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THE

BRYOPHYTES OF CONNECTICUT

By

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The plants treated in the present report are largely neglected by collectors, partly on account of their small size and the difficulties encountered in their identification, partly on account of their slight value from an economic standpoint. To the student of botany, however, and especially to the morphologist and taxonomist, they are of exceptional interest. The morphologist finds among them all gradations between simple and more complex types of structure, and is thus enabled to gain some idea of the way in which the higher plants may have been derived from the lower; while the taxonomist obtains from them a series of distinct and attractive genera and species, which offer for his solution many complicated problems in variation and geographical distribution. In presenting to the botanists of Connecticut some account of the work which has been done on the Bryophytes within the state, it is hoped that more interest in this neglected group of plants may be aroused.

The report includes a general description of the Bryophytes as a whole and of the six subdivisions or orders into which it seems advisable to divide them. It also contains keys, more or less artificial, to aid in the identification of those species which have been detected in Connecticut. But it makes no attempt to describe or illustrate the genera and species represented, and is not intended as a substitute for the works in which such descriptions and illustrations are to be found. The student who makes a careful study of our Mosses and Hepatics will still find it necessary to use books of this character in order to confirm the determinations made by the keys, but the report should make the work of determination more decisive by indicating which species are to be expected in our region. The various books, articles, and scattered notes, which relate directly to Connecticut Bryophytes, are listed in
the bibliography at the close of the report. The following recent works (not included in the bibliography) may also be recommended:


In the study of certain critical families and genera the writers have received much assistance from Mrs. Elizabeth G. Britton, of the New York Botanical Garden, Mr. C. Warnstorf, of Berlin, Germany, and Mr. J. Cardot, of Charleville, France. Other correspondents, who will be mentioned particularly in the catalogue of species, have kindly furnished material of Connecticut Bryophytes for examination, and have thereby made the report much more complete than it would otherwise have been. To all of these the writers would express their sincere thanks.

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Sheffield Scientific School.
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GENERAL CHARACTERISTICS OF THE BRYOPHYTES

The Bryophytes represent a very clearly defined Class in the Vegetable Kingdom, occupying a position just below the Pteridophytes, which include the Ferns and their allies. They comprise the plants which are properly known as Mosses and Liverworts. They must not be confused, however, with Algae and Lichens, both of which are sometimes called mosses, although simpler and less definite in organization, nor yet with the more highly developed Club Mosses, which belong to the Pteridophytes. The group is characterized by a clearly defined alternation of generations and by complex sexual organs, both antheridia and archegonia being multicellular, and showing a differentiation into sterile and fertile cells.

The gametophyte, or sexual individual, is a green plant, capable of absorption from the outside and therefore able to lead an independent life. It constitutes the plant-body of the Moss or Liverwort as ordinarily understood, and is usually much larger and more conspicuous than the sporophyte, or asexual individual. It consists of a dorsi-ventral thallus, usually closely appressed to the substratum, or else of a leafy shoot, the leaves being always destitute of stalks, and usually but a single cell thick throughout the greater part of their extent. Whatever its form the gametophyte exhibits an apical growth, frequently dying at one end while it advances at the other. It develops no true root, as do the higher plants, but clings to the substratum by means of filamentous organs called rhizoids, which often play no part in the process of absorption. The antheridia and archegonia are borne on the gametophyte; in monoicous species they arise on the same plant; in dioicous species, on different plants. The antheridium consists of a spheroidal or ovoid sac, sometimes stalkless and sometimes
borne on a short stalk. The sac is bounded on the outside by a wall composed of a single layer of sterile cells, and the whole interior is occupied by a compact mass of fertile cells, each one of which gives rise to a single male cell, or sperm. When the antheridium is mature, it absorbs water and bursts its wall, allowing the sperms to escape and swim away. Each sperm consists of a slender body, and swims by means of two long and delicate cilia attached at one end.

The archegonium may also be stalkless or borne on a short stalk, but is more slender than the antheridium. The single female cell, or egg, is developed in the swollen basal portion which is called the venter, and this is tipped with a somewhat longer cylindrical portion called the neck. Both venter and neck are bounded on the outside by a wall composed of sterile cells. The egg represents the lowest of a row of cells enclosed by this wall, the remaining cells, which fill the neck and a portion of the venter as well, being known as canal cells. When the mature archegonium absorbs water, the neck opens at the tip, and the canal cells break down into a mass of slime, some of which escapes through the opening. In this way a free canal is formed which leads from the outside into the venter, and at the base of this canal the egg becomes rounded off. The sperms, attracted by the protoplasmic slime exuding from the archegonium, swim toward it, and one of them makes its way down the canal, uniting with the egg and thus completing the process of fertilization.

As soon as this has been accomplished, the fertilized egg, without escaping from the archegonium, begins at once to develop into the sporophyte, which remains in contact with the gametophyte during its entire life, without being organically connected with it. The chief function of the sporophyte is to develop asexual spores, but some of its cells invariably remain sterile and perform functions not connected with reproduction. In the more primitive Bryophytes it is practically destitute of chlorophyll, and is therefore wholly dependent upon the gametophyte for food, living as a parasite upon it. In the higher forms it develops green cells, capable of performing photosynthesis, and probably derives nothing from the gametophyte except solutions of inorganic substances. In such cases the parasitism is only partial. The portion of the
sporophyte which remains in close contact with the gametophyte usually forms a special absorbing organ, or foot. This organ, however, never acquires the power of absorbing from the outside, so that the sporophyte is never able to exist as an entirely independent plant.

The spores are borne within a closed case, or capsule, which constitutes the so-called fruit in the Bryophytes. The capsule is bounded on the outside by a sterile wall, and the space in which the spores are developed is known as the spore cavity. When the spores are mature, they lie loose within the cavity, and are set free by the rupturing of the wall. In the majority of cases the capsule is borne on a slender cylindrical stalk, which connects it with the foot and at the same time lifts it above the gametophyte.

When the fertilized egg begins to divide, the sterile cells which form the wall of the venter also undergo divisions and develop into a protective covering for the young sporophyte. This covering is called the calyptra, and for a considerable period its growth keeps pace with that of the sporophyte. Sooner or later, however, it ceases to enlarge and is eventually ruptured by the swelling capsule. The neck of the fertilized archegonium plays no part in the development of the calyptra, but can frequently be detected at its apex in a shriveled condition. In a few specialized genera a true calyptra is not formed.

Upon germination a spore at first gives rise to an embryonic structure, or protonema, upon which the characteristic gametophyte afterwards develops. The protonema is sometimes very short-lived, but in many species persists for a considerable period. It usually consists of a copiously branched filamentous structure, but it may be composed of a flat layer of cells or of a small solid cell mass. In some cases the protonema is represented by a very few cells arranged in a simple cell row and is then scarcely distinguishable.

Although very few Bryophytes are truly aquatic, it has been shown that the presence of water is necessary for the process of fertilization. It not only enables the antheridia and archegonia to open, but it also affords a medium in which the motile sperms can swim. The water is usually supplied by rain, but, if no rain falls at the proper time, the antheridia and archegonia gradually shrivel away and sporophytes fail to
be developed. Any failure to effect fertilization is of course a menace to the further existence of a species, and the probability of failure is especially great in the case of dioicous species, where the male and female plants are often far apart, necessitating a long journey for the sperms. To a certain extent the danger is overcome by the development of organs of vegetative reproduction, known as gemmae or propagula. The simplest of these consist of single cells or of small groups of cells without definite form. They easily become separated from the parent plant and develop into new individuals if supplied with the proper conditions. In many cases the reproductive bodies are more complex and already show, even before they fall away, some indication of the thallus or leafy shoot into which they will develop. Certain species reproduce largely if not entirely by means of these vegetative bodies.

It is customary to divide the Bryophytes into two subclasses, known respectively as the Hepaticæ, or Liverworts, and the Musci, or Mosses. This classification, however, as Underwood and others have pointed out, does not altogether represent the facts, and it is more convenient, if not more natural, to divide the group into the following six orders, which may be considered as approximately equal in rank:—

I. Marchantiales; II. Jungermanniales; III. Anthocerotales; IV. Sphagnales; V. Andrezæales; VI. Bryales. By adopting this course it becomes much more practicable to assign definite characters to the various subdivisions. Of these six orders the first three comprise the Hepaticæ and the last three the Musci, as limited by the majority of botanical works; and it is still often convenient to employ the terms in this general sense.

THE MARCHANTIALES

The present order includes about half of the thalloid Bryophytes known from Connecticut, and most of the species are large and conspicuous. Two are normally aquatic, floating in ponds or slow streams; the others are all terrestrial, and even the aquatic species tend to become terrestrial through the drying up of the water in which they live. Except in the aquatic forms the thallus clings closely to the substratum,
sometimes so closely that it cannot be separated without injury. It develops two types of rhizoids, both of which represent simple outgrowths from cells. In one type the walls are thin throughout; in the other they bear scattered local thickenings in the form of short rods which project into the lumen. The rhizoids are all short-lived, and those of the first type simply anchor the plant to the substratum; those of the second type, however, by means of capillarity, play a certain part in the process of absorption. In addition to the rhizoids, the thallus often bears longitudinal rows of delicate scales on the lower surface. These are developed very early and arch up over the growing point, thus protecting it from injury.

The thallus is more or less differentiated, and always shows, at least in certain stages of development, a distinct epidermis, beneath which the photosynthetic tissue is situated. The latter consists of green cells loosely arranged with intercellular spaces containing air among them. In the higher forms these cells are in distinct air-chambers, which communicate with the outside air by means of pores in the epidermis. In the lower forms they simply line the intercellular spaces, and the communication with the outside air is often less definite. The Marchantiales are divided into two families, the Ricciaceae and the Marchantiaceae, which differ from each other most markedly in the structure of the sporophyte.

The Ricciaceae include both aquatic and terrestrial species, and are usually smaller than the Marchantiaceae. The terrestrial forms grow in old fields, along damp roadsides, and on the muddy borders of ponds. The thallus, which rarely attains a length of fifteen millimeters, forks repeatedly in one plane, thus giving rise to a characteristic rosette. All the New England species are annual, developing their sporophytes in the autumn. The aquatic Ricciaceae are larger than the others, and rarely produce sporophytes, the tips of the thallus being able to survive the winter. When they become terrestrial, they sometimes assume an appearance very different from their normal aquatic state.

The archegonia in the Ricciaceae are so deeply immersed in the thallus that only their necks protrude above the surface. In consequence of this fact the sporophytes begin their development beneath the surface, and they retain this position
until they are mature. The sporophyte is much simpler than in any of the other Bryophytes and consists of a spherical capsule only, which absorbs through its entire surface. The capsule contains nothing but spores, and these are at first enclosed by the capsule wall, consisting of a single layer of cells. As development advances, this wall gradually disappears, and the mature spores lie free within the calyptra. They are set free by the decay of the surrounding tissues of the gametophyte, and are dispersed largely through the agency of water.

The Marchantiaceae are all terrestrial, some of them growing on shaded rocks or in their crevices and others on damp or wet earth. The thallus is more highly differentiated than in the Ricciaceae, and in the larger species sometimes reaches a length of twenty centimeters or more and a width of ten millimeters. The branching is normally but not invariably by forking. The New England species are more or less perennial but some of them develop sporophytes during the first year.

Except in a few genera which do not occur in the eastern United States, the archegonia are borne on modified branches or outgrowths of the thallus known as carpocephala. These consist of two parts, an apical discoid or conical expansion and a basal cylindrical stalk. Sooner or later the stalk elongates and carries the expansion, to which it is attached in a peltate manner, high up above the surface of the thallus. As the sporophytes mature, they extend horizontally from the margin of the expanded portion or else hang downward from its lower surface. They are more complex than in the Ricciaceae and not only develop a capsule with a persistent wall but also a foot and a short stalk, although the line of demarcation between the two latter organs is not always clearly defined. The spore cavity contains not only the spores but also a large number of peculiar bodies known as elaters, each of which consists of a long and slender cell with a thin cell wall, strengthened on the inside by one or more spiral bands of thickening. When the spores become mature, the stalk elongates slightly, the calyptra is ruptured, and the wall bursts, either by means of irregular valves extending backward from the apex, or else by a circular line, which leaves the basal
portion of the capsule wall in the form of a cup. As the spores and elaters become dry, the latter through their elasticity stretch out and separate the spores. In this way the contents of the capsule form a loose cottony mass, which can be easily carried away by the wind. In certain genera the gametophyte develops a special protective organ for the sporophyte outside the calyptra. This is usually in the form of a hollow tube or sheath open at the tip, and may be called a pseudoperianth, to distinguish it from a very similar organ found in many of the leafy Jungermanniales.

THE JUNGERMANNIALES

Both thalloid and leafy forms are here represented. All are characterized by a slight degree of cell differentiation and by a lack of intercellular spaces, even among the green cells. The rhizoids are all essentially alike and agree with the first type described for the Marchantiales. Their only function is that of anchorage, and to perform this more efficiently they frequently become lobed or branched at the extremity. In many of the genera absorption seems to be carried on by all the surface cells.

With the exception of a very few primitive types which are not known from New England, the sporophyte is practically uniform throughout the entire order. It consists of a distinct foot, a stalk, and a capsule, and it remains enclosed within the calyptra until the spores are mature. The stalk consists of strongly flattened cells arranged in longitudinal rows, and the capsule, as in the Marchantiaceae, contains both spores and elaters. When the spores are ready to be disseminated, the stalk elongates rapidly through the lengthening of its individual cells and thus forces the capsule through the calyptra. The latter is thus irregularly ruptured but continues to enclose the base of the stalk. The capsule now raised on its stalk soon splits its wall, usually into four valves, the lines of dehiscence extending from the apex to or toward the base. The spores are scattered in much the same way as in the Marchantiaceae, although the elaters sometimes play a more active part in their dispersal. The Jungermanniales are also divided into two families, the Metzgeriaceae and the Jungermanniaceae, the most
important differences in this case being in the gametophytes.

In most of the Metzgeriacese the gametophyte is a thallus, but a few of the genera show a more or less complete differentiation into stem and leaves. The plants are usually composed of parenchyma throughout, but a few thalloid species develop a very primitive conducting tissue composed of elongated cells with lignified walls. The archegonia are borne on the upper surface of the gametophyte or of a special branch, and do not directly terminate its growth. In many cases a protective structure is developed outside the calyptra, and this sometimes assumes the form of a pseudoperianth as in the Marchantiaceae.

The Jungermanniaceae are sometimes called Scale Mosses, the gametophyte being invariably a leafy stem. Most of the species are prostrate, and the plants show a distinct dorsiventrality, even when ascending or erect. The leaves are normally alternate and arranged in three ranks, two of which are turned toward the light and the third toward the substratum. The leaves of this third rank are called underleaves, and are usually much smaller than the others and different from them in form. Sometimes they are so much reduced in size that they can scarcely be demonstrated, and in a few genera they are absent altogether. The two ranks of large leaves usually spread out in such a way that the whole shoot acquires a strongly flattened appearance, very characteristic of the family as a whole.

The leaves as a rule exhibit no cell differentiation whatever, and are invariably destitute of midribs. They show, however, a great deal of variation in form and in the way in which they are attached to the stem. They are sometimes undivided, sometimes variously toothed, lobed, or deeply cleft; they are sometimes developed in one plane, sometimes variously folded; they are sometimes attached by a continuous line, sometimes by two lines which meet at an angle. In a few genera the leaves develop peculiar organs, known as water sacs, in which water may be temporarily retained. The branches sometimes show a differentiation into those which bear normal leaves and those which assume a flagelliform appearance, the leaves in the latter case being strongly reduced or even absent altogether. The flagelliform branches frequently perform the
function of holding the plant more firmly in place, and are confined to certain species and genera.

The archegonia are borne at the apices of stems or of special branches and stop their further elongation. The leaves and underleaves which develop in the immediate vicinity of the archegonia are more or less modified, and are designated bracts and bracteoles respectively. Taken together they constitute the involucre. This often surrounds the developing sporophyte and helps protect it. In the majority of the genera, however, the gametophyte develops a special protecting organ. This usually consists of a hollow tube, open at the top and enclosed by the involucre; and, since this tube is theoretically formed by the coalescence of modified leaves, it is called a perianth, although it is not homologous with the perianth in flowering plants. In a few cases the fertile branch takes on a peculiar growth as the result of fertilization, and forms a hollow cup around the sporophyte. This is known as a perigynium, and may be either pendent or erect. In the latter case the uppermost bracts and bracteoles are often carried up on the outside. In very rare instances the young sporophyte penetrates the tip of the fertile branch, which serves directly as a protecting organ without undergoing marked modifications. Under these circumstances the calyptra itself often fails to develop.

The Jungermanniales are about nine times as numerous in Connecticut as the Marchantiales. Less than one seventh of the recorded species are Metzgeriaceae, the others being all Jungermanniaceae. A few are more or less aquatic, either floating on the surface of the water or attached to submerged rocks or stones. A few others are to be found in bogs or swamps. The remainder grow on rocks, on banks, on earth, or on the trunks of trees, usually in damp and shaded localities. They vary greatly in size, a few being hardly perceptible to the naked eye, while others attain a length of ten centimeters or more. The sporophytes, with few exceptions, reach maturity in the spring.
THE ANTHOCEROTALES

The Anthocerotales are sometimes called Hornworts or Horned Liverworts, and embrace the single family Anthocerotaceae. This includes only three recognized genera, two of which are represented in Connecticut. In spite of its small size, the order is of especial interest to the student of plant morphology and evolution, because it probably represents, more closely than any of the other existing Bryophytes, the ancestors of the Pteridophytes. The northern species are all annuals, and make their appearance in May or June in wet pastures, along roadsides, or on wet rocks. Each gametophyte has several sporophytes growing from it; they begin to develop late in the summer, and continue in many cases until the plants are killed by the frost.

The gametophyte is a thallus, sometimes bearing irregular and crispate outgrowths on the upper surface or along the margin, but never definitely divided into stem and leaves. The thallus branches by forking, but the forks are so close together that it soon assumes the form of a fleshy circular disc with many growing points scattered along the margin. It apparently absorbs throughout its entire surface, and is attached to the soil by means of thin-walled rhizoids, similar to those of the first type in the Marchantiales. The thallus shows but a slight degree of cell differentiation, but some of the species develop minute intercellular spaces, which, however, may contain slime as well as air. The green cells are characterized by the presence of a single large chloroplast in each. This is in the form of a plate with thin and irregular margins, lying close to the cell wall. Cells of this type are found nowhere else among the Bryophytes, and probably represent a primitive characteristic, indicative perhaps of a distant relationship with the green Algae. In all the other orders each green cell contains a number of small, disc-like chloroplasts, and agrees in structure with the green cells of the higher plants. Taking it as a whole, the gametophyte in the Anthocerotales is even more primitive than in either the Ricciaceae or Metzgeriaceae. Even the archegonia, although showing essentially the same structure as in the other Bryophytes, are imbedded in the
thallus so that only the tip of the neck protrudes. For this reason no true calyptra is developed, the function of this organ being assumed by a tubular outgrowth of the gametophyte, which encloses the base of the sporophyte.

Although the gametophyte in the present order is so simple, the sporophyte shows a high degree of complexity when compared with the preceding groups. It consists of two principal parts, a spherical or flattened foot, and a long and slender capsule, tapering somewhat toward the apex. No true stalk is formed, the base of the capsule passing imperceptibly into an undifferentiated region composed of embryonic cells. These continue to give rise to new cells, which gradually become differentiated into the permanent tissues of the capsule. The presence of these embryonic cells enables the sporophyte to grow indefinitely, a power which no other sporophytes possess until the Pteridophytes are reached. On account of the basal position of the growing region, the apex of the capsule is the first part to mature, and all stages of development are to be observed in passing from the apex toward the base. The cross section is approximately circular, but sometimes two longitudinal grooves are formed, showing where the wall will eventually split. The latter is relatively much thicker than in the preceding orders, the spore cavity being distinctly smaller. In the higher forms the wall is bounded on the outside by a distinct epidermis, with stomata, and this encloses several layers of green cells separated by minute air spaces. The wall therefore represents a photosynthetic tissue, comparable to the mesophyll in the higher plants. In the lower forms the wall is less highly differentiated and no stomata are developed. The center of the capsule is occupied by a slender but more or less clearly defined columnella composed of sterile cells, and the spore cavity is in the form of a hollow cylinder between the columnella and the capsule wall. The cavity is continuous over the tip of the columnella at the apex of the capsule. It contains both spores and elaters; but the latter are irregularly and poorly developed in northern species, and do not develop local thickenings in their walls. When the apex of the capsule is mature, the wall splits into two valves, the splits gradually extending downward as the development
proceeds. The valves, as they separate, soon become dry and black, and the columella appears like a fine hair projecting from the open capsule. The gametophyte covered over with sporophytes often presents the appearance of a tuft of fine grass.

The structure of the sporophyte in the Anthocerotales is so peculiar that Howe separated the order from the Hepaticae and made of it a distinct subclass, to which he gave the name Anthocerotes. He therefore divided the Bryophytes into three subclasses; Hepaticæ, Anthocerotes, and Musci. In this procedure he is followed, provisionally at least, by Campbell, but European writers continue to use the term Hepaticæ in the old sense.

