
- Capsule quadrivalved. Order IV. JUNGERMANIACEÆ *(thallosæ* Gen. 1–6).

C { Capsule more or less peduncled, columella present. Order III. ANTHOCEROTACEÆ.
Capsule sessile; columella wanting; *Targionia* in Order IV. MARCHANTIACEÆ.

In the following pages no attempt has been made at a complete bibliography or synonymy. References are made to Syn. Hep. = Gottsche, Lindenberg, and Nees' *Synopsis Hepaticarum*, 1844, and Hep. Europ. = Dumortier's *Hepaticæ Europæa*, 1874, where a more complete synonymy may be found. For figures reference is to Brit. Jung. = Hooker's *British Jungermanniæ*, 1816, and Ekart = Ekart's *Synopsis Jungermanniarum Germanicarum*, 1832.

ORDER I. RICCIACÆ ENDL.

Terrestrial or pseudo-aquatic, chiefly annual plants with thallose vegetation. Fruit short-pedicelled or sessile on the thallus or immersed in it. Calyptra crowned with a more or less deciduous colored style. Capsule either free or connate with the calyptra, globose, at length rupturing irregularly. Spores usually angular, reticulate or muriculate. Elaters wanting. Antheridia ovate, immersed in the thallus in flask-shaped cavities with protruding mouths (ostioles). Thalli with or without areolæ and air cavities.

SYNOPSIS OF GENERA

A { Spores separate; fruit immersed in the thallus. I. RICCIA.
Spores in fours, united in a coccus or berry — B.

B { Fruit immersed in the substance of the thallus. II. THALLOCARPUS.
Fruit aggregated, sessile on the thallus. III. SPHÆROCARPUS.

I. RICCIA MICH.

Fruit immersed in the thallus, sessile. Calyptra with a persistent style. Capsule sessile within the calyptra. Spores alveolate or muriculate, flattish and angular (except in *R.*

tenuis). Thallus at first radiately divided from the centre, which often soon decays; the divisions bifid or di-trichotomous, plane, depressed or canaliculate above, and usually convex and naked or squamulose beneath; margins either naked or spinulose-ciliate. Epidermis usually distinct, eporose; air cavities evident in some species, wanting in others. Rootlets papillose within (except in *R. Frostii*). Named for *Ricci*, an Italian botanist.

§ 1. Lichenodes Bisch. *Thallus solid, without air cavities; fruit mostly protuberant above; spores about 0.084 mm. in diameter, angular, issuing through openings which at length appear in the upper surface of the thallus.* Terrestrial species growing on damp, usually trodden or cultivated ground, and closely adhering to it.

* *Thallus naked on the margins or underneath (without cilia or scales).*

1. **R. Frostii** Aust. Thallus orbicular, 1.3—2.5 cm. in diameter, subsolid, thinnish, subpalmately or radiately divided, cinereous-green, fibrously reticulate, minutely pitted and either plane or channeled above, concolorous or *tinged with purple toward the apex beneath*, very narrowly membranous, somewhat papillose-squamulose, and *often tinged with purple on the margin;* divisions linear or subspatulate-linear, subdichotomous; lobes subtruncate and indistinctly emarginate; *rootlets smooth* or obsoletely papillose within; capsules irregularly disposed, very prominent underneath; spores nearly round, barely 0.051 mm. in diameter, fuscous, somewhat margined, minutely and obscurely reticulated and granulose-papillose, *the sides strongly depressed when dry.*

Hab.—Nev. (*Watson*), Col. (*Wolfe*), O. (*Beardslee*), Ill. (*Hall*).
Bib.—Torrey Bull. VI, p. 17.

2. **R. Watsoni** Aust. Diœcious; thallus of male *plant small, fuscous-purple both sides*, orbicular, deeply and many times divided, thick, fleshy, *broadly pitted,* papillose, fibrous-reticulate and *with rather large, terete subclavate, gland-like papillæ* (ostioles?) *above*, densely radiculose and nodulose be-

neath; divisions narrow, dichotomous, plane or when dry broadly canaliculate above, convex-thickened beneath; lobes nearly linear, very obtuse, narrowly emarginate and somewhat thickened at the apex; rootlets smooth within; antheridia large, immersed, causing the under surface to appear nodulose. Possibly only the male plant of No. 1.

Hab.—Nev. (*Watson*), Col. (*Wolfe*).
Bib.—Torrey Bull. VI, p. 17.

3. **R. glauca** L. Thallus orbicular, somewhat stellately lobed, 1.3—2.5 cm. in diameter; divisions linear-obovate or linear-obcordate, emarginate-lobed, channeled only toward the apex, *beautifully reticulate and glaucous above*, membranous along the margin, greenish beneath; spores 0.084 mm. in diameter, moderately reticulate and with a narrow pellucid margin.

Hab.—Cal. (*Bolander*). (Eu.)
Bib.—Syn. Hep. p. 599, Hep. Europ. p. 167.
Delin.—Lindenberg Monog. Ric. t. XIX.

4. **R. albida** Sulliv. in Herb. 1853. Thallus small, covered with *a thick, spongy, deeply-pitted, milk-white epidermis*, alternately or bifurcately divided; divisions oblong, much crowded, with a rounded sub-marginate apex, narrowly and deeply canaliculate above, densely radiculose and subsquamous beneath; fruit unknown.

Hab.—Tex. (*Wright*).
Bib.—Pro. Phil. Acad. 1869, p. 231.

5. **R. Beyrichiana** Hampe, MS. Thallus fleshy, cæspitose, adhering to the earth by long hyaline rootlets, sensibly dilated from a narrow linear base, mostly bifid $\frac{1}{3}$ the length, narrowly channeled and green above, the margins entire, ascending. Clothed with a dark-purple membrane beneath.

Hab.—"Between Jefferson and Gainsville, Tenn." (*Beyrich*).
Bib.—Syn. Hep. p. 601.

6. **R. bifurca** Hoffm. Thallus dichotomously or substellately divided, pale green; divisions wedge-shaped, 2-lobed at the apex; lobes spreading, dotted, broadly channeled above by the thick and ascending margins, purplish beneath.

Hab.—North America (*Synopsis Hepat.* p. 600). (Eu.) Doubtfully belonging to America.

Bib.—Syn. Hepat. p. 600, Hep. Europ. p. 167.

Delin.—Lindenberg Monog. Ric. t. XX.

** *Thallus naked on the margins, squamous underneath.*

† *Scales whitish.*

7. **R. Sorocarpa** Bisch. Thallus 0.6—1.9 cm. in diameter, pale green, or in the dry state or with age becoming albescent, *finely reticulate above*, subradiately or bifurcately divided; divisions oblong-linear, acutish, deeply and acutely sulcate above, much thickened beneath and furnished toward the apex with a few inconspicuous *white scales which do not extend beyond the margin;* margins erect, when dry; spores issuing through chinks which early appear along the groove above.

Hab.—Thin rocky soil and cultivated fields; Closter, N. J. (*Austin*), Western N.Y. (*Clinton*), Ill. (*Hall*), Cal. (*Bolander*), S.C. (*Ravenel*). (Eu.)

Bib.—Syn. Hep. p. 600, Hep. Europ. p. 167.

Exsic.—Hep. Bor.-Amer. No. 139.

8. **R. lamellosa** Raddi. Thallus pale green, elegantly reticulated above, subradiately divided; divisions obovate or obcordate, bifid or bilobed, 0.4—1.1 cm. long, canaliculate at apex; margins membranous, ascending; furnished *beneath with white, transverse, subundulate scales which extend considerably beyond the margin;* fruit as in *R. Sorocarpa* with which it is usually associated.

Hab.—Thin rocky soil; Closter, N.J. (*Austin*), Cal. (*Bolander*). (Eu.)

Bib.—Syn. Hep. p. 605, Hep. Europ. p. 169.

Delin.—Lindenberg Monog. Ric. t. XXX.

Exsic.—Hep. Bor.-Amer. No. 140.

†† *Scales dark purple.*

9. **R. nigrella** D.C. Thallus dichotomously divided; divisions linear, canaliculate, with entire, narrowly membranous margins, green above, *dark purple beneath and furnished with transverse, semi-circular scales of the same color,* which do not exceed the margin.

Hab.—Rocky ground; N. Y. (*Torrey*), Chester, Pa. (*Porter*), Cal. (*Bolander*). (Eu.)

Bib.—Syn. Hep. p. 605, Hep. Europ. p. 170.

Delin.—Lindenberg Monog. Ric. t. XXIX.

Exsic.—Hep. Bor.-Amer. No. 140 b.

*** *Thallus more or less ciliate on the margins, naked or obsoletely squamous along the extreme edge underneath; usually with a purple spot in the epidermis immediately over the fruit.*

10. **R. arvensis** Aust. Thallus always orbicular, radiately much divided, 0.6—1.8 cm. in diameter, *dull green both sides,* papillose-reticulate and becoming fuscous above; margins plane, entire, acute or apparently thickened, becoming purple by age; divisions often crowded, somewhat dilated above from a common base, dichotomous, distinctly sulcate, carinate-thickened especially toward the apex, nodulose beneath; lobes linear-elliptic or subspatulate, *acutish and obsoletely emarginate at the apex;* cilia white, very short or often papilla-like and inconspicuous; fruit aggregated beneath the canal chiefly toward the apex of the lobes; spores about 0.071—0.084 mm. in diameter, dark fuscous, slightly pellucid, distinctly reticulate, with a conspicuous pellucid margin.

Var. **hirta** Aust. Thallus decidedly ciliate on the margin, and with spine-like hairs scattered over the whole upper surface, at length purple and more or less squamigerous beneath, somewhat glaucous and reticulate above; divisions broader, more obtuse, becoming thin and strongly canaliculate or often convolute on drying; spores nearly black, larger, 0.084—0.101 mm. in diameter, opaque, very indistinctly reticulate, and obscurely papillose, obscurely if at all margined.

Hab.—Rocky ground and cultivated fields; Closter, N. J. (*Austin*). The var. in similar locations.

Bib.—Pro. Phil. Acad. 1869, p. 232.

Exsic.—Hep. Bor.-Amer. Nos. 141, 142.

11. **R. Lescuriana** Aust. Monœcious; thallus stellately or somewhat cruciately divided; divisions bilobed or di-trichotomous, obcordate or cuneate-linear, 0.4—1.3 cm. long, punctate-reticulate, somewhat glaucous or cinereous green and slightly

depressed-canaliculate above, convex and green or at length purple beneath; margins usually purple, thickened, sub-ascending, *hirsute-ciliate, with crowded*, short, thick, obtuse, *white, spine-like hairs,* obsolete in young states; fruit sparse, scattered chiefly near the base of the divisions; spores about 0.071—0.083 mm. in diameter, dark brown, reticulate, not margined.

Hab.—Cultivated fields and rocky ground; N. J. to Ill. and Fla.
Bib.—Pro. Phil. Acad. 1869, p. 232.
Exsic.—Hep. Bor.-Amer. No. 143.

12. **R. Californica** Aust. MS. Divisions of thallus expanded at apex, obcordate, cuneate, ciliate only at or toward the apex or sometimes almost entirely naked on the margins; spores as in *R. Lescuriana* which this species resembles.

Hab.—Cal. (*Bolander*).
Bib.—Torrey Bull. VI, p. 46.

13. **R. ciliata** Hoffm. Thallus dichotomously or substellately divided; divisions linear or cuneate, obtuse, subemarginate, subcanaliculate at the apex; cilia very long, slender and fuscous, spores about as in *R. Lescuriana.*

Hab.—With *Fossombronia longiseta* from Cal. (*Bigelow*). (Eu.)
Bib.—Syn. Hep. p. 602, Hep. Europ. p. 168.
Delin.—Lindenberg Monog. Ric. t. XXIII.

14. **R. intumescens** Bisch. Thallus bifurcately lobed: lobes very tumid, subcuneate-linear or subcuneate-oblong, deeply and narrowly canaliculate, cinereous green, reticulate only in the groove, which does not occupy more than $\frac{1}{3}$ of the apparent upper surface, *very dark purple (almost black) beneath*, emitting rootlets only along the middle; the whole surface of the thickened and strongly inflexed *margins densely clothed with long, appressed, white, slender, spine-like hairs, which in the dry state meet over the groove and entirely conceal it;* spores brown, very finely reticulated, not margined. (*R. tumida* Lindenb.)

Hab—Rocky ground; Cal. (*Bolander*). (Eu.)
Bib.—Syn. Hep. p. 603, Hep. Europ. p. 169.
Delin.—Lindenberg Monog. Ric. t. XXVII.
Exsic.—Hep. Bor.-Amer. No. 143 b.

******** *Thallus squamous beneath, squamous or squamous-ciliate on the margin, with a distinct costa.*

15. **R. Donnellii** Aust. Dioecious; primary thallus orbicular, large, often 3.8 cm. in diameter, substellately divided, nearly plane, elegantly and grossly cristate-reticulate above, pale green both sides; divisions more or less di-trichotomous, often deeply channeled when dry, emarginate at the apex; fruit in a single row, immersed in the midrib; spores very large 0.127—0.168 mm. in diameter, subrotund, black, opaque, subtuberculate; male thallus usually a little larger; ostioles numerous, filiform, hyaline, 1 mm. high.

Hab.—Gardens and cattle-ranges; Fla. (*J. Donnell Smith*).
Bib.—Torrey Bull. VI, p. 157.

§ 2. SPONGODES. *Thallus with large air-cavities and with a slight depression in the upper surface immediately over the fruit which is prominent on the under surface: upper surface usually broken up into pits communicating with the air-cavities; spores smaller 0.041—0.051 mm. in diameter, obtusely angular or globose.* Pseudo-aquatic or occurring on wet or muddy ground.

* *Thalli homomorphous, terrestrial.*

16. **R. crystallina** L. Thallus orbicular, 1—2 cm. in diameter; divisions obcordate or cuneate, bifid or bilobed, plane above, the margins subcrenate, the upper surface much broken up into pits; fruit scattered; spores issuing through the upper surface. (*R. plana* Tayl., *R. velutina* Hook. in part.)

Hab.—So. States (*Drummond, Ravenel*), Ill. (*Hall*), Col. (*Wolfe*), Nev. (*Watson*). (Eu.)
Bib.—Syn. Hep. p. 607, Hep. Europ. p. 170.
Delin.—Lindenberg Monog. Ric. t. XXII.

17. **R. lutescens** Schwein. Thallus light green, orbicular, 2.5—3.8 cm. in diameter; divisions 6—8, linear, twice or three times forking, narrowly channeled above, obcordate and convex-thickened at the apex, with delicate, whitish, obliquely ovate, appressed scales, and destitute of rootlets above the middle underneath; reproductive organs entirely unknown.

Hab.—In exsiccated pools and ditches; Can. to Fla., Mo. and Tex.; common.
Bib.—Spec. Flor. Amer. Sept. p. 26, Mem. Amer. Acad. n. ser. iv, p. 176, Pro. Phil. Acad. 1869, p. 234.
Delin.—Mem. Amer. Acad. n. ser. iv, t. IV; Lindenberg Monog. Ric. t. XXVI.

18. **R. tenuis** Aust. Thallus thin, olive or yellowish green, shining; divisions 2 or 4, expanded, roundish-obovate, plane, 4—8 mm. long, the margins sinuate; beneath green, narrowly carinate by a slender costa, with a few delicate rootlets; fruit in the nerve; capsule extremely delicate, closely adhering to the substance of the thallus, crowned with a minute oblong style; spores round or short oval with a conspicuous depression in one end when dry, bursting through neither surface of the thallus.

Hab.—Wet broken ground in open woods. Closter, N. J. (*Austin*), near Lawrence, N. J. (*James*), Mo. (*Hall*).

Bib.—Pro. Phil. Acad. 1869, p. 233.

Exsic.—Hep. Bor.-Amer. No. 150.

** *Thalli dimorphous or polymorphous, pseudo-aquatic.*

19. **R. fluitans** L. Thallus thin, green, orbicular, radiately expanding, 2.5—5 cm. in diameter, floating, often forming extensive patches; divisions often much imbricated or somewhat entangled, narrowly linear, usually 1—1.5 mm. wide, repeatedly forking, fibrous-nerved in parallel lines, plane above, convex and eradiculose beneath, cavernous only toward the apex; apices slightly dilated, very obtuse or subtruncate, emarginate; fruit present only in some terrestial forms, very prominent below, at length rupturing beneath the thallus. (*Riccielia fluitans* Al. Braun.) —— *Forma* LATA has a broader thallus and a minute patch of fuscous purple, triangular scales at the extremities of the divisions underneath; sterile. —— *Forma* NODOSA (*R. nodosa* Bouch.) has the thallus here and there tuberously thickened; sterile. —— *Forma* CANALICULATA (*R. canaliculata* Hoffm.) is small, pale, terrestrial from drying up of waters on which it floated; divisions narrower and thicker, more or less channeled above, radiculose beneath; rarely fertile. —— *Forma* TERRESTRIS is darker green with divisions shorter and slightly depressed-canaliculate above; usually fertile. Passes through the above forms to

Var. **Sullivanti** Aust. Thallus orbicular, radiately much divided, cellular-succulent, shining, yellowish green, 0.6—1.7 cm. in diameter; divisions twice or three times forked, linear, about 1 mm. wide, straight, canaliculate above, carinate thick-

ned beneath, cavernous the entire length; margins thin, undulate-crisped and crenulate; carina copiously radiculose, tumid from the abundant fruit; capsules single, crowned by a long, obliquely-ascending, funnel-mouthed, exserted style; spores obscurely angular, reticulate and margined, submuricate *(R. Sullivanti* Aust).

Hab.—Ponds, ditches and wet places; common. (Eu.) The variety in damp ground or cultivated fields.

Bib.—Syn. Hep. p. 610, Hep. Europ. p. 171.

Delin.—Lindenberg Monog. Ric. t. XXIV.

Exsic.—Hep. Bor.-Amer. No. 147, 148, 149.

20. **R. natans** L. Thallus large, purple, very narrowly channeled above, the epidermis with numerous uniform air-cavities beneath it, rooting toward the base and at length furnished with large dark purple scales at the apex underneath; divisions 0.8—1.2 cm. long, obcordate or obcuneate, broadly emarginate at the thin apex; rootlets very long, usually smooth within; inflorescence beneath the groove in one or two rows; ostioles very short, purple; spores angular, black, strongly papillose. *(Ricciocarpus natans Corda.)*

Hab.—Vegetating in summer in muddy bottoms of exsiccated pools, etc., sometimes terrestrial. Canada to Gulf of Mexico. (Eu.)

Bib.—Syn. Hep. p. 606, Hep. Europ. 172, Pro. Phil. Acad. 1869, p. 233-4.

Delin.—Lindenberg Monog. Ric. t. XXXI, XXXII.

Exsic.—Hep. Bor.-Amer. No. 144, 145.

II. THALLOCARPUS Lindb.

Thallus loosely spongy-reticulate, irregularly subpalmately lobed, thin, ecostate, the epidermis not distinct. Rootlets not papillose within, very long, interwoven. Fruit immersed in the substance of the thallus. Calyptra crowned with the black persistent style. Spores firmly united in fours into a sort of coccus, finely reticulate and papillose. Name from Gr. *thallos,* a shoot, and *karpos,* fruit.

1. **T. Curtisii** Aust. Thallus with somewhat imbricated, flabelliform divisions which are palmately or incisely-lobed; lobes crenate and obtuse, extremely thin and hyaline: spores

fuscous-black, strongly muricate. (*Riccia Curtisii*, in Herb. James, *Cryptocarpus Curtisii* Aust.)

Hab.—Moist ground, N. C. (*Curtis*), S. C. (*Ravenel*).
Bib.—Pro. Phil. Acad. 1869, p. 231, Torrey Bull. VI, p. 21, 305.

III. SPHÆROCARPUS Mich.

Fruit aggregated in the thallus. Involucre sessile, obtusely conic or pyriform, perforated at the apex, continuous at the thallus, 1-fruited. Calyptra crowned with a deciduous style, closely investing the globose capsule. Capsule indehiscent. Spores globose, muriculate, remaining united in a coccus. Antheridia in folliculose bodies on the surface of separate thalli. Thallus ecostate, epidermis not distinct. Name from Gr. *sphairos*, a sphere, and *karpos*, fruit.

1. **S. Micheli** Bell. Thallus orbicular, 0.6—1.3 cm. in diameter, lobed, the lobes entirely concealed by the aggregated, inflated involucres; involucres about 1.5 mm. long, three to four times the length of the capsule, obtuse or subtruncate; coccus 0.102—0.127 mm. in diameter, indistinctly lobed. (*S. terrestris* Mich., *Targionia sphærocarpa* Dicks.)

Var. **Californicus** Aust. Thallus substipitate, deeply lobed; lobes often leaf-like; involucre oblong or subcylindric, slightly acuminate. (*S. Californicus*, Aust., *S. Berterii*, Aust. not of Mont.)

Hab.—Cultivated fields, S. C. (Eu.) The variety in Cal.
Bib.—Syn. Hep. p. 595, Hep. Europ. p. 164.
Delin.—Lindenberg Monog. Ric. t. XXXVI.
Exsic.—Hep. Bor.-Amer. No. 138.

2. **S. Texanus** Aust. Thallus smaller, its lobes very slightly acuminate; involucre less obtuse at apex; spores about one-half as large as in *S. Micheli*, coccus 0.063 mm. in diameter.

Hab.—Texas (*Wright, 1849.*)
Bib.—Torrey Bull. VI, p. 158.

3. **S. Donnellii** Aust. Male thallus narrow, amber brown, with stipe-like base; lobes spike-like; female thallus with substipitate base and leaf-like lobes; coccus deeply lobed 0.145—0.170 mm. in diameter; spores strongly tuberculate, 0.078—0.101 mm. in diameter.

Hab.—Gardens, etc. Fla (*J. Donnell Smith*).
Bib.—Torrey Bull. VI, p. 157.

ORDER II. MARCHANTIACEÆ CORDA.

Terrestrial (rarely amphibious), usually perennial plants with thallose vegetation. Thallus dichotomously, subpalmately or radiately branched, usually continuous or proliferous from the apex of the midrib or from its side underneath, more or less thickened in the middle, furnished beneath with numerous long rootlets, and usually colored and imbricating scales (root-like hairs in *Dumortiera*). Epidermis more or less distinct, usually porose. Capsules globose, rarely obovate or oval, attached to the underside of disk-like receptacles which are elevated on peduncles (in a bivalved receptacle underneath the apex of the thallus in *Targionia*), opening variously or indehiscent. Elaters usually present, mixed with the spores.

ARTIFICIAL SYNOPSIS OF GENERA

A
- Fruit aggregated underneath large, peduncled receptacles ..... B
- Fruit sessile under the apex of the thallus which is small with conspicuous pores. XIII. TARGIONIA.

B
- Inner involucre present C
- Inner involucre wanting ..... E

C
- Inner involucre conspicuous, split into 8-16 pendent, linear divisions. X. FIMBRIARIA.
- Inner involucre 4-5 lobed ..... D

D
- Carpocephalum 7-9 rayed. I. MARCHANTIA.
- Carpocephalum hemispheric, 1-4 lobed, with as many rib-like rays. II. PREISSIA.

E
- Outer involucre present ..... F
- Outer involucre wanting; thallus obcordate, barely costate, eporose. VI. CRYPTOMITRIUM.

F
- Carpocephalum entire at margin or nearly so ..... G
- Carpocephalum lobed, cleft or divided ..... H

G { Thallus copiously reticulate and porose. IX. CONOCEPHALUS.
Thallus obscurely reticulated. V. DUVALIA.

H { Lobes of carpocephalum scarcely distinguishable from the involucres.....I
Lobes of carpocephalum clearly apparent.....K

I { Thallus distinctly areolate and porose, squamigerous. XII. LUNULARIA.
Thallus rigid, indistinctly porose. XI. AITONIA.

K { Androecium peduncled; thallus large, thin, with a slight costa. VIII. DUMORTIERA.
Androecium (so far as known) sessile.....L

L { Thallus very indistinctly porose. VII. ASTERELLA.
Thallus clearly porose.....M

M { Carpocephalum 3-4 lobed, hemispheric or conoidal. IV. GRIMALDIA.
Carpocephalum 2-4 divided to base. III. SAUTERIA.

I. MARCHANTIA L.

Plant dioecious. Carpocephalum peduncled, radiate or lobed. Peduncles areolate, arising from a sinus in the apex of the expanded forking thallus. Outer involucres alternate with the rays, 2-valved, lacerate, membranous, enclosing several 1-fruited, 4-5-parted involucres. Calyptra persistent, fissured at the apex. Capsule globular, exserted, pendulous, dehiscent by several revolute segments or teeth. Spores smooth. Elaters long, slender, attenuate at each end, bispiral. Androecium peduncled, peltate, radiate or lobed. Thallus large, areolate, porose, with a broad diffused midrib, densely rooting. Gemmæ lenticular, borne in a cup-shaped receptacle on the back of the thallus. Named for *Nicholas Marchant,* a French botanist, d. 1678.

1. **M polymorpha** L. Thallus usually 5—12.5 cm. long, 1.3—3.8 cm. wide, canaliculate, and with numerous small pores above, plicate-venulose; carpocephalum deeply divided into usually 9 terete rays; peduncles 2.5—7.5 cm. high, stout, pilose; involucres many-fruited; androecium on a naked peduncle 2.5 cm. high or less, crenately or often palmately 2-8-lobed, the lobes flat.

Hab.—Ditches and wet places; common. (Eu.)
Bib.—Syn. Hep. p. 522, 789; Hep. Europ. p. 150.
Delin.—Sulliv. Mosses U. S. t. VI.
Exsic.—Hep. Bor.-Amer. No 127.

2. **M. disjuncta** Sulliv. Thallus 2.5—5 cm. long, 0.6—1.3 cm. wide, innovating from the apex; carpocephalum $\frac{3}{4}$ circular, radiately 3-7-lobed, the lobes flat, cuneate, crenulate on the outer margin; peduncles 2.5 cm. high; androecium large, on a stout peduncle 2—4 mm. high, digitately parted, the divisions elongate-oblong or linear-oblong, subentire.

Hab.—Springy places, banks of Alabama R. near Clairborne (*Sullivant*).
Bib.—Mem. Amer. Acad. n. ser. III, p. 63.
Delin.—Mem. Amer. Acad. n. ser. III, t. III.
Exsic.—Musc. Alleghan. No. 286; Hep. Bor.-Amer. No. 128.

II. PREISSIA Nees.

Carpocephalum hemispheric, 1-4-lobed, with as many rib-like rays alternating with and shorter than the lobes, fibrous-barbulate underneath. Outer involucres as many as the rays, attached to the under side of the lobes, 1-3-fruited, opening beneath and outwardly by an irregular line. Inner involucre obconic-campanulate, angular, unequally 4-5-lobed. Calyptra persistent, rupturing obliquely at the apex. Capsule large, distinctly pedicelled, dehiscing by 4-8 revolute segments. Spores grossly tuberculate. Elaters short, bispiral. Inflorescence diœcious or monœcious. Thallus obcordate, sparingly forked, increasing by joints from the apex; pores conspicuous. Gemmæ wanting. Named for *L. Preiss,* a German botanist.

1. **P. hemisphærica** Cogn. Monœcious or sometimes dicœcious; thallus 2.5—5 cm. long, 0.6—1.3 cm. wide, with conspicuous white pores above and dark purple, imbricated scales beneath; carpocephalum somewhat angled by the prominent keel-like rays; peduncle 1—2.5 cm. high, slightly hairy or squamulose; capsules conspicuous, dark purple; androecium peduncled, peltate, repand-lobed at the margin, the peduncle 1—2.5 cm. high. (*Marchantia hemisphærica* L., *M. commutata* Lindenb., *Preissia commutata* Nees.)

Hab.—On slate and limestone rocks in moist ravines, N. J. westward to Col. and northward to Hudson's Bay. (Eu.)
Bib.—Syn. Hep. p. 539; Hep. Europ. p. 152.
Delin.—Sulliv. Mosses U. S. t. VI.
Exsic.—Hep. Bor.-Amer. No. 129.

III. SAUTERIA Nees.

Carpocephalum peduncled, 2-4 parted, the fruit-bearing lobes separate to the base, the intermediate rays obsolete or tooth-like. Peduncle pale, naked at the base, continuous with the thallus. Outer involucres as many as the lobes forming a declined tube, more or less separate, dehiscing with a wide slit and disclosing a 2-5 parted pileus, 1-fruited. Inner involucre wanting. Calyptra persistent, pyriform-campanulate, bursting irregularly, equalling or slightly exceeding the involucre. Capsule globose, 4-6-valved, pedicelled. Elaters formed at the base of the capsule, bi-quadrispiral, deciduous. Thallus subsimple or continuous at the apex, without median costa, papillose and porose above, squ. us below. Gemmæ wanting.

1. **S. limbata** Aust. Thallus obovate-oblong, sub-dichotomous, concave, reticulate-papillose and light-green above, much thickened, dark-purple and squamous beneath, with a broad, membranous, dark-purple, subplicate, undulate-crenate, incurved margin; scales closely imbricate, purple, the lower ones large, oblique, 2-horned, nodose-dentate and placed near the margin of the thallus; the upper still larger, lanceolate and extending beyond the apex of the thallus as an inflexed fringe, at length whitish; carpocephalum 1-3-fruited, shortly but

densely paleaceous underneath; peduncle about 2.5 cm. high, pale, naked, sulcate.

Hab.—Under wet rocks, Cal. (*Bolander*).
Bib.—Pro. Phil. Acad. 1869, p. 229.

IV. GRIMALDIA Raddi.

Carpocephalum pedunculed, 3-4-lobed, decurrent, hemispheric or conoidal, papillose and porose at the apex. Calyptra rupturing by lobes. Capsule circumscissile in the middle. Androecium on the same or a different thallus, disciform, oval, obovate or obcordate, immersed in the apex of the thallus, papillose. Thallus thick, deeply canaliculate, dichotomous, innovating from the apex, articulated, closely areolated and porose-scabrous above, the thick keel covered with imbricated scales often extending beyond the margin as a fringe. Epidermis very thick. Gemmæ wanting. Named for *D. Grimaldi*, an Italian botanist.

1. **G. barbifrons** Bisch. Thallus linear-obcuneate, 0.6—1.3 cm. long, 3—4 mm. wide, 2-lobed at the apex, pale-green with distinct white pores above, strongly involute when dry, the scales often extending far beyond the margin and becoming whitish; peduncle profusely paleaceous at the base and apex; monœcious, the androecium obcordate. (*G. fragrans* Corda., includes *G. sessilis* Sulliv.)

Hab.—Thin soil on rocks. Ia. (*Horton*), Ill. (*Hall*), Tex. (*Wright*), N. J. (*Austin*), N. Y. (*Miss Waterbury*), Conn. (*Eaton*) (Eu.)
Bib.—Syn. Hep. p. 550; Hep. Europ. p. 156.
Delin.—Sulliv. Mosses U. S. t. VII.
Exsic.—Hep. Bor.-Amer. No. 133.

2. **G. Californica** Gottsche, MS. is an unpublished species from California.

V. DUVALIA Nees.

Carpocephalum pedunculed, hemispheric, entire, cavernose-papillose above, concave and not decurrent beneath. Outer involucre intramarginal. Inner involucre wanting. Capsule deoperculating above the middle. Androecium suborbicular.

immersed in the apex of the lobes at the sinus, covered by a closer and more sharply papillose epidermis. Thallus weak, moderately thickened in the middle, bifid and sinuate-continuous from the apex, obscurely areolate above, concolorous or often purple, obscurely squamulose along the costa underneath, the scales minute and evanescent. Gemmæ wanting.

1. **D. rupestris** Nees. Thallus 0.6—1.3 cm. long, 2—6 mm. wide, the margins membranous; carpocephalum small, semiglobose, 1-4-fruited; peduncle about 2.5 cm. high, sparingly involucrate at the base, barbulate at the apex; involucres 1-fruited, short, thin erenulate: spores tuberculate: elaters bispiral. (*Grimaldia rupestris* Lindenb.)

Hab.—Calcareous or slaty rocks, Ontario (*Macoun*), O. (*Miss Biddlecome*), Central and Northern N. Y. (Eu.)

Bib.—Syn. Hep. p. 553, Hep. Europ. p. 156.

Exsic.—Hep. Bor.-Amer. No. 134.

VI. **CRYPTOMITRIUM** Aust. nov gen.

Carpocephalum on a peduncle arising from a marginal sinus, large, peltate, slightly convex and papillose above, with costa-like rays extending about half way toward the plane, naked, crenate margin and tuberously thickened from the end, flattish and naked beneath. Both involucres wanting. Calyptra very obscure or ephemeral. Capsules 4-7, large, pale, obliquely depressed, globose, immersed between the rays and closely adherent to the walls of the cavity, or at length partly emergent through an irregular longitudinal slit, dehiscent near the apex by a very small, irregular, oblique, brownish operculum, the orifice becoming very large and shortly lacerate. Spores very small, coarsely rugose and reticulate. Elaters very long and slender, attenuate at the ends, tortuous, bispiral. Thallus obcordate, cespitose-imbricate, thin and barely costate, eporose above, sparingly rooted, usually purplish and very imperfectly squamulose beneath. Gemmæ wanting. Name from Gr. *kruptos*, concealed, and *mitrion*, a turban.

1. **C. tenerum** Aust. Thallus 0.6—1.3 cm. long, striate or venulose-lacunose, crenulate on the margin, very slightly thickened in the middle, the cuticle beneath breaking up into

deciduous, more or less scale-like fragments; peduncles 2.5 cm. high, rather delicately cellular, pale above, purplish below, naked. (*Marchantia tenera* Hook., *Ducalia tenera* Gottsche, *D. pedunculata* Mont.)

Hab.—Cal. (*Parry, Bigelow, Bolander, Torrey*).
Bib.—Syn. Hep. p. 554.

VII. ASTERELLA Beauv.

Carpocephalum conic-hemispheric, becoming flattened, 1-6 (usually 4)-lobed, barbulate-palæaceous beneath. Outer involucres 1-fruited, coherent with the lobes, 2-valved. Inner involucre wanting. Calyptra minute, lacerate, persistent at the base of the capsule. Capsule greenish, globose, nearly sessile, rupturing at the apex by irregular narrow teeth, or by a fragmentary operculum. Spores tuberculate. Elaters moderately long, mostly bispiral. Inflorescence monœcious; androecium sessile, lunate-disciform. Thallus rigid, very indistinctly porose, the midrib broad, strong and distinct. Name the diminutive of Lat. *astrum*, a star, alluding to the mature carpocephalum.

1. **A hemisphærica** Beauv. Thallus forking and increasing by joints from the extremities, rather pale-green above, purple beneath; carpocephalum papillose on the summit, diminishing greatly by age; peduncle bearded at its base and apex, at first 2—2.5 cm. long, increasing often to 5—7.5 cm. after maturity of fruit. (*Reboulia hemisphærica* Raddi, *R. microcephala* Tayl.)

Hab.—Shaded banks chiefly along streams; common. (Eu.)
Bib.—Syn. Hep. p. 548, 790; Hep. Europ. p. 154.
Delin.—Sulliv. Mosses U. S. t. VI.
Exsic.—Hep. Bor.-Amer. No. 132.

VII. DUMORTIERA Nees.

Carpocephalum convex above, 2-8-lobed. Involucres 1-fruited, opposite and connate with the lower surface of the lobes, horizontal, opening by a vertical slit at the outer extremity. Inner involucre wanting. Calyptra rupturing at the apex.

Capsule oblong-globose, dehiscing by 4-6 irregular valves, distinctly pedicelled. Spores minute, muriculate. Elaters parietal,* very long, straight, attenuate at both ends, bi-trispiral. Androecium short pedunculed, paleaceous underneath the margin (in the young state ciliate). Thallus large, thin, soft, with a slight costa, dichotomous, continuous or articulate at the apex, with or without pores, usually with hair-like rootlets scattered over the entire under surface. Gemmæ wanting. Named for *B. C. Dumortier*, a Belgian botanist, born 1797.

1. **D. hirsuta** Nees. Dioecious; thallus 5—15 cm. long, 1.3—2 cm. wide, thin, deep-green, becoming blackish, plane and entire on the margins, exareolate and naked, or sometimes with a delicate, coarsely reticulated, closely appressed, cobweb-like pubescence above, hirsute and esquamulose beneath; carpocephalum many-fruited, convex, its margins like those of the involucres, closely setuose, the upper surface sparingly so; peduncle rather long, chaffy at the apex, slightly involucrate at the base, otherwise naked; capsule wall composed of very long thick cells containing broad rings or bands; androecium on a short peduncle, setulose over the entire upper surface; fruit rare. (*Marchantia hirsuta* Swz.)

Hab.—Faces of moist calcareous rocks, S. C. (*Ravenel*), Easton, Pa. (*Porter*), La. (*Featherman*).

Bib.—Syn. Hep. p. 543, 790.

Delin.—Sulliv. Mosses U. S. t. VI.

Exsic.—Hep. Bor.-Amer. No. 130.

IX. CONOCEPHALUS Neck.

Carpocephalum conic-mitriform, membranous. Involucres 5-8, tubular, 1-fruited, suspended from the apex of the peduncle, coherent with the interior surface of the carpocephalum. Inner involucre wanting. Calyptra persistent, campanulate, 2-4-lobed at the apex. Capsule oblong-pyriform, dehiscing by 5-8 revolute segments, pedicelled. Spores muriculate. Elaters short, thick, bispiral. Androecium disciform or oval, sessile near the apex of the thallus. Thallus dichotomous, copiously

* Adhering to the inner face of the capsule wall.

reticulated, with a narrow distinct costa. Gemmæ wanting. Name from Gr. *konos*, a cone, and *kephale,* head, alluding to the conic carpocephalum.

1. **C. conicus** Dumort. Thallus 5-15 cm. long, 1-2 cm. wide; carpocephalum conic, striate, crenate at the margin. (*Marchantia conica* L., *Conocephalus vulgaris* Bisch, *Fegatella conica* Corda.)

Hab.—Shady banks of rivulets; common. (Eu.)
Bib.—Syn. Hep. p. 546; Hep. Europ. p. 155.
Delin.—Sulliv. Mosses U. S. t. VI.
Exsic.—Hep. Bor.-Amer. No. 131

X. FIMBRIARIA Nees.

Carpocephalum pedunculate from the apex of the thallus or its innovations, conic or hemispheric, concave beneath and expanded at the margin into usually 4 large, pendent, campanulate, 1-fruited involucres. Inner involucre oblong-oval or subconic, protruding half its length beyond the involucre, with the projecting portion cleft into 8-16 fringe-like segments which are often more or less coherent at the apex. Calyptra with a long style, fugacious. Capsule scarcely pedicelled, globose, irregularly circumscissile near the middle. Spores angular, slightly reticulate, apparently margined. Elaters rather short, uni-quadrispiral. Antheridia immersed in the thallus, without receptacle. Thallus thickened in the middle, with a keeled costa, which in some species throws out lateral innovations, usually conspicuously porose above, and with dark purple scales beneath. Gemmæ wanting. Name from Lat. *fimbriæ*, a fringe.

* *Peduncles more or less pilose; divisions of inner involucre coherent at their apices.*
† *Inner involucre 8-cleft.*

1. **F. elegans** Spreng. Thallus 0.6—2.1 cm. long, 2—4 mm. wide, producing innovations from the costa underneath and also from the apex, linear-oblong, the innovations obcordate, emarginate or bilobed at the apex, glaucous-green and moderately porose above, abruptly carinate and usually dark purple

beneath, the margin undulate-crisped and more or less tinged with purple, the costa usually densely villous-radiculose and sparingly furnished with narrow and inconspicuous scales; peduncles arising from both the apex of the thallus and the innovations, 0.8—2. cm. high, usually dark-purple below, sparingly pilose or paleaceous except at the apex or often rather copiously so throughout, the base not involucrate; carpocephalum subhemispheric, strongly tuberculate above, barbulate-paleaceous beneath, papillose-crenulate on the margin; inner involucre ovate, tawny: a variable species.

Hab.—On calcareous rocks, Tex. (*Wright*), Cuba. (Eu.)
Bib.—Syn. Hep. p. 564; Hep. Europ. p. 159.
Exsic.—Hep. Bor.-Amer. No. 136c.

2. **F. fragrans** Nees. Thallus linear-cuneate, thick crenulate, convex beneath, the scales extending to the margin or the uppermost exceeding it, barbed at the ends; inner involucre ovate. (*Marchantia fragrans* Schleich.)

Hab.—N. Mex. (*Fendler*). (Eu.)
Bib.—Syn. Hep. p. 558; Hep. Europ. p. 158.
Exsic.—Hep. Bor.-Amer. No. 136b.

†† Inner involucre 10-cleft; plant small and delicate.

3. **F. Bolanderi** Aust. Thallus narrowly-linear, 1.3—2.1 cm. long, 2—3 mm. wide, with very numerous minute innovations especially near the base, solid, rigid, light-green, depressed canicuiate, indistinctly porous above, carinate-thickened and dark-purple beneath, the margins membranous, whitish and pellucid or often purple, bifid or 2-horned at the apex, somewhat dentate; peduncle slender 2.5—3.8 cm. high, slightly pilose at base, arising from the apex of the innovations; carpocephalum small, 4-fruited, subconic when moist, flattish and subcrenulate when dry; inner involucre subglobose, white; spores papillose-reticulate with a pellucid margin; elaters tri-quadrispiral.

Hab.—On the ground in fields. San Rafael, Cal. (*Bolander*).
Bib.—Pro. Phil. Acad. 1869, p. 230.
Exsic.—Hep. Bor.-Amer No. 136d.

††† Inner involucre 12-16 cleft; peduncles stout, purple.

4. **F. Californica** Hampe. Thallus obcordate, 0.6—1. cm. wide, undulate-lobed, abruptly carinate, the scales beneath not reaching beyond the broad brownish-purple margin; peduncle stout, rigid, pale purple, sparingly pilose; carpocephalum subhemispheric, convex-umbonate, mostly 4-lobed, paleaceous beneath; inner involucre large. (Near *F. Lindenbergiana* Corda.)

Hab.—Cal. (*Bolander, Bigelow*).
Exsic.—Hep. Bor.-Amer. No. 135.

5. **F. violacea** Aust. Thallus rigid and much thickened, sublinear, concave canaliculate, closely areolate and pale green above, imperfectly squamulose and densely rooting beneath, distinctly punctate, dark purple, innovating from the midrib beneath; margins strongly involute when dry; scales dark purple, short and narrow, slightly exceeding the margin at the apex of the thallus; peduncles dark purple, sparingly pilose, arising from the apex of the innovations which are often scarcely 2 mm. long; carpocephalum large, mostly 3-fruited, not lobed, obtusely conic, nearly smooth and distinctly porose above, barbulate-chaffy beneath; inner involucre pyriform-ovate, the segments violet purple.

Hab.—Cal. (*Bolander*).
Bib.—Torrey Bull. III, p. 17.

** *Peduncles naked; divisions of inner involucre not coherent at least when dry.*

6. **F. tenella** Nees. Thallus orbicular and composed of several elongated, obcuneate divisions, or by abortion of a single division; divisions emarginate at the apex, 1.3—2.1 cm. long, 3—4 mm. wide, grizzly-green and conspicuously porose above, purple on the margins, abruptly keeled and purple underneath; peduncle naked, 2.5—7.5 cm. high, not involucrate at the base, usually dark purple; carpocephalum obtusely conic, 3-4-fruited, naked beneath; inner involucre white, 8-cleft. (*F. nigripes* Bisch., *F. mollis* Tayl.)

Hab.—On damp ground in sandy fields, rarely in rock crevices. N. Eng. to Mo., Ga. and Tex.
Bib.—Syn. Hep. p. 562.
Delin.—Sulliv. Mosses U. S. t. VI.
Exsic.—Hep. Bor.-Amer. No. 136.

7. **F. pilosa** Tayl. Thallus bifurcate or dichotomous, 2—6 mm. long, subspatulate or narrowly obcordate, obtuse, emarginate, the margins thin and hyaline, repand-undulate, divergently striate and distinctly porose above, squamous beneath: scales large, fuscous purple, paler toward the apex, not reaching the margin; carpocephalum rather small, hemispheric, 3-4-fruited, umbonate and minutely verruculose in the center when dry, somewhat barbulate beneath at its juncture with the peduncle: peduncle 2.5—3.8 cm. high, tapering from a stout base, naked, fuscous brown, shining; inner involucre rather large, 8-12-cleft: spores large, rugose-cristate; elaters short somewhat obtuse, bispiral; androecium in a distinct lobe next the fertile one, circular, immersed. (*Marchantia pilosa* Wahl., *M. gracilis* Web. f., *F. gracilis* Lindb.)

Hab.—Br. Col. (*Macoun*), Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 557; Hep. Europ. p. 157.

F. Palmeri Aust. (Torrey Bulletin VI, 47), found by Dr. Palmer in Gaudalupe Island off Lower California, may occur in So. California.

XI. AITONIA Forst.

Carpocephalum deeply 1-4-lobed, the lobes small, ascending, discrete, their apices merging into ample, vertically bivalved involucres. Peduncle emerging from a pit in the back of the thallus, involucrate. Involucres subcompressed, ovoid, erect, 1-fruited opposite and concealing the lobes of the receptacle, vertically or horizontally dehiscing, 2-valved. Inner involucre wanting. Calyptra lacerate and persistent. Capsule globose, nearly sessile, somewhat horizontal, rupturing at the apex by an irregular vertical line. Spores enveloped in a transparent, rugose membrane, many angled, smoothish. Elaters of medium length, bi-quadrispiral. Androecium disciform, muricate-papillose, immersed in the apex or the middle of the thallus. Thallus rigid, thick, indistinctly porose, continuous or innovating from the apex, or proliferous from the costa underneath. Named for William Aiton, a Scottish botanist, 1731–93.

1. **A. Wrightii** (Sulliv.). Thallus 1—2 cm. long, 3—4 mm. wide, continuous from the apex, glaucous above with dark purple scales, the margins crenulate, ascending, convolute; involucres usually 3; peduncle scarcely 2 mm. high, paleaceous at the base and apex. (*Plagiochasma Wrightii* Sulliv.)

Hab.—Under overhanging rocks along streams. Tex. (*Wright*).

Delin.—Sulliv. Mosses U. S. t. VI.

2. **A. erythrosperma** (Sulliv.) Thallus expanded, obovate, 0.6—1 cm. wide, pale green, rugulose, fuscous margined, radiculose and squamous beneath; scales whitish, setaceous-incised, extending beyond the margin toward the apex; peduncle 1—1.7 cm. high, naked at the base, paleaceous at the apex; spores orange-red, tuberculate; elaters quadrispiral. (*Plagiochasma erythrosperma* Sulliv.)

Hab.—Rocky Mts. (*E. Hall*).

XII. LUNULARIA Mich.

Carpocephalum cruciately divided into 1-6 (usually 4) horizontal segments or involucres, which are tubular, vertically bilabiate and 1-fruited. Inner involucre wanting. Calyptra included, persistent, rupturing at the apex. Capsule exserted on a long pedicel, 4-8-valved, the valves spreading, subtortuous. Spores minute, nearly smooth. Elaters short, very slender, bispiral, deciduous or a few remaining attached to the apex of the valves. Peduncle very hairy, 2.5—3.8 cm. high, involucrate with numerous membranous scales at the base. Andrœcium oblong, sessile in the sinus at the apex of the thallus. Thallus oblong, with rounded lobes, distinctly areolate and porose, squamigerous. Scales imbricate, sublunulate, their apex abruptly contracted into a roundish cochleariform lobe. Gemmæ in crescent-shaped disks on the back of the thallus. Name from Lat. *lunula*, a little moon, alluding to the gemmæ-bearing receptacles.

1. **L. cruciata** Dumort. Thallus 2.5—5 cm long, furcately divided, innovating from the apex, with a somewhat diffused costa. (*L. vulgaris* Mich., *Marchantia cruciata* L.)

The only species; introduced into greenhouses; always sterile. (Eu.)

Bib.—Syn. Hep. p. 511; Hep. Europ. p. 147.

Exsic.—Hep. Bor.-Amer. No. 126.

XIII. TARGIONIA Mich.

Carpocephalum wanting, the involucre being sessile beneath the apex of the thallus, bivalved, 1-fruited. Inner involucre wanting. Calyptra thin, persistent. Style deciduous. Capsule short pedicelled. Spores globose, tuberculate. Elaters bi-trispiral. Androecium lateral, disciform, papillose, rising on a separate innovation from the ventral costa. Thallus furcate and continuous from the apex, conspicuously porose, squamulose beneath.

1. **T. hypophylla** L. Thallus 0.4—1.3 cm. long, obcuneate-linear or obovate, rigid, costate, involute when dry, with more or less conspicuous whitish pores above, dark purple beneath; scales densely imbricate, 2-horned or caudate, the upper ones extending to the margin of the thallus. (*T. Michelii* Corda.)

Hab.—Cal. (*Bolander*).
Bib.—Syn. Hep. p. 574; Hep. Europ. p. 162.
Exsic.—Hep. Bor.-Amer. No. 137.

Order III. ANTHOCEROTACEÆ Lindb.

Terrestrial, annual plants with thallose vegetation. Capsule dorsal, pod-like, mostly erect and bivalved, usually with stomata in its outer wall, tapering into a pedicel or often sessile with a bulbous base. Columella filiform. Involucre tubular, the inner wanting. Calyptra rupturing early near the base, carried up on the apex of the capsule, crowned with a subsessile stigma. Spores flattish, more or less convexo-prismatic, papillose or smooth. Elaters with or without fibres. Texture flaccid, more or less vesiculose; epidermis and pores wanting.

I. ANTHOCEROS L.

Monœcious or sometimes diœcious. Involucre tubular. Capsule linear or cylindric-oblong, bivalved. Spores papillose or smooth, colored. Elaters simple or branched, often geniculate, more or less heteromorphous, the fibres wanting or indis-

tinct. Thallus dark green or blackish, usually depressed, variously lobed and divided. Texture lax, vesiculose, with large chlorophyll grains, frequently glandularly thickened at the apex or in streaks along the middle so as to appear nerved. Name from *anthos,* flower, and *keras*, horn, from the appearance of the fructification.

* *Spores yellow; elaters yellow or with a yellowish tinge.*

† *Thallus usually smooth.*

1. **A. laevis** L. Thallus smooth, nearly plane above; involucre 2—4 mm. high, trumpet-shaped when dry, the mouth repand-toothed, often thickened, rarely scarious; capsule pale brown or yellowish, 2.5—3.8 cm. high, the valves often twisted when dry; spores rather small, nearly smooth, flattish, angular; elaters rather short, geniculate, somewhat articulated, yellowish.

Var. **major** Aust. Larger in all its parts except the spores and elaters. (*A. Carolinianus* Michx., *A. laciniatus* Schwein.)

Hab.—Can. to the Gulf of Mexico and Cal.; the var. southward and in Cal. (Eu.)

Bib.—Syn. Hep. p. 586; Hep. Europ. p. 160; Torrey Bull. VI, 25.

Delin.—Sulliv. Mosses U. S. t. VI.

Exsic.—Hep. Bor.-Amer. No. 123, 123b.

2. **A. Donnellii** Aust. Dioecious; thallus plane, rather narrow, smooth, very distinctly wide-nerved, deeply laciniate, somewhate crenate, copiously tuberous below; involucre large, funnel form, the mouth incised; capsule yellow; spores and elaters as in No. 1.

Hab.—Banks of Caloosahatchee R., Southwest Fla. (*Austin*); rare.

Bib.—Torrey Bull. VI, 304.

3. **A. Mohrii** Aust. Thallus thick, opaque, suberistate, lacunose, densely radiculose beneath, nerveless, tuber-bearing within; involucre short, thickened, the mouth truncate, indistinctly many crenate, often scarious-margined; capsule thick, rigid, yellowish-brown or blackish, variously curved and twisted, rather long pedicelled; spores ochreous, numerous, minutely papillose, opaque or somewhat pellucid; elaters various, some long and some short.

Hab.—Port Royal, S. C. (*Austin*), Mobile, Ala. (*Mohr*).

Bib.—Torrey Bull. VI, 304.

†† *Thallus more or less glandular.*

4. **A cæspiticius** DeNot. Thallus dissected to the base, the divisions 4—8.5 mm. long, narrow, variously lobed, expanded at the apex, dark green, more or less glandular; involucre broad, scarcely 2 mm. high, broadly sulcate and obtusely 2-angled on the back, minutely punctate, the apex subtruncate, repand-tridentate, the mouth narrowly scarious; capsule thick 1—1.5 cm. long, sessile, sulcate or angled, the apex obtuse and subtruncate; columella thickish, fibrillose. (*A. tuberosus* Tayl.)

Hab.—Tex.? Cal. (Eu.)
Bib.—Syn. Hep. p. 588; Hep. Europ. p. 161; Torrey Bull. VI, 25.

5. **A. Hallii** Aust. Thallus 1.3—2.5 cm. long, 1—2 mm. wide, cæspitose, often erect, linear or elongate-flabelliform, the apex entire or slightly lobed, most usually glandulose-thickened; involucre terminal, pellucid, pale green, 2—3 mm. long, the apex truncate; capsule about 6 mm. long, short pedicelled, sulcate, very narrow, the valves thick; spores smooth.

Hab.—On the ground and on rocks; Silverton and Salem, Ore. (*Hall*), Marine Co., Cal. (*Bolander*).
Bib.—Torrey Bull. VI, 26.

6. **A. Oreganus** Aust. Thallus thin, glandular-thickened in places, involucre very short, abruptly constricted above the middle, inflated below, minutely and closely punctate, the mouth subtruncate, slightly repand-lobate; capsule sessile, bulbous at base, somewhat thickened, about 1.3 cm. long, the valves splitting to the mouth of the involucre, coherent at the apex; spores small, indistinctly granulose.

Hab.—Ore. (*Hall*).
Bib.—Torrey Bull. VI, 26.

7. **A. sulcatus** Aust. Thallus 4—6 mm. long, deep green, apparently hollow, cæspitose, erect, attenuate at base, flabelliform, the margin variously lobed and repand; involucre obovate-quadrate, about 1 mm. high, somewhat roughened; capsule 4—5 mm. high, narrow, erect, or somewhat curved, sulcate, almost sessile, compressed-glandular; spores rather large; elaters short.

Hab.—On moist earth; Salem, Ore. (*Hall*).
Bib.—Torrey Bull. VI, 27.