THE SPHAGNALES

The Sphagnales or Peat Mosses comprise the single genus Sphagnum. They are well represented in Connecticut, and include some of our largest and most conspicuous Bryophytes. The peat mosses are occasionally found on wet rocks or banks, but are most at home in bogs, where they sometimes grow submerged but more frequently rise above the surface of the water. In favorable localities they form dense and extensive colonies. Under these circumstances the stems are upright and afford one another mutual support. No rhizoids are developed except when the plants are very young. The branching is always monopodial, the branches arising in fascicles of from three to eight. The fascicles are numerous, and the branches appear densely crowded at the tips of the plants because the elongation of the stem is at first very slow. In older parts the fascicles become more separated. The branches are of three types: — spreading branches, which remain simple and are limited in growth; pendent branches, which also remain simple and limited in growth, but which grow downward close to the stem and form a sort of loose covering around it; erect branches, which are unlimited in growth and give rise to spreading and pendent branches of their own. These erect branches are only occasionally produced, and, since they repeat the stem in all respects, apparently arise by forking.

The leaves are arranged in five longitudinal rows, although
this fact is sometimes difficult to demonstrate. They are desti-
tute of midribs, but show a remarkable differentiation into two
kinds of cells: — green cells, which remain alive for a long
time; and colorless cells, which soon lose their living contents
and become empty. In the leaves of the spreading branches
the green cells are united in such a way that they form a
loose network, each mesh of which is filled with a single
large colorless cell. The latter is characterized by a thin wall,
usually with band-like thickenings on the inside which keep
it from collapsing, and by holes or pores which place its
cavity in direct communication with the outside. The stems
and branches are usually covered over on the outside by a
cortex composed of similar colorless cells; within this is a
distinct zone of sclerenchyma enclosing a central pith. The
tufted habit of the peat mosses, their upright stems covered
with pendent branches, and their porous hyaline cells, account
for the ease with which they suck up and retain water. The
process is largely due to capillarity.

The archegonia are borne at the tips of branches, and
limit their growth just as in the Jungermanniaceae. The
sporophyte consists of a spherical capsule and a broad foot
with a deep constriction between them. No true stalk is
developed. The calyptra persists until the spores are mature,
and is then irregularly ruptured by the dehiscence of the
capsule. The latter while still immature contains a large
columella in the form of a hemisphere. This is covered over
at the apex by the small spore cavity in much the same way
as in the Anthocerotales, but the cavity contains spores only.
The wall of the capsule is several cells thick, the outer layer
forming a distinct epidermis. Some of the inner cells contain
chloroplasts, but there are no intercellular spaces among them,
and the epidermis develops no effective stomata, so that the
wall can hardly serve as a very useful photosynthetic tissue.
When the spores are mature, the upper part of the archegonial
branch elongates rapidly, thus simulating a stalk, and the
capsule opens by means of a circular split in the wall, which
cuts off a cap-like lid. As the drying of the capsule proceeds,
the pressure in the interior increases, until a sudden liberation
takes place which shoots out the spores together with the
lid to a distance of ten centimeters or more. The ripening and scattering of the spores occurs in the summer months.

THE ANDREÆALES

The present order contains the single genus Andreaea, separated from the Bryales on account of the peculiar structure of the capsule. The species are all small, and grow in tufts on siliceous rocks, usually in mountainous regions. The gametophyte consists of an upright and sparingly branched stem bearing crowded leaves in the three-eighths arrangement. Except for the midrib, which occurs in certain species only, the leaves show no cell differentiation.

The sporophyte bears a certain resemblance to that of Sphagnum. It consists of an oval capsule and a well-developed foot, but no true stalk is formed. The calyptra is very delicate and is ruptured long before the spores are mature; sometimes it is carried up on the tip of the capsule, sometimes it remains at the base and the capsule protrudes through it, very much as in the Jungermanniaceae. The capsule contains a definite columella, arched over by the spore cavity in the form of a hollow cylinder, and is bounded on the outside by a wall several cells thick. The wall has a distinct epidermis without stomata, and is probably not very efficient as a photosynthetic tissue, although some of its cells contain chloroplasts. When the spores are mature, the tip of the archegonial branch elongates rapidly, assuming the function of a stalk, and the wall of the capsule splits along four longitudinal lines. These do not extend, however, to the apex, but they are sufficient to expose the spores and to allow them to be scattered by the wind. The capsule usually reaches maturity in the spring or early summer.

THE BRYALES

The Bryales, or True Mosses, constitute the largest order of the Bryophytes, and include about two thirds of the Connecticut species. The gametophyte varies greatly in size, being sometimes only one millimeter long and sometimes attaining a length of ten centimeters or more. It always consists of a leafy shoot, the leaves being usually arranged in more than
three longitudinal rows. The leaves vary in form from linear to orbicular, and, although they are sometimes toothed or even ciliate on the margins, they are never deeply lobed or divided as in some of the Jungermanniaceae. Except for the midrib, which may or may not be present, the leaves very rarely show any differentiation in their cells. In prostrate species the plants sometimes acquire a dorsi-ventral appearance, and a slight differentiation in the leaves is occasionally to be observed. These peculiarities, however, are never so clearly marked as in the Jungermanniaceae, and there is little danger of confusing the True Mosses with the Scale Mosses. The branching in the Bryales is always of the monopodial type, and is often distinctly pinnate. In the lower forms the stem presents a simple and uniform structure, but in some of the higher genera it shows a distinct cell differentiation into storage, strengthening, and conducting tissues, and the same is sometimes true of the midribs of the leaves.

In the majority of cases the sporophyte shows a distinct foot, a firm stalk, which early becomes elongated, and a highly complex capsule. The calyptra at first keeps pace with the lengthening sporophyte but soon stops growing and becomes ruptured. In nearly every case the line of rupture is near the base, and the calyptra is carried up on the tip of the sporophyte. As the capsule gradually enlarges, the calyptra, which is now cut off from its source of food-supply, dries up and splits in one or more places, so that it frequently falls away long before the spores are mature. The spore cavity occupies a relatively small space in an immature capsule, and is in the form of a hollow cylinder open at both ends, differing in this respect from all the preceding Bryophytes. It encloses a massive columella, and is bounded by a thick wall, which, in most species, represents an efficient photosynthetic tissue. The outer cell layer of the wall forms an epidermis with stomata, the latter being usually restricted to the base of the capsule. The green cells are usually arranged in two more or less definite layers, one surrounding the spore cavity and the other lining the epidermis. These two layers are separated by a large air space in the form of a hollow cylinder. Stretching across the air space from one green layer to the other are
rows of green cells, which play a part in holding the central portion of the capsule in place. Of course the stomata afford a communication between the air space and the outside air.

As the spores mature, the photosynthetic tissue breaks down, the columella shrivels, and the spores eventually lie loose in an enlarged cavity, bounded by little more than the epidermal layer of the capsule wall. In a few of the simpler genera the capsule bursts irregularly at maturity. In the majority of cases, however, it splits by a circular line in the upper part, which cuts off an apical portion, or lid, from the capsule proper. Sometimes the region of splitting is marked by a row of modified epidermal cells, called an annulus, but this is not always developed. The walls of the annular cells have the power of absorbing water readily and swelling, thus forcing the lid to separate. After the lid has fallen away, the mouth of the capsule usually appears fringed with a circle of pointed teeth called a peristome, and in many genera two peristomes are developed, an inner and an outer. The inner peristome is always more delicate than the outer, and its divisions, when present, are called segments, instead of teeth. The segments are sometimes separated from one another by one or more delicate hair-like structures known as cilia. The peristome plays a peculiar part in the scattering of the spores; in moist weather the teeth come together and close the mouth of the capsule; in dry weather they separate and allow the wind to scatter the spores. Although the description just given will apply to the majority of cases, the structure of the capsule may be much simpler or even more complex than indicated. Taking the Bryales as a whole, the sporophyte shows the highest type of development to be found in the Bryophytes. It does not, however, show unlimited growth, the entire capsule maturing at the same time, and in this respect it is surpassed by the Anthocerotales.

The Bryales are divided by Brotherus into more than forty families, about half of which are represented in Connecticut. These are based on the general habit and structure of the gametophyte and on the peculiarities of the capsule, many of the most important characters being derived from the peristome. The species flourish best in moist and shaded
THE BRYOPHYTES OF CONNECTICUT

localities, and are often found in company with the Jungermanniales. Quite a number of them, however, are able to live in much drier localities, such as exposed rocks and sandy fields. Of the Connecticut species a few are annual but the majority are perennial. Most of them mature their spores in the fall or early winter, and the others in the spring or early summer. During the hot days of July, August, and September, many of the mosses become completely dried up, and their vegetative activities are interrupted. Even under favorable conditions for growth it is very unusual to find perfect capsules at this season of the year.

HISTORY OF BRYOLOGY IN CONNECTICUT

The first systematic collections of Bryophytes in Connecticut were made by Daniel C. Eaton, Professor of Botany in Yale University from 1864 until 1895, the year of his death. Professor Eaton was a member of the class of 1857, Yale College, and began his bryological studies while still an undergraduate. From the very outset he enjoyed the privilege of corresponding with W. S. Sullivant, of Columbus, Ohio, at that time the leading authority on North American Mosses and Hepatics, and this correspondence was continued until Sullivant’s death in 1864. During this period many doubtful Connecticut specimens were sent for comment or determination, among them being a sterile Fontinalis collected near New Haven. This specimen is apparently the first Connecticut Bryophyte which is definitely mentioned in the literature. It was first referred to *F. biformis* Sulliv., and is listed under this name in the “Musci and Hepaticæ of the United States,” originally written by Sullivant for the second edition of Gray’s “Manual of Botany,” published in 1856, but reprinted the same year as a separate work under the above title. *F. biformis* was based on Ohio specimens, and according to our present knowledge is restricted to the region of the Great Lakes. It was soon discovered therefore that the Connecticut material had been incorrectly determined. Sullivant hastened to call attention to this fact in the “Additions and Corrections” to his “Musci and Hepaticæ,” which appear in the separate
edition, but are not included in the “Manual.” The Connecticut Fontinalis is here transferred to *F. Novæ Angliæ* Sulliv., a species proposed as new and based on material from several stations in southern New England. Eight years afterward, in his “Icones Muscorum,” Sullivant accredited to Connecticut a second species of Moss, *Grimmia Olneyi* Sulliv., originally described from Rhode Island material.

About the time of Sullivant’s death, Professor Eaton began a correspondence with the late C. F. Austin, of Closter, New Jersey, who published many short papers on Bryophytes between 1863 and 1880. Austin was even more interested in the Hepaticæ than in the Mosses, and much of our present knowledge of this group of plants is based on his studies. In 1873 he issued his “Hepaticæ Boreali-Americanae,” the first set of exsiccatae devoted exclusively to North American Hepatics. For this publication Professor Eaton supplied a portion of the material distributed under No. 115, as *Aneura pinnatifida* Nees, now known as *Riccardia sinuata* (Dicks.) Trevis., and this is apparently the first published reference to a Connecticut Hepatic, the specimens being recorded from near New Haven.

With the exception of these scattered notes nothing of importance seems to have been published on Connecticut Bryophytes until 1878, although a large collection was gradually being accumulated. In this year the Berzelius Society of the Sheffield Scientific School printed “A Catalogue of the Flowering Plants and Higher Cryptogams growing without cultivation within thirty miles of Yale College.” This catalogue includes not only the Acrogens, or Pteridophytes, but also the Anogens, or Bryophytes, differing in this respect from the majority of local lists. The account of the Anogens, in which 170 Mosses and 54 Hepatics are enumerated, was prepared by Professor Eaton, and forms one of his most important contributions to the literature of bryology. The common and widely distributed species are listed by name only, but definite stations are given for the rarer species, and frequently the names of the collectors also are mentioned. Although Professor Eaton’s own name appears but rarely, it is evident from his herbarium that he had found most of the species listed. Mr. J. A. Allen
is quoted for a number of the most interesting species, and Professor O. D. Allen, Mr. A. Barron, Mr. E. E. Brewster, Mr. W. T. Browne, Mr. N. Coleman, Dr. F. W. Hall, Dr. G. R. Kleeberger, Mr. F. N. Pease, Mr. R. Veitch, and Mr. A. H. Young are also mentioned as collectors. The Berzelius List has of course served as a basis for subsequent work on Connecticut Bryophytes, but no publication on the entire group, dealing with either the whole or a part of the state, has since appeared.

During the last thirty years, however, the Mosses and Hepatics have by no means been neglected, and many additional species have been detected within the state. Several of these were found by Professor Eaton himself, who continued his active interest in bryology throughout his life. Others were collected by Mr. J. A. Allen, including a number of rare and minute species which have not been rediscovered by later observers. Still others were found by more recent students of Professor Eaton, Mr. E. B. Harger, Professor W. A. Setchell, and Dr. C. B. Graves being among the number. During the last decade some of the most interesting additions have been made by Mrs. Josephine D. Lowe and Miss Annie Lorenz, and the authors of the present catalogue have also had a share in swelling the list of Connecticut Bryophytes.

In spite of this active collecting very little has been published on the true Mosses (Bryales) of Connecticut since the Berzelius List. A search through the scattered literature has brought to light less than a dozen species which are actually additions. Among the more important of these are the following: — _Thuidium Alleni_ Aust., described from sterile specimens collected by Mr. J. A. Allen in Beaver Meadows, near New Haven; the rare _Claopodium pellucinerve_ (Mitt.) Best, collected by Mrs. Lowe at Noroton in the town of Darien, and reported upon by Miss Harriet Wheeler; and _Anacamptodon splachnoides_ Brid., first recorded by Mrs. Lowe from Burnside, in the town of East Hartford. As the present report shows, the number of known species is now 245. This does not include the two species of Andreæa discovered by Mr. J. A. Allen, which of course belong to a different natural order (Andreæales). For the "Musci Americæ Septentrionalis
Exsiccati," issued by Renauld and Cardot during the last fifteen years, Professor Eaton supplied a number of species from Connecticut, and these will be especially indicated in the list which follows.

The Peat Mosses (Sphagnales) and the Hepaticae have received rather more attention than the True Mosses, and the majority of the additions which have been made in these two groups have already been recorded. In the Berzelius List only three species of Sphagnum are included. About 1890, however, Professor Eaton and the senior writer began to collect these interesting plants systematically, and to submit specimens to Dr. C. Warnstorf, then of Neuruppin, Germany, for determination. In this way the number of known species was markedly increased. In 1892 Warnstorf described as new, under the name S. dasyphyllum, a species from East Haven, which is still known from this locality only. In 1893 Professor Eaton published his "Check-List of North American Sphagna," indicating the geographical distribution of each species, so far as known at that time. Although Connecticut is included in several of the wider ranges, only five species are definitely recorded from the state, all of these being additions to the Berzelius Catalogue. The check-list was prepared for the convenience and guidance of Professor Eaton and Mr. Edwin Faxon, of Malden, Massachusetts, who were collecting sets of North American species for distribution. These sets were issued in 1896 by Dr. George F. Eaton, under the title "Sphagna Boreali-Americana Exsiccata," and constitute the only published exsiccate devoted exclusively to North American Peat Mosses. They include twenty-nine numbers from Connecticut, representing fourteen species. Three species from the state had already been distributed by Warnstorf, in the fourth series of his "Europaeische Torfmoose." In 1906 Andrews listed nineteen species of Sphagnum from Connecticut, and twelve additional species have been recently determined by Warnstorf from Connecticut specimens, so that thirty-one species in all are now known.

Since the publication of the Berzelius List the number of known species of Hepaticae within the state has been almost doubled. The seven following species, occurring in Con-
necticut, have been described as new: Calypogeia tenuis (Aust.) Evans, Diplophyllaea apiculata Evans, Frullania Brittoniae Evans, Jungermannia Novcc-Casareae Evans, Lepidozia sphagnicola Evans, L. sylvatica Evans, and Plagiochila Sullivantii Gottsche. Unfortunately two of these have since been reduced to synonymy, Jungermannia Novcc-Casareae being now considered a form of Lophosia marchica (Nees) Steph., and Lepidozia sphagnicola being included under L. setacea (Web.) Mitt. Many other additions to the hepatic flora of the state have been recorded in a series of “Notes on New England Hepaticae,” and in a “Preliminary List,” both published by the senior writer in Rhodora. It should be noted, however, that the earliest references to Riccia arvensis Aust. and Mylia anomala (Hook.) S. F. Gray are to be found in the writings of Professor L. M. Underwood, and that Dr. M. A. Howe was the first to report Porella rivularis (Nees) Trevis. and Anthoceros punctatus L. Fifteen species of Connecticut Hepaticae and Anthocerotes have been distributed in Underwood and Cook’s “Hepaticae Americanæ,” all of which are indicated below. Several other species are included in the first two decades of the “American Hepaticæ,” recently issued by Miss Caroline C. Haynes.

The bryophytic flora of Connecticut is perhaps as well known as that of any equal area in North America, but the region has not yet been so intensively studied as certain parts of Europe. This is due partly to the fact that here, as in other groups, common species have been largely neglected by collectors, and are therefore less fully represented in our herbaria than some of the rarer and more local species. The attempt has been made of late to collect even the commonest species more systematically, but much still remains to be done, and many parts of the state still remain to be explored before our knowledge can be considered at all complete. This is especially true of the towns in the eastern and northeastern counties.
DISTRIBUTION OF THE BRYOPHYTES IN CONNECTICUT ACCORDING TO ENVIRONMENT

Even to the casual observer it is evident that the character of the vegetation which clothes the surface of the earth varies greatly under different conditions. There is a marked contrast, for example, between the impenetrable tangle of a tropical jungle with its wide diversity of species, and the northern spruce forests which are relatively open and are made up of comparatively few species. The vegetation at the summit of Mount Washington is scant and limited to shrubby and herbaceous plants, while the valleys but a few thousand feet below are heavily wooded. Ordinary land plants differ strikingly in appearance from seaweeds and other submerged aquatics.

These are perhaps extreme illustrations, but innumerable examples of this adaptation to environments which are less diverse may be seen everywhere. The vegetation in an open field presents a decided contrast to that of a pine grove but a few hundred yards distant, while the flora in a bog is totally different from that in a meadow.

It may be stated as a general rule that every plant is best adapted to a peculiar environment, and that for every species there are certain more or less well defined limits outside of which it cannot exist. What is true of the higher plants applies even more forcibly to the Mosses and Hepatics, for, as Lesquereux remarks, "these humble and apparently useless beings have their geological and lithological preferences far better marked than any other kind of vegetable."*

The factors which produce this environment and determine these limits are numerous, but the following are the most important:

I. Latitude.
II. Altitude.
III. Character of the substratum.
IV. Intensity of the light.
V. Water supply.

In treating an area such as the continent of North America, where all gradations from an arctic to a tropical climate are encountered, the first of these factors bears an important relationship to the character of the vegetation. Many Bryophytes are exclusively northern in their range, while others are restricted to tropical regions. A comparatively small number are found from the arctic regions to the equator. In considering the Mosses and Hepatics of Connecticut, however, latitude is of relatively little importance.

In the same way the second factor may be disregarded, since nowhere in the state are the differences in altitude sufficient to produce any appreciable climatic effect.

To a certain extent the nature of the substratum determines the character of the bryophytic flora, and various societies might be defined from this point of view, as, for example, the following: — species growing on rocks; species growing on soil; species growing on living trees; species growing on dead trees, rotten wood, etc. Yet the boundaries between such societies are often vague, since many species flourish equally well on a variety of substrata.

Except in the northwestern part of Connecticut, it is probable that the actual chemical composition of the rocks and soil has very little direct effect upon the character of the vegetation. Indirectly, however, the structure of the underlying rocks is an important factor, as may be seen by considering the geography of the state.

"The state of Connecticut is naturally divided into three areas, the Eastern Highland, the Western Highland, and the Central Lowland. The Central Lowland may be further divided into a central range of hills and an eastern and a western valley."* The sedimentaries in the valleys with the overlying drift tend to produce a more or less level surface, which is interrupted only by a few ravines and by occasional bogs. For the most part this area is under cultivation, but, although favorable for agriculture, it does not present conditions conducive to an extensive bryophytic flora. In marked contrast to this uniform area are the trap ridges which rise

abruptly to a height of several hundred feet above the surrounding plain. Geologically, these ridges are a part of the Central Lowland. From an ecological standpoint, however, they conform with the Highlands. The Eastern and Western Highlands are made up for the most part of a complex series of crystalline rocks—gneisses, schists, and granites. The forces of erosion, acting on these, have produced an uneven and rugged topography. Like the trap ridges, this region is well wooded, and, while on the whole unsuitable for agriculture, it exhibits a diversity of conditions, and is characterized by a rich bryophytic flora.