** *Spores black; elaters fuscous.*

8. **A. punctatus** L. Thallus small, depressed, or often cæspitose and somewhat erect, lax, more or less glandular, often falsely nerved; involucre rather short, oblong-linear, slightly repand, sometimes scarious at the mouth: capsule 2.5 cm. high, black; spores rather small, strongly muriculate, sharply angled; elaters rather short and broad, flattish, geniculate, variously contorted, somewhat articulated. Of several forms varying more or less from the type. *Var. scariosus* Aust. has the thallus lamellate, the involucre lamellate and broadly scarious at the mouth (*A. scariosus* Aust.)—*Var. Ohioensis* Aust. has the thallus distinctly nerved, the apex of the lobes much thickened and solid.—*Var. Eatoni* Aust. has the thallus cæspitose and erect, crowded, the involucre narrower, more or less lamellate, parallel to the surface of the thallus and more or less connate with it.

Hab.—Can. to Fla. and Mo. Var. *scariosus* in S. C. (*Ravenel*); var. *Ohioensis* in O. (*Lesquereux*); var. *Eatoni* in Fla. (*Eaton, Smith*), Cuba, (*Wright*). (Eu.)

Bib.—Syn. Hep. p. 583; Hep. Europ. p. 160; Torrey Bull. VI, 27, 304.

Exsic.—Hep. Bor.-Amer. No. 122.

9. **A. fusiformis** Aust. Differs from No. 8 in its larger size, its more dissected thallus, its much longer subfusiform involucre (4—8.5 mm. long): capsule black, 2.5—5 cm. long, solid; spores minutely papillose: elaters brownish, longer, narrower, more opaque. Probably a form of the last.

Hab.—Cal. (*Bolander*), Ore. (*Hall*), Observation Inlet (*Scouler*).

Bib.—Torrey Bull. VI, 28.

10. **A. stomatifer** Aust. Differs from No. 8 in the more solid thallus with glandulose-cristate margin; involucre longer, narrower, rising from the margin of the thallus; capsule longer, more slender, well provided with stomata, the valves much twisted in drying; spores a little larger, more papillose, deep black.

Hab.—Ore. (*Hall*).

Bib.—Torrey Bull. VI, 28.

11. **A. Ravenelii** Aust. Thallus small, thick, broadly flabelliform, pale when young, black when older, the laciniæ short, repand or lobed; involucre short, 1—1.5 mm. high, the

mouth somewhat truncate; capsule 0.6—2 cm. high, very thick, provided with stomata, the pedicel very short; spores large, plano-convex, distinctly papillose; elaters small, somewhat triangular prismatic. (*A. Lescurii et A. Joorii* Aust. are mature forms of the plant as originally described.)

Hab.—On moist earth; S. C. (*Ravenel*), Fla. (*Austin*), La. (*Joor*).
Bib.—Torrey Bull. VI, 28, 29, 305.

12. **A. Olneyi** Aust. Thallus subprostrate or erect, somewhat oblong-flabelliform, variously lobed or crenate, substriate-venose, with large, black, tuberculate granules beneath its surface; involucre cylindric, about 2 mm. high, slightly striate, impunctate, the apex truncate, the mouth crenate, repand or dentate; capsule 0.6—2 cm. high, erect; spores large, plano-convex, opaque, minutely papillose-granular; elaters strongly compressed, articulated.

Hab.—Fla. (*Chapman*).
Bib.—Torrey Bull. VI, 29.

II. **NOTOTHYLAS** Sullv.

Monœcious, the fructification dorsal, scattered. Involucre sessile, continuous with the thallus, closed at first, at length splitting by chinks above. Capsule very short, included in the involucre, oblong-spheroidal, compressed or ovate-cylindric, pedicelled, the pedicel arising from a thickened bulb, the suture breaking in small pieces. Columella linear. Spores in fours, subglobose, smoothish. Antheridia immersed in the thallus, elliptic-globose. Thallus orbicular, laciniate, tender, papillose-reticulate, the margin undulate, crisped, radiculose beneath. Name from Gr. *notos*, the back, and *thulos*, a bag, from the shape and position of the involucre.

1. **N. orbicularis** Sullv. Thallus 0.6—1.6 cm. wide; capsules more or less curved, 2—4 mm. high, erect or decumbent, wholly included in the involucre or slightly exserted, marked with a suture on each side, the texture thin and rather loose; elaters minute, pale, nearly or quite as long as broad; antheridia immersed in cavities which have their sides slightly

elevated. (*Targionia orbicularis* Schwein., *Carpobolus orbicularis* Schwein., *Carpolipum orbiculare* Nees., *Anthoceros orbicularis* Aust. Includes *N. calcata* Sulliv.)

Hab.—Can. to Gulf of Mexico.

Bib.—Syn. Hep. p. 551, 792; Mem. Amer. Acad. n. ser. III, p. 65; Torrey Bull. VI, 27.

Delin.—Mem. Amer. Acad. n. ser. III, t. IV; Sulliv. Mosses of U. S. t. VI.

Exsic.—Musc. Alleghan. No. 289; Hep. Bor.-Amer. No. 124.

2. **N. melanospora** Sulliv. Thallus small, depressed or sometimes cæspitose, the texture lax; capsule much as in No. 1; spores dark fuscous, smooth, larger by half than those of No. 1. (*Anthoceros melanosporus* Aust.)

Hab.—Moist ground, O. (*Sullie*).

Bib.—Mem. Amer. Acad. n. ser. III, p. 65; Torrey Bull. VI, 29.

Exsic.—Musc. Alleghan. No. 290; Hep. Bor.-Amer. No. 125.

ORDER IV. JUNGERMANIACEÆ DUMORT.

Terrestrial or rarely somewhat aquatic, chiefly perennial plants with either thallose or foliaceous vegetation. Capsule borne on an elongate, cellular pedicel, dividing lengthwise into four valves or quadridentate. Elaters present, uni-quadrispiral. Thallus with or without a midrib. (Genera I—VI.) Leaves when distinct, 2-ranked, often with a third row of smaller ones (*amphigastria*) on the under side, incubous (Genera VII—XI, XIII—XVIII) or succubous (Genera XII, XIX—XXXII).

The following artificial synopsis, tho imperfect, may assist in determining species:

ARTIFICIAL SYNOPSIS OF GENERA.*

A { Vegetation thallose ..... B
Vegetation pseudo-foliaceous; the lobes of the thallus leaf-like, succubous; inner involucre large, campanulate, with a large, more or less lobed and undulate mouth. VI. FOSSOMBRONIA.
Vegetation foliaceous ..... F

* See also Appendix C for another synoptic table.

B
- Midrib wanting or not apparent.....C
- Midrib clearly apparent.....D

C
- Sporogonium dorsal; elaters bispiral, free. II. PELLIA.
- Sporogonium borne on under side of thallus near the margin; elaters unispiral, adherent to the apex of the valves. I. ANEURA.

D
- Inner involucre tubular, at first terminal, at length dorsal; thallus sinuate or lobed. IV. STEETZIA.
- Inner involucre wanting or early vanishing.....E

E
- Outer involucre wanting; fructification apical; thallus simple or bifid. III. BLASIA.
- Outer involucre monophyllous, ventricose; sporogonium arising from lower surface of midrib; thallus furcate. V. METZGERIA.

F
- Leaves incubous: i. e. the apex lying on the base of the next one above .....G
- Leaves succubous: i. e. the apex lying under the base of the next one above .....O

G
- Leaves bilobed or with a small ventral lobe at base..H
- Leaves without ventral lobe at base, mostly 3-5-toothed, lobed or parted.....L

H
- Amphigastria present* I
- Amphigastria wanting; lower lobe usually convex underneath. XI. RADULA.

I
- Amphigastria entire or 2-toothed ..... K
- Amphigastria 4-5-lobed; lobes of leaves divided. XIII. BLEPHAROZIA.

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* Amphigastria are obsolete or wanting in three species of *Lejeunia*.

K
- Lower lobe of leaf auriculate; inner involucre with a mucronate mouth. VII. FRULLANIA.
- Lower lobe of leaf concave underneath; inner involucre with a small denticulate mouth. X. MADOTHECA.
- Inner involucre terete or angular, variously winged, cristate or ciliate at the angles, the mouth 3-4-lobed or dentate. VIII. LEJEUNIA.
- Inner involucre somewhat depressed, plane and bilabiate, the mouth trilobed or tridentate. IX. PHRAGMICOMA.

L
- Inner involucre wanting.....M
- Inner involucre present.....N

M
- Leaves entire or 2-toothed; outer involucre pendent. XVIII. CALYPOGEIA.
- Leaves palmately divided; fructification in a fork, not pendent. XV. TRICHOCOLEA.

N
- Leaves 2-cleft to the middle; the divisions lanceolate. XIV. SENDTNERA.
- Leaves and amphigastria 3-5-parted half way to the base or more, the lobes usually lance ulate. XVII. LEPIDOZIA.
- Leaves bi-tridentate at the apex. XVI. BAZZANIA.

O*
- Amphigastria present.....P
- Amphigastria wanting.....U

P
- Amphigastria entire or nearly so .....Q
- Amphigastria 2-4-cleft, parted or divided .....S

Q
- Involucral leaves numerous; inner involucre at first triquetrous often becoming plicate, the mouth denticulate, ciliate or laciniate. XXVI. CEPHALOZIA.
- Involucral leaves few.....R

* The forms with succubous leaves included in the genera beyond this point of the synopsis cannot be satisfactorily arranged in a synoptic table; the characters of the genera are poorly defined and they contain very diverse forms, some of which are described from imperfect and incomplete data, which makes their reference to genera uncertain.

R
- Inner involucre distant from the outer, fusiform, the mouth 3-5-fid, the laciniæ unequal; involucral leaves smaller than those of the stem. XXV. HARPANTHUS.
- Inner involucre elongate, cylindric, longer than the calyptra, the mouth compressed-bilabiate; involucral leaves connate at base. XXVII. COLEOCHILA.
- Inner involucre elongate fusiform, rising from the lower side of the stem, fleshy, solid, rooting at the base, the mouth compressed, 2-3-cleft; involucral leaves 3, minutely scale-like. XXII. PLEURANTHE.
- Involucral leaves small, incised; inner involucre arising from the ventral side of stem, terete, trigonal at the apex; the mouth denticulate. XXIV. ODONTOSCHISMA.
- Not included in the above. XXVIII. JUNGERMANIA.*

S
- Involucre saccate, fleshy, attached by one side of its mouth to the stem, pendent. XIX. GEOCALYX.
- Involucral leaves few, large; inner involucre tubular below, acutely triquetrous above, dilated and three-lobed at the mouth, the lobes toothed-crested; leaves decurrent on the dorsal side of the stem. XXI. LOPHOCOLEA.
- Involucral leaves more numerous.....T

T
- Involucral leaves smaller than those of the stem and differing from them; inner involucre usually short, deeply 2-3-cleft; leaves usually deeply 2-cleft. XX. CHILOSCYPHUS.
- Involucral leaves imbricate, jointed-ciliate; inner involucre terete, glabrous, contracted and ciliate at the mouth; leaves 3-4-parted, the divisions bristle-form. XII. BLEPHAROSTOMA.

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* The genus *Jungermania*, altho its original limits have been much reduced, still contains a heterogeneous lot of species that cannot be properly classified until, 1st. The limits of genera become more clearly defined, and, 2nd The sporogony phase of all of our species becomes known.

U
- Leaves complicate-bilobed, the dorsal lobe usually smaller; inner involucre compressed parallel to the plane of the stem, the apex usually decurved, the mouth truncate, entire or ciliate. XXIX. SCAPANIA.

NOTE.—Some forms of *Jungermania* without amphigastria have the leaves complicate-concave and may be sought here, especially Nos. 20, 21, 22 and 28. See foot note under R in this table.

- Leaves bilobed or bifid at apex, not complicate.....V
- Leaves entire or merely dentate at apex X

V
- Involucre many leaved..... .....W
- Involucre few leaved; some forms of XXVIII JUNGERMANIA.

W
- Involucral leaves imbricate; inner involucre wanting; leaves closely imbricate. XXXII. CESIA.
- Involucral leaves united nearly to the top into an oblong tube; inner involucre 6-toothed, connate with the outer. XXXI. NARDIA.
- Involucral leaves free; inner involucre present; some forms of XXVI. CEPHALOZIA.

X
- Involucral leaves larger than those of the stem; inner involucre compressed at right angles to the plane of the stem, the mouth truncate, entire or ciliate-toothed; leaves often turned to one side. XXX. PLAGIOCHILA.
- Involucral leaves similar to those of the stem; inner involucre retrorsely subarcuate or at length cylindric; the mouth contracted, ciliate; the cilia articulate, connivent in a short cone; leaves entire. XXIII. LIOCHLÆNA.
- Not included in the above are some species of the ubiquitous XXVIII JUNGERMANIA.

I. **ANEURA** Dumort.

Dioecious. Sporogonium arising from the under side of the thallus near the margin. Outer involucre cup-shaped, very short and lacerate or wanting. Inner involucre wanting. Calyptra ascending, nearly cylindric, fleshy. Capsule oval or oblong, 4-valved. Elaters unispiral, adherent to the apex of the valves. Antheridia immersed in the upper surface of receptacles proceeding from the margin of the thallus. Thallus fleshy, destitute of a midrib. (Riccardia B. Gr., Lindberg.)

* *Calyptra tuberculate.*

1. **A. multifida** Dumort. Thallus brownish-green, prostrate, pinnately divided, the primary portion biconvex, somewhat rigid; branches horizontal, the secondary pectinately pinnate with narrow linear divisions; fructification from the primary portion or from lateral branches; involucre top-shaped, fleshy. (*Jungermania multifida* L.)

Var. **major** Nees. Primary portion and branches thick, the branches interruptedly bipinnate; all the divisions short, obtuse. (*Jungermania bipinnata* Schwein.)

Hab.—On decaying wood and moss in swamps. N. J. (*Austin*), Alleghany Mts. (Eu.) The var. growing over mosses on rocks.

Bib.—Syn. Hep. p. 496, 788; Hep. Europ. p. 141; Schweinitz Spec. Flo. Amer. Sept. p. 20.

Delin.—Brit. Jung t. 45 ff 3 et 6; Ekart t. VII f. 50.

Exsic.—Hep. Bor.-Amer. No 116, 116 b.

2. **A. palmata** Nees. Thallus palmately divided, the primary portion depressed-plane, procumbent; branches ascending, 4—6 mm. high, pinnatifid-palmate, the divisions linear, obtuse or truncate; fructification lateral; involucre lacerate. (*Jungermania palmata* Hedw.)

Hab.—Rotten logs, etc. Eastern U. S. (Eu.)

Bib.—Syn. Hep. p. 498, 788; Hep. Europ. p. 143.

Delin.—Ekart t. XIII f. 115.

Exsic.—Hep. Bor.-Amer. No. 114.

** *Calyptra merely papillose at apex.*

3. **A. sessilis** Spreng. Thallus decumbent, irregularly lobed, 2.5—5 cm. long, 0.6—1 cm. wide; involucre wanting; pedicel 2—2.5 cm. long, sometimes folded upon itself and remaining within the calyptra, thus making the capsule appear sessile; sterile receptacles elongate.

Hab.—Wooded swamps. Eastern U. S.
Bib.—Syn. Hep. p. 495, 788; Mem. Amer. Acad. n. ser. III, p. 62.
Delin.—Mem. Amer. Acad. n, ser. III, t. V; Sulliv. Mosses, U. S. t. VII.
Exsic.—Hep. Bor.-Amer. No. 113.

*** *Calyptra smoothish.*

4. **A. pinguis** Dumort. Thallus decumbent or ascending, subsimple, somewhat linear; involucre short, lacerate; calyptra cylindric; sterile receptacles 2-lobed, the lobes obtuse. (*Jungermania pinguis* L.)

Hab.—Wet banks, So. States, O., Penn., N. J. (Eu.)
Bib.—Syn. Hep. p. 493-4; Hep. Europ. p. 143.
Delin.—Brit. Jung, t. 46; Ekart t. VII, f. 51.
Exsic.—Hep. Bor.-Amer. No. 112, 112 b.

5. **A. pinnatifida** Nees. Thallus pinnately divided or subsimple, flat or subcanaliculate; branches horizontal, the broader pinnatifid or dentate, obtuse.

Hab.—On dripping rocks, Hokokus, N. J. (*Austin*), near New Haven, Conn. (*Eaton*). (Eu.)
Bib.—Syn. Hep. p. 495, 788; Hep. Europ. p. 142.
Delin.—Ekart t. XIII f. 109.
Exsic.—Hep. Bor.-Amer. No. 115.

II. **PELLIA** Raddi.

Monœcious. Involucre arising from the upper side of the thallus near the apex, cup-shaped, short, the margin lacerate-dentate. Inner involucre wanting. Calyptra oval, membranous, longer or shorter than the involucre. Capsule globose. Elaters long, free, bispiral. Antheridia globose, immersed in the broad indeterminate costa of the thallus. Named for *Sig. A. L. Pelli*, an Italian botanist.

1. **P. epiphylla** Nees. Thallus rather membranous, sparingly divided, the divisions oblong or somewhat wedge-shaped, repand-lobed; calyptra distinctly tuberculate, exserted. (*Jungermania epiphylla* L.)

Hab.—On ground in springy places, ditches, etc. (Eu.)
Bib.—Syn. Hep. p. 488; Hep. Europ. p. 145; Torrey Bull. VI, 30.
Delin.—Brit. Jung. t. 47; Ekart t. VII f. 52; Sulliv. Mosses U. S. t. VII.
Exsic.—Hep. Bor.-Amer. No. 110.

2. **P. calycina** Nees. Thallus dichotomous, proliferous, the early divisions linear-oblong, the margins ascending, remotely sinuate; later divisions linear-palmatifid, coarsely nerved, the areolæ large, hexagonal: involucre ciliate-fringed or lacerate at the mouth: calyptra smooth, included. (*Jungermania calycina* Tayl.)

Hab.—Wet limestone and slate rocks. (Eu.)
Bib.—Syn. Hep. p. 490; Hep. Europ. p. 145; Torrey Bull. VI, 30.
Delin.—Brit. Jung. t. 47 f. 18.

III. BLASIA Mich.

Sporogonium in an oval cavity in the midrib of the thallus. Outer involucre wanting. Inner involucre wanting or a fusiform utricle vanishing early. Calyptra obovate. Capsule oval-globose, bursting through the thallus near its apex. Antheridia immersed in the thallus, covered with dentate scales. Gemmæ globose, issuing by a slender ascending tube from their large flask-like receptacles which are immersed in the thallus. Named for *P. D. Blasius*, a companion of Micheli.

1. **B. pusilla** L. Thallus 1.5—2.5 cm. long, 4—6 mm. wide, linear-obovate, simple or forked or stellately expanded, the margins pinnatifid-sinuous. (*Jungermania Blasia* Hook.)

Hab.—Wet banks, Eastern U. S. (Eu.)
Bib.—Syn. Hep. p. 491; Hep. Europ. p. 135.
Delin.—Brit. Jung. t. 82-84; Ekart t. XI f. 94, et t. XIII f. 114 Sulliv. Mosses U. S. t. VII.
Exsic.—Hep. Bor.-Amer. No. 111.

IV. **STEETZIA** Lehm.

Dioecious. Involucre at first terminal arising from the midrib of the thallus, at length dorsal, cup-shaped, short-lacerate. Inner involucre elongate, tubular, the mouth denticulate. Calyptra equaling the perianth, irregularly torn at the apex. Capsule oval, 4-valved. Elaters filiform, free, bispiral. Androecium dorsal on the midrib, covered with minute, fimbriated, perigonial leaves. Thallus with a distinct costa. (Dilæna Dumort.) Named for *J. Steetz*, a German botanist.

1. **S. Lyellii** Lehm. Thallus 2.5—10 cm. long, 0.6—1 cm. wide, simple or two-cleft, delicate, the margin entire, slightly crenate or obscurely serrate. (*Jungermania Lyellii* Hook., *J. sinuata* et *J. oblonga* Schwein., *Blyttia Lyellii* Endl., *Diplolæna Lyellii* Dumort., *Dilæna Lyellii* Dumort.)

Hab.—Among mosses in swamps, often aquatic; common. (En.)
Bib.—Syn. Hep. p. 785; Hep. Europ. p. 137.
Delin.—Brit. Jung. t. 77; Ekart t. X f. 87; Sulliv. Mosses U. S. t. VI.
Exsic.—Musc. Aileghan. No. 281; Hep. Bor.-Amer. No. 109.

V. **METZGERIA** Raddi.

Dioecious. Involucre arising from the lower surface of the midrib of the thallus, one leaved, scale-like, at length ventricose and two-lobed. Inner involucre wanting. Calyptra ascending, oblong-ovate, rather fleshy. Capsule ovate. Elaters unispiral, adherent to the tips of the valves. Antheridia 1-3, enclosed by a one-leaved involucre on the under side of the midrib. Gemmæ ovate, aggregated on the attenuate tips of the linear thallus. Midrib distinct. Named for *Sig. Giovanni Metzger*, an Italian botanist.

1. **M. pubescens** Raddi. Dioecious; thallus 3 cm. long, 2 mm. wide, not very elongate, alternately pinnate or somewhat decompound, the branches short, linear and of uniform width, flat, undulate on the margins, everywhere, above and below, uniformly and densely villose; the hairs beneath longer, all single, or many at the margin double or in threes, nodding, and

irregularly curved, without sucker-like branches at the apex; midribs showing scarcely any cortical layer, covered with 6-10, commonly 8 rows of very similar and uniform peripheral cells. (*Jungermania pubescens* Schrank.)

Hab.—Mountainous places eastward. (Eu.)

Bib.—Syn. Hep. p. 504; Hep. Europ. p. 140; Lindb, Monog. Metzg. n. 1.

Delin.—Brit. Jung. t. 73; Ekart t. III, f. 19; Lindb. Monog. Metzg. f. 1.

2. **M. myriopoda** Lindb. Dioecious; thallus 5 cm. long, 1 mm. wide, elongate, dichotomous, subsimple, the branches long, linear and of uniform width, convex above, the margins reflexed, not undulate; the midrib beneath densely setose-pilose, which is scarcely apparent on the foliaceous portion of the thallus; hairs rather long, straight or nodding, the marginal ones in bundles of 3-6, rarely single or double, some of them with sucker-like branching extremities; midribs covered above with two rows of enlarged cells, beneath with 3-7, commonly 4-6, rows of smaller, lax, often indistinct cells. (*Jungermania ciliifera* Schwein., *Metzgeria furcata*, Sulliv. Musc. Allegham. No. 283.)

Hab.—On shaded rocks and trees, Alleghany Mts. (*Sullivant*), Tenn. (*Frederickson*), N. Orleans (*Drummond*).

Bib.—Lindb. Monog. Metzg. n. 6, f. 4.

Exsic.—Musc. Alleghan. No. 283, "specimen solum dextrum."

3. **M. hamata** Lindb. Dioecious; thallus 10 cm. long, 2.5 mm. wide, most frequently much elongate, dichotomous, the branches long, linear, and of uniform width, strongly convex to slightly rounded above, the margins reflexed not undulate, the midrib densely setose-pilose beneath, which never extends to the foliaceous portion of the thallus; the hair very long, divaricate and hooked-deflexed, the marginal double, scarcely ever with sucker-like branching extremities; midribs both above and below covered with two rows of enlarged, lax cells.

Hab.—Alleghany Mts. (*Sullivant*).

Bib.—Lindb. Monog. Metzg. n. 7, f. 5.

Exsic.—Musc. Alleghan. No. 283, "specimen solum sinistrum."

4. **M. conjugata** Lindb. Monœcious; thallus 3.5 cm. long, 1—2 mm. wide, commonly dichotomous, the branches short, linear, narrower in some parts, convex above, the margins more or less distinctly undulate, the midribs and margins pilose with rather long, straight, divaricate hairs; the hairs usually double and very frequently with sucker-like branches at their extremities; midribs covered above with two, below with 3-6 rows of enlarged lax cells. (*Echinogyna furcata*, Dumort., *Metzgeria furcata* Dumort. in part.)

Hab.—On shaded siliceous rocks and trunks of living trees, etc. Catskill Mts., N. Y. (*P. T. Cleve*), Cal.? (*Bolander*). (Eu.)

Bib.—Lindb. Monog. Metzg. n. 8, f. 6; Hep. Europ. p. 139 (sub. *M. furcata*).

Delin.—Brit. Jung. t. 56, f. 2; Ekart, t. I, f. 1.

Exsic.—Hep. Bor.-Amer. No. 117.

VI. FOSSOMBRONIA Raddi.

Involucral leaves 5-6, minute, subulate, coherent with the perianth almost its entire length. Inner involucre terminal or by innovation dorsal on the main stem, subcampanulate, the large mouth open, crenate-lobed. Calyptra pear-shaped, rupturing early. Capsule globose, irregularly 4-valved. Elaters short, uni-trispiral. Androecium naked, borne on the back of the stem. Vegetation pseudo-foliaceous, the lobes of the thallus-like stem leaf-like, succubous, somewhat quadrate, 3-5 lobed, flaccid. Named for *Sig. Car. Vittorio Fossombroni*, an Italian minister of state.

* *Leaves mostly horizontal.*

† *Plant medium size or large.*

1. **F. pusilla** Nees. Plant small; stems 1.3—2.1 cm. long, usually subsimple yet forked-divergent or subdichotomous at the apex; leaves obliquely spreading, the lower undulate-lobed, the lobes barely mucronate, the upper angular, 3-4 lobed, crisped, the lobes narrower; inner involucre obconic, dentate; crests of the spores angular, subparallel. (*Jungermania pusilla* L.)

Hab.—On damp ground, mostly in unfrequented paths. (Eu.)

Bib.—Syn. Hep. p. 467; Hep. Europ. p. 14.

Delin.—Brit. Jung. t. 69; Ekart t. V, f. 38; Sulliv. Mosses U. S. t. VII.

Exsic.—Hep. Bor.-Amer. No. 120.

2. **F. angulosa** Raddi. Stems subsimple, narrowly forked at the apex; leaves subquadrate, horizontally expanded, the upper undulate-lobed with obtuse lobes; inner involucre conic-dilated, crenate; spores coarsely reticulate.

Hab.—Brackish meadows; common; fruiting in early spring. (Eu.)
Bib.—Syn. Hep. p. 468, Hep. Europ. p. 15.
Exsic.—Hep. Bor.-Amer. No. 119.

3. **F. Cubana** Aust. Near the last but the leaves broader, spores more minutely reticulate, elaters narrower. (*F. pusilla* var. *Cubana* Gottsche, *F. Texana* Lindb.)

Hab.—Tex. and Cuba (*Wright*).
Bib.—Bot. Bulletin (now Bot. Gazette) I, 36.

†† *Plant small.*

4. **F. cristula** Aust. Plant minute, whitish; stems 2—4 mm. long, forked or fastigately divided; leaves quadrate or obovate-rotund, subentire, strongly crisped-undulate; capsule on a short pedicel, immersed; spores pale fuscous, more or less tuberculate; elaters delicate, one-celled, short, more or less difform, with a single narrow annular and spiral fibre.

Hab.—On moist sand in unfrequented paths near Batsto, N. J. (*Austin.*)
Bib.—Pro. Phil. Acad. 1869, p. 228.
Exsic.—Hep. Bor.-Amer. No. 121.

5. **F. longiseta** Aust. Stems suberect or depressed, 6—8 mm. long, proliferous-branching from the dorsal surface, attached to the earth by purple rootlets; leaves pale, subimbricate, subhorizontal, subquadrate, the lobes mostly obtuse, undulate-lobed or subentire, the lower few and small; involucral leaves much larger, subflabelliform, somewhat attenuate at base and confluent with the apex of the stem into a tube; inner involucre mostly large, campanulate, variously incised or subentire; capsule large, filling the calyptra, bursting irregularly; pedicel rather long (8—12 mm.), slender, the base considerably included in the apex of the stem; spores subangular, blackish, strongly muricate; elaters rather long, bispiral. (*Androcryphia longiseta* Aust.)