From a bryological standpoint, the most interesting isolated formation in the state is the Stockbridge limestone, which covers the greater part of the towns of Salisbury and Canaan, extending southward through the Housatonic Valley more or less continuously to Ridgefield. A few species grow in this region which have been collected nowhere else in the state, viz.:

- Lophozia Muelleri
- Barbula fallax
- Thuidium abietinum

Other species occur here which, although characteristic of limestone regions, are found in other localities growing on serpentine or other rocks, e. g.:

- Preissia quadrata
- Frullania riparia
- Fissidens cristatus
- Chrysohypnum stellatum

The distribution of the Bryophytes is somewhat restricted and frequently the habit of the individual plant greatly modified by differences of light and shade. In a general way two rather broadly defined classes may be recognized: light-loving, and shade-loving Bryophytes. In the first of these classes may be placed such species as —

- Riccia arvensis
- Frullania eboracensis
- Anthoceros levis

- Tortula papillosa
- Bryum argenteum
- Thelia Lescurii
In the latter and by far the larger group should be placed such species as—

<table>
<thead>
<tr>
<th>Metzgeria conjuncta</th>
<th>Leucobryum glaucum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plagiochila asplenioides</td>
<td>Stereodon curvifolius</td>
</tr>
<tr>
<td>Bazzania trilobata</td>
<td>Thamnium alleghaniense</td>
</tr>
</tbody>
</table>

Yet, however much the preceding factors affect the distribution of the Mosses and Hepatics, the problem is eventually reduced to another factor, viz., the amount, nature and continuity of the water supply. Many species grow only on dry, exposed rocks, while to others the presence of free surface-water is essential. Some of the latter grow only in standing or slowly moving water, others are always found in rapidly flowing streams. But the majority of the Bryophytes thrive in an environment where they are not subjected to prolonged periods of drought or inundation.

Taking the requirements with regard to water as a basis, Warming* recognizes four groups of plants:

I. XEROPHYES: plants which grow on rocks, or on soil which contains, at least during the greater part of the year, a very small amount of water.

II. MESOPHYES: plants adapted to soil containing a moderate amount of water.

III. HYDROPHYES: plants which are completely or partly submerged, or which grow in very wet soil.

IV. HALOPHYES: plants which are adapted to a saline soil.

Considerable attention has been given to the ecological relationships of the higher plants, and several authors have attempted to classify the Bryophytes with respect to their habitats. Warnstorff†, however, was the first to adapt Warming’s classification to the group.

Among the Bryophytes there are no true halophytes. Following Warming’s classification the other three groups are

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† Warnstorff: Kryptogamenflora der Mark Brandenburg, i: 20-25, 1903.
well defined, and of these groups the species given below may be considered typical members:

**Xerophytes.**

1. Plants growing on exposed rocks with little or no earth covering — trap ledges, stone walls, bowlders, etc.

   - Frullania Asagrayana
   - Grimmia Olneyi
   - Andreae Rothii
   - Ulota Hutchinsiae
   - Hedwigia albicans

2. Plants growing on living trees in the open or in the woods.

   - Frullania eboracensis
   - Drummondia clavellata
   - Orthotrichum ohioense
   - Leucodon julateus
   - Thelia hirtella

3. Plants growing on earth, or on rocks with a thin earth covering in fields and along roadsides or in dry woods.

   - Nardia crenulata
   - Pogonatum tenue
   - Diplphyllclea apiculata
   - Thelia Lescuiii
   - Physcomitrium turbinatum
   - Rhynchostegium serrulatum

**Mesophytes** — for the most part shade-loving plants, but frequently found in the open on the borders of brooks, in meadows, etc.

1. Plants growing on the surface or in the crevices of cliffs and steep rocks.

   - Reboulia hemispharica
   - Rhabdoweisia denticulata
   - Leucotjeneuea clypeata
   - Didymodon rubellus
   - Hymenostylium curvirostre

2. Plants growing on soil or humus, on flat earth-covered rocks, on the roots and at the base of trees, or on decaying logs and stumps in wet woods.

   - Lophocolea heterophylla
   - Polytrichum ohioense
   - Ptilidium pulcherrimum
   - Ptilium Crista-Castraensis
   - Timmia cucullata
   - Climacium americanum
Hydrophytes.

1. Plants growing in more or less wooded swamps.
   a. On the ground.
      *Trichocolca tomentella*  *Brachythecium Nova-Angliae*  *Elodium paludosum*  *Calliergon cordifolium*
   b. On sticks and bushes.
      *Dichelyma capillaceum*

2. Plants growing on wet or dripping rocks in streams and ravines.
   *Riccardia sinuata*  *Eurynchium rusciforme*  *Jubula pennsylvanica*  *Amblystegium Lescurii*  *Thamnium alleghaniense*

3. Plants growing in open bogs, especially peat bogs, and usually forming compact masses of vegetation.
   *Lepidozia setacea*  *Sphagnum* (most species)  *Scapania irrigua*  *Acrocladium cuspidatum*  *Drepanocladus aduncus*

4. Plants submerged or, floating in the water.
   *Ricciella fluitans*  *Sphagnum obcesum*  *Ricciocarpus natans*  *Octodiceras Julianum*  *Porella pinnata*  *Fontinalis Lescurii*

**ECONOMIC VALUE OF THE BRYOPHYTES**

Although the majority of the Bryophytes are of small size when compared with the seed-bearing plants, they often form dense and extensive colonies and thus constitute a conspicuous feature of the landscape. This is especially true in mountainous and northern regions, where woody plants are stunted in growth and occur more sparingly than under more favorable climatic conditions. Even in Connecticut, however, where the higher plants exhibit a vigorous development, the Sphagnales and certain of the other Bryophytes are often abundant enough to attract the attention of the ordinary observer.

On account of the tufted habit of so many species and the power which they possess of absorbing and retaining water,
they exercise a marked influence on both agriculture and forestry. Their importance from this point of view, which is only beginning to be appreciated, has been clearly demonstrated by Georg Roth.* According to this author, the mosses tend to diminish floods and to reduce the gullying of the soil, at the same time preserving its porosity. They are also of value in adding to the richness of the soil through their decay and in assisting in the disintegration of rocks. The Sphagnales, through their peculiar place and habit of growth, are active in converting lakes and ponds into bogs, which afford a foothold for higher plants and eventually yield a serviceable soil.

From a commercial standpoint the Sphagnales are by far the most important of the Bryophytes. In countries where they are abundant they yield the best quality of peat. This is produced by the death of the older portions of the Peat Mosses, the living stems continuing their upward growth indefinitely. As the dead layer becomes thicker, it becomes more and more compressed, and finally forms a firm and compact mass at the bottom of the bog. This mass is cut into bricks, which are dried and constitute the peat of commerce. Of course the chief use of peat as a fuel is for domestic purposes. In certain localities, however, it is charred and then used in steel and copper mills, where its purity from foreign substances and its power to produce an intense heat make it especially effective.

The Peat Mosses are also useful as a packing substance. In a dry form they are sometimes employed as a filling for pillows and mattresses, especially those used by invalids. They may also be wrapped around steam pipes or packed in the walls of houses, where they act as a non-conducting substance. In a moist form they are being more and more used by gardeners and florists as a packing material for vegetables and other cultivated plants. Owing to their great power of absorption, Peat Mosses are sometimes substituted for straw in stables, and they have also been employed to a limited extent in surgical dressings. The same peculiarity makes it possible to use them for lamp-wicks in the far north.

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A few of the Bryales constitute a secondary source of peat, and others are used as a packing material but to much less extent than the Peat Mosses. Some of the large species, when dried without pressure and dyed, form a component part of decorative wreaths and cords, which are made use of more especially by milliners. The stiff and wiry stems of Polytrichum commune have also been employed instead of bristles in the manufacture of brushes. Among the Marchantiales the only species which have ever been used for practical purposes are Marchantia polymorpha and Conocephalum conicum. These were formerly prescribed in affections of the liver, but it is doubtful if they possess any true therapeutic properties. Except for the fact that a few of the Jungermanniales have been used in the tropics as a packing material for living plants, the remaining orders of the Bryophytes have been put to no practical uses whatever.

CATALOGUE OF CONNECTICUT BRYOPHYTES

The following catalogue records the distribution of the Bryophytes of Connecticut, so far as known to the writers. Under each species the characteristic environment and often the time of fruiting are given, together with the known localities for the state. These are arranged alphabetically by towns under the counties, the latter being given in the following order: Litchfield, Hartford, Tolland, Windham, Fairfield, New Haven, Middlesex, New London. The names of the collectors are also noted, but the only date mentioned is that of the earliest known collection. In case two or more persons have found the same species in the same township, the one who collected it first is the only one alluded to. The local distribution is followed by brief notes regarding the known distribution in North America and in other parts of the world. For the sake of completeness attention is also called to Connecticut specimens which have been distributed in exsiccate and to references in the scattered literature of bryology which relate directly to Connecticut plants. The numbers following the authors' names in these references correspond with the list and page numbers in the bibliography.
The genera, where represented by more than a single species, are supplied with artificial keys to the species, and the orders or families are supplied with similar keys to the genera. The arrangement followed is in most respects like that given in Engler & Prantl's "Die natürlichen Pflanzenfamilien." Since, however, the treatment of the Bryales in this work is still incomplete, the hypnoid Mosses are largely arranged according to Warnstorf in the second volume of the "Kryptogamenflora der Mark Brandenburg." Warnstorf is also followed in the position of the Polytrichaceae and allied families. These apparently represent the most highly developed members of the Bryophytes, and it is therefore most logical to place them at the conclusion of the series.

[Subclass Hepaticae]

ORDER MARCHANTIALES

FAMILY RICCIACEÆ

1. Terrestrial; green cells in rows at right angles to the upper surface of the thallus, enclosing air spaces in the form of narrow canals; epidermis without pores. Riccia
   Terrestrial or aquatic; green cells in layers one cell thick, separating the irregular air spaces from one another.

2. Epidermis without pores, sometimes becoming irregularly ruptured with age. Ricciella
   Epidermis with distinct pores, not becoming ruptured with age. Ricciocarpus

Riccia (Mich.) L.

Riccia carpocarpa (L.) Kuhn


Ricciella A. Br. (as Sect. in Cl.)

Capsules rupturing on the upper surface of the thallus; epidermis soon breaking down and leaving the sponge-like green tissue exposed. R. crystallina

Capsules rupturing on the lower surface of the thallus.

Other refs. in Conn. by Dyer & Clark

Sorocarpa

Elytrichium

Ricciella
2. Aquatic, or rooting on wet mud; epidermis persistent
\[ R. \text{ fluitans} \]
Terrestrial; epidermis eventually breaking down \[ R. \text{ Sullivantii} \]
\[ R. \text{ crystallina} \] (L.) Warnst. \[ R. \text{ crystallina} \] L.
Connecticut west to Oregon and south to the West Indies and California; Europe; Asia.
Ref. Evans, 26, 207; 28, 170.

\[ R. \text{ fluitans} \] (L.) A. Br. \[ R. \text{ fluitans} \] L.
New England and Ontario, west to British Columbia and south into tropical America; Europe; Asia; Africa; New Zealand.
Exsic. Underwood & Cook, Hep. Amer. No. II (as \[ R. \text{ fluitans} \]).

\[ R. \text{ Sullivantii} \] (Aust.) Evans. \[ R. \text{ Sullivantii} \] Aust. (\[ R. \text{ Huebrognata} \] muc. B. G. 19, 276, non Hindley.)

New England to Virginia and west to Ohio.
Ref. Eaton, 15, 68. Evans, 28, 170; 33, 56.

\[ R. \text{ natans} \] (L.) Corda. \[ R. \text{ natans} \] L.
Floating in ponds or growing on mud. May and June.

New England west to British Columbia and south to Mexico; Brazil; Europe; Asia; Australia.


FAMILY MARCHANTIACEÆ
1. Air chambers in several layers, separated from one another by plates of green cells......................... 2
Air chambers in a single layer, the green cells arranged in simple or branched rows arising from the floors of the chambers ................................................................. 4

2. Sporophytes destitute of distinct pseudoperianths........ 3
Sporophytes each surrounded by a distinct pseudoperianth, consisting of a thin membrane divided longitudinally into eight segments.......................... Asterella

3. Ventral scales of thallus purple, scarcely projecting beyond the margin; capsule only partially filling the involucral cavity .......................................................... Reboulia
Ventral scales of thallus soon becoming bleached, extending far beyond the margin, and usually forming a dense tuft at the apex; capsule completely filling the involucral cavity ......................................................... Grimaldia

4. Pores in epidermis of thallus simple, each surrounded by a single layer of cells.......................... 5
Pores in epidermis compound or barrel-shaped, each surrounded by cells arranged in several tiers........ 6

5. Outlines of air chambers distinct to the naked eye; gemmæ none; plant native ............................... Conocephalum
Outlines of air chambers indistinct to the naked eye; gemmæ abundant, produced in crescentic receptacles; plant introduced into greenhouses.................... Lunularia

6. Gemmæ none; carpocephala with indistinct flat rays Preissia Gemmæ usually abundant, produced in cup-shaped receptacles; carpocephala with distinct terete rays Marchantia

Reboulia Raddi

Reboulia hemisphærica (L.) Raddi. Asterella hemisphærica Beauv.

On shaded banks and in crevices of rocks. May and June.
Notes on Asterella, Grimaldia, & Reboulia, as seen at Yale Her., Jan. 1930.

Asterella, perianth dependent, conspicuous, with lobes like those of an orange peel bucket.

Grimaldia, perianth conspicuous, saffron, but not in regular segments.

Reboulia, no perianth visible, thallus purple beneath.

Aven, Evans; Orange, Alaska and south to southern Asia.

Amer. No. 121.

o. Underwood, 71, 35;

v.

Tolmbraria tenella Nees. rocks. May and June.

TOLLAND: Andover, Cantonbury, Mrs. Evans; East Haven, J. A. Oxford, Harger; Woodwton, Evans.

and south to Georgia.

170.

Wigg.

Dumort.

specially along streams. April Underwood; New Milford
into eight segments:

3. Ventral scales of thallus beyond the margin of involucral cavity.
Ventral scales of thallus far beyond the involucral cavity at the apex; cap cavity .............

4. Pores in epidermis of a single layer of cells.
Pores in epidermis complex, rounded by cells a

5. Outlines of air chambers none; plant native.
Outlines of air chambers gemmæ abundant, plant introduced in

6. Gemmæ none; carpocarpic receptacles; carpocarpic

Reboulia hemisphaerica Rica Beauv.

On shaded banks and

New England west to British Columbia and south to Mexico; Europe; Asia; Africa; South America; Australia.


**Grimaldia Raddi**

*Grimaldia fragrans* (Balb.) Corda. *Grimaldia barbifrons* Bisch.


Quebec and New England west to Alaska and south to New Mexico and Texas; Europe; northern Asia.


**Asterella Beauv.**


New England west to Missouri and south to Georgia.


**Conocephalum Wigg.**

*Conocephalum conicum* (L.) Dumort.

On shaded banks and rocks, especially along streams. April and May. Litchfield: Goshen, Underwood; New Milford

Newfoundland west to Alaska and south to Florida and Nebraska; Europe; Asia.


Preissia Corda

Preissia quadrata (Scop.) Nees.


Greenland to Alaska and south to Mexico; Europe; Asia.

Ref. Evans, 28, 170.

Lunularia (Mich.) Adans.

Lunularia cruciata (L.) Dumort. L. vulgaris Raddi.

Introduced into greenhouses, and reproducing (in the eastern United States) solely by means of gemmae. New Haven: New Haven (1868), Eaton. Doubtless widely distributed throughout the state.

New England west to California and south to the West Indies; native in the Mediterranean regions of Europe, Asia, and Africa; Chile; Australia.


Marchantia (March. f.) L.

Marchantia polymorpha L.

On banks and rocks, in swamps, gardens, and cultivated fields. June-August. Litchfield: Goshen, Underwood;

Greenland to Alaska, south to Florida and the West Indies; Europe; Asia.


**ORDER JUNGERMANNIALES**

**FAMILY METZGERIACEÆ**

1. Gametophyte a thallus with no indication of leaves; capsule splitting longitudinally at maturity into four valves

2. Gametophyte more or less clearly differentiated into stem and leaves

3. Thallus composed of parenchyma throughout

4. Thallus with a median strand of narrow elongated cells

5. Branches lateral: capsule oval

6. Thallus repeatedly forking, bearing cilia on the margin; antheridia and archegonia borne on short ventral branches

7. Thallus simple or with scattered ventral branches, margin entire; antheridia and archegonia borne on dorsal surface

8. Leaves in the form of marginal crenulate scallops; rhizoids colorless; capsule splitting longitudinally at maturity into four valves

9. Leaves distinct; rhizoids purple; capsule splitting irregularly at maturity

**Riccardia** S. F. Gray

1. Thallus mostly 4-10 mm. broad, sparingly branched *R. pinguis*

2. Thallus pinnate or bipinnate

3. Ultimate branches distinctly bordered by 2 or 3 rows of cells

4. Ultimate branches indistinctly bordered by one row of cells

**Pallavicinia**
4. Cortical cells averaging $0.07 \times 0.04$ mm; gemmæ rare

*R. latifrons*

Cortical cells averaging $0.04 \times 0.025$ mm; gemmæ two-celled, often abundant.................*R. palmata*

**Riccardia pinguis** (L.) S. F. Gray. *Aneura sessilis* Spreng.


Greenland to Alaska, and south to the West Indies, Mexico, and Brazil; Europe; Asia; Africa; Australia.


**Riccardia multifida** (L.) S. F. Gray. *Aneura multifida* Dumort.


**Riccardia sinuata** (Dicks.) Trevis. *Aneura pinnatifida* Nees, in part.

On dripping rocks. April and May. NEW HAVEN: Hamden (1855), *Eaton*; Woodbridge, J. A. Allen.

New England south to New Jersey; also in British Columbia; Europe; Asia. A rare species, the range of which is very incompletely known.


**Riccardia latifrons** Lindb.

THE BRYOPHYTES OF CONNECTICUT.

Ref. Evans, 28, 170.

**Riccardia palmata** (Hedw.) Carruth.
On rotten logs. May and June. **NEW HAVEN**: Cheshire (1887), Setchell.
Nova Scotia west to Alaska and south to New England, New York, and California; Europe; Asia.
Ref. Evans, 28, 170.

**Metzgeria Raddi**

**Metzgeria conjugata** Lindb. *M. furcata* of some authors.
On shaded rocks and trunks of trees. May and June.
**LITCHFIELD**: New Milford, Evans. **WINDHAM**: Canterbury, Mrs. Hadley; Killingly, Rounds. **FAIRFIELD**: Danbury, Eaton; Redding, Miss Haynes. **NEW HAVEN**: East Haven, Eaton; Hamden, J. A. Allen; Meriden, Evans; New Haven (1856) and Orange, Eaton; Seymour, Evans. **MIDDLESEX**: Killingworth, Evans. **NEW LONDON**: Norwich, Setchell.

New England west to Alaska and south to Argentina and Chile; Europe; Asia; Africa. Ref. Eaton, 15, 69. Evans, 28, 170.

**Pallavicinia S. F. Gray**

In swamps and bogs, sometimes aquatic. April-June.

Newfoundland west to Ontario and south into tropical America; Europe; Asia; Africa; New Zealand. Ref. Eaton, 15, 69. Evans, 28, 170.
Pellia Raddi

Pellia epiphylla (L.) Corda.


Labrador to Alaska and south to New England, New York, and Indiana; Europe; Asia.


Blasia L.

Blasia pusilla L.


Nova Scotia west to Alaska and south to Virginia, New Mexico, and California; Europe; Asia.


Fossombronia Raddi

1. Annual; capsules mature in autumn.............................. 2
Perennial; capsules mature in May and June........F. salina
2. Spores with subparallel and rarely anastomosing ridges

Spores with anastomosing ridges forming a network

F. Wondraczekii

Fossombronia salina Lindb.

On earth in wet pastures and swamps. May and June. New Haven: East Haven, Evans; Hamden (1879) and Orange, J. A. Allen.

Connecticut south to Florida and the West Indies and west to Tennessee and Arkansas.
Ref. Evans, 24, 10; 28, 170.
**Fossombronia Wondraczekii** (Corda) Dumort.

In damp fields and along roadsides. Sept.-Nov. **New Haven**: Oxford (1894), Harger. **Middlesex**: Portland, Johnson.

New England west to Indiana and south to Maryland; Europe; Asia.

Ref. Evans, 24, 10; 28, 170.

**Fossombronia foveolata** Lindb.

In damp fields and along roadsides. Sept.-Nov. **New Haven**: Branford, Cheshire, and Hamden, Evans; Milford, Miss Lorens; New Haven, Evans; Orange (1879), J. A. Allen. **Middlesex**: Portland, Evans.

Quebec and Ontario west to British Columbia and south to New Jersey and Delaware; Europe. Ref. Evans, 28, 170.

**FAMILY JUNGERMANNIACEÆ**

1. Leaves undivided and with entire margins...................... 2
   Leaves variously toothed, lobed, cleft, or divided........ 9

2. Archegonia borne on the stem or a leading branch........... 3
   Archegonia borne on a short branch, usually arising ventrally ........................................... 7

3. Bracts undivided, similar to the leaves...................... 4
   Bracts variously incised or cleft.......................Jamesoniella, p. 52

4. Uppermost bracts apparently adnate with the base of the perianth ..............................................Nardia, p. 50
   Uppermost bracts entirely free from the perianth........ 5

5. Perianth terete and more or less contracted at the mouth
   Jungermannia, p. 51
   Perianth laterally compressed and truncate at the mouth
   Plagiochila, p. 56

6. Growing in damp or wet woods on various substrata; stems with few or no rhizoids; leaves never gemmiparous
   Plagiochila, p. 56
   Growing in open bogs; stems with numerous rhizoids; leaves often gemmiparous
   Mylia, p. 56

7. Leaves succubous; sporophyte enclosed within the perianth
   Calypogeia, p. 62
   Leaves incubous; sporophyte developed within a pendent perigynium
   Calypogeia, p. 62

8. Leaf cells without trigones ......................Chiloscyphus, p. 58
   Leaf cells with distinct trigones...........Odontoschisma, p. 62
9. Leaves not complicate, usually expanded in one plane... 10
Leaves distinctly complicate, the two portions meeting at a more or less distinct keel. 22

10. Leaves succubous .......................... 11
Leaves incubous ............................ 19

11. Leaves bidentate or bilobed .................. 12
Leaves with more than two teeth or lobes ...... 18

12. Underleaves distinct ........................ 13
Underleaves none or very minute ............... 16

13. Underleaves distinctly bifid .................. 14
Underleaves undivided or with a few marginal teeth or cilia .......................... 15

14. Sporophyte enclosed within a perianth... Lophocolea, p. 57
Sporophyte developed within a pendent perigynium Geocalyx, p. 59

15. Growing on rotten logs, often gemmiparous. . Harpanthus, p. 59
Growing on calcareous rocks, never gemmiparous... Lophozia Muelleri, p. 53

16. Perianth terete, more or less plicate at the mouth... Lophozia, p. 52

Perianth trigonous ............................ 17

17. Leaf cells 0.025-0.05 mm. in diameter...... Cephalozia, p. 59
Leaf cells 0.01-0.02 mm. in diameter..... Cephaloziella, p. 61

18. Leaves undivided, margin sharply toothed. . Plagiochila, p. 56
Leaves with three or four broad teeth...... Lophozia, p. 52

19. Leaves bidentate at the apex; ventral flagelliform branches none .......................... Calypogeia, p. 62
Leaves mostly with three or four teeth, lobes, or divisions 20

20. Stems apparently dichotomous; ventral flagelliform branches numerous ................. Bazzania, p. 64
Stems pinnately branched; ventral flagelliform branches none .................................. 21

21. Divisions or lobes of leaves two or more cells wide, at least at the base; archegonia borne on short ventral branches ........................................ Lepidozia, p. 65
Divisions of leaves only one cell wide throughout; archegonia borne on the main stem or on leading lateral branches ........................................ Blepharostoma, p. 66

22. Ventral lobe of leaf equaling or surpassing the dorsal in size ............................................. 23
Ventral lobe smaller than the dorsal .......... 26
23. Bracts apparently adnate to the base of the perianth.......................... Marsupella, p. 50
   Bracts entirely free from the perianth...................................... 24
24. Perianth strongly dorsi-ventrally compressed, not plicate in upper part.................. Scapania, p. 68
   Perianth terete or slightly compressed, more or less plicate in upper part............... 25
25. Keels of leaves sharp.......................... Diplophylleia, p. 67
   Keels of leaves blunt.......................... Sphenolobus, p. 55
26. Leaves and underleaves with fringed margins.......................... 27
   Leaves and underleaves (when present) with entire or denticulate margins................ 28
27. Plants green, often tinged with brown or red, growing in rather dry localities; leaf cells with trigones and a smooth cuticle ........................................... Ptilidium, p. 66
   Plants pale green or yellowish, growing on the ground in swamps; leaf cells thin-walled, with a minutely striolate cuticle ........................................... Trichocolea, p. 67
28. Underleaves present ........................................... 29
   Underleaves none ........................................... 33
29. Underleaves undivided ........................................... 30
   Underleaves bifid ........................................... 31
30. Ventral lobe of leaf not inflated, attached to the stem by a narrow base.................. Porella, p. 76
   Ventral lobe of leaf inflated and forming a small water-sac, attached to the stem by a broad base.......................... Leucolejeunea, p. 72
31. Ventral lobe of leaf attached to the stem by a broad base, forming an inflated water-sac.......................... Lejeunea, p. 72
   Ventral lobe of leaf usually forming an inflated water-sac, entirely free from the stem.......................... 32
32. Archegonial branch with one or two subfloral innovations.......................... Jubula, p. 72
   Archegonial branch without subfloral innovations.......................... Frullania, p. 73
33. Dorsal lobes of leaves smooth and entire; perianth dorsi-ventrally compressed, truncate at the mouth.......................... Radula, p. 69
   Dorsal lobes of leaves denticulate and minutely roughened on outer surface by projecting cells; perianth inflated, five-keeled, and contracted at the mouth into a tubular beak.......................... Cololejeunea, p. 71
Plants varying from green to reddish; leaves with a broad sinus and bluntly pointed lobes .......... **M. emarginata**

Plants varying from green to deep purplish black; leaves with a narrow sinus and rounded lobes .......... **M. Sullivantii**

**Marsupella emarginata** (Ehrh.) Dumort. 2 2 9

On damp shaded rocks. May and June. **Litchfield**: Salisbury, Nichols. **New Haven**: Branford, Evans; Middlebury, Harger; Naugatuck, Evans; Oxford, Harger; Woodbridge (1879), J. A. Allen. **Ref.**

Labrador west to Alaska and south to Virginia, Minnesota, and California; Europe; Asia. **Ref.**

**Ref.** Evans, 28, 172.

**Marsupella Sullivantii** (DeNot.) Evans. **Marsupella sphacelata** of some authors, not (Gieseke) Dumort. **M. media** (Gottsche) Schiffn. <esytralumia limn.> Schiffn. 225

On shaded rocks. May and June. **Hartford**: Southington, Miss Lorenz. **New Haven**: Hamden and Naugatuck (1890), Evans.

Nova Scotia south to Georgia; Washington; Europe. **Ref.**

Evans, 28, 172; 30, 167; 33, 57. **Ref.**

**Nardia S. F. Gray**

1. Growing on sandy soil; rhizoids colorless; leaves (or at least the bracts) bordered by a row of thick-walled cells; leaf cells otherwise thin-walled throughout or with minute trigones .......... **N. crenulata**

Growing on damp rocks or banks; rhizoids more or less tinged with purple; leaf cells with distinct trigones 2

2. Leaves bordered by a row of thick-walled cells .......... **N. crenuliformis**

Leaves not bordered, their cell structure uniform throughout .......... **N. hyalina**

**Nardia crenulata** (Sm.) Lindb. **Jungermannia crenulata** Sm. 326 **P. crenulata** (Sm.) Bach, Evans, Bleadow

On sandy soil, especially along roadsides and shaded paths. April-June. **Litchfield**: Cornwall and Litchfield, Underwood. **Tolland**: Bolton, Nichols. **Fairfield**: Huntington

Greenland west to British Columbia and south to Alabama and California; Europe; Asia.


*Nardia crenuliformis* (Aust.) Lindb. 331


*Nardia hyalina* (Lyell) Carr. 333 P. hyal. (lyell) Mitt.


Ref. Evans, 26, 209; 28, 172.

**Jungernannia** (Rupp.) L.

1. Leaf cells with trigones; monoicous: perianth abruptly contracted at the apex into a short depressed beak....

   *J. lanceolata*

Leaf cells without trigones; perianth gradually contracted

at the apex ........................................ 2

2. Small species, stems 5-10 mm. long; monoicous.....*J. pumila*

Large species, stems mostly 2-8 cm. long; dioicous.....

   *J. cordifolia*

**Jungernannia lanceolata** L. *Liochlca lanceolata* Nees. 278

On shaded banks. May and June. New Haven: Hamden (1877) and New Haven, J. A. Allen; Oxford, Harger. Labrador west to British Columbia and south to New Jersey, Indiana, and Washington; Europe; Asia; Madeira Islands.

Ref. Eaton, 15, 71. Evans, 28, 171. Ref. Farn. 508
Jungermannia pumila With. 286
On wet rocks, often in brooks. May and June. New Haven: Hamden (1877), J. A. Allen; North Branford, Evans.
Greenland south to Maryland; Europe.
Ref. Evans, 28, 171.

Jungermannia cordifolia Hook. 284
On wet rocks along streams. Hartford: Windsor (1903).
Miss Lorenz.
Greenland west to Alaska and south to New England and Colorado; Europe; Asia; South America.
Ref. Evans, 30, 170.

Jamesoniella (Spruce) Steph.

Jamesoniella autumnalis (DC.) Steph. Jungermannia Schraderi Mart. 272
Greenland to British Columbia and south to Virginia and Missouri; Europe; Asia.
Ref. Eaton, 15, 71. Evans, 28, 171.

Lophozia Dumort.

1. Leaves bidentate or bilobed throughout......................... 2
Leaves tri- or quadridentate, at least on fertile stems, sometimes bidentate on poorly developed stems............ 7
2. Teeth or lobes acute ............................................. 3
Teeth or lobes rounded ......................................... L. inflata
3. Underleaves none; perianth plicate in upper part, and not strongly contracted at the mouth............... 4
Underleaves present; perianth scarcely plicate in upper part, and contracted at the mouth into a short beak... L. Muelleri
4. Dioicus ......................................................... 5
Monoicus (paroicus) ............................................. 6
5. Growing on rocks; leaf cells with small trigones... **L. ventricosa**
Growing on rotten logs; leaf cells with large trigones...

**L. porphyroleuca**

6. Plants with a distinct aromatic odor; leaf cells with
strongly thickened walls .................. **L. bicrenata**
Plants odorless; leaf cells thin-walled, but with small
trigones ............................... **L. excisa**

7. Plants firm, dark green; leaves but little altered when dry
Plants delicate, pale or bright green; leaves strongly
crispate when dry ........................ **10**

8. Teeth of leaves subequal, the lateral margins nearly
straight and of about the same length............... **9**
Apical (or ventral) tooth larger than the others, the cor-
responding lateral margin long and strongly curved...

**L. Lyoni**

9. Gemmae usually abundant, borne on upright flagelliform
shoots with closely appressed leaves........... **L. attenuata**
Gemmae rare, not borne on flagelliform shoots...... **L. barbata**

10. Lobes of leaves more or less toothed ............ **L. incisa**
Lobes of leaves entire........................ **L. marchica**

**Gymnocolus inflatus (Huds.) Dum.**

**Lophozia inflata** (Huds.) M. A. Howe. **368**
On damp shaded rocks. **Tolland**: Bolton, Nichols. **New Haven**: Branford (1892) and Naugatuck, **Evans**.
Greenland to Alaska and south to New Jersey and Cali-
ifornia; Europe; Asia. **Ref. Evans, 28, 172.**

**Lepidocola** M. (Nees in Kunkelbr.) Joerg.

**Lophozia Muelleri** (Nees) Dumort. **385**
In crevices of calcareous rocks. May and June. **Litch-
field**: Salisbury (1897), **Evans**.
Quebec to Connecticut; Europe; Asia.
**Ref. Evans, 32, 35.**

**Lophozia bicrenata** (Schmid.) Dumort. **Jungermannia**

**excisa** of some authors. **348 373**
On rocks, shaded earth, and banks. May and June.
**Litchfield**: Goshen, Underwood. **Tolland**: Bolton and
Vernon, **Nichols**. **Fairfield**: Huntington, **Evans**. **New Haven**: Beacon Falls, **Nichols**; Hamden (1878), **J. A. Allen**;
Meriden, **Evans**; Orange, **J. A. Allen**; Seymour, **Harger**.
Quebec and Ontario south to Pennsylvania and New Jersey; Europe; Asia. Ref. E. e. 812 a, b.

Lophozia excisa (Dicks.) Dumort. 346
Labrador to New England and west to British Columbia; Europe; Asia. The species has been confused in North America with L. bicrenata, and its range is therefore not very definitely known.
Ref. Evans, 33, 73. Miss Haynes, 44, 99, pl. 9, f. 10-13.

Lophozia ventricosa (Dicks.) Dumort. 349
On rocks. Litchfield: Salisbury (1908), Miss Lorenz.
Greenland to Alaska, south to New England, Minnesota, and California; Europe; Asia.

Lophozia porphyroleuca (Nees) Schiffn. 362
On rotten logs. Tolland: Stafford (1906), Nichols.
Greenland to British Columbia, south to New England and Washington; Europe; Asia.
Ref. Evans, 33, 73.

In bogs and on wet sandy soil. May and June. Fairfield: Huntington, Evans. New Haven: East Haven (1892) and Orange, Evans.
New England south to Delaware and West Virginia; Europe.
Ref. Evans, 20, 309; 26, 212; 28, 172. Stephani, 672, 153.

Lophozia incisa (Schrad.) Dumort. 365
Greenland to Alaska, and south to New England, Minnesota, and California; Europe; Asia. Ref. E. e. 812 a, b.
Ref. Evans, 28, 172.
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Lophozia barbata (Schreb.) Dumort. Jungermannia bar-
bata Schreb. 426

On rocks. May and June. LITCHFIELD: Goshen, Under-
wood. HARTFORD: Farmington, Miss Lorens. NEW HAVEN:
East Haven, Evans; Hamden, J. A. Allen; Meriden, Evans;
New Haven (1877), J. A. Allen; Southbury, Harger. MID-
DESEX: Durham, Evans.

Greenland to Yukon, and south to New York and New
Jersey; Europe; Asia. Ref. Eaton, 15, 71. Evans, 28, 172.

Orthocaulis gracilis (Schleich.) Buch. Lophozia attenuata (Mart.) Dumort. L. gracilis
(Schleich.) Steph. 409

On shaded rocks and logs. LITCHFIELD: Salisbury (1892),
Evans.

Greenland to Alaska, south to New England and New
York; Europe; Asia. Ref. Evans, 31, 58.

Triatomaria gracilis erecta (Huds.) Buch. Lophozia Lyoni (Tayl.) Steph. 421

On shaded rocks. NEW HAVEN: Meriden (1890), Evans.
Greenland to Alaska, and south to New England and
Minnesota; Europe; Asia. Ref. Evans, 26, 210; 28, 172.

Sphenolobus (Lindb.) Steph.

Dorsal lobe much smaller than the ventral, often tooth-like
S. exsectus

Lobes subequal .................... S. Michauxii

Triatomaria exsecta (Schmid.) Schütte. 4012 Sarg's
Sphenolobus exsectus (Schmid.) Steph. 417

On shaded rocks. LITCHFIELD: New Milford, Evans.

NEW HAVEN: Branford (1903) and Naugatuck, Evans.
Quebec to British Columbia, south to West Virginia and
Colorado; Europe; Asia. Ref. Evans, 28, 173; 30, 171.

Sphenolobus Michauxii (Web. f.) Steph. 393

On shaded rocks. LITCHFIELD: Salisbury (1892), Evans.
Labrador to British Columbia, south to Virginia and Minnesota; Europe; Asia. Ref. Evans, 31, 58.

Plagiochila Dumort.

Leaves broadly ovate, entire or denticulate, the teeth more than ten .......................... \textit{P. asplenioiides}
Leaves narrowly ovate, sharply dentate, the teeth less than ten .......................... \textit{P. Sullivantii}

Plagiochila asplenioiides (L.) Dumort. Including \textit{P. poreloioides} Nees. 451

On rocks and banks, often in wet localities. May and June.


Newfoundland to Alaska, and south to Virginia, Minnesota, and California; Europe; Asia.


Plagiochila Sullivantii Gottsche. \textit{P. spinulosa} of some authors. 439


New Hampshire to North Carolina.

\textbf{Exsic.} Underwood & Cook, Hep. Amer. No. 111 (as \textit{P. spinulosa}), collected at Naugatuck, Evans, but incorrectly labeled “Beacon Falls.”


\textbf{Mylia} S. F. Gray

\textbf{Mylia anomal}a (Hook.) S. F. Gray. 302

Among Sphagna in bogs. \textbf{Litchfield}: Woodbury, Evans. \textbf{New Haven}: Bethany (1892) and New Haven, Evans.
New Brunswick to Yukon, and south to New Jersey and Washington; Europe; Asia.


Ref. Evans, 28, 172. Underwood, 73, 300.

**Lophocolea** Dumort.

1. Plants growing on wet rocks; leaves gradually narrowed toward the apex and divided into two sharp teeth; dioicous .................................. *L. bidentata*

   Plants growing on banks, rotten logs, or damp rocks; leaves scarcely narrowed toward the apex .................. 2

2. Leaves varying from bifid to truncate and undivided; monoicous (paroicous); gemmae none ........... *L. heterophylla*

   Leaves bidentate; dioicous; gemmae abundant, borne on rudimentary leaves .................. *L. minor*

**Lophocolea bidentata** (L.) Dumort. 2.54


Ontario south to Connecticut and Virginia; Europe; tropical and antarctic America.


Ref. Eaton, 15, 71; Evans, 28, 172.

**Lophocolea heterophylla** (Schrad.) Dumort. Including *L. Austini* Lindb. 2.52


Nova Scotia to British Columbia, and south to North Carolina, Minnesota, and California; Europe; Asia.
Ref. Eaton, 15, 71. Evans, 23, pl. 6; 28, 172.

Lophocolea minor Nees. 256
On shaded banks and rocks, especially in limestone regions.
Ref. Evans, 28, 172.

Chiloscyphus Corda
Leaf cells usually less than 0.03 mm. in diameter; lobes of perianth entire or nearly so.............. C. polyanthus
Leaf cells mostly 0.035-0.04 mm. in diameter; lobes of perianth dentate or lacerate.............. C. pallescens

Chiloscyphus polyanthus (L.) Corda. 241
Labrador to Alaska, and south to New Jersey, Missouri, and California; Europe; Asia.
Ref. Eaton, 15, 70. Evans, 28, 171.

Chiloscyphus pallescens (Ehrh.) Dumort. C. ascendens Sulliv. 247
Ontario to British Columbia, south to New England, New York, and Indiana; Europe; Asia.
Ref. Eaton, 15, 70. Evans, 28, 171; 31, 54.

**Harpanthus** Nees

_Harpanthus scutatus_ (Web. f. & Mohr) Spruce. 458
Labrador west to British Columbia and south to Virginia; Europe; Asia. _Ref_. Eaton, 28, 171.

**Geocalyx** Nees

_Geocalyx graveolens_ (Schrad.) Nees. 462
Nova Scotia to British Columbia, south to Virginia and Washington; Europe; Asia.
Ref. Eaton, 15, 70. Evans, 28, 171.

**Cephalozia** Dumort.

1. Stems bounded by a layer of enlarged cortical cells
2. Stems uniform in cell structure; lobes of leaves obtuse or obtusely pointed ................. _C. fluitans_  
3. Leaves inflated at the base, the segments ending in long slender points ............................................... _C. curvifolia_  
4. Leaves not inflated at the base, the segments acute or acuminate ............................................ 3  
5. Leaves not decurrent, symmetrical, the segments straight or scarcely connivent .......................... _C. bicuspidata_  
6. Leaves more or less decurrent, unsymmetrical, the segments connivent ................................. 4  
7. Leaf cells 0.04-0.045 mm. in diameter ......................... _C. connivens_  
8. Leaf cells 0.02-0.03 mm. in diameter ........................... 5
5. Leaf cells thin-walled; segments of bracts entire or sparingly laciniate ................. C. lunulæfolia

Leaf cells with uniformly thickened walls; segments of bracts dentate or denticulate ............ C. serriflora

Cephalozia curvifolia (Dicks.) Dumort. N.e.(Dicks.) Whltf


Newfoundland to Ontario, south to North Carolina and Minnesota; Europe; Asia. Ref. Faree 498 a 1–.

Ref. Eaton, 15, 71. Evans, 28, 171.

Cephalozia bicuspidata (L.) Dumort. 482


Greenland to Alaska, and south to New England, Minnesota, and California; Asia; northern Africa.


Cephalozia connivens (Dicks.) Lindb. 486


Prince Edward Island to Ontario, and south to Florida; Europe; Asia.


Cephalozia lunulæfolia Dumort.] Cephalozia Lunulæfolia Dumort. 493

North Branford, Evans; North Haven, Nichols. Middlesex: Durham, Evans.

Greenland to Alaska, and south to Florida, Minnesota, and California; Europe; Asia.

Ref. Evans, 28, 171.

Cephalozia serriflora Lindb. C. catenulata of some authors. 492.


Nova Scotia to British Columbia, south to Florida and Louisiana; Europe; Asia.

Ref. Evans, 28, 171; 30, 173.

Cephalozia fluitans (Nees) Spruce. 501

In wet bogs. Litchfield: Salisbury and Woodbury, Evans. NEW HAVEN: Bethany (1888), Harger.

Labrador to British Columbia, south to New Jersey, Minnesota, and Washington: Europe; Asia.


Cephaloziella (Spruce) Schiffn.

Dioicus ......................................... C. divaricata
Monoicous (paroicous) ....................... C. myriantha

Cephaloziella divaricata (Sm.) Schiffn. Cephalozia di-

varicata Dumort.

On damp banks, sandy soil, and rocks. May and June.


Greenland to Alaska, south to Maryland, Minnesota, and California; Europe; Asia.


Ref. Eaton, 15, 71. Evans, 28, 171.