Hab.—Cal. (*Bolander*), Tex. (*Wright*).
Bib.—Pro. Phil. Acad. 1869, p. 228.
Exsic.—Hep. Bor.-Amer. No. 118.

** *Leaves vertical, incurved.*

6. **F. Macouni** Aust. Stems thickened, very short, leaves imbricate, strongly cristate-undulate and plicate, acutely incised-dentate; inner involucre small, cup-shaped or funnel-shaped, the margin crenate and somewhat undulate; capsule large, exserted; spores very small, somewhat opaque, minutely and closely papillose; elaters rather thick, bispiral.

Hab.—Portage la Lochs, lat. 57° Canada (*Macoun*).
Bib.—Bot. Bulletin (now Bot. Gazette) 1, 36.

VII. **FRULLANIA** Raddi.

Dioecious. Sporogonium terminal on the branches. Involucral leaves 2 or 4, 2-lobed, not auriculate. Inner involucre oval or obovate, terete or 3-4-angled, mucronate at the apex by a tubular mouth. Calyptra pear-shaped, persistent, rupturing below the apex. Capsule globular, 4-cleft halfway down. Elaters truncate at both ends, unispiral, adherent to the valves, erect. Spores large, irregular, minutely muricate. Archegonia 2 or 4. Antheridia in the saccate base of closely imbricate, 2-lobed perigonial leaves. Leaves 2-lobed, the lower lobe usually an inflated helmet-shaped auricle. Amphigastria entire or 2-toothed, throwing out rootlets from the base. Named for *Sig. Leonardo Frullani*, an Italian minister of state.

* *Auricles galeate or cucullate-ratund.*
† *Amphigastria small, scarcely wider than the stem.*
‡ *No teeth on the margin of the involucral leaves.*
a. *Auricles much smaller than the leaves.*

1. **F. Eboracensis** Gottsche. , Stems creeping, clustered-branched; leaves loosely disposed (those of the branches imbricate), round-ovate, entire; amphigastria ovate, a little wider than the stem, bifid, entire; inner involucre smooth, pyriform, slightly compressed and repand, beneath obscurely carinate and gibbous toward the apex. (*F. saxatilis* Lindenb., *F. microcypha*, *læviscypha et nana* Tayl.)

Hab.—Trees and rocks; common northward.
Bib.—Syn. Hep. p. 423.
Exsic.—Hep. Bor.-Amer. No. 105.

2. **F. saxicola** Aust. Stems closely creeping, numerous and widely branching; leaves orbicular, scarcely oblique, plane, the auricles approximating the stem, small, rarely larger, and then rotund-galeate; amphigastria scarcely wider than the stem, subovate, bifid; inner involucre broadly oblong, the mouth very short, bowl-shaped, papillose, beneath abruptly and broadly carinate, 1-many nerved on both sides the carina, 2-angular.

Hab.—"On inclined surface of dry trap rocks, Closter, N. J." (*Austin*), Tex. (*Wright*).

Bib.—Pro. Phil. Acad. 1869, p. 225.

Exsic.—Hep. Bor.-Amer. Nos. 104.

b. *Auricles about three-fourths the size of the leaves.*

3. **F. Oakesiana** Aust. Stems widely branching, the fertile branches short, sub-erect; leaves somewhat obliquely orbicular, loosely imbricate, sub-convex, the margins slightly repand, the auricles almost equaling the leaves, rotund, nearly contiguous to the stem; amphigastria ovate-rotund or sub-obovate, little wider than the stem, bifid, entire or subserrulate; inner involucre small, subobovate-pyriform, somewhat inflated, broadly carinate beneath, smooth or 1-7-nerved or alate on both sides; involucral leaves bilobed, entire, more or less connate, the lobes equal, obtuse, parallel.

Hab.—On bark of stunted spruce and birch trees; White Mts. (*Oakes, Austin*).

Bib.—Pro. Phil. Acad. 1869, p. 226.

Exsic.—Hep. Bor.-Amer. No. 105c.

4. **F. Sullivantii** Aust. Stems closely appressed, short branching; leaves subrotund, convex, entire, obtuse, the auricle large, galeate-rotund, equaling ¾ the width of the leaf, approximate to the stem; amphigastria obovate, obtusely bifid, subentire, scarcely wider than the stem, those toward the fructification oblong or cuneate, the lobes obtuse or the uppermost acute; inner involucre obovate, subcompressed, short-beaked, dorsally 1-2-nerved, ventrally unicarinate, the carina 2-angled or 2-winged; involucral leaves rotund, connate with the inner involucre, and one or the other with the amphigastria.

Hab.—On the bark of trees; Ga. (*Sullivant*), S. C. (*Curtiss*).

Bib.—Pro. Phil. Acad. 1869, p. 226.

‡‡ *A tooth on the margin of the involucral leaves above the middle of the lower lobe.*

5. **F. Pennsylvanica** Stephani. Dioecious; stems creeping, dichotomous-branching; leaves imbricate, plane, ovate, mucronate, more rarely obtuse, entire; cells charged with chlorophyll, smaller toward the base, much dilated at the base, more or less regularly hexagonal, thick walled; auricles naked, rising from the margin of the leaves, large, cucullate-rotund, slightly contracted beneath the hood, extending beyond the margin of the leaves; amphigastria subimbricate, plane, broadly ovate, exceeding the stem, deeply parted with a narrow obtuse sinus, the laciniæ ovate, long acuminate, connivent; male spikes on short lateral branches, elongate, with loose foliage; involucral leaves complicate, entire, the lobes ovate, acuminate, much narrowed at the base; involucral amphigastrium large, carinate-concave, deeply parted, the laciniæ ovate apiculate, entire or with one or more teeth.

Hab.—In rocky places in shade; Stony Creek, Carbon Co., Penn. (*Rau.*)

Bib.—Hedwigia, No. 10, 1883; Torrey Bull. X, 132.

6. **F. Hallii** Aust. Stems prostrate, much branched at the apex, often erect, flagelliferous, with dense squarrose amphigastria; fruit-bearing branches short, clavate, ascending; leaves small, subdistant or subimbricate, obliquely ovate-rotund, strongly convex, the apex incurved, the auricle rather large, oval-rotund, contiguous to the stem; amphigastria scarcely wider than the stem, obovate-quadrate, slightly bilobed; inner involucre broadly obovate, somewhat compressed, dorsally 2-nerved toward the apex, ventrally 4-nerved, unicarinate; involucral leaves repand-subdentate, the amphigastria ovate or rotund, entire or barely emarginate at the apex, the margins entire or obtusely dentate.

Hab.—On trees; Salem, Ore. (*E. Hall*).

Bib.—Torrey Bull. VI, p. 20.

7. **F. Bolanderi** Aust. Stems creeping, clustered branching, flagelliferous, the fruit-bearing branch erect-ascending, clavate; leaves small, imbricate, obliquely orbicular, convex, margined, the basal auricle large orbicular-galeate; amphigastria somewhat spreading, minute, orbicular or subobovate, bifid, the lobes obtuse or somewhat acute, entire, repand-

dentate or serrulate; involucral leaves somewhat appressed, deeply connate with the amphigastria; inner involucre rather large, compressed, unequally triangular, obovate-elliptic, concave or at length somewhat convex dorsally, unequally 2-4-nerved and unicarinate ventrally, slightly 2-costate toward the apex, otherwise smooth. (*F. Petalumensis* Gottsche, in Bolander's Cat.)

Hab.—On trees near the coast; Cal. (*Bolander*).
Bib.—Pro. Phil. Acad. 1869, p. 226.
Exsic.—Hep. Bor.-Amer. No. 105b.

†† Amphigastria 2-3 times the width of the stem.
‡ Leaves orbicular or suborbicular.

8. **F. squarrosa** Nees. Stems decumbent, pinnately branching, the fruit-bearing branch short, lateral; leaves subvertical, crowded, suborbicular, obtuse, entire, the auricle obovate cucullate or galeate, somewhat appressed; amphigastria cordate or rotund, sinuate-subdentate, slightly emarginate-bifid, the laciniæ acute; inner involucre oblong, prismatic-triquetrous, convex dorsally, strongly unicarinate ventrally. (*Jungermania squarrosa* Nees, *J. tuberculosa* Lehm. et Lindenb.)

Hab.—On rocks, bark of trees, etc.; N. J. to O. and common southward.
Bib.—Syn. Hep. p. 416.
Exsic.—Hep. Bor.-Amer No. 100.

9. **F. plana** Sulliv. Monœcious; stems procumbent, widely branching or subpinnate; leaves somewhat imbricate, orbicular, the auricle small, galeate, equally broad and long, contiguous to the stem; amphigastria large, three times the width of the stem, flat, rotund, slightly bifid, the sinus and laciniæ acute; lobes of the involucre oval, the margin reflexed, subrepand, the lower margin unidentate; inner involucre on a short branch, oblong-oval or subobovate, triquetrous, dorsally sulcate, ventrally acutely unicarinate; male spikes globose.

Hab.—On shaded rocks; N. Y. and N. J. (*Austin*) to Tenn. (*Sullivant*)
Bib.—Mem. Amer. Acad. n. ser. III, p. 175.
Exsic.—Hep. Bor.-Amer. No. 102.

‡‡ Leaves somewhat cordate, at least at base.

10. **F. Wrightii** Aust. Stems short, prostrate, the fruit-bearing branch shortened; leaves imbricate, subrotund, strongly convex, obliquely decurved, unequally cordate at base, the margin entire, the auricle rotund or subobovate; amphigastria broadly obovate, emarginate-bidentate ¼ their length, the margin repand-dentate; involucral leaves united with one another or with the amphigastria, the dorsal lobe oblong, entire or subrepand, inflexed-cucullate at the apex, the ventral lobe shorter by half, ovate-lanceolate, often subfalcate.

Hab.—N. Mex. (*Wright*).
Bib.—Torrey Bull. III, p. 15.

11. **F. æolotis** Nees. Stems procumbent, irregularly branching or subpinnate; leaves semi-vertical, subsquarrose, obliquely cordate, the auricle either galeate or expanded into a canieulate, ovate-lanceolate lobule; amphigastria ovate, entire or the upper margin angular-dentate, acutely bifid; sporogony phase unknown. (*F. riparia* Hampe MS.)

Hab.—On trees and rocks chiefly in mountainous regions.
Bib.—Syn. Hep. p. 417.
Exsic.—Hep. Bor.-Amer. No. 101.

‡‡‡ ‡‡‡ *Leaves orate or oral.*

12. **F. Virginica** Gottsche. Stems creeping, vaguely branching; leaves ovate, entire, somewhat concave, the auricle sometimes expanded into a lanceolate lamina; amphigastria ovate-rotund, bifid, double the width of the stem; inner involuere compressed, pyriform, tuberculate, quadricarinate ventrally, bi-quadricarinate dorsally, the carinæ tuberculate.

Hab.—On bark of trees, rarely on rocks; common.
Bib.—Syn. Hep. p. 419.
Exsic.—Hep. Bor.-Amer. No. 103.

13. **F. Hutchinsiæ** Nees *var.* Stems subpinnately branching; leaves dark olive-green verging on black, ovate, acute, entire, or subrepand, the auricle ovate, not spurred as in European forms; amphigastria roundish, plane, bifid, subserrate; inner involuere oblong-obovate, plane above, carinate beneath; involucral leaves bifid, serrate. (*Jungermania Hutchinsiæ* Hook., *Jubula Hutchinsiæ* Dumort.)

Hab.—Wet rocks chiefly in mountain rivulets. (Eu.)
Bib.—Syn. Hep. p. 426, Hep. Europ. p. 26 (sub *Jubula*).
Delin.—Brit. Jung. t. 1; Ekart, t X, f. 82.
Exsic.—Musc. Alleghan. No. 271; Hep. Bor.-Amer. No. 106.

14. **F. Nisquallensis** Sulliv. Stems procumbent, pinnately decompound; leaves closely imbricate, obliquely oval acuminate, apiculate, strongly inflexed, the auricle small ovate-galeate; amphigastria obovate-rotund, double the width of the stem, bifid, the sinus and laciniæ somewhat obtuse, the margin retlexed; lobes of the involucre linear, deflexed-falcate, cristate-ciliate at the base; inner involucre oval-obovate, subimmersed trigonal, dorsally somewhat convex, ventrally unicarinate.

Hab.—Fort Nisqually, Ore. (*U. S. Expl. Exped.*)
Bib.—Mem. Amer. Acad. n. ser. III, p. 175.

** *Auricles oblong-cylindric or clavate (or oblong-galeate in No. 16).*
† *Leaves marked with a row of moniliform cells.*
‡ *Leaves orbicular.*

15. **F. tamarisci** Nees. Stems bipinnately branching, somewhat rigid: leaves orbicular, obtuse, mucronately acute or subacuminate, decurved, entire, marked with a moniliform median line, the auricle oval or oblong, distant from the stem; amphigastria quadrate-ovate or obovate, emarginate, revolute at the margin; inner involucre oblong, sulcate dorsally, obtusely carinate ventrally; involucral leaves bifid, serrulate. (*Jungermania tamarisci* L.)

Hab.—"In America Septentrionale" (*Beyrich*). (Eu.)
Bib.—Syn. Hep. p. 438, Hep. Europ. p. 29.
Delin.—Brit. Jung. t. 6; Ekart, t. II, f. 17.

16. **F. Grayana** Mont. Stems creeping, simply pinnate; leaves nearly orbicular, concave, decurved, marked in the middle by a moniliform line, the auricle oblong-clavate, emarginate at the lower end; amphigastria oblong, flat, 2-cleft, the sinus obtuse; inner involucre pyriform, 3-sided, obtusely carinate beneath; involucral leaves unequally 2-cleft, the dorsal segment oblong, pointed, nearly entire, the ventral subulate. (*F. Asa-grayana* Mont. in Syn. Hep. p. 441!)

Var. **Californica** Aust. MS. Dark or brownish red; stems somewhat irregularly branched; leaves obliquely ovate, obtuse or acuminate-apiculate, convex, decurved, with sometimes a few firmer and deeper colored but not enlarged cells scattered or in an oblique central row; amphigastria obovate, emarginate, flat or with recurved margins toward the apex; involucral leaves often connate with the amphigastria to the sinus, the lobes entire, obtuse or acute, the lower often narrow, channeled and somewhat contorted, with one or more hairs on the margin near the base; inner involucre oblong, triquetrous, strongly keeled below, the mouth usually emarginate. (*F. Nisqualleusis* Aust. Hep. Bor.-Amer. No. 108, not of Sulliv., *F. tamarisci* (?) of Bolander's Cat., *F. anciflora* var. *Californica* Gottsche MS. (?) of Bolander's Cat.)

Hab.—On rocks and on the bark of spruce and larch trees; common in the Atlantic States; the *var.* on rocks near San Francisco, Cal. (*Bolander*) and along the coast.

Bib.—Syn. Hep. p. 441 (sub *F. Asagrayana*).

Delin.—Sulliv. Mosses U. S. t. VII.

Exsic.—Musc. Alleghan. No. 266; Hep. Bor.-Amer. No. 107, 108.

‡‡ *Leaves oblong from a narrowed base.*

17. **F. fraligifolia** Tayl. Stems procumbent, subpinnate, the branches flattened, alternate, somewhat remote; leaves subimbricate, ascending, oblong-rotund from a narrowed base, recurved, entire, marked with a moniliform line, the auricle oblong-galeate; amphigastria obovate-rotund, plane, appressed, bifid at the apex, entire or angulate at the margins; inner involucre obovate-cordate, concave dorsally, unicarinate ventrally, smooth; involucral leaves subequilobed, obtusely few toothed. (*F. polysticta* Mont., *F. Sullivantiæ* Aust.)

Hab.—On trees in cedar swamp near Urbana, O. (*Sullivant*). (Eu.)

Bib.—Syn. Hep. p. 437; Hep. Europ. p. 28; Torrey Bull. III, 16; VI, 306.

†† *Texture of the leaves uniform.*

‡ *Amphigastria double the width of the stem.*

18. **F. Donnellii** Aust. Monœcious, reddish, very small; stems with long black hairs interwoven, usually pinnately or somewhat clustered branching; leaves ovate-rotund,

somewhat convex, obtuse, entire, contiguous or imbricate, the auricle somewhat enlarged, oblong-clavate or subcylindric, distant from the stem and subparallel with it or deflexed; amphigastria double the width of the stem, subobovate, bifid, the segments somewhat obtuse; inner involucre obcuneate-oblong, flattish dorsally, slightly unicarinate toward the compressed truncate apex; involucral leaves deeply incised, serrate; androecium minute, globose, short-peduncled.

Hab.—E. Fla. (*J. Donnell Smith*).
Bib.—Torrey Bull. VI, 301.

++ *Amphigastria narrower.*

19. **F. Kunzei** Lehm. and Lindenb. Stems creeping, simply pinnate; leaves approximate, obicular, entire, the auricle oblong-cucullate, obliquely truncate, approximate to the stem: amphigastria subremote, plane, ovate, subangular at the margin, bifid, the laciniæ erect, obtuse; inner involucre broadly obovate, compressed, acutely unicarinate ventrally; involucral leaves entire. (*F. parasitica* Mont., *F. Drummondii* Tayl.)

Hab.—Bark of trees; So. States.
Bib.—Syn. Hep. p. 449.
Exsic.—Hep. Bor.-Amer. No. 105d.

20. **F. brunnea** Spreng. Stems pinnate or bipinnate; leaves dense, 2-ranked, spreading, orbicular, entire, the auricle clavate, arising from the margin of the leaf, distant from the stem with a triangular lobe interposed; amphigastria and involucral leaves acuminate, deflexed, serrate-dentate at the margin; inner involucre oblong, sulcate dorsally, unicarnate ventrally. (*F. obcordata* Lehm. and Lindenb., *F. Caroliniana* Sulliv. Musc. Alleghan. No. 270).

Hab.—Bark of trees; So. States; rare.
Bib.—Syn. Hep p. 441.
Exsic.—Musc. Alleghan. No. 270; Hep. Bor.-Amer. No. 105c.

VIII. LEJEUNIA Libert.

Inner involucre oval or oblong, terete or angular, variously winged, cristate or ciliate at the angles, the month 3-4-lobed or dentate. Capsule quadrifid to the middle, the valves connivent, the pedicel tuberous-geniculate when dry. Elaters per-

sistent at the apex of the valves, erect, unispiral. Leaves delicate. Amphigastria entire or bifid. Stems faciculate or irregularly branching. Entire plant of small size, some species scarcely visible to the unaided eye. Named for *A.-L.-S. Lejeune* a French botanist.

* *Amphigastria entire or barely emarginate.*

1. **L. calyculata** Tayl. Stems entangled, branched; leaves spreading-recurved, oblong, obtuse, entire, the lower lobe involute, lanceolate; amphigastria rotund; inner involucre axillary, somewhat exserted, obcordate, 4-winged, the wings entire; involucral leaves narrow, acute.

Hab.—On lichens; Laurel Mts., Pa. (*Lea in Herb. Hook.*)
Bib.—Syn. Hep. p. 752.

2. **L. cyclostipa** Tayl. Stems 1—1.5 cm. long, widely branched; leaves pale green, imbricate, spreading-recurved, oblong, obtuse, entire, the ventral lobe quadrate-ovate, involute, one-toothed; amphigastria reniform-rotund; inner involucre terminal, obcordate, compressed, plane above, ventricose-4-winged beneath, the wings ciliate with dentate cilia; involucral leaves nearly covering the inner involucre.

Hab.—Bark of trees; near Cincinnati, O. (*Sullivant*).
Bib.—Syn. Hep. p. 749.

3. **L. polyphylla** Tayl. Stems cæspitose, 6—8 mm. long, ascending; leaves olive-green, vertical, imbricate, concave, semicordate, entire, the lobe involute, lanceolate; amphigastria minute, reniform; inner involucre immersed, rotund-obovate, 5-6-angled near the apex, the angles crested, somewhat denticulate.

Hab.—Near Cincinnati, O. (*Herb. Hook.*)
Bib.—Syn. Hep. p. 751.

4. **L. auriculata** Hook. and Wils. Stems 1—1.7 cm. long; leaves dark-green, closely imbricate, acinaciform, complicate and somewhat 2-lobed at base; amphigastria obovate-rotund, emarginate; inner involucre obovate-triangular.

Hab.—Bark of trees; La.

5. **L. testudinea** Tayl. Stems 1—1.5 cm. long; leaves whitish-green, closely imbricate, patent-divergent, oblong, nearly acinaciform, obtuse, complicate-2-lobed at the base, the lobes small, lanceolate; amphigastria rotund, minute; sporogony phase unknown.

Hab.—Bark of trees, Southern O. (*Sullivant*).

6. **L. longiflora** Tayl. Stems procumbent, widely branching; leaves almost membranous, imbricate, patent, oblong, the apex rounded, entire, the lobe minute, ovate, somewhat one-toothed, involute; amphigastria rotund, plane, scarcely bidenticulate at the apex; inner involucre lateral, sessile, somewhat naked, obovate from a narrow base, 5-winged, the wings almost entire.

Hab.—On trees, Southern O. to Fla.
Bib.—Syn. Hep. p. 763.

7. **L. Mohrii** Aust. Stems 1.3—2 cm. long, somewhat simple; leaves dirty or fuscous-green, subcontiguous, obliquely ovate, obtuse, entire or slightly repand, widely spreading, somewhat decurved, the lobe small, inflated, the apex one-toothed; amphigastria small, orbicular, distant; sporogony phase unknown.

Hab.—Mobile, Ala. (*Mohr.*)
Bib.—Torrey Bull. VI, 20.

** *Amphigastria bifid.*

8. **L. serpyllifolia** Libert, *var.* **Americana** Lindb. Stems elongate, narrower than the typical form of the species, pale, pellucid, less branching, fragile; leaves more or less remote, the anterior lobe flat, opening from a basilar sac, scarcely decurved, obliquely ovate-oval, obtuse or sometimes narrower at the apex but never acute, entire or often slightly repand, the upper margin especially in drying, the basilar sac ¼ to ⅓ as large; amphigastria somewhat appressed, 2-3 times larger than the posterior lobe, somewhat convex or plane, rotund-oval, the sinus broad and obtuse, often semilunar, the segments acute, the margins often repand or slightly unidentate outwardly at the base of the segments; inner involucre always on

a lateral branch, obovate-clavate. (*L. serpyllifolia* Sulliv. Musc. Alleghan. No. 272, *L. curifolia* Aust. Hep. Bor.-Amer. No. 97.)

Hab.—On trees, near Charleston, S. C. (*Sullivant*), La. (*Drummond*), Catskill Mts., N. Y. (*P. T. Cleve*), Belleville, Ont. (*Macoun*).

Bib.—Lind. Hep. Hibern. p. 488.

Exsic.—Musc. Alleghan. No. 272; Hep. Bor.-Amer. No. 97.

9. **L. Austini** Lind. Stems straightish, subsimple; leaves subimbricate, oblique, obovate-rotund, erect-patent, the margin sub-repand, the areolation rather small diminishing toward the margin, the lobe somewhat hooded, one-toothed; amphigastria 2-3 times the width of the stem, bifid with a narrow sinus, the laciniæ semi-ovate, somewhat acute; sporogony phase unknown. (*L. Sullivantiæ* Aust. which name is preoccupied as *L. Sullivanti* Gottsche is described, 1863, *Mex. Lev.* p. 196.)

Hab.—Roots of trees and on the ground; So. States (*Sullivant*), La. (*Featherman*).

Bib.—Torrey Bull. III, 15.

Exsic.—Hep. Bor.-Amer. No. 96.

10. **L. cucullata** Nees. Stems filiform, rather pinnately branching, flaccid; leaves oblong-ovate, distant, the lower margin inflexed-hooded; amphigastria distant, oval, much smaller than the leaves; inner involucre terminal on short branches, obovate, rather compressed, obtusely keeled beneath, convex above and bicarinate toward the apex; plant minute, light green. (*L. lucens* Tayl.)

Hab.—On moist rocks, Alleghany Mts. (*Sullivant*).

Bib.—Syn. Hep. p. 389, 767.

Exsic.—Musc. Alleghan. No. 274; Hep. Bor.-Amer. No. 98.

11. **L. Caroliniana** Aust. Stems 2—4 mm. long, rather flaccid; leaves somewhat fuscous, rotund, convex, squarrose-patent, subvertical, rather dense, the apex strongly decurved, the lobe small, subinflated; amphigastria rotund; inner involucre pyriform, subcompressed, 5-angled, the angles naked; male spikes large, terminal and lateral.

Hab.—With *Frullania Kunzei* from Mobile, Ala. (*Sullivant*).

Bib.—Bot. Bulletin (now Bot. Gazette), I, 36.

12. **L. læto-fusca** Aust. Stems creeping, 1—1.7 cm. long; leaves fuscous more or less imbricate, very broadly falcate-ovate, patent, slightly convex, obtuse, with 2—3 much enlarged cells in the centre next the basal row, the lobe minute, subovate; amphigastria small, orbicular, the laciniæ erect, somewhat acute: sporogony phase unknown.

Hab.—So. States? (*Sullivant*).
Bib.—Bot. Bulletin (now Bot. Gazette) I, 36.

13. **L. Ravenelii** Aust. Stems short, flexuous, convex below; leaves yellowish, imbricate, obdeltoid-orbicular, strongly convex, the lobe minute, subinflated; amphigastria minute, rotund, 2-lobed, the lobes obtuse; areolation of leaves large, opaque; sporogony phase unknown.

Hab.—Bark of trees, S. C. (*Ravenel*).
Bib.—Bot. Bulletin (now Bot. Gazette) I, 35.

*** *Amphigastria obsolete or wanting.*

14. **L. minutissima** Dumort. Stems capillary, flexuous, sparingly branched; leaves small, approximate, vertical, subrotund, imperfectly 2-lobed, the lower lobe an indistinct fold; amphigastria obsolete; inner involucre terminal on a rather long branch, broadly obovate, compressed, 5-angled, the mouth obtuse, papillose. (*L. ulicina* Tayl., *Jungermania minutissima* Sm.)

Hab.—Roots of trees, Ala. (Eu.)
Bib.—Syn. Hep. p. 387, 767; Hep. Europ. p. 19.
Delin.—Brit. Jung. t. 52.

15. **L. echinata** Tayl. MS. Stems loosely branching, minute, the whole plant scarcely visible to the unaided eye; leaves ovate, acuminate, cellular-echinate and denticulate, falcate-decurved, sinuate-complicate at the base; amphigastria obsolete; inner involucre on a very short lateral branch, pyriform-clavate, acutely 5-angular, the margin echinate-muricate; involucral leaves bifid, the laciniæ entire. (*L. calcarea* Libert, *Jungermania hamatifolia* var. *echinata* Hook.)

Hab.—Rocks and roots of trees; rather common. (Eu.)
Bib.—Syn. Hep. p. 344 (sub. *L. calcarea*;) Hep. Europ. p. 19.
Delin.—Brit. Jung. t. 51.
Exsic.—Musc. Alleghan. No. 275; Hep. Bor.-Amer. No. 99.

16. **L. Jooriana** Aust. Stems minute, creeping, sparingly branched, with lax foliage; leaves pale green, ovate, obtuse, somewhat plane, scarcely papillose, the lobe moderate, inflated, one-toothed; amphigastria wanting; inner involucre minute, subovate, not compressed, the apex slightly 5-angled, otherwise smooth.

Hab.—*On reeds*, La. (*Dr. Joor*).
Bib.—Torrey Bull. VI, 20.