C. Lorensiana Doniu 519

Type local only W. Hartford, 1911.
Cephaloziella myriantha (Lindb.) Schiffn. 535
On sandy soil and rocks. Hartford: East Granby and West Hartford (1907), Miss Lorenz.
New England and New York; range in North America not definitely known; Europe.

Odontoschisma Dumort.
Leaves bordered by one to three rows of rectangular cells; gemmæ none .................................. O. prostratum
Leaves uniform in cell structure; gemmæ usually abundant, borne at the tips of erect shoots with rudimentary leaves O. denudatum

Odontoschisma prostratum (Sw.) Trevis. O. Sphagni of some authors. 470
Southern New England, south into tropical America.
Ref. Eaton, 15, 71. Evans, 28, 172; 29, 344, pl. 19, f. 42-54, pl. 20, f. 55, 57, 59, 60, 63, 64.

Odontoschisma denudatum (Mart.) Dumort.
Greenland to Nova Scotia and Ontario, south into tropical America; Europe; Asia. Ref. Evans, 28, 172; 29, 342, pl. 19, f. 35-38.

Calypogeia Raddi
1. Leaves rounded to obtuse at the apex, rarely bifid or bidentate; leaf cells with a smooth cuticle.......................... 2
Leaves sharply bidentate; leaf cells with a minutely striate-verruculose cuticle ............................................. C. Sullivantii
2. Leaf cells without trigones ................................................ 3
Leaf cells with small but distinct trigones............................ 4
3. Plants robust, growing on banks, earth in woods, or shaded rocks; underleaves bifid about one-third. \textit{C. Trichomanis}

Plants delicate, growing in bogs, underleaves bifid to the middle or beyond \textit{C. tenuis}

4. Growing in bogs; leaves spreading at an angle of about 30° \textit{C. sphagnicola}

Growing on rotten logs; leaves spreading at an angle of about 45° \textit{C. suecica}

\textbf{Calypogeia Trichomanis (L.) Corda. Kantia Trichomanis S. F. Gray. 681}

On shaded banks and earth in woods. May and June.


Labrador to Alaska, and south to North Carolina and California; Europe; Asia. \textit{Ref. Eaton, 15, 70. Evans, 28, 171; 33, 70.}

\textbf{Calypogeia tenuis (Aust.) Evans. Sunk in \textit{C. sphagnicola}}


\textit{Ref. Evans, 33, 69, pl. 73, f. 9-14.}

\textbf{Calypogeia sphagnicola (Arn. & Persss.) Warnst. \& Loeske. 680}

In bogs. Litchfield: New Milford (1906), Evans. The only known locality outside of Europe.

\textit{Ref. Evans, 33, 65.}

\textbf{Calypogeia suecica (Arn. & Persss.) C. Müll. Frib.}

On rotten logs. Tolland: Stafford (1906), Nichols. Maine to Connecticut; Europe; range not yet definitely known. 684

\textit{Ref. Evans, 33, 66.}

Bazzania S. F. Gray

Plants large, the leaves often 2.5 mm. long, broadly ovate, truncate and tridentate at the apex. . . . . . . . . . . . . . . . . . . B. trilobata
Plants smaller, the leaves mostly 0.7 to 1.2 mm. long, ovate, acute or irregularly bidentate or tridentate at the apex

B. tricrenata

Bazzania trilobata (L.) S. F. Gray. *Mastigobryum trilobatum* Nees.


Newfoundland to Ontario, and south to Alabama; Europe; Asia. Ref. Eaton, 15, 70. Evans, 28, 171.

Bazzania tricrenata (Wahl.) Trevis. B. triangularis (Schleich.) Lindb.

Lepidozia Dumort.

1. Leaves divided to the middle or a little beyond into three or four triangular lobes .................. \textit{L. reptans}

Leaves divided almost to the base into three or four setaceous divisions ........................................... 2

2. Underleaves of stem mostly quadrifid with subequal divisions; bracts mostly trifid or quadrifid......... \textit{L. setacea}

Underleaves of stem mostly trifid, one or two of the divisions regularly aborted; bracts mostly bifid........ \textit{L. sylvatica}

\textbf{Lepidozia reptans} (L.) Dumort. 653


Newfoundland to Alaska, and south to Virginia, Minnesota, and California; Europe; Asia. \textit{Ref. J. Arct.} 5-09.

\textsc{Ref.} Eaton, 15, 70. Evans, 28, 172.

\textbf{Lepidozia setacea} (Web.) Mitt. \textit{L. sphagnicola} \textit{Evans}.660

In bogs. May and June. \textsc{New Haven}: Bethany (1892), \textit{Evans}.

Range in North America not definitely known; Europe; Asia.

\textit{Exsic.} Underwood & Cook, Hep. Amer. No. 168 (as \textit{L. sphagnicola}).

\textit{Ref.} Evans, 20, 308, pl. 162; 28, 172; 30, 186.

\textbf{Lepidozia sylvatica} \textit{Evans}. \textit{L. setacea} of some authors. 658


New England to Florida.


**Blepharostoma** Dumort.

**Blepharostoma trichophyllum** (L.) Dumort. 191

On shaded banks and rocks, also on rotten logs. May and June. **TOLLAND:** Stafford, Nichols. **FAIRFIELD:** Sherman, Evans. **NEW HAVEN:** Beacon Falls, Evans; New Haven, J. A. Allen; Orange, Evans. **MIDDLESEX:** Killingworth (1875), Hall.

Greenland to Alaska, and south to New Jersey, Colorado, and California; Europe; Asia. Ref. Eaton, 15, 70. Evans, 28, 171.

**Ptilidium** Nees

Stems erect or ascending; stem leaves distant or loosely imbricated .................................................. **P. ciliare**

Stems prostrate; stem leaves densely imbricated........... **P. pulcherrimum**

**Ptilidium ciliare** (L.) Nees. **Blepharozia ciliaris** Dumort. 198

On earth among rocks. May and June. **LITCHFIELD:** Cornwall and Goshen, Underwood. **NEW HAVEN:** East Haven, Evans; Hamden (1877), J. A. Allen; Meriden, Miss Lorenz. **MIDDLESEX:** Durham, Evans. **NEW LONDON:** Norwich, C. B. Graves.

Greenland to Alaska, and south to New England and Minnesota; Europe; Asia. Ref. Eaton, 15, 70. Evans, 28, 172; 32, 44.

**Ptilidium pulcherrimum** (Web.) Hampe. Included under **P. ciliare** by many writers. 199

On shaded rocks, trunks of trees, and rotten logs; rarely on banks rich in humus. May and June. **LITCHFIELD:** Cornwall and Goshen, Underwood; New Milford and Salisbury, Evans. **HARTFORD:** Burlington and Canton, Nichols; TOLLAND: Ellington, Pease; Stafford, Nichols. **WINDHAM:** Canterbury, Mrs. Hadley. **FAIRFIELD:** Redding and Sherman, Evans. **NEW HAVEN:** Beacon Falls, Evans; Bethany, Ham-

Nova Scotia to Alaska, and south to Virginia, Minnesota, and Montana; Europe; Asia.

Ref. Evans, 32, 43.

Trichocolea Dumort. Propter fr canes. (R. 57)

Trichocolea tomentella (Ehrh.) Dumort. 202


Newfoundland to Ontario, and south to North Carolina; Europe; Asia. Ref. Eaton, 15, 70. Evans, 28, 173.

Ref. Eaton, 15, 70. Evans, 28, 173.

Diplophyllleia Trevis.

Diplophyllleia apiculata Evans. Scapania albicans var. taxifolia (Wahl.) Aust. Scapania albicans var. taxifolia minor Aust. 569


Southern New England to Georgia.


Diplophylleia taxifolia (Wahl.) Trevis. 583

Scapania Dumort.

1. Ventral lobe obtuse, acute, or apiculate, mostly entire. 2
   Ventral lobe rounded .......................... 3

2. Growing on earth or rocks; stems usually less than 2 cm. long. S. curta
   Growing in bogs; stems mostly 2-10 cm. long. S. irrigua

3. Growing on rocks or banks; leaves mostly toothed or ciliate
   Growing on wet rocks, usually in streams; leaves mostly entire, the dorsal lobe arching beyond stem; leaf cells thin-walled S. undulata

4. Bright green, varying to yellowish or brownish; dorsal lobe arching beyond stem; leaf cells with uniformly thickened walls except near base; leaf margins mostly ciliate S. nemorosa
   More or less tinged with red; dorsal lobe scarcely arching across stem; leaf cells with thin walls but with more or less evident trigones; leaf margins mostly dentate S. dentata

Scapania curta (Mart.) Dumort. 601
On rocks. New Haven: Meriden (1907), Miss Lorenz.
Greenland to Alaska, south to Maryland and California; Europe; Asia.

Scapania irrigua (Nees) Dumort. 607
Greenland to Alaska, south to New Jersey and British Columbia; Europe; Asia.
Exsic. Underwood & Cook, Hep. Amer. No. 190 (Bethany, F. Bement, incorrectly labeled, "Lebanon, Ct.").
Ref. Evans, 28, 172. Müller, 60, 80.
Scapania nemorosa (L.) Dumort. 69

Scapania dentata Dumort. Smile in S. undulata, f&. On damp rocks. Hartford: Burlington (1908), Nichols. New England, Minnesota, Montana, British Columbia, and California; Europe; Asia; range in North America not definitely known. Ref. 32.

Scapania undulata (L.) Dumort. 628
Greenland to Alaska, south to Florida, Missouri, and California; Europe; Asia. Ref. 33a, b.
Ref. Evans, 28, 173. Müller, 60, 133.

Radula Dumort.
1. Plants pale or bright green; ventral lobes of stem leaves not arching across axis, attached by a long and almost longitudinal line; leaf cells thin-walled throughout or with very indistinct trigones; monoicous (usually paroicous) ........................................... 2
Plants often tinged with brown; ventral lobes of stem leaves arching partially or wholly across the axis, and attached by a short oblique line; leaf cells with distinct trigones; dioicous .......................... R. tenax

2. Subfloral innovations usually none .................. R. complanata
   Subfloral innovations single or double ............... R. obconica

Radula complanata (L.) Dumort. 70 2
   Ref. Eaton, 15, 70. Evans, 28, 172.
   Quebec to Alaska, south to Florida, Louisiana, and California; Europe; Asia; northern Africa.

Radula obconica Sull. 70 0
   Connecticut west to Ohio and south to Georgia.
   Ref. Evans, 26, 213: 28, 172.

Radula tenax Lindb. 6 9
   New England to North Carolina.
   Ref. Evans, 28, 172.

Porella (Dill.) L.
1. Ventral lobes lingulate-oblong, closely appressed to the stem or to the dorsal lobes ..................... P. pinnata
   Ventral lobes broadly ovate to oblong ................ 2
2. Ventral lobes slightly or not at all decurrent; underleaves contiguous or slightly imbricated ................ P. platyphylla
   Ventral lobes long-decurrent; underleaves distant .... P. rivularis
Porella pinnata L. Madotheca Porella Dumort. \[\text{715}\]


Nova Scotia to Ontario, south to Georgia and Louisiana; Europe.


Porella platyphylla (L.) Lindb. Madotheca platyphylla Dumort. \[\text{717}\]


Nova Scotia west to Alaska and south to Georgia and Missouri; Europe; Asia; northern Africa.


Porella rivularis (Nees) Trevis. \[\text{731}\] P. cordacana \(\text{Hib}^{\text{b}}\)

On shaded rocks. New Haven: Cheshire (1856), Eaton. Connecticut and Ohio, south to Texas and New Mexico, west to California, British Columbia, and Alaska; Europe.


Cololejeunea (Spruce) Schiffn.

Cololejeunea Biddlecomiae (Aust.) Evans. Lejeunea echinata and L. calcarea of some authors. \[\text{845}\]

Cololejeunea (Spruce) Schiffn.

New England to Ontario, south to Florida and Alabama.


**Lejeunea Libert**


New England west to Ontario and Minnesota and south to Pennsylvania; Europe; Asia.


**Leucolejeunea Evans**


Southern New England and New York, south to Georgia and Louisiana.


**Jubula Dumort.**

*Jubula pennsylvanica* (Steph.) *Evans*. *Frullania* and *Jubula Hutchinsiae* of some authors.

72


**Frullania** Raddi

1. Ventral lobes about as broad as long; leaves without ocelli
   Ventral lobes distinctly longer than broad; leaves with ocelli

   2. Underleaves cordate at base..............................F. plana
      Underleaves not cordate at base..........................3

   3. Leaves strongly squarrose when moist..............F. squarrosa
      Leaves scarcely or not at all squarrose..............4

   4. Ventral lobes usually explanate.......................F. riparia
      Ventral lobes usually inflated........................5

   5. Underleaves dentate or crenate above the middle..F. Brittoniae
      Underleaves entire or unidentate on the sides.F. eboracensis

   6. Dorsal lobes rounded or very obtuse..............F. Asagrayana
      Dorsal lobes more or less sharp-pointed.............F. Tamarisci

**Frullania riparia** Hampe. 774


Ref. Evans, 22, pl. 5, f. 1, 4, 5; 28, 171.

**Frullania squarrosa** (R. Bl. & N.) Dumort.

On rocks and trees. New Haven: East Haven (1890), Evans. 776
Connecticut to Ohio, and south into the tropics of South America; Asia; Africa; Australia.

**Frullania Brittoniae** Evans. 772

New England west to Illinois, south to Virginia.

**Frullania eboracensis** Gottsche. Including *F. virginica* Gottsche.771

Nova Scotia to Manitoba, south to Florida.
Ref. Eaton, 15, 69. Evans, 28, 171; 32, 44.

**Frullania plana** Sull. 740

On shaded rocks. New Haven: Woodbridge (1890), Evans.
Connecticut and New York, south to New Jersey and Tennessee.

**Frullania Asagrayana** Mont. Sometimes called *F. Grayana*. 751

On rocks and trees. Litchfield: New Milford and Salisbury, Evans. Tolland: Stafford, Nichols. Windham: Can-
Newfoundland to Ontario, south to Georgia.

Frullania Tamarisci (L.) Dumort. 7448
Newfoundland to Connecticut; Europe; Asia. Range not definitely known in North America.
Ref. Evans, 33, 72.

ORDER ANTHOCEROTALES
FAMILY ANTHOCEROTACEÆ
Capsule scarcely projecting beyond the basal sheath; wall without stomata ........................................ Notothylas
Capsule projecting far beyond the basal sheath; wall with distinct stomata ..................................... Anthoceros

Notothylas Sull.
Notothylas orbicularis (Schwein.) Sull. N. valvata Sull.
New England to Indiana, south to North Carolina; South America (Galapagos Islands); Europe. Exsic. Underwood & Cook, Hep. Amer. No. 65.

Anthoceros (Mich.) L.
Spores yellow .............................................. A. levis
Spores dark brown or black .............................. A. punctatus

Anthoceros levis L.
On moist ground and damp or wet rocks. Aug.-Nov. Litchfield: Goshen, Underwood. New Haven: Hamden
#4321 Coney Rock. Willow String House

New England and Ontario, south to the Gulf States and Mexico and west to Iowa; Europe; Asia.


**Anthoceros punctatus** L.


Nova Scotia to Ohio, south to Florida and Louisiana; Europe.

Ref. Evans, 28, 173. Howe, 48, 16.

**[Subclass Musci]**

**ORDER SPHAGNALES**

**FAMILY SPHAGNACEÆ**

**Sphagnum** (Dill.) L.

1. Cortical cells of stem and branches without spiral fibrils; branch leaves mostly truncate and toothed or fringed at the apex ............................................. 2

   Cortical cells of stem and branches with spiral fibrils and pores; branch leaves densely imbricated, cucullate at the apex, not truncate, entire (Cymbifolia, p. 80)............. 28

2. Branches in fascicles of 3-6.............................. 3

   Branches in fascicles of 7-14; chlorophyll cells of branch leaves elliptical in cross section and enclosed toward both surfaces of the leaf by the hyaline cells* (Polyclada, p. 81).................................. **S. Wulfianum**

3. Chlorophyll cells mostly triangular to trapezoidal in cross section, either free at both surfaces of the leaf or enclosed toward one leaf surface by the hyaline cells, but always with the base free toward one of the two leaf surfaces ............................................. 4

* What is said here regarding the form and position of the chlorophyll cells refers always to median cross sections of leaves taken from the middle of one of the spreading branches.
No. 11.] THE BRYOPHYTES OF CONNECTICUT.

Chlorophyll cells elliptical, spindle-shaped, or rectangular in cross section, not triangular or trapezoidal (except in *S. dasyphyllum*) ........................................ 20

4. Base toward the inner surface of the leaf; hyaline cells strongly convex toward the outer surface; branch leaves erect (*Acutifolia*, p. 83) ........................................ 5

   Base toward the outer surface of the leaf; hyaline cells usually strongly convex toward the inner surface... 13

5. Stem leaves lacerate-fringed at the broadly rounded apex, without fibrils ........................................ 6

   Stem leaves more or less truncate and toothed at the apex, not fringed ........................................ 7

6. Stem leaves broadened above, spatulate, apex and upper margins fringed; monoicous .................... *S. fimbriatum*

   Stem leaves not broadened above, lingulate, fringed only at the apex; dioicous .................... *S. Girgensohniu*

7. Stem leaves lingulate, fibrils usually absent, though sometimes present in the upper part of the leaf. .......... 8

   Stem leaves triangularly lingulate to equilaterally triangular, usually with fibrils ........................... 10

8. Plants usually red, never brown ............................... 9

   Plants usually brown, never red; pores as in *S. Warnstorfii*; stem leaves without fibrils .................... *S. fuscum*

9. Pores present on outer surface of the branch leaves, small, round, and situated in the cell angles; stem leaves without fibrils ........................................ *S. Warnstorfii*

   Pores present on outer surface of the lower branch leaves, large, more or less semicircular, and situated along the lateral margins of the cells; stem leaves frequently with fibrils ........................................ *S. rubellum*

10. Branch leaves when dry distinctly 5-ranked; outer wall of cortical cells in stem often with irregular pores in the upper ends of the cells .................. *S. quinquefariurn*

   Branch leaves when dry not arranged in distinct rows... 11

11. Stem leaves with fibrils and pores; branch leaves not glossy when dry ........................................ 12

   Stem leaves mostly without fibrils or pores; branch leaves glossy when dry; cortical cells of stem seldom with pores; hyaline cells of stem leaves usually 2-6-septate *S. subnitens*

12. Outer wall of cortical cells in stem often with irregular pores in the upper ends of the cells; hyaline cells of stem leaves not divided, or, if so, uniseptate. *S. acutifolium*

   Cortical cells in stem without pores; hyaline cells of stem leaves copiously divided by oblique walls .......... *S. tenerum*
13. Chlorophyll cells narrowly trapezoidal or rectangular in cross section, free at both surfaces, but with the surface walls strongly thickened (Squarrosa, p. 81) .......... 14

Chlorophyll cells with the free walls scarcely, if at all, thickened; branch leaves erect-spreading* (Cuspidata, p. 82) ................................................................. 15

14. Plants large, monoicous; branch leaves mostly squarrose from the middle ...................... S. squarrosum

Plants medium-sized, dioicous; branch leaves more or less imbricated, not squarrose ...................... S. teres 15

15. Chlorophyll cells triangular in cross section, often enclosed toward the inner leaf surface by the hyaline cells...... 17

Chlorophyll cells trapezoidal in cross section and free on both surfaces ................................................................. 16

16. Pores numerous on outer surface of the branch leaves, frequently large and usually in rows.............. S. Dusenii

Pores mostly lacking on outer surface of the branch leaves, when present, small and restricted to the angles of the cells ................................................................. S. cuspidatum 17

17. Cortex well differentiated from the central strand ......... 18

Cortex not well differentiated from the central strand.... 19

18. Stem leaves lacerate-fringed at the apex....... S. Pulchricoma

Stem leaves toothed at the apex.................. S. Torreyanum 19

19. Pores on outer surface of the branch leaves in the apical half restricted to the angles of the cells...... S. recurvum

Pores on outer surface of the branch leaves in the apical half occurring in the angles and also along the lateral margins of the cells............................... S. parvifolium 20

20. Chlorophyll cells enclosed toward one or both surfaces of the leaf by the hyaline cells, elliptical or spindle-shaped in cross section; branch leaves squarrose from the middle (Rigida, p. 81) ................................................................. 21

Chlorophyll cells free toward both surfaces of the leaf; branch leaves more or less secund or falcate (Sub-secunda, p. 85) ................................................................. 22

21. Chlorophyll cells elliptical in cross section and enclosed toward both leaf surfaces by the hyaline cells...... S. compactum

Chlorophyll cells spindle-shaped in cross section and enclosed toward the inner surface of the leaf by the hyaline cells; the outer wall free, but very strongly thickened .......................................... S. Garberi 21

* S. dasycladum may be looked for here.
22. Chlorophyll cells trapezoidal in cross section; the walls not thickened, and the broad base toward the outer surface of the leaf; hyaline cells strongly convex toward the inner surface ...................... S. dasyphyllum
Chlorophyll cells barrel-shaped to rectangular in cross section, equally free toward both surfaces, and with the free walls usually thickened ...................... 23
23. Cortex of stem consisting of 2-several layers of cells.... 24
Cortex of stem consisting of one layer of cells............. 25
24. Stem leaves small, not more than 1 mm. long, fibrils present only near the apex; branch leaves secund....... S. contortum
Stem leaves larger, 1.5-2 mm. long, fibrils usually abundant throughout; branch leaves not secund....... S. platyphyllum
25. Branch leaves with many pores, at least on the outer surface; pores frequently in bead-like rows......... 26
Branch leaves with very few or no pores................. S. obesum
26. Pores few or lacking on the inner surface............. 27
Pores numerous on both surfaces, especially on the outer; stem leaves 1-2 mm. long......................... S. rufescens
27. Stem leaves less than 1 mm. long, hyaline cells rarely septate .................................. S. subsecundum,
Stem leaves 1-1.5 mm. long, hyaline cells often septate S. inundatum
28. Chlorophyll cells of branch leaves usually free toward both surfaces of the leaf............................ 29
Chlorophyll cells of branch leaves enclosed by the hyaline cells, equidistant from both surfaces of the leaf, and elliptical in cross section; hyaline cells smooth or faintly papillose on the lateral walls........... S. medium
29. Chlorophyll cells triangular or trapezoidal in cross section, the base toward the inner surface of the leaf and not thickened; hyaline cells strongly convex toward the outer surface ........................................... 30
Chlorophyll cells more or less elliptical in cross section, cell cavity almost central, and both surface walls strongly thickened; hyaline cells more strongly convex toward the outer surface of the leaf than toward the inner surface, and papillose on the lateral walls...... S. papillosum
30. Chlorophyll cells broadly triangular to trapezoidal; hyaline cells with irregular bands of thickening on the lateral walls .............................................. S. imbricatum
Chlorophyll cells narrowly triangular; hyaline cells smooth on the lateral walls.............................. S. cymbifolium
Sphagnum imbricatum Hornsch.