L. biseriata Aust. is a doubtful species founded on few broken stems without fruit that were mixed with other species of this genus collected in 1845 by Sullivant near Augusta, Ga. There is too much uncertainty regarding this plant to refer it definitely. See Proceedings Phila. Acad. 1869, p. 225, also Botanical Gazette, II, 142.

IX. PHRAGMICOMA Lindb.

Sporogonium on a very short lateral branch. Inner involucre somewhat depressed-plane and bilabiate, the mouth trilobed or tridentate. Capsule quadrivalved a little beyond the middle, membranous, pale, the valves erect-spreading. Elaters persistent at the apex of the valves, erect, unispiral. Leaves inflexed to the base beneath. Amphigastria entire. Name from Gr. *phragma*, partition, and *koma*, hair, from the position of the elaters.

1. **P. clypeata** Sulliv. Stems 1.5—2 cm. long, procumbent, somewhat pinnately branched; leaves whitish-green, with the upper lobe round-ovate and deflexed, the lower oblong, quadrate; amphigastria orbicular, approximate; inner involucre lateral, sessile, obovate, obtusely carinate dorsally, the margin subcompressed. (*Jungermania clypeata* Schwein., *Lejeunia Dorotheæ* Lehm.)

Hab.—On rocks and trees; common southward and westward.
Bib.—Syn. Hep. p. 332 (sub *Lejeunia*).
Exsic.—Musc. Alleghan. No. 271; Hep. Bor.-Amer. No. 95.

2. **P. xanthocarpa** Lehm. and Lindenb. Stems 6—8 mm. long, creeping, subpinnately branching; leaves imbricate, ovate-subcultrate, obtuse, entire, the ventral margin straightish, the lobule convolute, ovate, the apex emarginate-truncate; amphigastria contiguous, reniform-subrotund, entire; inner involucre lateral, subsessile, obovate, emarginate, ventrally carinate, the carina 2-winged at the apex. (*Lejeunia catenulata* Nees, *Jungermania transversalis* Schwein.)

Hab.—On trees in the So. States (*Sullivant, Ravenel*).
Bib.—Syn. Hep. p. 323 (sub *Lejeunia*).
Exsic.—Hep. Bor.-Amer. No. 95b.

X. **MADOTHECA** Dumort.

Dioecious. Sporogonium lateral, nearly sessile. Inner involucre ovate, biconvex, the mouth bilabiate, incised or entire. Involucral leaves 2 or 4, 2-lobed. Calyptra globose, persistent, rupturing below the apex. Capsule globose, on a peduncle little exceeding the inner involucre, membranous, pale. Elaters free, attenuate at both ends, bispiral. Spores rather large, somewhat angular. Antheridia in the saccate bases of closely imbricate, 2-lobed perigonial leaves. Leaves deeply and unequally bilobed. Amphigastria large, decurrent. Name from Gr. *mados*, bald, and *theka*, capsule.

* *Amphigastria entire or nearly so.*
† *Stems commonly simply pinnate.*

1. **M. rivularis** Nees. Stems somewhat pinnate or trifid; leaves entire, closely imbricate, the lobes ovate; upper lobe convex, obtuse, decurved; lower lobe much smaller, separated nearly to the base, revolute from the middle backward; amphigastria somewhat scattered, subquadrate, rounded and reflexed at the apex; involucral leaves entire, the lobes acute, the upper ovate, the lower smaller, ovate-oblong; inner involucre bilabiate.

Hab.—On shaded rocks, near Yellow Springs, O. (*Sullivant*), Cal. (*Bolander*), N. Mex. (*Fendler*). (Eu.)
Bib.—Syn. Hep. p. 278, Hep. Europ. p. 24.
Exsic.—Hep. Bor.-Amer. No. 91b, 91c.

2. **M. thuja** Dumort. Stems creeping, sparingly branched, simply pinnate; branches short; leaves fusconsgreen, closely imbricate; upper lobe strongly incurved, obtuse with the apex mucronulate or 2-4-denticulate; lower lobe oblong, somewhat acute, repand and somewhat denticulate; amphigastria broadly ovate, reflexed-spreading, subentire. (*Jungermania thuja* Dicks.)

Hab.—Ill. (*Wolf*). (Eu.)
Bib.—Hep. Europ. p. 24.

3. **M. Sullivanti** Aust. Stems mostly simply pinnate, the apex strongly decurved in drying; leaves somewhat erect, the ventral margin close, strongly involute toward the apex; cells large punctate-stelliform; inner involucre broadly carinate beneath, the carina biangular; otherwise near *M. involuta* Hampe.

Hab.—Alleghany Mts. (*Sullivant*).
Bib.—Torrey Bull. III, 15.
Exsic.—Hep. Bor.-Amer. No. 94.

†† *Stems somewhat bi-tripinnate.*

‡ *Lower lobe of leaves narrow, ovate-lanceolate.*

4. **M. involuta** Hampe. Stems irregularly pinnately decompound; leaves closely imbricate, subrotund, deflexed, repand or entire, the ventral margin slightly involute, the base decurrent, the lobe narrow; amphigastria approximate, quadrate-ligulate, entire.

Hab.—Banks of rivers, So. States (*Lesquereux, Beyrich*).
Bib.—Syn. Hep. p. 282.
Exsic.—Hep. Bor.-Amer. No. 93.

‡‡ *Lower lobe of leaves broader.*

5. **M. platyphylla** Dumort. Stems irregularly bipinnate; upper lobe of leaf roundish-ovate, the basal margin more or less undulate; the inferior lobes smaller, obliquely oval or subrotund, the margins deflexed; amphigastria round-obovate with reflexed margins, subentire; involucral leaves denticulate or entire; mouth of inner involucre nearly entire. (*Jungermania platyphylla* L., *Lejeunia platyphylla* Corda.) A variety is *Jungermania platyphylloidea* Schwein.. (*Madotheca platyphylloidea* Dumort.), (*Austin*).

Hab.—On rocks and trees; common eastward. (Eu.)
Bib.—Syn. Hep. p. 278; Hep. Europ. p. 23.
Delin.—Brit. Jung. t. 40; Ekart, t. III, f. 24; Sulliv. Mosses U. S. t. VIII.
Exsic.—Hep. Bor.-Amer. No. 89, 90.

6. **M. navicularis** Nees. Stems subbipinnate, somewhat rigid, most of the branches recurved at the apex, some obtuse, others attenuate; upper lobe of leaves somewhat smooth, suborbicular, obtuse, the posterior margin undulate-crisped at the base and beyond; inferior lobe entire, obliquely cordate-oval, obtuse, deflexed, boat-shaped; amphigastria subrotund, obtuse, the margins reflexed, entire or undulate at the base; mouth of the inner involucre subentire. (*M. Californica* Hampe., *Jungermania navicularis* Lehm.)

Hab.—On rocks, Cal. (*Bolander*). (Eu.)
Bib.—Syn. Hep. p. 277 (ex parte); Hep. Europ. p. 24.
Exsic.—Hep. Bor.-Amer. No. 91.

7. **M. porella** Nees. Stems 5—10 cm. long, bi-tripinnate, the branches forked, divergent; leaves somewhat distant, the upper lobe oblong-ovate, obtuse; lower lobe much smaller, appressed to the stem, oblong, flat; amphigastria quadrate, entire; involucral leaves entire, the lobes ovate; inner involucre bilabiate, the lips subcrenate. (*M. Cordaana* Dumort., *Jungermania porella* Dicks., *Porella pinnata* Schwægr.) A variety is *Jungermania distans* Schwein. (*Austin*).

Hab.—On rocks and trees subject to inundation, common. (Eu.); the variety in the So. States.
Bib.—Syn. Hep. p. 281; Hep. Europ. p. 25.
Exsic.—Hep. Bor.-Amer. No. 92, 92b.

8. **M. Wataugensis** Sulliv. Similar to the last but smaller and more delicate, with fascicles of rootlets springing from the base of the amphigastria; leaves light yellowish brown, the upper lobe slightly repand-dentate.

Hab.—On decayed logs, banks of Watauga R., N. C. (*Sullivant*).

** *Amphigastria with 2-3 caudæ on either side at base.*

9. **M. Bolanderi** Aust. Stems short, tumid; subflexuous, slightly twisted, nearly simple; leaves densely imbricate, dimidiate-ovate or oblong, widely spreading, nearly plane, the margin repand or in places caudato-dentate; the lobe almost separate, small, lanceolate-subulate, falcate, twisted, canaliculate, obtuse or acute, repand-undulate at the margin, sparingly caudate at the base; amphigastria scarcely wider than the stem, lingulate-ovate or oblong, obtuse or acute, the margins long decurrent, repand-undulate, caudate-lacinulate; inner involucre large, sharply 2-keeled or somewhat winged beneath, indistinctly nerved above; lower lobe of the involucral leaves acute, acuminate; capsule oval.

Hab.—Cal. (*Bolander*).
Bib.—Torrey Bull. III, 14.

XI. **RADULA** Nees.

Sporogonium terminal on short branches or in a fork. Inner involucre compressed or nearly terete, truncate, entire, the mouth dilated. Involucral leaves 2, deeply bilobed. Calyptra pyriform, persistent, opening below the apex. Capsule oval, 4-parted to the base. Elaters attenuate at both ends, bispiral, deciduous. Spores large, globose. Antheridia in the ventricose bases of minute perigonial leaves. Leaves 2-lobed, the small intlexed ventral producing rootlets. Amphigastria wanting. Name from Lat. *radula*, a scraper or spatula, from the form of the inner involucre.

* *Leaves rather closely imbricate or somewhat remote in No. 1.*
† *Stems dichotomously branching.*

1. **R. tenax** Lindb. Dioecious; stems brownish-green, rigid, tenacious; leaves remote, scarcely decurrent, obliquely elliptic-ovate, opaque, the cells rounded and strongly chlorophylliferous, the posterior lobe rotund-ovate, scarcely half the breadth of the stem, the interior margin free, rotund, equal to the width of the stem or more, the apex plane or scarcely incurved; male spike borne on the side of the stem below the

carina of the leaf, long linear, somewhat obtuse. (*R. pallens* Sulliv. Mosses of U. S. and Muse. Alleghan. No. 261; Aust. Hep. Bor. Amer. No. 87.)

Hab.—On rotten trunks; Md., N. C. (*Sullivant*), Catskill Mts. N. Y. (*P. T. Cleve*), mostly in mountain regions.

Bib.—Lindb. Hep. Hibern. p. 492.

Exsic.—Muse. Alleghan. No. 261; Hep. Bor.-Amer. No. 87.

†† *Stems more or less pinnately branching.*

‡ *Mouth of inner involucre bilabiate.*

2. **R. australis** Aust. Stems 1.3—2.5 cm. long, prostrate, sparingly subpinnately branched, loosely cæspitose; leaves somewhat decurrent, the lobule adnate to the stem along its inner margin; inner involucre elongate, compressed-cylindric from a pyriform or obconic base, the lips of the bilabiate mouth emarginate or crenate; male spikes short and broad, found only on the branches.

Hab.—Near Augusta, Ga. (*Sullivant*), Northern Fla. (*Austin*).

Bib.—Bot. Bulletin (now Bot. Gazette) I, 32; Torrey Bull. VI, 302.

3. **R. Caloosiensis** Aust. Stems short, somewhat rigid, closely creeping, sparingly branching, scarcely pinnate; leaves convex, entire or obscurely crenulate, obtuse, the margins mostly gemmiparous, the lower lobe rather large, somewhat acuminate or obtuse, the inner margin adnate to the stem and somewhat protracted above it; inner involucre somewhat short, from an obconic base, broadly oblong-quadrate, strongly compressed, the lips almost entire, subdecurved; male spikes rather long and loose, subinterrupted.

Hab.—Caloosa, Fla. (*Austin*).

Bib.—Torrey Bull. VI, 301.

‡‡ *Mouth of inner involucre entire or crenulate.*

4. **R. complanata** Dumort. Stems flat, irregularly and somewhat pinnately branched, flaccid; leaves imbricate, the dorsal lobe roundish, the ventral much smaller, triangular-ovate, appressed; inner involucre oblong, compressed, the mouth truncate, entire. (*Jungermania complanata* L.)

Hab.—On rocks and roots of trees; common. (Eu.)

Bib.—Syn. Hep. p. 257; Hep. Europ. p. 31.

Delin.—Brit. Jung. t. 81; Ekart. t. IV, f. 31.

Exsic.—Hep. Bor.-Amer. No. 85, 86.

5. **R. Hallii** Aust. Size, sporogonium and general habit like the last; leaves more incurved at the apex; inner involucre larger, elliptic-oblong, subinflated, narrower at the apex, the mouth often somewhat fleshy; involucral leaves smaller, more equally bilobed.

Hab.—Salem, Ore. (*Hall*).
Bib.—Torrey Bull. VI, 19.

6. **R. Xalapensis** Mont. Stems procumbent, densely pinnately branching, flaccid; leaves densely imbricate, orbicular, obtuse, complicate, somewhat inflated at base, the lobe broad, subrotund, produced above the stem, the margin undulate, the base acutely excised and somewhat adnate to the stem: sporogonium on a terminal or lateral branch; inner involucre elongate, funnel form, the mouth compressed, obsoletely crenate.

Hab.—On wet rocks, Tallulah Falls, Ga (*Sullivant, Lesquereux*). (Eu.)
Bib.—Syn. Hep. p. 255.
Exsic.—Hep. Bor.-Amer. No. 88b.

** *Leaves loosely imbricate.*

7. **R. Sullivanti** Aust. Stems close, subparallel, imbricate-cæspitose; branches short, diverging; leaves subimbricate, flaccid, rotund-oval, falcate, convex, more or less decurved at the apex, abruptly complicate ventrally at the base, the margin subrepand-dentate, the inferior rounded and carinate, the lobe rather small, subinflated at the apex, obtusely triangular or semicircular-rotund, the inner margin adnate to the stem and parallel with it; sporogony phase unknown.

Hab.—On rocks in mountain regions; Ga. (*Sullivant, Lesquereux*).
Bib.—Torrey Bull. VI, 19.
Exsic.—Hep. Bor.-Amer. No. 88c.

8. **R. spicata** Aust. Stems short, prostrate, strongly innovate-branching; leaves semivertical or subascending, broadly obovate, obtuse, entire, inflated at the base, very obtusely complicate for a short space then bilobed, the lobes convex on both sides, the ventral smaller by half, triangular-ovate, obtuse, adnate to the inner margin of the stem; leaves of the branches smaller, more inflated at the base; inner involucre oblong from

an obconic base, compressed, subtruncate at the apex; involucral leaves small, the lobes equal, somewhat oval; capsule oblong; spores large, fuscous, minutely papillose; male spikes 2—8 mm. long, closely leaved.

Hab.—On trees, Cal. (*Bolander*), Salem, Ore. (*Hall*).
Bib.—Torrey Bull. VI, 19.

*** *Leaves distant; inner involucre somewhat clavate.*

9. **R. obconica** Sulliv. Stems indeterminately branched; leaves distant, the dorsal lobe obovate-roundish, convex; inner involucre clavate-obconic, the mouth obliquely truncate, entire.

Hab.—On trees in cedar swamps, rare; O. (*Sullivant*), N. J. (*Austin*).
Bib.—Sulliv. Mosses U. S. p. 100.
Delin.—Sulliv. Mosses U. S. t. VIII.
Exsic.—Hep. Bor.-Amer. No. 88.

XII. BLEPHAROSTOMA Dumort.

Sporogonium terminal on the main stem or a short branch. Involucral leaves numerous, everywhere imbricate, jointed-ciliate. Inner involucre free, exserted, terete, glabrous, exceeding the calyptra, contracted and ciliate at the mouth. Capsule quadrivalved, coriaceous. Elaters bispiral, deciduous. Name from Gr. *blepharon*, an eyelid, and *stoma*, mouth, from the form of the inner involucre.

1. **B. trichophylla** Dumort. Plant minute, light-colored; stems flaccid, branched, creeping; leaves and amphigastria 3-4-parted, the divisions straight, spreading bristle-formed, each composed of a single row of cells; inner involucre terminal, ovate. (*Jungermania trichophylla* L.)

Hab.—On the ground and rotten wood, common. (Eu.)
Bib.—Syn. Hep. p. 146, 687; Hep. Europ. p. 95.
Delin.—Ekart, t. IV, f. 27.
Exsic.—Hep. Bor.-Amer. No. 84.

XIII. BLEPHAROZIA Dumort.

Dioecious. Sporogonium terminal on short branches. Involucral leaves 2-4, 4-cleft. Inner involucre terete, obovate, the mouth connivent, plicate, denticulate. Calyptra pyriform,

coriaceous. Capsule ovate, quadrivalved to the base. Ealters bispiral. Antheridia covered by closely imbricated perigonial leaves. Leaves palmatifid or complicate-2-lobed, each lobe divided and ciliate. Amphigastria 4-5-lobed. Name from Gr. *blepharon*, an eyelid, and *ozos*, a bud.

1. **B. ciliaris** Dumort. Stems crowded, somewhat pinnate; the 4-cleft leaves and amphigastria both lacerate-ciliate, the fringes long and setaceous; inner involucre obovate, the mouth contracted-plicate, laciniate-dentate. (*Jungermania ciliaris* L., *Ptilidium ciliare* Nees.)

Hab.—Roots of trees, old logs, etc., in woods or on wet rocky ground on high mountains; common. (Eu.)

Bib.—Syn. Hep. p. 250; Hep. Europ. p. 53.

Delin.—Brit. Jung. t. 65; Ekart, t. V, f. 36.

Exsic.—Hep. Bor.-Amer. No. 83.

XIV. **SENDTNERA** Endl.

Sporogonium terminal on an elongate branch. Inner involucre tubular, deeply many-cleft. Involucral leaves numerous, incised, free or connate at the base. Calyptra chartaceous. Capsule globular. Elaters free, bispiral. Antheridia on special branches in the axils of ventricose, perigonial leaves. Leaves 2-5-cleft or entire. Amphigastria 2-many-cleft. Named for *O. Sendtner*, a German botanist.

1. **S. juniperina** Nees. Stems erect, nearly simple, slender, elongate; leaves and amphigastria nearly alike, oblong, curved and one-sided, 2-cleft to the middle, the divisions lanceolate. (*Jungermania* Swz.)

Hab.—On rocks, Catskill Mts., N. Y. (*Peck*), Greenwood Mts., N. J. (*Austin*). The European variety is now regarded as specifically distinct, *S. aduncа* Gottsche (*Schisma aduncum* Dumort.).

Bib.—Syn. Hep. p. 239.

Delin.—Brit. Jung. t. 4 (?); Sulliv. Mosses U. S. t. VIII (?).

Exsic.—Hep. Bor.-Amer. No. 82.

XV. **TRICHOCOLEA** Dumort.

Sporogonium in a fork. Inner involucre wanting. Involucral leaves numerous coalescent into an oblong, truncate, coriaceous, hairy tube, concrete with the calyptra. Capsule oblong. Elaters free, bispiral. Antheridia on the upper side of the stem in the axils of leaves. Leaves palmately divided, the divisions laciniate. Amphigastria usually many-cleft. Name from Gr. *trichos*, hair, and *koleos*, sheath, from the form of the inner involucre. Dumortier in his later works reduces the name to Tricolea.

1. **T. tomentella** Dumort. Stems forked, 2-3-pinnately branched; leaves 4-5-divided, the divisions capillary, many-cleft; amphigastria setaceously many-cleft. (*Jungermania tomentella* Ehrh., *Tricolea tomentella* Dumort.)

Hab.—Among mosses in swamps and along rivulets; common. (Eu.)

Bib.—Syn. Hep. p. 237; Hep. Europ. p. 111.

Delin.—Brit. Jung. t. 36; Ekart. t. VI, f. 49; Sulliv. Mosses U. S. t. VIII.

Exsic.—Hep. Bor.-Amer. No. 81.

2. **T. Biddlecomiæ** Aust. Stems tender, closely creeping, simply and rather distantly pinnate; leaves transverse, split almost to the base into capillary divisions, as are also the amphigastria.

Hab.—On rotten logs in swamps, Urbana, O. (*Miss Biddlecome*).

Bib.—Bot. Gazette, III, 6.

XVI. **BAZZANIA** B. Gr.

Sporogonium on a branch ascending from the axil of the amphigastria. Inner involucre elongate, trigonal, obtusely trilobed, frequently more deeply fissured on one side, membranous. Involucral leaves small, narrow, subsquarrose, acutely incised at the apex. Calyptra membranous, included. Capsule globose, quadrivalved to the very base. Elaters bispiral. Antheridia spike-shaped, growing from the axils of the amphigastria. Leaves imbricate, oblique, decurved, the apex mostly tridentate rarely bifid or subentire. Amphigastria rather broad, mostly 3-4-toothed or crenate or some incised, serrate or entire. (Mastigobryum Nees, Pleuroschisma Dumort.)

1. **B. trilobata** B. Gr. Stems creeping, dichotomous-proliferous; leaves imbricate, obliquely ovate, antrorsely gibbous at the base, the apex rather broad, acutely tridentate, the teeth entire; amphigastria subrotund-quadrangular, spreading, the upper margin 4-6-toothed, the teeth subdenticulate; inner involucre curved, cylindric, plicate at the narrow apex, the mouth tridentate. (*Jungermania trilobata* L., *Pleuroschisma trilobatum* Dumort., *Mastigobryum trilobatum* Nees). A variety is *Mastigobryum trideuticulatum* Lindenb., (*Jungermania tridenticulata* Michx.)

Hab.—In ravines, wet woods and swamps; common nort' ward and on the mountains. The variety from N. J. southward. (Eu.)
Bib.—Syn. Hep. p. 230; Hep. Europ. p. 103.
Delin.—Brit. Jung. t. 76; Ekart, t. III, f. 22: Sulliv. Mosses U. S., t. VIII.
Exsic.—Hep. Bor.-Amer. No. 77, 78, 79.

2. **B. deflexa** B. Gr. Stems narrow, forked or alternately branching; leaves strongly deflexed, cordate-ovate or ovate-oblong, falcate, arcuate at the dorsal margin, bi-tridentate or entire at the narrow apex; amphigastria somewhat approximate, suborbicular-quadrate, the upper margin bifid, crenate or entire; inner involucre cylindric, arcuate, plicate at the apex, the mouth denticulate. (*Jungermania deflexa*, Mart., *Pleuroschisma deflexum* Dumort., *Mastigobryum deflexum* Nees. Includes *Mastigobryum ambiguum* Lindenb., and *M. decadatum* Torrey MS.)

Hab.—On rocks in the higher mountains. (Eu.)
Bib.—Syn. Hep. p. 231; Hep. Europ. p. 104.
Delin.—Ekart, t. XII, f. 98.
Exsic.—Hep. Bor.-Amer. No. 80.

XVII. LEPIDOZIA Nees.

Sporogonium terminal on short branches arising from the under side of the stem. Inner involucre elongate, obtusely 3-plaited, the mouth denticulate. Involucral leaves small, rather broad, acutely 2-4-lobed at the apex. Calyptra membranous, slender, included. Capsule globose, 4-valved at the base. Elaters bispiral. Antheridia on short, spike-like branches, arising

from the underside of the stem, single in the base of conduplicate 2-3-cleft perigonial leaves. Leaves usually 4-toothed or 4-parted. Amphigastria 3-5-cleft. Name from Gr. *lepis*, a scale, and *ozos*, a bud, from the form of the involucre.

1. **L. reptans** Dumort. Stems creeping, pinnately compound or decompound, the branches often furnished with a flagellum; leaves decurved, subquadrate, acute, acutely 3-4-toothed; amphigastria subquadrate, 3-4-cleft; involucral leaves ovate, truncate, unequally 4-denticulate; inner involucre incurved, the mouth dentate. (*Jungermania reptans* L., *Pleuroschisma reptans* Dumort.)

Hab.—On the ground and on rotten wood, N. J. (*Austin*), and northward. (Eu.)

Bib.—Syn. Hep. p. 205; Hep. Europ. p. 109.

Delin.—Brit. Jung. t. 75; Ekart, t. III, f. 21; Sulliv. Mosses U. S. t. VIII.

Exsic.—Hep. Bor.-Amer. No. 75.

2. **L. setacea** Mitt. Leaves and amphigastria uniform, deeply 2-3-cleft or 3-parted, incurved, the laciniæ subulate, formed of a somewhat double series of cells; inner involucre ciliate at the mouth. (*Jungermania setacea* Web., *Blepharostoma setacea* Dumort.)

Hab.—On ground and rotten wood; common. (Eu.)

Bib.—Syn. Hep. p. 144, 686; Hep. Europ. p. 95 (sub. *Blepharostoma.*)

Delin.—Brit. Jung. t. 8; Ekart, t. IV, f. 28.

Exsic.—Hep. Bor.-Amer. No. 76.

3. **L. Californica** Aust. Stems subfiliform, flaccid, much branching; leaves loosely imbricate, deeply palmately 3-5-cleft, the laciniæ filiform-attenuate, unequal, entire or repand, or occasionally again cleft; amphigastria wider than the stem, suboblong, deeply bifid, the laciniæ incised-ciliate. (*Mastigophora Californica* Aust.)

Hab.—Bark of trees, Mts. of Cal. (*Bolander*), Vancouver's Island (*Macoun.*)

Bib.—Torrey Bull. VI, 19, 302.

XVIII. **CALYPOGEIA** Raddi.

Inner involucre wanting. Outer involucre oblong, saccate, truncate, fleshy, hairy, attached by one side of its mouth to the stem, pendent or descending into the earth. Calyptra membranous, partly connate with the involucre. Capsule oblong, twisted, the valves narrow and contorted. Elaters bispiral. Antheridia on short, lateral, capitate branches, one in each perigonial leaf. Leaves entire or 2-toothed. Amphigastria 2-cleft. (Kantia B. Gr., Lindberg.) Name from Gr. *kalux*, a cup, *upo*, under, and *gea*, earth, from the subterranean involucre.

1. **C. trichomanis** Corda. Foliage delicate, pale-green; leaves roundish-ovate, obtuse, spreading, imbricate; involucre imbedded in the soil; ventral flagella wanting (*Jungermania trichomanis* Dicks., *Cincinnulus trichomanis* Dumort.)

Var. **rivularis** Aust. Foliage blackish or dusky-green; stems longer, more delicate; leaves more scattered, flaccid, loosely reticulate.

Var. **tenuis** Aust. Stems climbing among *Sphagna*, very slender, innovate branching; leaves smaller, usually decreasing upward, dimidiate-ovate or subfalcate, somewhat decurrent.

Hab.—On ground and rotten logs; common. (Eu.) The varieties in Southern N. J. (*Austin*).

Bib.—Syn. Hep. p. 198; Hep. Europ. p. 115 (sub. *Cincinnulus*).

Delin.—Brit. Jung. t. 79; Ekart, t. IV, f. 35; Sulliv. Mosses, U. S. t. VIII.

Exsic.—Hep. Bor.-Amer. No. 72, 73, 74.

2. **C. Sullivanti** Aust. Stems prostrate, furnished with ventral flagella; leaves flat, subcontiguous or imbricate; obliquely rotund-ovate, minutely 2-toothed at apex, the teeth usually straight, the sinus lunulate, obtuse, the inferior margin abruptly and narrowly decurrent; areolation lax, everywhere uniform; amphigastria minute, the uppermost orbicular, bifid, the medial and lower bifurcately 4-lobed, the primary lobes rotund-quadrate, strongly divaricate, the secondary ovate or subulate, usually acute.