Var. affine (Ren. & Card.) Warnst.


Var. subleve Warnst.

LITCHFIELD: Salisbury, Nichols. NEW HAVEN: New Haven (1891), Evans. Newfoundland and Labrador to Alaska, south to Louisiana; Europe; Asia.


Ref. Andrews, i, 62.

Sphagnum cymbifolium Ehrh. (=: palustre L.)


Sphagnum papillosum Lindb.

TOLLAND: Stafford, Nichols. NEW HAVEN: East Haven (1891), Evans.
Newfoundland and Labrador to Alaska, south to Alabama and Washington; Europe.

_Sphagnum medium_ Limpr. (= _moellerianum_ Brid.)


Newfoundland and Labrador to Alaska, south to Florida; South America; Europe; Asia.

Exsic. Eaton & Faxon, _Sphag. Bor.-Amer._ Nos. 166 (var. _roseum_), 167 (var. _purpurascens_), and 168 (var. _versicolor_).

Ref. Andrews, i, 63.

**Rigida**

_Sphagnum compactum_ DC.

In wet woods. _New Haven:_ Beacon Falls (1907), _Nichols_.

Arctic America, Canada, and the northern United States; Europe; Asia; Madeira Islands.

_Sphagnum Garberi_ Lesq. & James var. _squamulosum_ Warnst. = _S. strictum_ Swell.

_New Haven:_ Naugatuck (1905), _Evans_.

Newfoundland to Florida; Europe.

**Polyclada**

_Sphagnum Wulfianum_ Girgens.

In swampy woods. _Litchfield:_ Salisbury (1907), _Nichols_; Winchester, _Miss Lorenz_.

Greenland to Connecticut, westward to the Rocky Mountains; Europe; Asia.

**Squarrosa**

_Sphagnum squarrosum_ Pers. var. _spectabile_ Russ.

Deep wooded swamps. _Litchfield:_ Salisbury (1907), _Nichols_.*

* _S. squarrosum_ was reported from Hamden by Hall in the Berzelius List (Eaton, 15, 68), but the specimens have been lost sight of.
Arctic America, Canada, and the northern United States; Europe; Asia; Azores.

**Sphagnum teres** (Schimp.) Aongstr.


Arctic America, Canada, and the northern United States; Europe; Asia.

**Cuspidata**

*Sphagnum Pulchricoma* C. Müll.


Connecticut to Florida and Louisiana; South America; Africa.


Newfoundland and Labrador to Alaska, south to the Gulf of Mexico; a cosmopolitan.


*Ref. Andrews*, i, 63.

*Sphagnum parvifolium* (Sendt.) *Warnst.* (not found in *E.R.*).

*Litchfield*: Salisbury (1907), *Nichols*.

Probably has the same range as *S. recurvum*.
**Sphagnum Dusenii** C. Jens.
Litchfield: Salisbury (1907), Nichols.
Newfoundland and Quebec to Connecticut and New York; Europe; Asia.

**Sphagnum cuspidatum** Ehrh.
Var. *falcatum* Russ. *Deer. in Brevia. p. 83*
New Haven: Bethany and Hamden (1892), Evans.
Var. *plumosum* Nees & Hornsch. *Deer. in E. C. p. 84*
New Haven: Bethany and Hamden (1891), Evans.
Newfoundland to the Gulf of Mexico; a cosmopolitan.
Ref. Andrews, 1, 62.

**Acutifolia**

**Sphagnum fimbriatum** Wils.
New Haven: Hamden (1891), Evans.
Arctic America, Canada, and the northern United States; South America; Europe; Asia.
Exsic. Eaton & Faxon, Sphag. Bor.-Amer. No. 11 (var. *tenue*).
Ref. Andrews, 1, 62.

**Sphagnum Girgensohni** Russ.
Litchfield: Norfolk (1875), Eaton; Salisbury, Nichols.
Arctic America, Canada, and the northern United States; Europe; Asia.

**Sphagnum rubellum** Wils. *S. tenellum* (Schimp.) Klinggr.
Newfoundland and Labrador to Connecticut, westward to Alaska; Europe.


**Sphagnum Warnstorffii** Russ.


Newfoundland to Connecticut, westward to the Pacific; Europe.

Ref. Andrews, i, 63. Cardot, ii, 419.

**Sphagnum fuscum** (Schimp.) Klinggr.


Canada and the northern United States; Europe.

Exsic. Eaton & Faxon, Sphag. Bor.-Amer. No. 35.


**Sphagnum quinquefarium** (Lindb.) Warnst.

New Haven: Hamden and New Haven (1890), *Evans*.

Newfoundland to Connecticut, and southward along the Alleghany Mountains; Europe.


**Sphagnum subnitens** Russ. & Warnst.


Var. flavicomans (Card.) Warnst. = \( S. flavicomans \)

New Haven: Bethany, East Haven (1891), and New Haven, *Evans*.

Newfoundland to New Jersey; Alaska; Azores; Europe; Asia; the variety found only in North America.

Exsic. Eaton & Faxon, Sphag. Bor.-Amer. Nos. 51 (var. flavicomans) and 54 (var. obscurum).

Sphagnum tenerum (Aust.) Warnst.
New Haven: East Haven and Hamden (1891), Evans; New Haven, Eaton.
Newfoundland to New Jersey; Europe.
Exsic. Eaton & Faxon, Sphag. Bor.-Amer. No. 60.

Sphagnum acutifolium Ehrh.
Exsic. Eaton & Faxon, Sphag. Bor.-Amer. Nos. 40 (var. rubrum), 44 (var. versicolor), 48 (var. viride), and 50 (var. roseum).
Ref. Andrews, i, 62.

Subsecunda

Sphagnum dasyphyllum Warnst.
New Haven: New Haven (1891), Evans. This is the only known locality.

New Hampshire to Virginia; Europe.

Sphagnum contortum Schultz. S. loricinum Spruce.
Massachusetts to Pennsylvania and probably southward; Europe.


**Sphagnum platyphyllum** (Lindb.) Warnst.

Massachusetts to Ohio; Europe.
Ref. Andrews, i, 63.

**Sphagnum subsecundum** Nees.


Newfoundland to Ohio and Alabama; Europe; Asia.
Exsic. Eaton & Faxon, Sphag. Bor.-Amer. Nos. 130 (var. macrophyllum) and 134 (var. mesophyllum).
Ref. Andrews, i, 63.

**Sphagnum inundatum** Russ.


Range probably the same as that of *S. subsecundum*.

**Sphagnum rufescens** (Nees & Hornsch.) Warnst.

Frequently submerged. New Haven: Hamden (1891) and New Haven, Evans; Oxford, Eaton; Woodbridge, Evans.

Newfoundland and Labrador to Alabama; Europe.
Ref. Andrews, i, 63. Eaton, 18, 7.

**ORDER ANDREÆALES**

**FAMILY ANDREÆACEÆ**

**Andreæa** Ehrh.

Midrib present ........................................... A. Rothii
Midrib wanting ........................................... A. petrophila
Andreaea petrophila Ehrh.

On non-calcareous rocks in mountainous or hilly regions. Summer. Hartford: Bloomfield, Miss Lorenz. New Haven: Meriden, Miss Lorenz; Woodbridge (1878), J. A. Allen.

Arctic America, Canada, and the northern United States; South America; Europe; Asia; Tasmania; New Zealand.

Andreaea Rothii Web. f. & Mohr.


Newfoundland to Alabama and Tennessee; Greenland; Europe.


ORDER BRYALES

Sporophyte borne at the apex of the stem or of a more or less elongated branch............ACROCARPI, p. 87

Sporophyte borne on a very short branch...PLEUROCARPI, p. 91

[ACROCARPI]

1. Capsule almost never opening by means of a lid........ 2
   Capsule opening by means of a clearly defined lid........ 8

2. Green protonema persistent; plants fruiting in autumn.... Ephemerum, p. 116

Green protonema not persistent; plants fruiting in spring 3

3. Spores few (16-20) and very large, sometimes 0.2 mm. in diameter ............................................... Archidium, p. 95
   Spores numerous and small, rarely more than 0.05 mm. in diameter ...................................................... 4

4. Leaf margins plane or involute .................................. 5
   Leaf margins more or less revolute............................ 7

5. Capsule pyriform ............................................ Bruchia, p. 95
   Capsule ovoid-globose ........................................ 6

6. Leaves smooth ............................................. Pleuridium, p. 96
   Leaves papillose; a rudimentary lid present but persistent Astomum, p. 106
7. Leaves smooth, eroso-denticulate at the apex  
   Acaulon, p. 108
   Leaves papillose, entire  
   Phascum, p. 108
8. Peristome, when present, with articulate teeth  
   9
   Peristome teeth not articulate  
   53
9. Peristome present  
   10
   Peristome none  
   48
10. Leaves in 2 ranks, clasping at the base, and with a prominent dorsal wing  
    Leaves in 3 or more ranks, not clasping at the base or winged  
    11
    12
11. Plants flaccid, aquatic, floating  
    Octodiceras, p. 105
    Plants not flaccid, sometimes submerged, but not floating  
    Fissidens, p. 103
12. Leaves with a single layer of small chlorophyll cells enclosed by two or more layers of large hyaline cells  
    Leucobryum, p. 102
    Leaves mostly with a single layer of uniform cells  
    13
13. Peristome single, consisting of 16 or 32 teeth; teeth usually without a median longitudinal line on the outer surface  
    Peristome double, the outer more or less thickened and consisting of 16 teeth, the inner thin and divided into segments or cilia or both; teeth with a distinct median longitudinal line on the outer surface  
    14
    33
14. Capsule with 8 longitudinal ridges of differentiated cells  
    Rhabdoweisia, p. 99
    Capsule smooth or, when plicate, the epidermis of uniform cell structure  
    15
15. Peristome teeth with very minute longitudinal striations on the outer surface  
    Peristome teeth without longitudinal striations on the outer surface, smooth or papillose  
    16
    19
16. Alar cells large, hyaline or brown  
    Alar cells not differentiated  
    17
    18
17. Leaves tufted; capsule distinctly strumose; monoicous  
    Oncophorus, p. 99
    Leaves regularly secund; capsule not strumose or obscurely so; dioicous  
    Dicranum, p. 100
18. Lamina of leaves strongly papillose  
    Dichodontium, p. 99
    Lamina of leaves smooth  
    Dicranella, p. 98
19. Peristome distinctly twisted, teeth 32  
    Peristome not twisted, teeth 16, often deeply cleft  
    20
    22
20. Midrib with 2 median guides, upper band of stereid cells lacking ........................................Tortula, p. 109
    Midrib with several (4-8) median guides and 2 bands of stereid cells ........................................ 21
21. Leaf margins revolute, at least below the middle..............Barbula, p. 108
    Leaf margins plane, not revolute..........................Tortella, p. 107
22. Calyptra mitrate .............................................. 23
    Calyptra cuculate ........................................... 27
23. Calyptra plicate ............................................... 24
    Calyptra not plicate ........................................ 25
24. Calyptra smooth; teeth distantly articulate...................... Glyphomitrium, p. 110
    Calyptra hairy; teeth closely articulate.................Orthotrichum, p. 113
25. Beak long, clavate ............................................Encalypta ciliata, p. 110
    Beak apiculate to aciculate .................................. 26
26. Teeth narrowly cleft nearly to the base.........................Racomitrium, p. 112
    Teeth subentire, cribrose or irregularly cleft..............Grimmia, p. 111
27. Teeth of peristome arising from a distinct basal membrane 28
    Teeth of peristome not arising from a basal membrane .... 31
28. Teeth short; leaves papillose on upper surface .................Didymodon, p. 108
    Teeth long; leaves mostly smooth.............................. 29
29. Capsule inclined, distinctly plicate when dry; leaf cells roundish quadrate above ......................Ceratodon, p. 97
    Capsule erect, smooth or slightly plicate when dry; leaf cells more or less elongated above ............. 30
30. Leaves glaucous .................................................Saelania, p. 97
    Leaves bright or dark green, glossy........................Ditrichum, p. 96
31. Plants growing on trees........................................Drimondia, p. 113
    Plants growing on earth or rocks.................................. 32
32. Leaf margins strongly involute above, entire..................Weisia, p. 106
    Leaf margins plane, minutely crenulate......................Trichostomum, p. 107
33. Inner peristome without a basal membrane........................ 34
    Inner peristome with a distinct carinate basal membrane .... 37
34. Calyptra cuculate ..............................................Funaria, p. 117
    Calyptra mitrate ............................................. 35
35. Calyptra not plicate, smooth, entirely enclosing and extending below the base of the capsule ..........Encalypta contorta, p. 110
    Calyptra plicate, usually hairy and partially enclosing the capsule ........................................... 36
36. Leaves usually crispate when dry, base oval; stomata in neck of capsule, always superficial. ... *Ulota*, p. 115
Leaves not crispate when dry, base not oval; stomata in neck and upper part of capsule, mostly immersed. ... *Orthotrichum*, p. 113

37. Capsule distinctly ribbed when dry. 38
Capsule smooth, not ribbed when dry. 41

38. Capsule ovoid-cylindrical. *Aulacomnium*, p. 125
Capsule subglobose. 39

Cilia none, or very rudimentary. 40

40. Leaf cells smooth. *Plagiopus*, p. 126
Leaf cells papillose. *Bartramia*, p. 127

41. Leaves papillose on upper surface. *Timmia*, p. 127
Leaves smooth. 42

42. Inner peristome 2-3 times as long as the outer, cilia rudimentary. *Meesea*, p. 126
Inner peristome about as long as the outer, cilia well developed. 43

43. Cilia appendiculate. 44
Cilia smooth or nodose, not appendiculate. 46

44. Leaf cells narrow, linear-rhomboidal above. *Leptobryum*, p. 117
Leaf cells rhomboidal-hexagonal, never linear. 45

45. Plants stoloniferous; capsules clustered. *Rhodobryum*, p. 120
Plants not stoloniferous; capsules borne singly. *Bryum*, p. 119

46. Upper leaves ovate; cells broadly polygonal, never linear. *Mnium*, p. 121
Upper leaves linear-lanceolate; cells narrowly polygonal to linear above. 47

47. Leaves glaucous green; annulus none. *Mniobryum*, p. 118
Leaves green to golden yellow, often glossy; annulus present. *Pohlia*, p. 118

48. Plants growing on rocks or in crevices. 49
Plants growing on earth. 51

49. Leaves without a midrib; stalk less than 1 mm. long; lid apiculate. *Hedwigia*, p. 128
Leaves with a midrib; stalk 2-10 mm. long; lid rostrate. 50

50. Usually growing on calcareous rocks; capsule smooth. *Hymenostylium*, p. 106
Usually growing on non-calcareous rocks; capsule ribbed. *Anecestangium*, p. 112
No. 11.] THE BRYO PHYTES OF CONNECTICUT. 91

51. Leaf cells isodiametric above the middle; calyptra cucullate ........................................ Pottia, p. 109
Leaf cells elongated above the middle; calyptra mitrate 52

52. Stalk almost lacking ..................................... Aphanorrhegma, p. 117
Stalk long (to 2 cm.) ........................................ Physcomitrium, p. 117

53. Capsule symmetrical or nearly so .......................... 54
Capsule strikingly unsymmetrical .......................... 57

54. Teeth of peristome 4 ...................................... Georgia, p. 172
Teeth of peristome 32 or 64 .................................. 55

55. Calyptra cucullate, nearly smooth ........................... Catharinæa, p. 172
Calyptra mitrate, densely hairy ............................. 56

56. Capsule without stomata, cylindrical ........................ Pogonatum, p. 174
Capsule with stomata, prismatic or cylindrical .............. Polytrichum, p. 174

57. Capsule sessile; leaves green and conspicuous .. Webera, p. 171
Capsule raised on a thick, red stalk; leaves colorless and very minute ................................. Buxbaumia, p. 172

[Pleurocarpi]

1. Leaves distichous ........................................ Fissidens, p. 103
Leaves in 3 or more ranks ................................... 2

2. Segments of inner peristome rudimentary or filiform, not split; cilia none ............................... 3
Segments of inner peristome distinctly carinate, often split along the keel ................................. 10

3. With a distinct, carinate basal membrane, segments very rudimentary; leaves papillose ............... Thelia, p. 135
Without a basal membrane; leaves smooth or nearly so .......................... 4

4. Segments connected, at least in the apical region, by transverse bands .................................. 5
Segments entirely free, sometimes very rudimentary ...... 6

5. Leaves with an excurrent midrib .......................... Dichelyma, p. 130
Leaves without a midrib ...................................... Fontinalis, p. 128

6. Leaves complanate, transversely undulate ...... Neckera, p. 131
Leaves spreading, not transversely undulate .................. 7

7. Plants soft, often forming wide, velvety tufts; capsule strikingly contracted below the mouth when dry ...... Anacamptodon, p. 134
Plants coarse, growing in lax, frequently pendent tufts; capsule not contracted below the mouth when dry ...... 8

8. Leaves with a midrib ....................................... 9
Leaves without a midrib ..................................... Leucodon, p. 130
9. Branches terete; capsule immersed. \[Cryphaea, p. 130\]  
Branches flattened; capsule emergent on a short stalk. \[Forrststroemia, p. 131\]

10. Leaves mostly rough-papillose. \[11\]  
Leaves smooth, rarely slightly papillose at the cell angles. \[21\]

11. Capsule symmetrical, erect or nearly so. \[12\]  
Capsule unsymmetrical, arcuate \[16\]

12. Leaves with a midrib, margin usually entire. \[13\]  
Leaves without a midrib \[15\]

13. Midrib extending nearly to apex of leaf. \[14\]  
Midrib vanishing at middle of leaf or below. \[Haplohyemenium, p. 136\]

14. Primary stem stoloniform; stem leaves minute. \[Anomodon, p. 137\]  
Stem not stoloniform; stem and branch leaves uniform \[Leskea, p. 138\]

15. Plants glaucous green, branches julaceous; leaves closely imbricated; cilia two. \[Myurella, p. 136\]  
Plants light green, branches slightly flattened; leaves loosely appressed; cilia none. \[Schwetschkeopsis, p. 132\]

16. Monoicous. \[17\]  
Dioicous. \[20\]

17. Stem and branch leaves differing in size and shape; leaf cells with several minute papillae. \[18\]  
Stem and branch leaves similar in size and shape; leaf cells with one, rarely two papillae, or smooth. \[19\]

18. Lid short-rostrate; paraphyllia multiform. \[Rauia, p. 139\]  
Lid long-rostrate; paraphyllia simple. \[Thuidium, p. 140\]

19. Leaf cells smooth or lightly papillate; plants of swampy woods or meadows. \[Elodium, p. 142\]  
Leaf cells strongly papillate on both surfaces; plants of moist woods \[Haplocladium, p. 139\]

20. Stem and branch leaves similar in size and shape; paraphyllia mostly lacking. \[Claopodium, p. 140\]  
Stem and branch leaves differing in size and shape; paraphyllia numerous. \[Thuidium, p. 140\]

21. Stem erect from a creeping caudex, dendroid; capsules clustered \[22\]  
Stem prostrate or ascending; capsules borne singly. \[23\]

22. Cilia lacking \[Climacium, p. 170\]  
Cilia well developed, appendiculate. \[Thamnium, p. 171\]
23. Capsule symmetrical, erect or nearly so; inner peristome without cilia ............................................. 24
Capsule unsymmetrical, more or less inclined and curved; inner peristome arising from a broad basal membrane; cilia well developed ............................................. 29