Hab.—So. States (*Sullivant, Ravenel, Mohr.*), Delaware Water Gap, N. J. (*Austin*).
Bib.—Torrey Bull. VI, 18.
Exsic.—Hep. Bor.-Amer. No. 74b.

XIX. **GEOCALYX** Nees.

Inner involucre wanting. Outer involucre oblong, saccate, truncate, fleshy, naked, attached by one side of its mouth to the stem, pendent. Calyptra membranous, partly connate with the involucre. Capsule oblong. Elaters bispiral, deciduous. Antheridia on spike-like, lateral branches, in the axils of small perigonial leaves. Name from Gr. *gea*, earth, and *kalux*, a cup, from the subterranean involucre.

1. **G. graveolens** Nees. Leaves ovate-quadrate, 2-toothed, light-green; amphigastria oval-lanceolate, 2-cleft to the middle, the segments linear; involucre subterranean. (*Jungermania graveolens* Schrad.)

Hab.—On the ground in wet places; not common. (Eu.)
Bib.—Syn. Hep. p. 195; Hep. Europ. p. 118.
Delin.—Ekart, t. IX, f. 67; Sulliv. Mosses U. S., t. VII.
Exsic.—Hep. Bor.-Amer. No. 71.

XX. **CHILOSCYPHUS** Corda.

Sporogonium terminal on a short lateral branch. Involucral leaves 2-6, different from those of the stem, smaller. Inner involucre usually short, deeply 2-3-cleft. Calyptra globose, oblong or subclavate, slightly chartaceous. Capsule oval, quadrivalved to the base. Elaters bispiral, deciduous. Perigonial leaves like those of the stem, concealing the antheridia in their saccate bases. Leaves decurrent on the back of the stem. Amphigastria usually deeply 2-cleft, the root hairs proceeding only from their bases. Name from Gr. *cheilos*, lip, and *skuphos*, bowl, from the form of the inner involucre.

* *Amphigastria 4-parted; involucral leaves 2.*

1. **C. ascendens** Hook. and Wils. Large, pale-green; stems prostrate; leaves ascending, roundish-oblong, slightly emarginate; involucral leaves 2-cleft; inner involucres 2-3-lobed, the lobes long and irregularly lacerate-toothed. (*C. labiatus* Tayl.)

Hab.—On rotten logs, etc., rather common.
Bib.—Sulliv. Mosses U. S., p. 91.
Delin.—Sulliv. Mosses U. S., t. VIII.
Exsic.—Hep. Bor.-Amer. No. 70.

** *Amphigastria bifid; involucral leaves 2.*

2. **C. pallescens** Dumort. Stems procumbent, creeping; leaves flattened, ovate-subquadrate, retuse or obtuse; amphigastria ovate, distant, subentire, free; involucral leaves 2-toothed; inner involucre deeply trifid, the laciniæ spinose-dentate; calyptra conspicuous, mostly longer than the inner involucre. (*Jungermania pallescens* Ehrh.)

Hab.—Mts. of N. Eng. (*Oakes*). (Eu.)
Bib.—Syn. Hep. p. 187; Hep. Europ. p. 101.
Exsic.—Hep. Bor.-Amer. No. 69.

3. **C. polyanthos** Corda. Stems procumbent, creeping; leaves subascending, ovate-subquadrate, truncate-subretuse; amphigastria free, distant, ovate-oblong; involucral leaves slightly 2-toothed; inner involucre 3-lobed, the lobes short and nearly entire; calyptra longer than the inner involucre. (*Jungermania polyanthos* L.)

Var. **rivularis** Nees. Larger, more branching, succulent; leaves mostly rounded at the apex; amphigastria often divided into halves or entirely wanting, when present broader and somewhat denticulate.

Hab.—On ground and rotten logs; common. (Eu.) The variety in shady rills. (Eu.)
Bib.—Syn. Hep. p. 188; Hep. Europ. p. 101.
Delin.—Brit. Jung. t. 62; Ekart, t. VI, f. 50.
Exsic.—Hep. Bor.-Amer. No. 67, 68.

*** *Amphigastria almost entire; involucral leaves 3-4.*

4. **C. Drummondii** Tayl. Small, densely cæspitose; stems branching, prostrate, the gemmiferous ones ascending, attenuate; leaves erect-spreading, oblong, 2-cleft; amphigastria ovate, acute, connate with the adjacent pair of leaves; inner involucre terminal on short naked branches, oblong, inflated, bifid and subcompressed at the mouth, gibbous at the ventral base; involucral leaves laciniate, scale-like.

Hab.—"Bark of trees; N. A." (*Drummond*).
Bib.—Syn. Hep. p. 709.

XXI. LOPHOCOLEA Nees.

Fructification terminal on the main stem or on primary branches. Inner involucre tubular below, acutely triquetrous, more or less dilated and 3-lobed at the mouth, the lobes tooth-crested. Involucral leaves 2-4, large. Calyptra short, membranous, included, circumcissile at the base or rupturing irregularly at the apex. Capsule oval or oblong, 4-valved to the base. Elaters bispiral. Antheridia in the saccate bases of the involucral leaves. Leaves decurrent on the dorsal side of the stem, flaccid, 2-several cleft at the apex. Amphigastria 2-4 divided, the divisions more or less incised. Name from Gr. *lophos*, a crest, and *koleos*, a sheath, alluding to the crested inner involucre.

* *Divisions of amphigastria entire.*
† *Amphigastria minute.*

1. **L. bidentata** Dumort. Stems elongate, 2.5—5 cm. long, sparsely branching; leaves pale green, ovate-triangular, spreading, 2-toothed at the apex, the teeth oblique, acute, with a crescent-shaped sinus; amphigastria about 4-cleft. (*Jungermania bidentata* L.)

Hab.—On rocks in shady rills; not common. (Eu.)
Bib.—Syn. Hep. p. 159, 691; Hep. Europ. p. 83.
Delin.—Brit. Jung. t. 30; Ekart, t. VII, f. 53.

†† *Amphigastria medium size.*

2. **L. minor** Nees. Stems diffusely branching; leaves pale green, oval, subquadrate, somewhat rigid, the sinus lunate the teeth equal, acute; amphigastria one-third the size of the leaves, deeply bifid, the laciniæ lanceolate-acuminate, entire; inner involucre trigonal-plicate; involucral leaves mostly uniform.

Hab.—On roots of trees in woods. (Eu.)
Bib.—Syn. Hep. p. 160; Hep. Europ. p. 84.
Exsic.—Hep. Bor.-Amer. No. 65b.

3. **L. Macouni** Aust. Stems very short, prostrate, ascending at the apex, densely radiculose; leaves somewhat erect, ovate subquadrate, retuse or emarginate, bilobed or often entire, the margin slightly repand, the sinus and lobes obtuse; amphigastria light pink, deeply bifid, the sinus broad, obtuse, the laciniæ spreading incurved, setaceous, often formed of a single series of cells; inner involucre subobovate, slightly trigonal; involucral leaves suboblong, somewhat repand at the margin, unequally 2-4-repand-dentate at the apex.

Hab.—On logs, among other Hepaticæ, Ontario (*Macoun*), Little Falls, N. Y. (*Austin*).
Bib.—Pro. Phil. Acad. 1869, p. 223.
Exsic.—Hep. Bor.-Amer. No. 66.

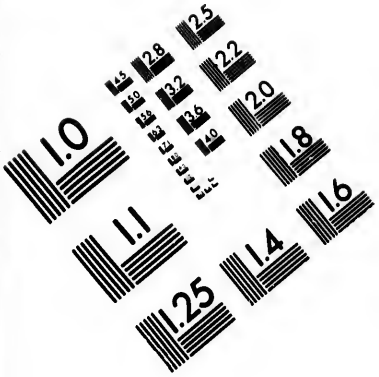
** *Dicisions of amphigastria somewhat dentate.*

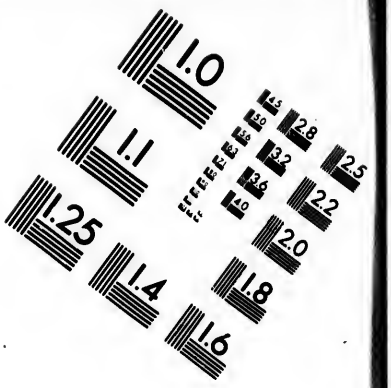
† *Amphigastria large.*

4. **L. heterophylla** Nees. Stems short, creeping or ascending, much branched; leaves ovate-subquadrate, entire, retuse and bidentate on the same stem; amphigastria large, 2-cleft, the laciniæ slightly dentate. (*Jungermania heterophylla* Schrad.)

Hab.—On the ground and old logs, etc. in woods and swamps; very common. (Eu.)
Bib.—Syn. Hep. p. 164; Hep. Europ. p. 86.
Delin.—Brit. Jung. t. 31; Ekart, t. VII, f. 54; Sulliv. Mosses U. S. t. VII.
Exsic.—Hep. Bor.-Amer. No. 64.

†† *Amphigastria of medium size.*





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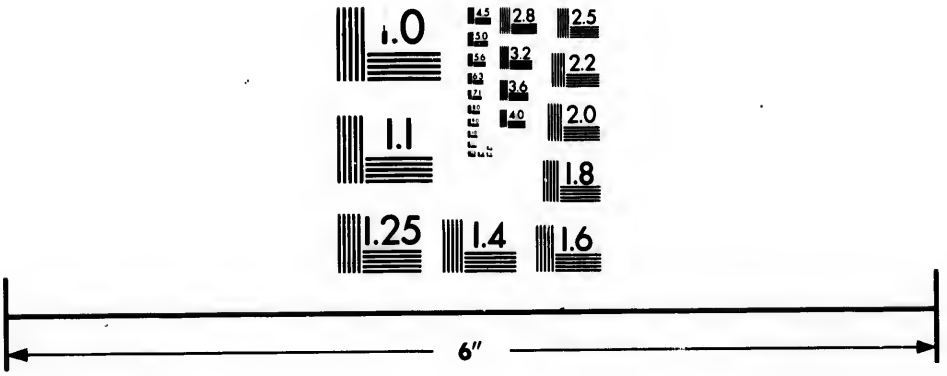

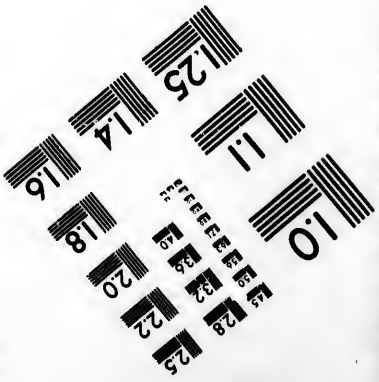

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5. **L. crocata** Nees. Stems creeping, branching; leaves pale, oval-subquadrangular, plane-ascending, somewhat rigid, the sinus somewhat lunate, the teeth slightly unequal, distant, acute or obtuse; amphigastria one-third as large as the leaves, ovate, deeply bifid, the laciniæ lanceolate-acuminate, extrorsely 1-toothed. (*Jungermania crocata* DeNot.)

Hab.—On ground and on dry rocks in limestone regions. (Eu.)
Bib.—Syn. Hep. p. 160; Hep. Europ. p. 85.
Exsic.—Hep. Bor.-Amer. No. 65.

6. **L. Hallii** Aust. Stems creeping, very slightly radiculose; leaves subvertical, oblong, entire or subrepand, crenulate, bilobed almost to the middle, the sinus obtuse, the laciniæ suberect, mostly obtuse; lower amphigastria small, deeply biparted, the sinus obtuse, the laciniæ subequal; upper amphigastria larger, extrorsely unidentate on both sides or palmately 3-4-parted; apical amphigastria sublanceolate, narrowly bifid, extrorsely repand-dentate.

Hab.—On the ground; Ill. (*E. Hall*).
Bib.—Pro. Phil. Acad. 1869, p. 222.

XXII. **PLEURANTHE** Tayl.

Fructification lateral. Inner involucre elongate-fusiform, rising from the lower side of the stem, fleshy, solid, rooting at the base, membranous above, the mouth compressed or triquetrous, 2-3-cleft, lacerate. Involucral leaves 3, minute, scale-like, 2-3-cleft. Calyptra concrete with the inner involucre except at its apex. Capsule oval. Elaters bispiral. Leaves 2-lobed or emarginate. Amphigastria lanceolate, entire. Name from Gr. *pleura*, the side, and *anthos*, flower, from the lateral fructification.

1. **P. olivacea** Tayl. Stems creeping, mostly simple, profusely rooting; leaves imbricate, rotund-oblong, somewhat emarginate; inner involucre rather large.

Hab.—"North America" (*Drummond*).
Delin.—Sulliv. Mosses U. S. t. VII.
Bib.—Syn. Hep. p. 689.

XXIII. **LIOCHLÆNA** Nees.

Inner involucre terminal, ascending, retrorsely subarcuate, at length cylindric, the vertex truncate, depressed plane, the mouth contracted, ciliate, the cilia articulate, connivent in a short cone. Involucral leaves 2, similar to those of the stem. Capsule oval, 4-valved to the base. Elaters inserted in the middle of the valves, bispiral. Antheridia in the axils of the unchanged upper leaves, naked. Leaves entire. Amphigastria wanting. Name from Gr. *leios,* smooth, and *chlaina,* a cloak (inner involucre).

1. **L. lanceolata** Nees. Stems closely creeping, branching; leaves entire, sometimes decurrent on the stem, the terminal ones vertically contiguous. (*Jungermania lanceolata* L., *Aplozia lanceolata* Dumort.)

Hab.—On banks and rotten logs in woods; not rare. (Eu.)
Bib.—Syn. Hep. p. 148; Hep. Europ. p. 58 (sub *Aplozia*).
Delin.—Brit. Jung. t. 28; Ekart t. I f. 7.
Exsic.—Hep. Bor.-Amer No. 62.

XXIV. **ODONTOSCHISMA** Dumort.

Monœcious. Fructification terminal on a short branch, arising from the ventral side of the stem. Inner involucre ascending, terete, trigonal at the apex, the mouth denticulate. Involucral leaves few, small, incised. Calyptra membranous. Capsule oblong. Elaters placed at the middle of the valves, caducous, bispiral. Antheridia in the axils of minute involucral leaves of pendent branches. Amphigastria sometimes wanting, except on gemmiferous branches. Gemmæ collected in heads upon the attenuated tips of the branches. (Sphagnœcetis Nees). Name from Gr. *odos*, *odontos*, tooth, and *schisma*, a split, from the form of the inner involucre.

1. **O. sphagni** Dumort. Stems creeping; leaves elliptic-orbicular, entire, ascending; amphigastria wanting except on fructiferous and gemmiferous stems, ovate, entire or bifid. (*Sphagnœcetis communis* Nees, *Jungermania sphagni* Dicks.)

Hab.—Among mosses; common from N. J. and O. to the Gulf of Mexico. (Eu.)

Bib.—Syn. Hep. p. 148 (sub *Sphagnœcetis*); Hep. Europ. p. 108.

Delin.—Brit. Jung. t. 33; Ekart t. VI f. 43-48.

Exsic.—Musc. Alleghan. No. 228; Hep. Bor.-Amer. No. 61.

2. **O. Macouni** (Aust). Stems stoloniferous from beneath, or innovate-branching, sparingly radiculose; leaves imbricate, oval-rotund, concave, appressed or obliquely somewhat spreading, narrowly hyaline-margined; amphigastria somewhat obsolete, ovate-lanceolate; gemmiferous branches succulent, subclavate, the leaves thin, appressed, more distinctly striolate-areolate; gemmæ pale, oval; sporogony phase unknown. (*Sphagnœcetis Macouni* Aust.)

Hab.—On damp ground near Lake Superior, Can. (*Macoun*).

Bib.—Torrey Bull. III, p. 13.

3. **O. denudata** Dumort. Stem procumbent, branching, flagelliferous, the branches ascending; leaves subvertical, connivent, orbicular, entire, decurrent toward the apex. (*O. Hubeneriana* Rabenh. Hepat. Exsic. Europ. n. 16.)

Hab.—On rotten wood, Ala. to O., N. Eng. and Canada. (Eu.)

Bib.—Hep. Europ. p. 108.

Exsic.—Hep. Bor.-Amer. No. 61b.

XXV. HARPANTHUS Nees.

Fructification on a short lateral branch. Involucral leaves smaller than those of the stem. Inner involucre distant from the outer, fusiform, thickened below, the mouth 3-4-fid, the laciniæ unequal, entire. Capsule quadrivalved to the base. Elaters bispiral. Leaves succubous, somewhat semivertical, bidentate at the apex. Amphigastria entire or nearly so. Name from Gr. *arpa*, a sickle, and *anthos*, flower, from the form of the involucre.

1. **H. scutatus** Spruce. Stems loosely creeping, ascending at the apex; leaves semivertical, suborbicular, emarginate-bidentate, the sinus semilunar, the laciniæ subequal, acute; amphigastria ovate-triangular, acute, entire or 1-2-toothed at

base; inner involucre ovate, the mouth plicate-denticulate; involucral leaves emarginate-bidentate, erect, equal. (*Jungermania scutata* Web., *Odontoschisma scutata* Aust.)

Hab.—On rotten wood in swamps and damp woods; common. (Eu.)
Bib.—Syn. Hep. p. 101; Hep. Europ. p. 67.
Delin.—Brit. Jung. t. 41; Ekart t. VIII, f. 64.
Exsic.—Musc. Alleghan. No. 224; Hep. Bor.-Amer. No. 61c.

XXVI. **CEPHALOZIA** Dumort.

Fructification terminal on clavate branches arising from the lower side of the stem. Inner involucre at first triquetrous, often becoming plicate, the mouth denticulate or ciliate or often laciniate. Involucral leaves numerous, enlarged, usually 2-4-cleft, in 3 or more ranks. Capsule ovate or oval, 4-valved to the base, long-pedicelled. Elaters bispiral. Antheridia in the base of inflated leaves which form a spike-like andrœcium. Leaves small, usually roundish and bidentate, with or without amphigastria. Name from Gr. *kephale*, head, and *ozos*, a bud, from the form of the fruit-bearing buds.

* *Amphigastria wanting (sometimes minute in No. 3).*
† *Leaves (at least the lower ones) distant.*

1. **C. bicuspidata** Dumort. Minute, dark green; fruit-bearing branch short; stems loose, procumbent; leaves distant or sometimes crowded, half-vertical, ovate-orbicular, usually wider than the stem, bifid to the middle with obtuse sinus and acute segments; involucral leaves in several ranks, 2-5-lobed, the lanceolate divisions repand or subdentate; inner involucre linear, complicate-triangular above, the mouth denticulate; capsule oblong, reddish brown. (*Jungermania bicuspidata* L., *Trigonanthus bicuspidatus* Spruce.)

Var. **conferta** Austin. Involucral leaves mostly bilobed, somewhat one-toothed outwardly; mouth of the inner involucre subciliate.

Hab.—On the ground in the high mountains of N. Y., N. Eng., Can. and Cal. (*Bolander*) (Eu.) The var. on banks, Closter, N. J. (*Austin*).
Bib.—Syn. Hep. p. 138; Hep. Europ. p. 91.
Delin.—Brit. Jung. t. 11; Ekart t. IV f. 33.
Exsic.—Hep. Bor.-Amer. No. 58, 59.

2. **C. multiflora** Lindb. Fruit-bearing branch very short; stem and sterile branches creeping, flexuous; leaves a little wider than the stem, orbicular with a broad decurrent base obliquely attached to the stem, bifid with a lunulate sinus and strongly connivent lobes; involucral leaves 2-ranked, imbricate, 3-5-fid with entire erect linear divisions; inner involucre slender, oblong, the mouth lacerate-ciliate; capsule oval, pale fuscous. (*Jungermania connivens* Dicks., *Trigonanthus connivens* Spruce, *Cephalozia connivens* Aust., *Blepharostoma connivens* Dumort.)

Hab.—On decaying moss, rotten wood and on the ground; common. Eastern U. S. to Cal. (Eu.)

Bib.—Lindb. Hep. Hibern. p. 501.

Delin.—Brit. Jung. t. 15 (exlc. f. 2, 3); Ekart t. VIII, f. 60; Sulliv. Mosses U. S. t. VII.

Exsic.—Hep. Bor.-Amer. No. 57.

3. **C. divaricata** Dumort. Plant minute, dark green; fruit-bearing branch elongate, terminal; stems usually short, rigid, with ascending branches; leaves scarcely wider than the stem, spreading, rather fleshy, oblong, bifid to the middle with acutish sinus and segments, the lower somewhat distant with entire divaricate lobes, the upper sometimes imbricate with lobes more or less serrate and not divaricate; involucral leaves 3-ranked, imbricate, 2-3-cleft, incised-dentate; inner involucre short, 4-5-angled, plicate, the scarious mouth entire or laciniate; capsule oval. (*Jungermania divaricata* Engl. Bot., *J. byssacea* Roth., *Trigonanthus divaricatus* Spruce.)

Hab.—Dry rocks in mountain woods and on dry sand, Pine Barrens, N. J. (*Austin*), and northward; also in Cal. (*Bolander*).

Bib.—Syn. Hep. p. 138 (sub *Jungermania*); Hep. Europ. p. 91.

Delin.—Brit. Jung. t. 4; Ekart, t. IV, f. 33.

Exsic.—Hep. Bor.-Amer. No. 51, 52, 53, 54.

4. **C. pleniceps** (Aust.) Stems densely cæspitose, very short, strongly radiculose beneath, with numerous ventral innovations; leaves thick, orbicular, strongly concave, vertical-connivent, somewhat half clasping but not decurrent, bifid $\frac{1}{3}$ their length, the sinus somewhat acute or obtuse; the lobes acute, incurved, strongly connivent; involucral leaves oblong,

palmately 2-4-cleft, the ventral ones amphigastria-like; inner involucre terminal on a ventral branch, large, oblong-cylindric, obtusely trigonal, the mouth plicate, denticulate. (*Jungermania pleniceps* Aust.)

Hab.—Among *Sphagna*, White Mts., N. H. (*Oakes*).
Bib.—Pro. Phil. Acad. 1869, p. 222.

†† Leaves imbricate or subimbricate.

5. **C. catenulata** Lindb. Fruit-bearing branch short; stem somewhat rigid, branching, with flexuous ascending sterile branches; leaves scarcely wider than the stem, ascending, concave, thickened at the middle, mostly bifid with a somewhat obtuse sinus and incurved segments; involucral leaves appressed, many ranked, bi-trifid, subentire; inner involucre subchartaceous, cylindric, complicate upward, the mouth ciliate; capsule oval, cinnamon-colored. (*Jungermania catenulata* Hübn.)

Hab.—On rotten wood in swamps and on the ground, N. Eng. to La.; very common southward. (Eu.)
Bib.—Syn. Hep. p. 138; Hep. Europ. p. 92.
Exsic.—Hep. Bor.-Amer. No. 56.

6. **C. curvifolia** Dumort. Fruit-bearing branch short; stems and sterile branches flexuous, creeping; leaves ascending, nearly orbicular, inflated at the ventral base, lunately 2-cleft, the segments long, linear, inflexed; involucral leaves erect, 2-3-cleft, serrate, imbricate, inner involucre elongate, narrow, the mouth denticulate; capsule oval. (*Jungermania curvifolia* Dicks., *Trigonanthus curvifolius* Spruce).

Hab.—Rotten logs in damp woods and swamps; common. (Eu.)
Bib.—Syn. Hep. p. 142; Hep. Europ. p. 93.
Delin.—Brit. Jung. t. 16.
Exsic.—Musc. Alleghan. No. 242; Hep. Bor.-Amer. No. 60.

7. **C. Macouni** Aust. Stems slender, diffusely cæspitose; fruit-bearing branch short; leaves little wider than the stem, subimbricate, somewhat concave at the base, subcuneate-quadrate, bifid to below the middle, the sinus usually broad, obtuse, the segments ovate or triangular-lanceolate, acute, nearly straight, divaricate when pressed; inner involucre mi-

nute, whitish, subtrigonal, oval-obovate, subinflated, the apex contracted or subplicate, the mouth denticulate or ciliate; involucral leaves subobovate, somewhat unequal, bi-trifid, serrate, often long ciliate; capsule oval. (*Jungermania Macouni* Aust. 1869).

Hab.—On rotten logs Can. (*Macoun*), Mts. of N. Eng. (*Austin*).
Bib.—Pro. Phil. Acad. 1869, p. 222.
Exsic.—Hep. Bor.-Amer. No. 55.

** *Amphigastria present.*

8. **C. Francisci** Dumort. *var.* **fluitans** Austin. Stems very long, climbing among *Sphagna* or floating in water, flagelliferous-branching ventrally, copiously radiculose; leaves pale, loose, narrower at base, scarcely decurrent, oblong-elliptic, deeply bilobed, the margin entire, the sinus narrow, the lobes obtuse, more or less unequal, the apex incurved or flat; amphigastria minute, appressed, inconspicuous, mostly triangular-lanceolate; inner involucre short, oval, obtuse, obtusely trigonal, the mouth plicate, sublaciniate, the laciniæ truncate, naked. (*Jungermania inflata* var. *fluitans* Nees, *Cephalozia obtusiloba* Lindb.)

Hab.—Peat bogs, N. J. to Can. (Eu.)
Bib.—Bot. Bulletin (now Bot. Gazette) I, 31; Syn. Hep. p. 106; Hep. Europ. p. 89.
Exsic.—Hep. Bor.-Amer. No. 35.

9. **C. Sullivanti** Aust. Plant very minute, olive-green; stem 0.6—1.2 cm. long, fleshy, strongly radiculose, the fruit-bearing branch suberect, clavate, the sterile creeping, subfiliform or subjulaceous; leaves imbricate, often narrower than the stem, subquadrate-ovate, more or less dentato-serrate, bifid, the sinus and segments somewhat acute; inner involucre broadly oval or subobovate, obtusely and sparingly angulate, the apex slightly plicate, truncate, the mouth connivent, dentate, sometimes narrowly scarious; involucral leaves 3, erect, not grown together; capsule oval. (*Jungermania Sullivantii* Aust. 1869, *J. divaricata* Sulliv. *Musc. Alleghan.* No. 239.)

Hab.—On rotten wood, N. J., O., Ill.; rare.
Bib.—Pro. Phil. Acad. 1869, p. 221.
Exsic.—Hep. Bor.-Amer. No. 50.

10. **C. albescens** Dumort. Stems loosely creeping, arcuate, fastigiately branching; leaves subvertical, orbicular, hemispheric-concave, bifid with a short sinus, the segments equal, rather obtuse; involucral leaves uniform, mostly imbricate; amphigastria ovate- or oblong-scutiform, obtuse, entire or obtusely 1-2-toothed at the base; inner involucre oblong, smooth, the mouth contracted, denticulate. (*Jungermania albescens* Hook.)

Hab.—Ill. (*Wolf*). Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 102 (sub *Jungermania*); Hep. Europ. p. 89.

11. **C. nematodes** Gottsche. Texture lax; leaves rather long, distant; amphigastria small, 2-parted, the segments acute, their apices incurved; inner involucre on a short ventral branch.

Hab.—Banks of ditches and in swamps, Fla., Southern Ga. (*Austin*).
Bib.—Torrey Bull. VI, 302.

XXVII. COLEOCHILA Dumort.

Involucre oligophyllous, the leaves connate at the base. Inner involucre terminal, elongate, cylindric, longer than the calyptra, the mouth compressed, bilabiate. Capsule quadrivalved, coriaceous. Elaters deciduous, bispiral. Leaves entire. Amphigastria present. Name from Gr. *koleos*, sheath, and *cheilos*, lip, from the form of the inner involucre.

1. **C. Taylori** Dumort. Stems erect, nearly simple, radiculose; leaves convex, orbicular, entire, with large areolæ; amphigastria lanceolate-subulate, entire or subdentate; inner involucre terminal, oval, the mouth compressed, bilabiate; calyptra finally long exserted. (*Jungermania Taylori* Hook., *Leptoscyphus Taylori* Mitt.)

Hab.—On wet rocks, high Mts. of N. Y. and N. Eng. (*Sullivant, Austin*), Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 82; Hep. Europ. p. 106.
Delin.—Brit. Jung. t. 57.
Exsic.—Hep. Bor.-Amer. No. 24, 25 (?).

XXVIII. JUNGERMANIA L.

Fructification terminal on the main stem or on a short branch. Involucral leaves free, like or unlike the stem leaves. Inner involucre tubular, more or less angular, the mouth laciniate. Calyptra included, or in some species projecting. Capsule globose or oval. Elaters bispiral. Antheridia in the base of special inflated leaves. Leaves entire, bidentate, or 2-many-lobed or cleft. Amphigastria present or absent. Named for *L. Jungermann*, a German botanist of the 17th century.

(The genus as originally described by Linnæus included nearly the entire order *Jungermaniaceæ*, but has been subdivided over and over again so that its original characters are far different from those given above. The genus as given here is further broken up by recent European writers.)

* *Leaves and amphigastria uniform, 3-ranked.*

1. **J. julacea** L. Stem ascending, branching, filiform: leaves and amphigastria uniform, 3-ranked, imbricate, deeply bifid, the laciniæ oval-lanceolate, acute, somewhat serrate: inner involucre terminal, oval, plicate above, the mouth denticulate; involucral leaves more closely imbricate, larger, otherwise like those of the stem. (*Anthelia julacea* Dumort.)

Hab.—Cal. (*fide Gottsche*), Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 140; Hep. Europ. p. 98.
Delin.—Brit. Jung. t. 2; Ekart t. VIII, f. 61.

** *Amphigastria present, unlike the leaves.*

† *Leaves entire.*

2. **J. Schraderi** Mart. Stems creeping, flexuous; leaves elliptic-orbicular, entire, ascending; amphigastria broadly subulate, obsolete on old stems; involucral leaves large, elongate, entire or emarginate spreading at the apex, the inner smaller, more or less laciniate; inner involucre oval-obovate, ascending. (*Aplozia Schraderi* Dumort.)

Hab.—On the ground, rotten wood, etc.; very common. (Eu.)
Bib.—Syn. Hep. p. 83; Hep. Europ. p. 56.
Delin.—Ekart t. XI, f. 97.
Ersic.—Hep. Bor.-Amer. No. 27.

†† *Leaves bidentate.*

3. **J. Mü̈ leri** Nees. Stems creeping, ascending at the apex, somewhat branching; leaves imbricate, semivertical, repand, obliquely ovate, emarginate-bidentate, the laciniæ unequal, acute or obtuse; amphigastria bi-trifid, subciliate at the base; involucral leaves ciliate-dentate, larger than those of the stem; inner involucre cylindric, the mouth rostrate. *(J. Bantriensis,* var. *Müllerі* Lindb.)

Var. **Danensis** Gottsche MS. is an unpublished form found in Cal. (Mt. Dana).

Hab.—Rocky Mts. (*Botanists of Wheeler Survey*). (Eu.)
Bib.—Syn. Hep. p. 99; Hep. Europ. p. 70.

4. **J. Hornschuchiana** Nees. Stems simple, radiculose, innovating from beneath: leaves semivertical, ascending, soft, orbicular, concave, bidentate with an obtuse sinus, the teeth inflexed, mostly acute; amphigastria bifid or simple, lanceolate-acuminate, ciliate-dentate at base.

Hab.—In mountains Col. (?) (*Botanists of Wheeler Survey*). (Eu.)
Bib.—Syn. Hep. p. 101; Hep. Europ. p. 69.

†††† Leaves bifid or bilobed.

5. **J. Gillmani** Aust. Stems short, densely cæspitose, prostrate, subarcuate, strongly radiculose; leaves orbicular-ovate, vertical, subconcave, bifid, the lower with sinus and teeth mostly acute, the upper much larger, more or less undulate, emarginate-bilobed, the lobes mostly rounded, the sinus obtuse; amphigastria filiform or filiform-subulate, sometimes sublanceolate, mostly entire, the broader bifid, appressed to the stem; inner involucre dorsal, sessile, without involucral leaves, vertical, obovate-lageniform, somewhat gibbous in front, the mouth ciliate, at length much incised.

Hab.—In a cave in sandstone, Traine Is. L. Superior (*Gillman*).
Bib.—Torrey Bull. III, 12.

6. **J. Wattiana** Aust. Stems rather thick, 4—8.5 mm. long, fragile, subflexuous, strongly radiculose; leaves erect-subvertical or somewhat spreading, subovate, concave, emarginate-bilobed, the lower lobe mostly acute, the upper acute or obtuse, often incurved, the sinus lunulate or angled; amphigastria

somewhat obsolete, difform, mostly hairlike or subulate, sometimes ciliate-appendiculate at the margin, the apex incurved; involucral leaves little larger, somewhat undulate, less deeply bilobed; inner involucre terminal, inflated, small, lageniform-ovate, the apex contracted, whitish, the mouth ciliate.

Hab.—On the ground in L. Superior region, Can. (*Macoun*).
Bib.—Torrey Bull. III, 11.

†††† *Leaves 3-5-cleft.*

7. **J. barbata** Schreb. Stems procumbent, sparingly branched; leaves roundish-quadrate, 3-5-lobed, the sinuses obtuse and undulate, the lobes obtuse, acute or mucronulate variously directed; amphigastria broad, entire or 2-toothed, sometimes obsolete; inner involucre terminal, oval, plicate-angular toward the apex, the mouth denticulate.

Var. **attenuata** Mart. Stems ascending with numerous subcylindric innovations; primary leaves semivertical, obliquely spreading, roundish, mostly concave, 2-4-toothed, the teeth acute, subequal; leaves on the innovations closely imbricate, ovate-subquadrate, premorsely 2-4-denticulate; involucral leaves 2, tridentate; inner involucre terminal, oblong, plicate at the apex. (*Jungermania attenuata* Lindenb.)

Hab.—On rocks in mountain regions; common. (Eu.)
Bib.—Syn. Hep. p. 122; Hep. Europ. p. 71, 72.
Delin.—Brit. Jung. t. 70; Ekart. t. XII, f. 102 (var.)
Exsic.—Hep. Bor.-Amer. No. 47, 48.

8. **J. setiformis** Ehrh. Stems erect or ascending, dichotomous and with the leaves terete-sulcate; leaves toothed at the base, 3-4-cleft, the lobes channeled, ovate-oblong, acute; amphigastria ciliate-dentate at the base, deeply bifid, the laciniæ lanceolate-acuminate; involucral leaves more toothed than those of the stem; inner involucral terminal, oval, plicate. (*Anthelia setiformis* Dumort.)

Hab.—Alpine summits of White Mts. N. H. (*Oakes*), Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 130; Hep. Europ. p. 97.
Delin.—Brit. Jung. t. 20; Ekart, t. II, f. 15.
Exsic.—Hep. Bor.-Amer. No. 49.

*** *Amphigastria wanting.*

† *Leaves entire or nearly so.*

9. **J. fossombronioides** Aust. Stems densely cæspitose, ... ading, strongly radiculose; leaves distichous-subvertical, closely imbricate, orbicular, the margin undulate-repand, the apex uniplicate, slightly emarginate, spreading-subrecurved, the base subcordate, clasping the stem, subventricose, radiculose; inner involucre very large, exserted, subcampanulate, 6-10-plicate, the mouth deeply laciniate, the laciniæ entire; capsule short-oval; calyptra violet.

Hab.—On rocks in a rivulet; Closter, N. J. (*Austin*).
Bib.—Pro. Phil. Acad. 1869, p. 220.
Exsic.—Hep. Bor.-Amer. No. 32.

10. **J. crenulata** Smith. Stems prostrate, branching; leaves orbicular, entire, those toward the involucre larger and bordered with large marginal cells; inner involucre obovate, compressed-4-angled, the mouth much contracted, toothed; capsule subrotund, elliptic. (*Solenostomum crenulatum* Mitt., *Aplozia crenulata* Dumort.) Var. *gracillima* (*Aplozia gracillima* Dumort.) is also found.

Hab.—On the ground in old fields, etc., N. Y. to Ala. (Eu.)
Bib.—Syn. Hep. p. 90; Hep. Europ. p. 57.
Delin.—Brit. Jung. t. 37, et Suppl. t. 1; Ekart, t. III et XII, f. 25.
Exsic.—Hep. Bor.-Amer. No. 30.

11. **J. crenuliformis** Aust. Densely cæspitose; fertile stems creeping, increasing upward, strongly radiculose, the rootlets mostly purplish; sterile stems somewhat ascending, decreasing upward; leaves orbicular, gently repand-undulate, entire or subemarginate, obliquely patent, somewhat decurrent, concave, almost cup-shaped when dry; inner involucre small, subobovate, more or less connate with the involucre, not at all or slightly exserted, radiculose at the base, at first subtriquetrous at the apex and somewhat laterally compressed, at length almost terete and somewhat beaked at the apex; capsule oval-globose; calyptra often violet purple.

Hab.—On rocks in rivulets near Closter, N. J. (*Austin*), Coshocton Co., O. (*Sullivant*).
Bib.—Torrey Bull. III, 10.
Exsic.—Hep. Bor.-Amer. No. 31.

12. **J. hyalina** Lyell. Stems creeping, strongly radiculose, branching, at length dichotomous-fastigiate, ascending; leaves semivertical, subrotund, repand and undulate, divergent-ascending; involucral leaves like those of the branches, appressed; inner involucre little exserted, ovate, acute, the apex plicate, the mouth somewhat 4-cleft; capsule globose. (*Aplozia hyalina* Dumort.)

Hab.—On banks in woods; Closter, N. J. (*Austin*), O. (*Lesquereux*). (Eu.)

Bib.—Syn. Hep. p. 92; Hep. Europ. p. 58.

Delin.—Brit. Jung. t. 63; Ekart, t. VI, f. 45.

Exsic.—Hep. Bor.-Amer. No. 28.

13. **J. biformis** Aust. Stems densely cæspitose, innovating from beneath, much branched, strongly radiculose; leaves of the stem scarcely imbricate, somewhat flattened, obliquely semicircular or broadly ovate, the dorsal margin decurrent, the apex retuse or entire, the areolation large, hyaline; leaves of the branches a half smaller, ovate or obovate, very obtuse, scarcely decurrent; sporogony phase unknown. (*Southbya biformis* Aust.)

Hab.—On steep wet rocks; Delaware Water Gap, N. J. (*Austin*).

Bib.—Pro. Phil. Acad. 1869, p. 220; Torrey Bull. VI, p. 85.

Exsic.—Hep. Bor.-Amer. No. 26.

14. **J. sphærocarpa** Hook. Stems creeping, ascending at the apex, subsimple, greenish; leaves semivertical, somewhat rigid, orbicular, obliquely spreading, decurrent dorsally at the base, pale-green; involucral leaves discrete; inner involucre exserted, obovate-oblong, the mouth 4-cleft; capsule spherical. (*Aplozia sphærocarpa* Dumort.)

Hab.—Mts. of N. Eng. (*Austin*); rare. (Eu.)

Bib.—Syn. Hep. p. 93; Hep. Europ. p. 61.

Delin.—Brit. Jung. t. 74; Ekart, t. III, f. 20.

Exsic.—Hep. Bor.-Amer. No. 29, 29b.

15. **J. cordifolia** Hook. Stems erect, fastigiately branching; leaves very lax, ovate, subrotund, not margined, erect, broadly clasping, dingy brown; involucral leaves discrete; inner involucre exserted, oblong, smoothish, the mouth minutely denticulate; capsule oval. (*Aplozia cordifolia* Dumort.)

Hab.—On the ground in moist places, Col.? (*Botanists of Wheeler Survey*), Greenland. (Eu.)

Bib.—Syn. Hep. p. 95; Hep. Europ. p. 59.

Delin.—Brit. Jung. t. 32; Ekart t. III f. 26.

16. **J. pumila** With. Stems creeping, somewhat ascending at the apex, radiculose, subsimple, pale; leaves ovate, obtuse, concave, ascending, entire; involucral leaves like those of the stem, erect; inner involucre terminal, lanceolate, plicate above, the mouth denticulate; capsule oval. (*Aplozia pumila* Dumort.)

Hab.—On shaded rocks along rivulets, Closter, N. J. (*Austin*), Col. (*Brandegee*). (Eu.)

Bib.—Syn. Hep. p. 97; Hep. Europ. p. 59.

Delin.—Brit. Jung. t. 17; Ekart, t. II, f. 13.

Exsic.—Hep. Bor.-Amer. No. 33.

†† *Leaves bidentate.*

17. **J. alpestris** Schleich. Stems densely creeping, bifid-branching, ascending at the apex; leaves semivertical, ovate-subquadrate, obliquely bidentate, the laciniæ unequal, acute or mucronulate, distant; involucral leaves wider than those of the stem, 2-3-cleft; inner involucre twice as long as the outer, oblong, smooth, the mouth complicate; capsule oval.

Hab.—Alpine regions of White Mts., N. H (*Oakes*). (Eu.)

Bib.—Syn. Hep. p. 113; Hep. Europ. p 75.

Exsic.—Hep. Bor.-Amer. No. 39.

18. **J. ventricosa** Dicks. Stems dense, close creeping, branching from beneath; leaves semivertical, subquadrate, plane or inflexed at the base anteriorly, broadly emarginate-bidentate, the teeth acute, often bearing globules; involucral leaves larger, erect-spreading, rotund, 3-4-cleft, somewhat dentate; inner involucre ovate, inflated, narrow-complicate toward the apex, oval. (*J. porphyroleuca* Nees is a variety *fide* Austin).

Hab.—On rotten wood and on the ground in mountainous regions and far northward; common. (Eu.)

Bib.—Syn. Hep. p. 108, 109; Hep. Europ. p. 76, 77; Pro. Phil. Acad. 1869, p. 220.

Delin.—Brit. Jung. t. 28; Ekart. t. VII, f. 58; t. X, f. 79 et. XII, f. 29 (*var.*)

Exsic.—Hep. Bor.-Amer. No. 36, 37, 38.

19. **J. Wallrothiana** Nees. Blackish, very minute; stems creeping, subsimple or innovate-branching, 1.2 mm. long, strongly radiculose; leaves wider than the stem, clasping, firm, ovate-quadrate, closely imbricate, semivertical, concave, connivent upwards, emarginate-bidentate, the sinus obtuse in the lower, acute in the upper leaves, the teeth obtuse, entire; involucral leaves larger, erect, tridentate, wavy-plicate, connate at the base; inner involucre oval-cylindric, contracted above, plicate, the mouth subdentate, pellucid, reddish below. *(Gymnocolea affinis* Dumort. var. B.)

Hab.—On coarse sand, slopes of White Mts., N. H. (*Oakes*). (Eu.)
Bib.—Syn. Hep. p. 104; Hep. Europ. p. 66.

††† Leaves bifid or bilobed.
‡ Involucral leaves cleft or lobed.

20. **J. Helleriana** Nees. Stems creeping, intricate; leaves complicate-concave, spreading, subascending, bifid ½—⅓ their length, the lobes equal, acute, entire or serrate; involucral leaves bi-trifid, spinulose-serrate; inner involucre ovate, the mouth contracted. *(Diplophyllum Hellerianum* Dumort.*)*

Hab.—On rotten wood; Can., N. Y., N. Eng.; rare. (Eu.)
Bib.—Syn. Hep. p. 120; Hep. Europ. p. 50.
Delin.—Ekart t. XII, f. 103.
Exsic.—Hep. Bor.-Amer. No. 44.

21 J. **minuta** Crantz. Stems rootless; leaves complicate-concave, spreading, bifid ¼—½ their length, the lobes somewhat equal, ovate, acute or obtuse, entire or the gemmiferous somewhat dentate; involucral leaves trifid; inner involucre oval-oblong or subcylindric. *(Diplophyllum minutum* Dumort.)

Hab.—On rocks in high mountain regions and northward to Greenland (*Vahl*). (Eu.)
Bib.—Syn. Hep. p. 120; Hep. Europ. p. 49.
Delin.—Brit. Jung. t. 44: Ekart, t. I, f. 3.
Exsic.—Hep. Bor.-Amer. No. 45.

22. **J. polita** Nees. Stems subsimple, flexuous, blackish, ascending; leaves shining, vertical, broadly clasping, flexuous spreading, broadly cuneate-quadrate, 2-3-lobed, the margin obtusely undulate-plicate; involucral leaves 2, very broad and

short, strongly cristate-undulate, obtusely many-lobed; inner involucre terminal, elongate subcylindric, naked, the apex subplicate, the mouth minutely ciliate. (*Diplophyllum politum* Dumort.)

Hab.—In a peat bog near Closter, N. J. (*Austin*). (Eu.)

Bib.—Syn. Hep. p. 122; Hep. Europ. p. 50; Pro. Phil. Acad. 1869, p. 220.

Exsic.—Hep. Bor.-Amer. No. 46.

23. **J. inflata** Huds. Stems procumbent or ascending, loosely radiculose, branching; leaves semivertical, elliptic-subrotund, unequal-sided, unequally bilobed, the sinus and lobes obtuse; involucral leaves like those of the stem; inner involucre terminal, at length dorsal, longer than the outer, oval or pyriform, smooth, the mouth connivent; capsule oblong. (*Gymnocolea inflata* Dumort.)

Hab.—On sterile ground and on rocks, N. J. (*Austin*) and in high mountains northward to Greenland (*Vahl*). (Eu.)

Bib.—Syn. Hep. p. 105; Hep. Europ. p. 65.

Delin.—Brit. Jung. t. 38; Ekart, t. III, f. 23.

Exsic.—Hep. Bor.-Amer. No. 34.

24. **J. Sullivantiæ** Aust. Stems closely creeping, flexuous, cæspitose; leaves subovate, little wider than the stem, whitish, erect-spreading or somewhat horizontal, somewhat concave or plane, much narrowed at the base, bifid $\frac{1}{2}$—$\frac{2}{3}$ their length, the sinus obtuse, the laciniæ very acute, divergent or connivent; involucral leaves 3, larger, erect, 2-3-cleft, one of them narrower, amphigastroid; inner involucre terminal on a short ventral branch, obovate-oblong, strongly plicate, at first triquetrous, at length terete, the mouth deeply about 10-cleft with the same number of folds; the laciniæ subconnivent, serrate or subentire.

Hab.—On rotten wood, O. (*Sullivant*), Ill. (*Hall*).

Bib.—Torrey Bull. III, 12.

‡‡ *Involucral leaves merely toothed.*

25. **J. excisa** Dicks. Stems subsimple, short, closely creeping, somewhat rigid; leaves semivertical, erect-spreading, subrotund, pellucid, inflexed at the base anteriorly, the sinus deep, obtuse, the excised laciniæ straight, acute; involucral

leaves erect, quadrate, usually 4-5-toothed; inner involucre erect, oblong, pale with a rosy band and spots, plicate above, the mouth truncate, irregularly denticulate.

Var. **crispa** Hook. Leaves quadrate-subrotund, closely imbricate, deeply and obtusely emarginate-bi-trifid; involucral leaves 3-4-cleft, subserrate, connate at base. (*J. intermedia* Lindenb.)

Hab.—Sterile ground in open woods; common. (Eu.) The *var.* in rock crevices near the Passaic, Hudson and Delaware Rivers (*Austin*).

Bib.—Syn. Hep. p. 112, 117; Hep. Europ. p. 76, 78.

Delin.—Brit. Jung. t. 9; et Suppl. t. 2 *var.;* Ekart, t. IV, f. 29; et t VI et XII, f. 46.

Exsic.—Hep. Bor.-Amer. No. 40, 41.

26. **J. incisa** Schrad. Stems thick, closely creeping or ascending, radiculose; leaves densely crowded, somewhat quadrate, complicate, semivertical, 2-6-cleft, the laciniæ unequal, acute, more or less spinulose-dentate; involucral leaves similar, more plicate and dentate, free; inner involucre short, oval or obovate, the mouth plicate, denticulate.

Hab.—On rotten wood in mountainous regions and northward. (Eu.)

Bib.—Syn. Hep. p. 118; Hep. Europ. p. 80.

Delin.—Brit. Jung. t. 10; Ekart, t. IV, f. 59, et t. X, f. 77.

Exsic.—Hep. Bor.-Amer. No. 42.

27. **J. Michauxii** Web. Stems ascending, flexuous by repeated innovations from beneath the summit; leaves subvertical, crowded, erect-spreading, somewhat saccate at the base, subquadrate, bifid, the sinus narrow, the lobes acute not curved; involucral leaves similar to those of the stem, the outer serrulate, the inner smaller; inner involucre oval-subclavate, obtuse, plicate at the apex, the mouth fringed.

Hab.—On fallen trunks, etc. Mts. of N. Y. and N. Eng.; common. (Eu.)

Bib.—Syn. Hep. p. 119; Hep. Europ. p. 81.

Exsic.—Musc. Alleghan. No. 236; Hep. Bor.-Amer. No. 43.

28. **J. Dicksoni** Hook. Stems prostrate, copiously rooting beneath, somewhat simple, the apex ascending; leaves spreading from a somewhat erect base, somewhat involute

when dry, pale brown or becoming whitish, deeply 2-lobed, the lower lobe obliquely ovate or ovate-lanceolate or falcate, mostly acute, subrepand or subserrate and somewhat margined on the ventral side toward the base; the upper lobe a half smaller, lanceolate, acute; cells rather large, roundish, nearly uniform; inner involucre ovate, the mouth plicate-laciniate. (*Diplophyllum Dicksoni* Dumort.)

Hab.—Mendocino City, Cal. (*Bolander*). (Eu.)
Bib.—Syn. Hep. p. 77; Hep. Europ. p. 49.
Delin.—Brit. Jung. t. 48; Ekart, t. IX, f. 68.

29. **J. rubra** Gottsche MS.,

30. **J. Danicola** Gottsche MS., and

31. **J. Bolanderi** Gottsche MS. are unpublished species from California.

XXIX. SCAPANIA Dumort.

Monœcious or diœcious. Inner involucre terminal, compressed parallel to the plane of the stem, the apex usually decurved and the mouth truncate entire or ciliate. Involucral leaves 2, larger and usually more denticulate than those of the stem. Calyptra membranous. Capsule oval. Elaters long, inserted in the middle of the valves, bispiral, deciduous. Antheridia 3-20, in the axils of small saccate leaves which are scarcely imbricate or crowded into terminal heads. Leaves complicate-2-lobed, the dorsal lobe usually smaller. Amphigastria wanting. (Martinellia B. Gr. in part.) Name from Gr. *skapanion*, a hoe or shovel, from the shape of the inner involucre.

* *Lobes of leaves subequal.*

1. **S. subalpina** Nees. Leaves denticulate outwardly, equidistant, imbricate, bifid almost to the middle, the lobes subrotund, obtuse; inner involucre very much longer than the outer, obovate from a narrow base, compressed, truncate, denticulate.

Hab.—Mts. of N. Eng. (*Oakes, Austin*); near L. Superior (*Gillman*); rare. (Eu.)
Bib.—Syn. Hep. p. 64, 661; Hep. Europ. p. 36.
Delin.—Ekart, t. XI, f. 91.
Exsic.—Hep. Bor.-Amer. No. 15b.

2. **S. glaucocephala** Aust. Stems small, cæspitose, somewhat simple, creeping or ascending, producing numerous suckers; leaves entire, obtusely complicate-bilobed, the lobes broadly ovate, mostly obtuse and apiculate; involucral leaves uniform, some of them somewhat denticulate; inner involucre small, subcuneate, strongly compressed, the mouth truncate, entire, often somewhat recurved. (*S. Peckii* Aust., *Jungermania glaucocephala* Tayl.)

Hab.—On rotten wood, Canada (*Macoun*), N. Y. (*Peck*), N. Eng. (*Austin*).

Bib.—Syn. Hep. p. 684 (sub *Jungermania*); Pro. Phil. Acad. 1869, p. 218; Torrey Bull. VI, 85.

Exsic.—Hep. Bor.-Amer. No. 20.

** *Ventral lobes about double the size of the dorsal (except in upper leaves of No. 8).*

† *Margins of leaves subentire.*

3. **S. albicans** Mitt. *var.* **taxifolia**. Stems ascending, almost rootless; leaves closely complicate-bifid, subdenticulate, either wholly evittate or with only a rudimentary vitta near the base, the lobes obtuse or somewhat acute, the ventral oblong-acinaciform, the dorsal subovate; inner involucre ovate-plicate. (*Jungermania albicans* L. var. *taxifolia*, *Diplophyllum taxifolium* Dumort. A smaller form is *J. obtusifolia* Sulliv. Musc. Alleghan. No. 230, not of Hook.)

Hab.—Under rocks in mountain ravines, the smaller form also on the ground. (Eu.)

Bib.—Syn. Hep p. 76 (sub *Jungermania*); Hep. Europ. p. 49 (sub *Diplophyllum*).

Exsic.—Musc. Alleghan. No. 229, 230; Hep. Bor.-Amer. No. 22, 23.

4. **S. compacta** Dumort. *var.* **irrigua**. Stems creeping; leaves repand, somewhat rigid, deeply unequally bilobed, the lobes rounded, submucronate, the ventral appressed, the dorsal half as large, convex, with incurved apex; involucral leaves bifid, the lobes subequal, denticulate; inner involucre ovate, subcompressed-angular, the mouth denticulate. (*Jungermania irrigua* N s, *S. irrigua* Dumort.)

Hab.—In wet places, Mts. of N. Eng. (*Oakes*), Catskill Mts. (*Austin*), Canada (*Macoun*), near Tom's R., N. J. (*Austin*). (Eu.)

Bib.—Syn. Hep. p. 67; Hep. Europ. p. 37.

Exsic.—Hep. Bor.-Amer. No. 15c.

†† *Margins of leaves serrate-dentate.*

5. **S. Oakesii** Aust. Leaves obovate, somewhat spreading, often deflexed, convex, closely complicate-bilobed, the lobes obtuse, serrate-dentate, the upper twice as large, coarsely dentate on the margin and the carina with deep purple spur-like teeth, the dorsal lobe subrotund, less dentate; inner involucre compressed, the mouth truncate, usually dentate.

Hab.—White Mts., N. H. (*Oakes, Austin*), Observatory Inlet (*Douglas*).
Bib.—Torrey Bull. III, p. 10.
Exsic.—Hep. Bor.-Amer. No. 14.

††† Margins of leaves ciliate-dentate.

6. **S. nemorosa** Nees. Stems ascending, crowded; leaves unequally complicate-bilobed, the lobes convex, obtuse, ciliate-dentate, the ventral obovate, oblique, twice as large as the dorsal; texture rather fine; inner involucre ciliate at the mouth. (*Jungermania nemorosa* L.)

Hab.—On rocks and on the ground in swamps, etc.; common, very variable. (Eu.)
Bib.—Syn. Hep. p. 68; Hep. Europ. p. 38.
Delin.—Brit. Jung. t. 21 (excl. f. 1, 8, 17-19); Ekart, t. II, f. 10.
Exsic.—Musc. Alleghan. No. 224, 225, 226; Hep. Bor.-Amer. No. 16, 17, 18.