24. Branches strongly complanate; leaves cultriform .......... Homalia, p. 132
Branches terete or somewhat flattened; leaves ovate to lanceolate ............................................. 25

25. Segments either partially or wholly lining the teeth, basal membrance lacking or obscure ........ 26
Segments entirely free from the teeth .................. 27

26. Leaves with a midrib; stalk rough . . . Homalothecium, p. 134
Leaves without a midrib; stalk smooth . . . . Pylaisia, p. 133

27. Basal membrane broad and distinct ........ Pylaisia subdenticulata, p. 134
Basal membrane very narrow, or lacking ............ 28

28. Stem oval in cross-section; capsule 3-4 mm. long .......... Entodon, p. 132
Stem round in cross-section; capsule 1.5-2.5 mm. long; annulus several cells broad .......... Platygyrium, p. 132

29. Midrib single ............................................. 30
Midrib double or furcate, frequently short or lacking .... 42

30. Lid more or less long-rostrate ............................ 31
Lid conical to short-rostrate .................................. 33

31. Leaves spreading or imbricated ............................ 32
Leaves complanate ............................................. Rhynchostegium, p. 150

32. Leaves very concave, spoon-shaped, abruptly filiform-acuminate ............................................. Cirriphyllum, p. 147
Leaves plane or slightly concave, acute or gradually acuminate ............................................. Eurynchium, p. 148

33. Leaves obtuse, apiculate, or acute ........................ 34
Leaves acuminate ............................................. 36

34. Large mosses (6-20 cm.), growing in swamps; stem leaves 2-3.5 mm. long, spreading or imbricated . Calliergon, p. 166
Medium-sized mosses (3-8 cm.), growing on rocks and earth in or along streams; leaves 0.6-1.6 mm. long, frequently secund ............................................. 35

35. Midrib strong, disappearing abruptly just below apex of leaf ............................................. Amblystegium fluviatile, p. 157
Midrib faint, vanishing near middle of leaf, frequently forked ............................................. Hygrohypnum, p. 169

36. Leaves secund .............................................. 37
Leaves equally spreading ..................................... 39
37. Leaves strongly transversely undulate .......... *Rhytidium*, p. 160
   Leaves not transversely undulate .................. 38
38. Paraphyllia numerous .............................. *Cratoneuron*, p. 159
   Paraphyllia lacking .................................. *Drepanocladus*, p. 167
39. Capsule oblong-ovoid; stem leaves much larger than
   branch leaves ........................................ *Brachythecium*, p. 143
   Capsule oblong-cylindrical; leaves mostly uniform in size 40
40. Stem densely tomentose, erect; leaves glossy ............ *Camptothecium*, p. 142
   Stem not densely tomentose; leaves rarely glossy .... 41
41. Stem prostrate and irregularly branched; rhizoids mostly
   numerous ............................................. *Amblystegium*, p. 155
   Stem prostrate or ascending; rhizoids few ........... *Chrysohypnum*, p. 158
42. Leaves complanate ..................................... 43
   Leaves not complanate ................................ 44
43. Leaves decurrent; basal areolation lax, alar cells often
   more or less enlarged ............................... *Plagiothecium*, p. 152
   Leaves not at all or very slightly decurrent; basal cells
   scarcely differentiated .............................. *Isopterygium*, p. 151
44. Operculum long-rostrate ............................. *Sematophyllum*, p. 150
   Operculum conical to short-rostrate .................. 45
45. Leaves obtuse or apiculate, rarely acute ............... 46
   Leaves acuminate .................................... 48
46. Leaves usually more or less secund, gradually narrowed
   above to an obtuse or rarely acute apex; mosses growing
   on dripping or wet rocks ............................ *Hygrohypnum*, p. 169
   Leaves imbricated or spreading, with a broad rounded apex 47
47. Mosses growing in swamps; stem with an outer layer of
   large hyaline cells .................................. *Acrocladium*, p. 167
   Mosses growing in dry woods; stem bright red, cortical
   cells small ........................................... *Hypnum*, p. 166
48. Leaves secund, falcate or circinate .................... 49
   Leaves mostly spreading ................................ 51
49. A large moss (8-20 cm.), very regularly pinnate, frondi-
   form; leaves multiplicate, smooth; paraphyllia numerous
   .................. *Ptilium*, p. 162
   Medium-sized mosses (1-10 cm.), irregularly pinnate;
   leaves scarcely or not at all plicate; paraphyllia few or
   none .................................................. 50
50. Leaves sharply serrate, papilllose .................... *Ctenidium*, p. 161
   Leaves entire or serrulate, smooth ................ *Stereodon*, p. 162
51. Alar cells inflated Plagiothecium striatellum, p. 154
Alar cells not inflated, frequently quadrate, rectangular, or oblong .......................... 52

52. Annual growth regularly marked off Hylocomium, p. 161
Annual growth not clearly defined .......................... 53

53. Leaves erect-spreading ........................................ 54
Leaves squarrose ........................................ 55

54. Plants medium-sized, forming loose, spreading tufts; paraphyllia numerous and large Heterophyllon, p. 165
Plants small, forming thin, depressed mats; paraphyllia lacking ........................................ 56

55. Plants robust; stems 0.5-0.9 mm. in diameter; leaves 3-5 mm. long; capsules broadly ovoid Rhytidiadelphus, p. 160
Plants robust or slender; stems 0.1-0.4 mm. in diameter; leaves 1-3 mm. long; capsules cylindrical Chrysohypnum, p. 158

FAMILY ARCHIDIACEÆ

Archidium Brid.

Archidium ohioense Schimp.
Throughout the eastern United States and westward to the Rocky Mountains.

FAMILY DICRANACEÆ

Bruchia Schwaegr.

Capsule ovoid, neck short .................. B. flexuosa
Capsule elongated, neck long .................. B. Sullivantii

Bruchia flexuosa (Schwaegr.) C. Müll.
New England to Minnesota, south to the Gulf States.
Ref. Eaton, 15, 72.

Bruchia Sullivantii Aust.
Clayey or sandy ground in fields. Spring. New Haven: New Haven (1890), Evans.
New England to Florida, west to Missouri and Louisiana.
Pleuridium Brid.

Leaves spreading, upper leaves long-subulate. *P. alternifolium*
Leaves of sterile shoots closely appressed, upper leaves of fertile shoots abruptly short-pointed. ....... *P. Sullivantii*

Pleuridium alternifolium (Dicks.) Rabenh.
New England to Wisconsin, south to the mountains of Alabama; Europe; Asia.

Pleuridium Sullivantii Aust.
Connecticut to South Carolina.

Ditrichum Timm

1. Monoicous; stalk yellow; fruiting in June. .......... *D. pallidum*
Diocicous; stalk red; fruiting in autumn. ............... 2
2. Stem leaves imbricated; perichaetial leaves long-sheathing

*D. vaginans*
Stem leaves spreading; perichaetial leaves scarcely sheathing ...

*Leptotrichum vaginans* (Sull.) Hampe. 

New Brunswick to North Carolina, west to Missouri; Europe.
Ref. Eaton, 15, 62.

*Ditrichum tortile* (Schrad.) Lindb. *Leptotrichum tortile* C. Müll.

Clayey soil along roadsides and in fields. Autumn. Hartford: Glastonbury, Miss Lorenz. Tolland: Bolton and
Stafford, Nichols. Windham: Canterbury, Mrs. Hadley.

Newfoundland and Labrador to Minnesota, south to the Gulf States; Europe; Asia; Africa.

Ref. Eaton, 15, 62.

**Ditrichum pallidum** (Schreb.) Hampe. *Leptotrichum pallidum* Hampe.


Ontario to the Gulf of Mexico, west to Kansas; Europe; Asia; Africa.

Ref. Eaton, 15, 62.

**Saelania** Lindb.

**Saelania glaucescens** (Hedw.) Broth. *S. caesia* (Vill.) Lindb.


Greenland and Labrador to the Middle Atlantic States, west to British Columbia and Colorado; Europe; Asia; New Zealand.

**Ceratodon** Brid.

**Ceratodon purpureus** (L.) Brid.

Burnt-over woods, roadsides, waste ground, and roofs. May-June. Litchfield: New Milford, Nichols; Salisbury,

Throughout North America; a cosmopolitan.

Ref. Eaton, 15, 62. Mrs. Lowe, 54 (incorrectly determined as C. minor Aust.).

**Dicranella** Schimp.

1. Capsule plicate when dry; epidermis composed of narrow cells; stalk yellowish.....................**D. heteromallia**

Capsule always smooth; epidermis composed of quadrate cells; stalk reddish............................2

2. Capsule cernuous ..................................**D. varia**

Capsule erect .......................................**D. rufescens**

**Dicranella heteromallia** (L.) Schimp. **Dicranum heteromallum** Hedw.


Newfoundland to Louisiana, westward to the Pacific; Europe; Asia.


**Dicranella rufescens** (Dicks.) Schimp.

Nova Scotia to West Virginia, west to Alaska and Washington; Europe; Asia.
Ref. Mrs. Lowe, 57.

Dicranella varia (Hedw.) Schimp. Dicranum varium Hedw.
Nova Scotia to Georgia, westward to the Pacific; Alaska; Europe; Asia; Africa.

Rhabdoweisia Br. & Sch.
Rhabdoweisia denticulata (Brid.) Br. & Sch.
Newfoundland to Wisconsin and North Carolina; Europe.

Dichodontium Schimp.
Dichodontium pellucidum (L.) Schimp.
Arctic America, Canada, and the northern United States; Europe; Asia.

Oncophorus Brid.
Oncophorus virens (Sw.) Brid. Cynodontium virens Schimp.
Moist non-calcareous earth and rocks or damp wood in mountainous or hilly woods. Spring. Tolland: Stafford (1906), Nichols.
Canada and the northern United States; Europe; Asia.
Dicranum Hedw.

1. Capsule cernuous, arcuate ................................. 2
   Capsule erect, symmetrical ............................... 5

2. Leaves not undulate, midrib percurrent........D. scoparium
   Leaves transversely undulate, midrib not reaching apex.... 3

3. Upper leaf cells elongated; capsules clustered...D. undulatum
   Upper leaf cells isodiametric; capsules borne singly...... 4

4. Upper part of leaves strongly papillose at back...D. spurium
   Leaves smooth at back..................................D. Bergeri

5. Lamina of leaves more or less bistratose in upper part....
   D. fulvum
   Lamina unistratose throughout ............................ 6

6. Midrib without median guides and excurrent; leaves sudden-ly narrowed into a long setaceous point.D. longifolium
   Midrib with median guides and vanishing below apex of leaf; leaves lanceolate-subulate ................................ 7

7. Cells in upper part of leaves rectangular, papillose at back;
   plants not producing flagelliform branchlets..D. montanum
   Cells in upper part of leaf less regular, smooth at back;
   plants frequently characterized by numerous flagelliform
   branchlets ..................................................D. flagellare

Dicranum spurium Hedw.

Shaded sandy soil and rocks, never on limestone. June.

   Newfoundland to Wisconsin, south to Florida; Europe; Asia.


Dicranum undulatum Ehrh.

Moist soil and earth-covered rocks in hilly woods. Summer.

   Canada and the northern United States; Europe; Asia.


* Reported by Barron from "near the Sound" (Eaton, 15, 61).


Arctic America, Canada, and the northern United States; Europe; Asia.

Ref. Eaton, 15, 61 (misprinted *D. Schreberi*). *Miss Lorenz*, 52 (incorrectly determined as *D. Muhlenbeckii*).

**Dicranum scoparium** (L.) Hedw.


Throughout Canada and the United States; Europe; Asia.


**Dicranum fulvum** Hook. *D. interruptum* Brid.

Trees and decayed logs in pine or hemlock woods in mountainous or hilly regions. Summer. **New Haven**: East Haven, *Hatcher*; Woodbridge (1879), *O. D. Allen*.

Newfoundland to Manitoba, south to West Virginia; Europe; Asia.

**Dicranum flagellare** Hedw.


* D. fulvum occurs twice in text, at the west part of the map. The key is not indicated.

Nova Scotia to North Carolina, and westward to British Columbia; Mexico; Europe; Asia.


**Dicranum fulvum** Hook. *D. interruptum* Brid.


Nova Scotia to Wisconsin, south to North Carolina and Missouri; Europe.


**Dicranum longifolium** Ehrh.

On rocks and tree trunks in mountainous or hilly regions; not on pure limestone. Late summer. **NEW HAVEN:** Meriden (1856), *Eaton;* Oxford, *Harger.*

Nova Scotia to North Carolina, west to British Columbia and Colorado; Greenland; Europe; Asia.

Ref. Eaton, 15, 61.*

**FAMILY LEUCOBRYACEÆ**

**Leucobryum** Hampe

**Leucobryum glaucum** (L.) Schimp. *L. vulgare* Hampe.

On moist soil or rocks in the woods. Fruit occasional,

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*Two other species of *Dicranum,* *D. fuscescens* Turn. and *D. viride* (Sull. & Lesq.) Lindb. (as *Campylopus viridis* Sull. & Lesq.), are reported by Eaton (15, 61) on the authority of Barron, but no Connecticut specimens examined by the writers have been referable to either of these species.

Newfoundland to the Rocky Mountains, south to Florida and Louisiana; Europe; Asia; Africa.


FAMILY FISSIDENTACEÆ

Fissidens Hedw.

1. Fruit borne on the stem or on a leading branch............ 2
   Fruit borne on a short branch........................................ 5

2. Leaves without a border........................................... 3
   Leaves bordered by a narrow band of pale, elongated cells 4

3. Leaves obtuse, margin entire.................. F. obtusifolius
   Leaves apiculate, margin crenulate............. F. osmundoides

4. Border thick, usually confluent at apex of leaf with the midrib .................. F. bryoides
   Border narrow, almost wanting at apex of leaf; midrib percurrent ............... F. incurvus

5. Leaves without a border................................. 6
   Leaves bordered by several rows of paler, often thick-walled cells ............. 7

6. Midrib percurrent .................................. F. taxifolius
   Midrib vanishing below the apex............... F. subbasilaris

7. Leaf cells obscure (0.007-0.009 × 0.01-0.012 mm.)......
   Leaf cells distinct (0.01-0.014 × 0.014-0.018 mm.)......
   F. cristatus
   F. adiantoides

Fissidens bryoides (L.) Hedw.

Throughout temperate North America, and north to Yukon Territory; Europe; Asia; Africa; New Zealand.

Ref. Eaton, 15, 62.*

**Fissidens incurvus** Schwaegr. Including *F. minutulus* Sull.

On wet shaded stones, usually in brooks. Autumn.


Canada and the northern United States; Cuba; Europe; Asia; Africa; New Zealand; Tasmania.

Ref. Eaton, 15, 62.

**Fissidens obtusifolius** Wils.


New England to Minnesota and Colorado, south to Alabama and Texas.

**Fissidens adiantoides** (L.) Hedw.


Newfoundland to Alaska, south to Florida and Washington; Europe; Asia; Africa; New Zealand; Tasmania.

Ref. Eaton, 15, 62.

**Fissidens cristatus** Wils. *F. decipiens* DeNot.

On moist, preferably calcareous, rocks in hilly regions.

*"In a greenhouse, R. Veitch; also on the sides of a well on Church Street, New Haven, W. T. Brown." Both of these stations have since probably been destroyed."
No. 11.| The Bryophytes of Connecticut. 105


Nova Scotia to the Rocky Mountains, and south to the Gulf States; Europe; Asia.

Fissidens taxifolius (L.) Hedw.


Throughout the eastern United States; Europe; Asia; Africa.

Ref. Eaton, 15, 62 (incorrectly reported as F. osmundoides).

Fissidens osmundoides (Sw.) Hedw.


Arctic America, Canada, and the northern United States; Europe; Asia.

Fissidens subbasilaris Hedw.


Ontario and the eastern United States.

Octodiceras Brid.

Octodiceras Julianum (Savi) Brid. Conomitrium Julianum Mont.


Ontario to Montana, south to Mexico; Cuba; South America; Europe; Africa.
Exsic. Renauld & Cardot, Musci Amer. Sept. No. 16 (as Conomitrium Julianum).
Ref. Mrs. E. G. Britton, 9, 83. Eaton, 15, 62; 16, 244.

FAMILY POTTIACEÆ

Astomum Hampe

Astomum Sullivantii Schimp. Systegium Sullivantii Schimp.
Probably throughout temperate North America.
Ref. Eaton, 15, 72.

Weisia Hedw.

Weisia viridula (L.) Hedw.
Throughout Canada and the United States; Europe; Asia; Africa; New Zealand; Tasmania.
Ref. Eaton, 15, 62.

Hymenostylium Brid.

Hymenostylium curvirostre (Ehrh.) Lindb. Gymnostomum curvirostre Hedw.
Labrador to Alaska, south to California and South Carolina; Europe; Asia; Africa.
No. II.] THE BRYOPHYTES OF CONNECTICUT. 107

Trichostomum Hedw.

Trichostomum cylindricum (Bruch) C. Müll. Didymodon cylindricus Br. & Sch.

Wet non-calcareous stones in or beside brooks in mountainous or hilly regions. Fruit very rare, autumn. New Haven: Hamden (1879), J. A. Allen; Orange, O. D. Allen.

Greenland to North Carolina, west to Manitoba; South America; Europe; Asia.

Tortella (C. Müll.) Limpr.

Monoicous; plants less than 1 cm. high, loosely cæspitose; leaves linear, abruptly mucronate............T. cæspitosa

Dioicous; plants 2-6 cm. high, in pulvinate tufts; leaves lanceolate, long-acuminate or cuspidate........T. tortuosa


Greenland, Canada, and the northern United States; Europe; Asia; Africa.

Ref. Eaton, 15, 62.

Tortella cæspitosa (Schwaegr.) Limpr. Barbula cæspitosa Schwaegr.


Ontario and New England to the Gulf States, west to British Columbia; Mexico; South America; Europe; Asia; Africa.

Didymodon Hedw.

**Didymodon rubellus** (Hoffm.) Br. & Sch.

Wet, usually calcareous rocks, in mountainous or hilly regions. Summer. **Litchfield**: Salisbury, Nichols. **Tolland**: Bolton, Nichols. **New Haven**: Woodbridge (1879), J. A. Allen.

Alaska, Canada, and the northern United States; Europe; Asia; Africa; Tasmania.

Barbula Hedw.

Leaves gradually acuminate, midrib percurrent....**B. fallax** Leaves obtuse and mucronate, midrib excurrent..**B. unguiculata**

**Barbula fallax** Hedw.


Canada and the northern United States, north to the arctic regions; Europe; Asia; Africa.

**Barbula unguiculata** (Huds.) Hedw.

On all sorts of earth formations. Winter. **Litchfield**: New Milford, Nichols. **New Haven**: East Haven and New Haven (1855), Eaton; Orange and Oxford, Harger; Wallingford, Evans; Woodbridge, J. A. Allen.

Probably throughout the northern United States and Canada; Europe; Asia; Africa.

Ref. Eaton, 15, 62.

Acaulon C. Müll.

**Acaulon muticum** (Schreb.) C. Müll. **Sphærangium muticum** Schimp.

Clay or earth in fields. Spring. **New Haven**: Hamden (1878), J. A. Allen; New Haven, Eaton; Orange, J. A. Allen. Probably throughout temperate North America; Europe; Africa.


Phascum L.

**Phascum cuspidatum** Schreb.

On earth in fields and grassy places. Spring. **New**
Haven: East Haven and New Haven, Eaton; Woodbridge (1878), J. A. Allen.
Ontario to South Carolina, westward to the Pacific States; South America; Europe; Asia; Africa.

Pottia Ehrh.

Pottia truncatula (L.) Lindb. P. truncata Fürn.
In moist places,— meadows, banks of streams, etc. Autumn to spring. New Haven: Woodbridge (1878), J. A. Allen.
Quebec and New England to Pennsylvania; Nevada; Europe: Asia; Africa.

Tortula Hedw.

1. Growing on trunks of trees; midrib bearing gemmæ in upper half; not yet found fruiting in this country...... T. papillosa

Growing on rocks; midrib not gemmiparous; frequently fruiting .......................................................... 2

2. Dioicus; tufts large, 2-5 cm. high; midrib excurrent into a long smooth hair-point......................... T. montana
Monoicus; tufts small, 5-15 mm. high; midrib excurrent into a long toothed hair-point......................... T. muralis

Throughout North America; a cosmopolitan.

Tortula papillosa Wils. Barbula papillosa C. Müll.
Throughout the northern Atlantic States; South America; Europe; Australia; New Zealand; Tasmania.
Ref. Eaton, 15, 62.
Tortula montana (Nees) Lindb.
Sunny rocks, usually calcareous, in mountainous or hilly regions. New Haven: East Haven (1880) and Orange, J. A. Allen.
Northern North America; Europe; Asia; Africa.

Encalypta Schreb.
Gemmæ wanting; monoicous; capsule smooth, peristome single .................................................. E. ciliata
Gemmæ brown, slender, borne in clusters in the axils of the leaves; dioicous; capsule spirally striate, peristome double .................................................. E. contorta

Encalypta ciliata (Hedw.) Hoffm.
Shaded earth or rocks in mountainous or hilly regions. Summer. New Haven: Branford (1881), J. A. Allen.
Arctic America, Canada and the northern United States; Europe; Asia; Africa; Australia; Hawaiian Islands.