7. **S. Bolanderi** Aust. Stems somewhat dichotomous, cæspitose, ascending; leaves acutely complicate, coarsely ciliate-dentate, the ventral lobe strongly convex, obliquely obovate-oblong, round-obtuse, decurved-spreading, the dorsal a half shorter, not narrower, less convex, orbicular or broadly ovate, erect-subvertical or somewhat appressed, the apex somewhat acute, more coarsely dentate, slightly incurved, the outer margin produced at the base into long deflexed often compound cilia; inner involucre compressed, oblong, the mouth subciliate. (*S. Californica* Gottsche in Bolander's Cat.)

Hab.—Redwood trees, Cal. (*Bolander*), Oregon and Br. Col. (*Scouler*), Vancouver's Island (*Douglas*).
Bib.—Pro. Phil. Acad. 1869, p. 218; Torrey Bull. VI, 85.
Exsic.—Hep. Bor.-Amer. No. 19.

8. **S. undulata** Nees and Mont. Stems erect, subdichotomous; leaves lax, spreading, entire or ciliate-denticulate, the lobes round-trapezoidal, the dorsal half as large except at the

summit of the stem where they are equal; texture thin, flaccid; inner involucre twice the length of the outer. (*Jungermania undulata* L.)

Var. **purpurea** Nees. Stems elongate, rather more lax; leaves rose-colored or purplish, flaccid.

Hab.—In woods, damp meadows and rills, Eastern U. S. and Cal. (*Bolander*). (Eu.)

Bib.—Syn. Hep. p. 65; Hep. Europ. p. 37.

Delin.—Brit. Jung. t. 22; Ekart, t, II, f. 14.

Exsic.—Hep. Bor.-Amer. No. 12, 13.

**** Ventral lobe 3-4 times the size of the dorsal.*

† Margins entire.

9. **S. exsecta** Aust. Stems ascending; leaves somewhat complicate, entire, the dorsal lobe small, tooth-like, the ventral ovate, acute or bidentate, concave; involucral leaves 3-5-cleft; inner involucre oblong, obtuse, plicate. (*Jungermania exsecta* Schmid.)

Hab.—On high mountains far northward; rare. (Eu.)

Bib.—Syn. Hep. p. 77 (sub. *Jungermania*); Hep. Europ. p. 73 (sub *Jungermania*).

Delin.—Brit. Jung. t. 14; Ekart, t. V. f. 37, et t. XI.

Exsic.—Hep. Bor.-Amer. No. 21.

10. **S. uliginosa** Nees. Stems frequently floating, erect when terrestrial; leaves entire, somewhat rigid, deeply and unequally bilobed, the lobes rotund, the ventral convex, spreading, about four times as large as the dorsal, the dorsal lobe reniform, arched, incumbent; involucral leaves uniform with those of the stem, the lobes entire; inner involucre larger than the outer. (*Jungermania uliginosa* Swz.)

Hab.—Col. (*Botanists of Wheeler's Surv.*), Greenland (*Syn. Hepat.*) (Eu.)

Bib—Syn. Hep. p. 67; Hep. Europ. p. 39.

†† Margins serrate or dentate.

11. **S. breviflora** Tayl. Stems ascending; leaves dentate, deeply 2-lobed, the lobes triangular, the dorsal springing from the plane of the ventral near its dorsal margin, the ventral about four times as large; inner involucre as long as the

outer, obconic, plicate, compressed, shortly 4-laciniate and dentate at its mouth, its narrow base surrounded by lanceolate serrate scales.

Hab.—Near Philadelphia, Pa. (*Dr. Watson*).
Bib.—Syn. Hep. p. 661.

12. **S. umbrosa** Nees. Stems somewhat erect, branching; leaves unequally conduplicate-bilobed, the lobes ovate, acute, serrate, the ventral three times as large as the imbricate dorsal lobes; inner involucre naked at the mouth. (*Jungermania umbrosa* Schrad.)

Hab.—White Mts., N. H.; rare. (Eu.)
Bib.—Syn. Hep. p. 69; Hep. Europ. p. 38.
Delin.—Brit. Jung. t. 24 et Suppl. t. 3; Ekart. t. 11, f. 12.
Exsic.—Hep. Bor.-Amer. No. 15.

XXX. PLAGIOCHILA Dumort.

Fructification terminal or lateral. Inner involucre compressed at right angles to the plane of the stem, the mouth truncate, entire or ciliate-toothed. Involucral leaves 2, larger than those of the stem. Calyptra membranous. Capsule oval. Elaters inserted in the middle of the valves, long, bispiral, deciduous. Antheridia covered by small ventricose imbricate leaves. Leaves with the dorsal margin decurrent and deflexed, often turned to one side. Name from Gr. *plagios*, sideways, and *cheilos*, a lip, from the shape of the inner involucre.

* *Ventral margins of the leaves decurrent and forming two parallel crestlike lines on under side of stem.*

1. **P. Ludoviciana** Sulliv. Main branches ascending, flexuous, sparingly ramulose; leaves patent-divergent, semiovate, 2-3-dentate at the apex, the dorsal margins reflexed, entire, the ventral spinulose-dentate; amphigastria deeply 2-3-cleft, the segments ciliate-dentate.

Hab.—On the bark of trees, La. and Ala. (*Sullivant*).
Bib.—Syn. Hep. p. 660; Amer. Jour. Sci. and Arts, 1846, p. 73.
Exsic.—Musc. Allegnan. No. 223; Hep. Bor.-Amer. No. 11.

2. **P. undata** Sulliv. Like No. 1 but more rigid, with simple branches; leaves horizontal, triangular-ovate, obtuse, emarginate, or sparingly dentate at the apex, the dorsal margins reflexed and entire, the ventral repand-undulate; amphigastria 2-cleft, the segments dentate.

Hab.—Shaded banks of rivers and wet rocks, Ga. (*Sullivant, Lesquereux*).

Bib.—Syn. Hep. p. 659; Amer. Jour. Sci. and Arts, 1846, p. 73.

Exsic.—Musc. Alleghan. No. 222; Hep. Bor.-Amer. No. 10.

** *Under side of stems without crestlike lines.*

† *Amphigastria 2-3-cleft, fugacious.*

3. **P. porelloides** Lindenb. Stems divided, the branches ascending; leaves somewhat imbricate, convex-gibbous, obovate-rotund, those near the summit of the stem repand-denticulate, the others entire, the dorsal margin reflexed; inner involucre terminal, oblong-ovate, the mouth compressed, denticulate. (*Jungermania viticulosa* Schwein.) A variety is *P. nodosa*, Tayl.

Hab.—Among mosses in swamps and rivers; common. The *var.* in mountain ravines, Canada, N. Eng, N. J. (*Austin*).

Bib.—Syn. Hep. p. 48, 645.

Exsic.—Musc. Alleghan. No. 220; Hep. Bor.-Amer. No. 7, 7b.

4. **P. interrupta** Dumort. Stems prostrate, copiously rooting, branched, the branches horizontal; leaves imbricate, oval, horizontal, entire or slightly repand; amphigastria lanceolate, 2-3-cleft; inner involucre terminal, broadly obconic, the mouth compressed, repand-crenulate. (*P. macrostoma* Sulliv., *Jungermania interrupta* Nees.)

Hab.—On moist banks and decayed logs; O. (*Sullivant*), N. Eng. (*Oakes*), Greenland (*Vahl*). (Eu.)

Bib.—Syn. Hep. p. 48, 659; Hep. Europ. p. 44; Sulliv. Mosses U. S. p. 96; Torrey Bull. VI, 85.

Delin.—Sulliv. Mosses U. S. t. VIII.

Exsic.—Musc. Alleghan No. 221; Hep. Bor.-Amer. No. 6.

†† *Amphigastria wanting.*

5. **P. spinulosa** Nees and Mont. Stems creeping, the branches ascending; leaves remote, obliquely spreading, obovate-cuneate, the dorsal margin reflexed, entire, the ventral and apex spinulose-toothed; inner involucre subrotund, at length oblong, the mouth spinulose. (*Jungermania spinulosa* Dicks.)

Hab.—Shaded rocks in mountain regions; rare. (Eu.)
Bib.—Syn. Hep. p. 25; Hep. Europ. p. 44.
Delin.—Brit. Jung. t. 14; Ekart, t. II, f. 10.
Exsic.—Hep. Bor.-Amer. No. 9.

6. **P. asplenoides** Nees and Mont. Stems creeping, branched; leaves somewhat imbricate, obliquely spreading, obovate-rotund, entire or denticulate, the dorsal margin reflexed; inner involucre much exceeding the outer, terminal, oblong, dilated and compressed at the apex, the mouth truncate, ciliate. (*Jungermania asplenoides* L.)

Hab.—In rocky rivulets; common. (Eu.)
Bib.—Syn. Hep. p. 49; Hep. Europ. p. 43.
Delin.—Brit. Jung. t. 13; Ekart, t. I, f. 4.
Exsic.—Hep. Bor.-Amer. No. 8.

XXXI. **NARDIA** B. Gr.

Fructification terminal, inner involucre 6-toothed, included in the outer and connate with it excepting the teeth. Involucral leaves united nearly to the top into an oblong tube. Capsule globose, 4-valved or sometimes opening irregularly, pedicelled. Elaters bispiral. Antheridia in the saccate base of leaves on the back of the stem. Leaves 2-lobed or emarginate. Amphigastria rarely present. Stems often sending out flagella from their base. (Sarcoscyphus Corda, Alicularia Corda.)

* *Amphigastria wanting.*
† *Leaves imbricate, at least the upper.*
‡ *Areolation of leaves very large.*

1. **N. Bolanderi** Aust. Small, densely cæspitose, varying from dark lurid green to blackish; stems entangled with numerous rootlets, creeping, the apex ascending, elavate; lower leaves distant, scarcely broader than the stem, subvertical, spreading, the upper imbricate, much larger, erect-spreading,

all round-ovate, obscurely margined, emarginate-bilobed at the apex ¼—⅓ their length, the sinus acute or somewhat obtuse, the lobes strongly obtuse. *(Sarcoscyphus Bolanderi* Aust.)

Hab.—Exposed rocks, Mts, of Cal. (*Bolander*).
Bib.—Torrey Bull. III, 9.
Exsic.—Hep. Bor.-Amer. No. 4b.

‡‡ *Areolation moderate.*

2. **N. adusta** Aust. Stems very short, creeping at their base; branches ascending, subclavate, terete, straight; leaves ovate, closely imbricate, bifid at the apex, the margins pellucid punctate. *(Gymnomitrium adustum* Nees, *Acolea brevissima* Dumort., *Sarcoscyphus adustus* Aust.)

Hab.—Alpine regions of White Mts., N. H. (*Oakes, Austin*). (Eu.)
Bib.—Syn. Hep. p. 3 (sub *Gymnomitrium*); Hep. Europ. p. 123 (sub *Acolea*).
Exsic.—Hep. Bor.-Amer. No. 4.

3. **N. emarginata** B. Gr. (?) Stems somewhat erect, mostly dichotomous; leaves erect, approximate, embracing the stem by their broad base, somewhat quadrate; lobes obtuse, the foliage dark green or brownish purple. *(Jungermania emarginata* Ehrh., *Marsupella emarginata* Dumort., *Sarcoscyphus Ehrhartii* Corda, *S. emarginatus* Boul.)

†† *Leaves distant.*

Var. **aquatica** (Nees). Stems elongate somewhat floating; leaves spreading, more scattered.

Hab.—On wet rocks chiefly in high mountain rivulets, N. Y., N. Eng. (Eu.)
Bib.—Syn. Hep. p. 6 (sub *Sarcoscyphus Ehrhartii*); Hep. Europ. p. 126 (sub *Marsupella*).
Delin.—Brit. Jung. t. 27; Ekart, t. VII, f. 56.
Exsic.—Hep. Bor.-Amer. No. 2, 3.

4. **N. sphacelata** B. Gr. (?) Stems erect, somewhat branched; leaves obovate-rotund, narrower at the base, embracing the stem, the apical sinus somewhat obtuse, the lacinie rounded, sphacelate at the apex. *(Jungermania sphacelata* Gieseke, *Sarcoscyphus sphacelatus* Nees, *Marsupella sphacelata* Dumort.)

Hab.—Wet rocks, Mts. of N. Eng. to N. J. and southward; also Greenland. (Eu.)

Bib.—Syn. Hep. p. 7; Hep. Europ. p. 127 (sub *Marsupella*).

Delin.—Ekart. t. XI, f. 91.

Exsic.—Musc. Alleghan. No. 216; Hep. Bor.-Amer. No. 3b.

** *Amphigastria triangular-subulate.*

5. **N. Lescurii** (Aust.) Stems prostrate, copiously radiculose beneath as well as the usually emarginate-bilobed leaves; areolation lax; amphigastria entire or the uppermost subdentate. (*Alicularia Lescurii* Aust.)

Hab.—Wet rocks, Tallulah Falls, Ga. (*Lesquereux*, 1850).

Bib.—Torrey Bull. VI, 18.

Exsic.—Hep. Bor.-Amer. No. 5.

XXXII. **CESIA** B. Gr.

Involucral leaves numerous, imbricate. Inner involucre wanting. Calyptra immersed in the involucral leaves. Capsule quadrivalved, coriaceous. Elaters bispiral, deciduous. Leaves closely imbricate. Amphigastria wanting. (Acolea Dumort.)

1. **C. concinnata** B. Gr. Stems intricately branching, thickened at the apex; leaves closely imbricate, ovate, the apex bifid, with a narrow scarious margin. (*Jungermania concinnata* Lightf., *Gymnomitrium concinnatum* Corda, *Acolea concinnata* Dumort.)

Hab.—Alpine regions of White Mts., N. H. (*Oakes*). (Eu.)

Bib.—Syn. Hep. p. 3 (sub *Gymnomitrium*); Hep. Europ. p. 122 (sub *Acolea*).

Delin.—Brit. Jung. t. 3; Ekart, t. VIII, f. 63.

Exsic.—Hep. Bor.-Amer. No. 1.

APPENDIX A.

The geographic distribution of the American Hepaticæ may be represented as follows. It must be remembered that the table is made from incomplete data, and will be necessarily changed as further knowledge of our species is received.

Species common to America and Europe are italicized. Those followed by the letter L. have been found in only a very limited territory. Those marked with a (*) are reported from Illinois.

I. BOREAL.

Fimbriaria pilosa.
Fossombronia Macouni.
Frullania Oakesiana.
*F. æolotis.
F. Hutchinsiæ.
Bazzania deflexa.
Chiloscyphus pallescens.
Odontoschisma Macouni.
Cephalozia Macouni.
C. pleniceps.
**Coleochila Taylori?*
Jungermania alpestris.
J. cordifolia.
J. Gillmani.
J. Hornschuchiana.
J. incisa.
J. inflata.
J. Michauxii.
J. Wattiana.
J. minuta.
J. setiformis.
J. sphærocarpa.
J. ventricosa.
J. Wallrothiana.
Scapania albicans, var. *taxifolia.*
S. compacta, var. *irrigua.*
S. exsecta.
S. Oakesii.
S. glaucocephala.
S. subalpina.
S. uliginosa.
S. umbrosa.
Plagiochila interrupta.
P. spinulosa.
Nardia adusta.
N. emarginata.
N. sphacelata.
Cesia concinnata. —38.

II. MEDIAL.

*Riccia Frostii.
R. Watsoni.
R. Beyrichiana. L.
R. bifurca?
R. arvensis. L.
*R. Lescuriana.
*R. lutescens.
R. tenuis.
**R. natans.*
Preissia hemisphærica.
**Grimaldia barbifrons.*
Duvalia rupestris.
**Asterella hemisphærica.*
*Fimbriaria tenella.
Aitonia erythrosperma. L.
*Notothylas orbicularis.
N. melanospora.
**Aneura multifida.*
A. palmata.
**A. pinguis.*
A. pinnatifida. L.
*A. sessilis.
Pellia epiphylla.
P. calycina.
Blasia pusilla.
Steetzia Lyellii.
Metzgeria myriopoda.
M. conjugata.
M. pubescens.
M. hamata.
Fossombronia angulosa.
F. cristula. L.
F. pusilla.
*Frullania Eboracensis.
F. Pennsylvanica.
*F. Grayana.
F. plana.
F. saxicola.
F. tamarisci?
*F. Virginica.
F. fragilifolia. L.
Lejeunia calyculata.
L. serpyllifolia, var. Americana.
L. cucullata.
L. cyclostipa. L.
L. echinata.
L. polyphylla. L.
L. testudinea. L.
Phragmicoma clypeata.
Madotheca platyphylla.
**M. porella.*
M. Sullivanti.
**M. thuja.*
**Radula complanata.*
R. obconica.
R. tenax.
**Blepharostoma trichophylla.*
**Blepharozia ciliaris.*
Sendtnera juniperina.
Trichocolea tomentella.
T. Biddlecomiæ. L.
Bazzania trilobata.
Lepidozia reptans.
L. setacea.
**Calypogeia trichomanis.*
Geocalyx graveolens.
*Chiloscyphus ascendens.
C. Drummondii?
C. polyanthus.
**Lophocolea bidentata.*
L. crocata.
L. Hallii.
**L. heterophylla.*

*L. Macouni.
**L. minor.*
Pleuranthe olivacea.
Liochlæna lanceolata.
**Harpanthus scutatus.*
Odontoschisma denudata.
**Cephalozia currifolia.*
*C. Sullivanti.
**C. albescens. ?*
C. Francisci, var. *fluitans.*
Jungermania barbata.
J. biformis. L.
J. crenulata.
J. crenuliformis. L.
J. excisa.
J. fossombronioides. L.
J. Helleriana.
**J. hyalina.*
J. pumila.
J. polita.
**J. Schraderi.*
J. Sullivantiæ.
Scapania breviflora. L.
**S. nemorosa.*
Plagiochila asplenoides.
P. porelloides. = 99.

III. AUSTRAL.

Riccia albida.
R. Donnellii.
Thallocarpus Curtisii.
Sphærocarpus Michelii.
S. Texanus.
S. Donnellii.
Marchantia disjuncta. L.
Dumortiera hirsuta.
Fimbriaria elegans.
F. fragrans.
Aitonia Wrightii.
Anthoceros Donnellii. L.
A. Mohrii.
**A punctatus.*
A. Ravenelii.
A. Olneyi.
Fossombronia Cubana.
Frullania brunnea. L.
F. Donnellii.
*F. squarrosa.
F. Kunzei.
F. Sullivantii.
F. Wrightii.
Lejeunia auriculata.
L. Caroliniana. L.
L. longiflora.
L. Jooriana.
L. minutissima.
L. Mohrii.
L. Austini.
L. læte-fusca.
L. Ravenelii.
Phragmicoma xanthocarpa.
Madotheca involuta.
M. Wataugensis. L.
Radula australis.
R. Caloosiensis.
R. Sullivantii.
R. Xalapensis. L.
Calypogeia Sullivanti.
Odontoschisma sphagni.
Cephalozia catenulata.
C. nematodes.
Plagiochila Ludoviciana.
P. undata.
Nardia Lescurii. = 46.

IV. Occidental.

Riccia glauca.
R. Californica.
R. ciliata.
R. intumescens.
Sauteria limbata.
Grimaldia Californica.
Cryptomitrium tenerum.
Fimbriaria Bolanderi.
F. Californica.
F. violacea.
Targionia hypophylla.
Anthoceros Hallii.
A. cæspiticius.
A. Oreganus.
A. sulcatus.
A. fusiformis.
A. stomatifer.
Fossombronia longiseta.
Frullania Bolanderi.
F. Hallii.
F. Nisquallensis.
Madotheca Bolanderi.
M. naviculuris.
Radula Hallii.
R. spicata.
Lepidozia Californica.
Jungermania Bolanderi.
J. Mülleri. ?
J. Dicksoni.
J. Danicola.
J. julacea.
J. rubra.
Scapania Bolanderi.
Nardia Bolanderi. = 34.

V. Cosmopolitan.

**Riccia sorocarpa.*
R. lamellosa.
R. nigrella.
**R. fluitans.*
R. crystallina.
**Marchantia polymorpha.*
**Conocephalus conicus.*
Lunularia cruciata. Introd.
**Anthoceros lævis.*
Madotheca rivularis.
**Cephalozia divaricata.*
**C. bicuspidata.*
**C. multiflora.*
Scapania undulata. = 14.

APPENDIX B.

In order to make more widely known the classification adopted by Lindberg the following schedule is given:

GENERA EUROPÆA HEPATICARUM.

ORDER I. MARCHANTIACEÆ.

A. *Schizocarpæ.*

1. Marchantieæ.

1. Marchantia.
2. Preissia.
3. Conocephalus.
4. Fimbriaria.
5. Duvalia.
6. Asterella.
7. Dumortiera.
8. Sauteria.
9. Clevea.
10. Aitonia.
11. Lunularia.

2. Targonieæ.

12. Targionia.

B. *Cleistocarpæ.*

3. Corsinieæ.

13. Corsinia.
14. Tessel'ina.

4. Ricciеæ.

15. Riccia.

Order II. Jungermaniaceæ.

A. *Schizocarpæ.*

* Anomogamæ.

1. Frullanieæ.

1. Frullania.
2. Lejeunia.
3. Radula.
4. Porella.
5. Pleurozia.

2. Metzgerieæ.

6. Metzgeria.

** Homogamæ.

† Opisthogamæ.

3. Lepidozieæ.

7. Lepidozia.
8. Bazzania.
9. Odontoschisma.
10. Cephalozia.
11. Lophocolea.
12. Pedinophyllum
13. Chiloscyphus.
14. Harpanthus.

4. Saccogyneæ.

15. Kantia.
16. Saccogyna.

5. Riccardieæ.

17. Riccardia.

†† Acrogamæ.

18. Trichocolea.
19. Blepharozia.
20. Mastigophora.
21. Herberta.
22. Anthelia.
23. Blepharostoma

7. Jungermanieæ.

24. Martinellia.
25. Diplophyllum.
26. Plagiochila.
27. Mylia.
28. Southbya.
29. Jungermania.
30. Nardia.
31. Cesia.

8. **Acrobolbeæ.**

32. Acrobolbus. 33. Calypogeia.

9. **Fossombronieæ.**

34. Scalia. 36. Petalophyllum. 38. Blasia.
35. Fossombronia. 37. Pallavicinia. 39. Pellia.

B. *Cleistocarpæ.*

10. **Sphærocarpeæ.**

40. Durieua. 41. Sphærocarpus.

11. **Thallocarpeæ.**

42. Thallocarpus.

Order III. Anthocerotaceæ.

1. **Anthoceroteæ.**

1. Anthoceros. 2. Notothylas.

APPENDIX C.

For another form of synoptical table, as well as the outline of another classification, the following translation from *Hepaticæ Europæ*, by Dumortier, is added. It will be seen to be based entirely on the fructification. All of Dumortier's genera of foliose *Jungermaniaceæ* are given.

SYNOPSIS OF TRIBES.

A { Capsule univalve.....B
  { Capsule quadrivalve; involucre polyphyllous or wanting.....D

B { Capsule irregularly dehiscing. Tribe I. CODONIEÆ.
  { Capsule quadridentate.....C

C { Elaters persistent. Tribe. II. LEJEUNIACEÆ.
  { Elaters deciduous. Tribe III. MADOTHECEÆ.

D { Inner involucre erect, free.....E
  { Inner involucre erect, adherent to the outer. Tribe XI. MESOPHYLLEÆ.
  { Inner involucre pendulous, affixed by the mouth. Tribe IX. SACCOGYNEÆ.
  { Inner involucre wanting. Tribe X. ACOLEÆ.

E { Outer involucre wanting. Tribe VIII. TRICHOLEÆ.
  { Outer involucre polyphyllous .....F

F { Elaters persistent. Tribe VI. JUBULEÆ.
  { Elaters deciduous .....G

G
- Inner involucre compressed. Tribe V. RADULEÆ.
- Inner involucre terete, dentate. Tribe IV. JUNGERMANIEÆ.
- Inner involucre terete, fissured. Tribe VII. CHILOSCYPHEÆ.

Tribe I. CODONIEÆ.

Capsule chartaceous. *Fossombronia.*
Capsule coriaceous. *Codonia.*

Tribe II. LEJEUNIACEÆ.

Inner involucre depressed at the apex, caudate. *Colura.*
Inner involucre rotund at the apex, ecaudate. *Lejeunia.*

Tribe III. MADOTHECEÆ.

Inner involucre compressed. *Madotheca.*

Tribe IV. JUBULEÆ.

A
- Involucre 2-leaved. *Jubula.*
- Involucre indefinite ..... B

B
- Elaters solitary. *Frullania.*
- Elaters double. *Phragmicoma.*

Tribe V. RADULEÆ.

A
- Involucre indefinite, the leaves bilobed ..... B
- Involucre 2-leaved, the leaves simple C

B
- Capsule semipellucid, funnel form. *Radula.*
- Capsule coriaceous, decussate. *Scapania.*

C
- Leaves of involucre foliose. *Plagiochila.*
- Leaves of involucre squamiform. *Adelanthus.*

Tribe VI. Jungermanieæ.

A
- Involucre oligophyllous.....A
- Involucre polyphyllous.....F

B
- Leaves of involucre conduplicate. *Diplophyllum.*
- Involucre 2-leaved, the leaves concave, deeply bilobed, dissected ciliate. *Blepharozia.*
- Involucre 2-leaved, the leaves concave, entire. *Pleurozia.*
- Leaves of involucre 2-many-dentate.....C
- Leaves of involucre undivided, entire. *Aplozia.*

C
- Leaves of involucre like those of them. *Gymnocolea.*
- Leaves of involucre and of stem dissimilar.....D

D
- Mouth of inner involucre cristate. *Lophocolea.*
- Mouth of inner involucre dentate .....E

E
- Inner involucre semiconnate with calyptra. *Harpanthus.*
- Calyptra free within the inner involucre. *Jungermania.*

F
- Leaves of involucre dissected. *Cephalozia.*
- Leaves of involucre articulate-ciliate. *Blepharostoma.*
- Leaves of involucre palmate. *Anthelia.*

Tribe VII. Chiloscypheæ.

A
- Inner involucre shorter than the calyptra. *Chiloscyphus.*
- Inner involucre longer than the calyptra.....B

B
- Involucre oligophyllous. *Coleochila.*
- Involucre polyphyllous.....C

C
- Leaves of involucre squamiform. *Lepidozia.*
- Leaves of involucre undivided, serrulate. *Pleuroschisma.*
- Leaves of involucre bilobed. *Odontosc' isma.*

Tribe VIII. Tricholeæ.

Inner involucre rough. *Tricholea.*
Inner involucre smooth. *Gymnoscyphus.*

Tribe IX. Saccogyneæ.

A { Capsule spirally twisted.....B
  { Capsule regularly valved C

B { Mouth of inner involucre fissured. *Calypogeia.*
  { Mouth of inner involucre irregular. *Cincinnulus.*

C { Inner involucre terminal, laterally pedunculate. *Gymnanthe.*
  { Inner involucre lateral, sessile .....D

D { Inner involucre not barbed at its insertion. *Saccogyna.*
  { Inner involucre barbed at its insertion. *Geocalyx.*

Tribe X. Acoleæ.

A { Calyptra exserted. *Muiopsis.*
  { Calyptra included in the involucre.....B

B { Leaves of involucre free. *Acolea.*
  { Leaves of involucre connate. *Schisma.*

Tribe XI. Mesophylleæ.

A { Involucre imbricate. *Mesophylla.*
  { Involucre in a circle.....B

B { Inner involucre exserted. *Southbya.*
  { Inner involucre included.....C

C { Leaves of involucre opposite. *Alicularia.*
  { Leaves of involucre whorled. *Marsupella.*

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