Encalypta contorta (Wulf.) Lindb. E. streptocarpa Hedw.
Ontario to Virginia, and westward to the Rocky Mountains; Europe; Asia.
Ref. Eaton, 15, 63.

FAMILY. GRIMMIACEÆ

Glyphomitrium Brid.
Glyphomitrium incurvum (Schwaegr.) Broth. Ptychomitrium incurvum Sull.
Ontario and New England to Georgia, westward to Kansas and Texas.
Ref. Eaton, 15, 62.

**Grimmia Ehrh.**

1. Capsule shorter than stalk, emergent or exserted... *G. Olneyi*
Capsule longer than stalk, immersed......................... 2
2. Walls of lower leaf cells sinuate....................... *G. pilifera*
Walls of lower leaf cells not sinuate.................... 3
3. Plants in small dense cushions, soft, lurid green; leaf cells rounded-quadrate, 0.009-0.01 mm. above........... *G. conferta*
Plants in laxer cushions, more robust, coarse, brownish;
leaf cells rounded, 0.006-0.007 mm. above............ *G. apocarpa*

**Grimmia apocarpa** (L.) Hedw.

On rocks and stones of various kinds. Late spring.
Litchfield: Salisbury, Gilman; Torrington, Mrs. Lowe.

Alaska, Canada, and the northern United States; found in most quarters of the globe.
Ref. Eaton, 15, 62.

**Grimmia conferta** Funck.


Nova Scotia to the Middle Atlantic States, and westward to the Pacific; Europe; Asia; Africa.
Ref. Eaton, 15, 62.

**Grimmia pilifera** Beauv. *G. pennsylvanica* Schwaegr.

Moist rocks in hilly woods. May-June. Litchfield: New Milford and Salisbury, Nichols. Hartford: Simsbury,
Nova Scotia to Minnesota, south to Georgia; Mexico; Japan.
Ref. Eaton, 15, 62.

Grimmia Olneyi Sull.
Sloping rocks and boulders, never on limestone. Spring.
Ontario and New England to Georgia.

Racomitrium Brid.
Racomitrium aciculare (L.) Brid.
Alaska, Canada, and southward to California and Alabama; Europe; Africa.
Ref. Eaton, 15, 62.

FAMILY ORTHOTRICHACEÆ

Anoectangium Hedw.
Anoectangium Mougeotii (Br. & Sch.) Lindb. Amphoridiium Mougeotii Schimp.
Crevices of damp, shaded rocks in mountainous or hilly regions. Fruit very rare, July-Aug. New Haven: Branford and Hamden, Eaton; Meriden, Price; Woodbridge (1878), O. D. Allen.
Newfoundland to Alabama, westward to Alaska and Oregon; Europe; Asia.
Drummondia Hook.

Drummondia clavellata Hook.

Ontario and New England, south to Alabama and Missouri; Asia.

Ref. Eaton, 15, 62.

Orthotrichum Hedw.

1. Capsule with superficial stomata; plants growing on trees

   Orthotrichum sordidum

   Capsule with immersed stomata.............................. 2

2. Peristome single, capsule plicate when dry; plants growing on rocks ........................................ 3

   Peristome double; plants growing on trees.................. 4

3. Capsule long-exserted .................................. Orthotrichum anomalum

   Capsule immersed or emergent ........................... Orthotrichum Lescurii

4. Capsule smooth when dry ................................. Orthotrichum pusillum

   Capsule plicate when dry ................................ 5

5. Calyptra hairy ............................................. 6

   Calyptra smooth ........................................... Orthotrichum pumilum

6. Capsule strongly plicate, reddish brown, contracted under the mouth when dry; leaves acute .................. Orthotrichum Braunii

   Capsule not strongly plicate, pale yellowish, very slightly or not at all contracted below the mouth when dry; leaves obtuse .................................. Orthotrichum ohioense

Orthotrichum sordidum [Sull. & Lesq.]


New Brunswick to Pennsylvania and Lake Superior.

Ref. Eaton, 15, 63.
Orthotrichum anomalum Hedw.
Throughout Canada and the northern United States; Alaska; Europe; Asia; Africa.

Orthotrichum Lescurii Aust. O. cupulatum Hoffm. var. minus Sull.
Dry shaded granite or trap rocks. Spring. New Haven: Hamden (1876), Pease; Woodbridge, Eaton.
Ontario and New England, south to Pennsylvania and Missouri, and in the Rocky Mountain region.

Orthotrichum pusillum Mitt. O. psilocarpum James.
New England and New York to Georgia, west to Missouri.
Ref. Eaton, 15, 63. Rau & Hervey, 64, 21.

Orthotrichum Braunii Br. & Sch. O. strangulatum Sull. not Beauv.
Prince Edward Island to Georgia, westward to Iowa; Europe; Asia; Africa.
Ref. Eaton, 15, 63.

Orthotrichum ohioense Sull. & Lesq.
Trunks of trees. Spring. Hartford: Southington,
Prince Edward Island to Georgia, west to Michigan.
Ref. Eaton, 15, 63.
Orthotrichum pumilum Sw.
New England and Ontario to Idaho, south to Florida and Texas; Europe; Asia; Africa.

Ulota Mohr

1. Leaves rigid when dry; plants growing on rocks. U. Hutchinsiae
   Leaves crispate when dry; plants growing on trees........ 2
2. Capsule smooth, slightly plicate only below the narrowed
   mouth ........................................... U. Ludwigii
   Capsule longitudinally plicate throughout, mouth wide..... 3
3. Capsule constricted below the mouth, gradually narrowed
   toward the neck when dry and empty............... U. ulophylla = crisps
   Capsule slightly or not at all contracted below the mouth,
   abruptly narrowed toward the neck.................. U. crispula

Ulota Hutchinsiae (Sm.) Hammar. U. americana
(Beanv.) Limpr. Not Mitt.
Non-calcareous rocks in mountainous or hilly districts.
Spring. Litchfield: Kent, Eames; New Milford, Nichols;
Canterbury, Mrs. Hadley. Fairfield: Danbury, Nichols;
Darien, Mrs. Lowe; Sherman, Nichols. New Haven: Madi-
son and Meriden. Nichols; New Haven (1854), Eaton; Ox-
ford, Harger. Middlesex: Killingworth, Nichols. New
New Brunswick to Georgia, westward to the Rocky
Mountains; Europe; Asia.
Ref. Eaton, 15, 63.

Ulota Ludwigii Brid.
Trunks of trees in mountainous or hilly woods. Summer.
Litchfield: Salisbury, Nichols. Windham: Canterbury,
Mrs. Hadley. New Haven: Branford, Eaton; East Haven,
J. A. Allen; Hamden and Woodbridge (1866), Eaton.
Middlesex: Chester and Killingworth, Nichols.
Newfoundland to Ontario and North Carolina; Europe.
Ref. Eaton, 15, 63.
Ulota ulophylla (Ehrh.) Broth. *U. crispa* (Hedw.) Brid.
Newfoundland to Wisconsin, south to Georgia; Alaska; Europe; Asia; Canary Islands.
Ref. Eaton, 15, 63.

Ulota crispula Bruch.
Same range as the preceding species.
Ref. Eaton, 15, 63.

**FAMILY FUNARIACEÆ**

**Ephemerum** Hampe

1. Leaves without a midrib
   2. Midrib present, percurrent or nearly so..*E. crassinervium*

2. Leaves obscurely serrulate; stomata present in upper half of capsule
   3. Leaves distinctly serrulate; stomata restricted to base of capsule..*E. serratum*

Wet or periodically inundated earth. Autumn. New Haven: Orange (1891), Evans.
Connecticut to Georgia.

**Ephemerum serratum** (Schreb.) Hampe:
New London: Norwich (1888), Setchell.
Probably throughout temperate North America; Europe.

**Ephemerum crassinervium** (Schwaeegr.) C. Müll.
New England to Minnesota, south to Florida.
Aphanorrhegma Sull.

Aphanorrhegma serratum (Hook. & Wils.) Sull.
Temperate North America.

Physcomitrium (Brid.) Br. & Sch.

Physcomitrium turbinatum (Michx.) C. Müll. P. pyriforme of some authors.
Quebec to Florida, and west to the Rocky Mountains.
Ref. Eaton, 15, 63. Mrs. Hadley, 40.

Funaria Schreb.

Funaria hygrometrica (L.) Schreb.
Throughout North America: a cosmopolitan.
Ref. Eaton, 15, 63.

FAMILY BRYACEÆ

Leptobryum (Br. & Sch.) Wils.

Leptobryum pyriforme (L.) Wils.
Throughout North America; South America; Europe; Asia; Tasmania; New Zealand.

Ref. Eaton, 15, 63.

**Pohlia** Hedw.

1. Plants producing gemmæ in axils of leaves, rarely fruiting
   
   Plants not gemmiparous, richly fruiting ................. 2

2. Basal membrane of inner peristome one-third to one-half height of segments .................. **P. nutans**
   Basal membrane of inner peristome one-fourth height of segments .......................... **P. cruda**

**Pohlia cruda** (L.) Lindb.

Shaded earth and fissures of rocks in mountainous or hilly regions. Early summer. **New Haven**: Derby (1881), J. A. Allen.

Greenland to Pennsylvania, and westward to the Pacific; found in most quarters of the globe.

**Pohlia nutans** (Schreb.) Lindb. *Webcra nutans* Hedw.


Throughout most of North America; a cosmopolitan.

Ref. Eaton, 15, 63. Mrs. Hadley, 43.

**Pohlia proligera** Lindb.

On earth. Fruit rare, summer. **New Haven**: Beacon Falls and Hamden, Nichols; New Haven (1905), Evans.

- Widely distributed throughout Canada and the United States; Alaska; Europe.

**Mniobryum** (Schimp.) Limpr.

**Mniobryum albicans** (Wahl.) Limpr. *Webcra albicans* Schimp.

Arctic America, Canada, and the northern United States; south in the east to Florida; found in most quarters of the globe.

Ref. Eaton, 15, 63.

Bryum (Dill.) L.

1. Plants monoicous (syncoicous); leaves with a broad border, midrib excurrent into a short point.................B. bimum

Plants dioicous ......................................................... 2

2. Midrib vanishing below the apex, leaves not bordered, or very indistinctly so .........................B. argenteum

Midrib excurrent (or frequently vanishing below the apex in B. capillare) ........................................... 3

3. Leaves short-cuspidate, distinctly bordered....B. ventricosum

Leaves long-cuspidate ............................................. 4

4. Leaves bordered, twisted when dry...............B. capillare

Leaves not bordered or only faintly so, scarcely twisted when dry ........................................B. caespiticium

Bryum ventricosum Dicks. B. pseudotriquetrum (Hedw.) Schwaegr.


Arctic America, Canada, and the northern United States; found all over the world.

Exsic. Holzinger, Musci Acro. Bor.-Amer. No. 246 (as B. pseudotriquetrum).

Ref. Eaton, 15, 63.

Bryum bimum Schreb.


Arctic America, Canada, and southward to Florida and Arizona; a cosmopolitan.

Ref. Eaton, 15, 63.

Bryum caespiticium L.


Throughout North America; a cosmopolitan.

Ref. Eaton, 15, 63. Mrs. Lowe, 54.

Bryum argenteum L.


Throughout North America; a cosmopolitan.

Ref. Eaton, 15, 63.

Bryum capillare L.


Throughout temperate North America, and north to the arctic regions; Mexico; Europe; Asia; Africa.

Rhodobryum (Schimp.) Hampe


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New Haven: Hamden, Evans; Meriden, Eaton; Milford, Harger; New Haven (1855) and Orange, Eaton; Oxford, Harger; Woodbridge, Nichols. Middlesex: Killingworth, Nichols.

New Brunswick to Nebraska, south to Georgia; California; Europe; Asia; Africa.

Ref. Eaton, 15, 63.

FAMILY MNIACEÆ

Mnium (Dill.) L.

1. Leaf cells not arranged in oblique rows; border of leaves several cells thick; marginal teeth in pairs............. 2

Leaf cells tending to be arranged in diverging rows, gradually increasing in size from the border toward the midrib .......................................................... 5

2. Lid strongly convex, mammiform or apiculate; midrib toothed at back ........................................... M. horns

Lid rostrate .......................................................... 3

3. Midrib smooth at back; monoicous (synoicous).......... 4

Midrib toothed at back; dioicous........... M. orthorrhynchum

4. Perichaetial leaves forming a rosette, not crispate when dry; capsules borne in clusters................. M. spinulosum

Perichaetial leaves not forming a rosette, crispate when dry; capsules borne singly.................... M. marginatum

5. Leaves serrate, teeth single, border one cell thick...... 6

Leaves entire ......................................................... 11

6. Monoicous (synoicous) ........................................... 7

Dioicous ............................................................... 9

7. Lid rostrate; stomata scattered over the entire capsule...

M. rostratum

Lid strongly convex, apiculate; stomata present only on neck of capsule .................................................. 8

8. Capsules borne singly; leaves serrate to middle. M. cuspidatum

Capsules borne in clusters; leaves serrate to base. M. medium

9. Margin of leaves obscurely toothed...................... M. rugicium

Marginal teeth of 2-4 cells........................................ 10

10. Marginal teeth robust ......................................... M. affine

Marginal teeth slender ........................................... M. ciliare

11. Border narrow, scarcely thickened, of one layer of cells...

M. cinclidoides

Border broad, thickened ........................................ M. punctatum
Mnium hornum L.
Moist banks and wet rocks in the woods. May-June.
Newfoundland to Wyoming, and southward to Georgia; Europe; Asia; Africa.

Mnium orthorrhynchum Br. & Sch.
Rocks and soil, usually calcareous, in shaded ravines.
Arctic America, Canada, and the northern United States; Europe; Asia.
Ref. Eaton, 15, 63.

Mnium marginatum (Dicks.) Beauv. M. serratum Schrad.
Shaded banks and rocks near streams and in moist woods.
Canada, Alaska, and the northern United States; Europe; Asia.

Mnium spinulosum Br. & Sch.
Nova Scotia and the northern Atlantic States, westward to Alaska and Washington; Europe; Asia.
Mnium rostratum Schrad.


Throughout temperate North America, and in most temperate regions of the globe.

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Ref. Mrs. E. G. Britton, 8, 5.


Earth, stones, or old logs in moist woods. May-June. **Litchfield**: New Milford and Salisbury, **Nichols**. **Hartford**: Hartford, Mrs. **Lowe**; Windsor, W. E. Britton. **Tolland**: Ellington, Peasc; Stafford, **Nichols**. **Windham**: Canterbury, Mrs. **Hadley**. **Fairfield**: Darien, Mrs. **Lowe**; Fairfield, Eames; Monroe, Miss **Lorenz**; Sherman, **Nichols**; Trumbull, Eames. **New Haven**: East Haven (1875), Eaton; Madison, **Nichols**; New Haven, Eaton; North Branford and North Haven, Evans. **Middlesex**: Killingworth, **Nichols**. **New London**: Groton and Montville, C. B. Graves; Norwich, **Setchell**; Waterford, C. B. Graves.

Newfoundland to Florida and westward to the Pacific; Europe; Asia.

Ref. Eaton, 15, 63. Mrs. Hadley, 41.

Mnium medium Br. & Sch.

On earth or rotting stumps in moist, shaded places. May-June. **Litchfield**: New Milford (1877), Eaton. **New Haven**: New Haven, Eaton.

Greenland to Pennsylvania, westward to Alaska and California; Europe; Asia.

Mnium ciliare (Grev.) Lindb. *M. affine* var. *ciliare* C. Müll.

Moist sandy soil in woods. May-June. **Litchfield**: Salisbury, Gilman. **Windham**: Canterbury, Mrs. **Hadley**. **New Haven**: Beacon Falls and East Haven, **Nichols**; Hamden (1858), Eaton; Woodbridge, Chatterton.
Nova Scotia to Louisiana, westward to British Columbia; Europe; Asia.


Ref. Mrs. E. G. Britton, 8, 5.

*Mnium affine* Bland.

Moist earth and rocks in woods and swamps. May-June.


Throughout northern North America, south to Florida and California; Europe; Asia; Africa.

Ref. Eaton, 15, 63.


On the ground in shaded swamps and ravines. May-June.


Greenland and Labrador to Alaska, south to Louisiana and Colorado; Europe.

*Mnium punctatum* (L.) Hedw.


Var. *elatum* Schimp.

Arctic America, Canada, and the northern United States; Europe; Asia.
Ref. Mrs. E. G. Britton, 8, 5. Eaton, 15, 64.

 Mnium cinclidioides Hüben.
Northern North America, south in the east to Pennsylvania; Europe; Asia.
Ref. Eaton, 15, 64.

FAMILY AULACOMNIACEÆ
Aulacomnium Schwaegr.

Monoicus; leaves coarsely serrate in upper half; plants not gemmiparous .................A. heterostichum
Dioicus; leaves serrulate near apex; sterile plants frequently producing gemmae at the tips of flagelliform branches .....................................A. palustre

Aulacomnium heterostichum (Hedw.) Br. & Sch. Munsfield
Ontario to Wisconsin, south to Florida and Texas; Asia.
Ref. Eaton, 15, 64.
Aulacomnium palustre (L.) Schwaegr.

In bogs and swampy woods. June. LITCHFIELD: Salisbury, Nichols. HARTFORD: Canton, Nichols; Farmington, Mrs. Lowe; West Hartford, Miss Lorenz. TOLLAND: Ellington, Pease; Willington, Nichols. WINDHAM: Canterbury, Mrs. Hadley. FAIRFIELD: Darien, Mrs. Lowe; Stratford, Nichols. NEW HAVEN: East Haven, Eaton; Madison, Miss Lorenz; Meriden, Nichols; New Haven (1855), Eaton; Oxford, Harger. MIDDLESEX: Chester, Nichols; Durham, Evans; Killingworth, Nichols. NEW LONDON: North Stonington, Old Lyme, and Waterford, C. B. Graves.

Arctic America, southward to the mountains of South Carolina, Utah, and California; South America; Europe; Asia; Australia.

Ref. Eaton, 15, 64. Mrs. Hadley, 40.

FAMILY MEESIACEÆ

Meesia Hedw.

Meesia triquetra (L.) Aongstr. M. tristicha Br. & Sch.


Arctic America, Canada, and the northern United States; Europe; Asia.

Ref. Eaton, 15, 64.

FAMILY BARTRAMIACEÆ

Plagiopus Brid.

Plagiopus Oederi (Gunn.) Limpr. Bartramia Oederi Sw.

Moist calcareous rocks or soil in mountainous and hilly woods. Spring. LITCHFIELD: Salisbury, Gilman. HARTFORD: West Hartford, Miss Lorenz. FAIRFIELD: Monroe, Harger; Sherman, Nichols. NEW HAVEN: Cheshire (1856), Eaton; Hamden, J. A. Allen; Meriden, Eaton.

Canada and the northern United States, south in the east to North Carolina; Europe; Asia.

Ref. Eaton, 15, 64.
Bartramia Hedw.

**Bartramia pomiformis** (L.) Hedw.

Rocks or soil in moist woods. Spring. **Litchfield**: New Milford, Nichols; Salisbury, Gilman. **Hartford**: Hartford, Mrs. Lowe; Southington, Chamberlain; West Hartford, Miss Lorenz; Windsor, W. E. Britton. **Tolland**: Stafford, Nichols. **Windham**: Canterbury, Mrs. Hadley. **Fairfield**: Huntington and Sherman, Nichols; Trumbull, Eames. **New Haven**: Beacon Falls and East Haven, Nichols; Hamden, Eaton; Madison and Meriden, Nichols; New Haven (1855), Eaton; North Haven, Nichols; Oxford, Harger. **Middlesex**: Killingworth, Nichols. **New London**: Ledyard, Nichols; North Stonington, C. B. Graves.

Arctic America and Canada, southward to Alabama and Colorado; South America; Europe; Asia; Africa; New Zealand.

Ref. Eaton, 15, 64.

**Philonotis** Brid.

**Philonotis fontana** (L.) Brid.

In swamps or wet places and on dripping rocks, rarely on limestone. Fruit occasional. June. **Litchfield**: New Milford. Nichols; Salisbury, Todd. **Hartford**: Hartford and Windsor, Miss Lorenz. **Tolland**: Bolton, Nichols; Ellington, Pease; Stafford, Nichols. **Windham**: Canterbury, Mrs. Hadley; Windham, Nichols. **Fairfield**: Easton, Eames; Huntington, Nichols; Redding, Evans. **New Haven**: Beacon Falls, Nichols; Hamden, Eaton; Meriden, Nichols; New Haven (1856) and North Branford, Eaton. **Middlesex**: Killingworth, Nichols. **New London**: Groton and Ledyard, C. B. Graves.

Arctic and temperate North America, south in the east to Florida; a cosmopolitan.

Ref. Eaton, 15, 64.

**FAMILY TIMMIACEÆ**

**Timmia** Hedw.

**Timmia cucullata** Michx. *T. megapolitana* of American authors, in part.

Newfoundland to Pennsylvania and westward to the Pacific; Europe.

Ref. Eaton, 15, 72.

FAMILY HEDWIGIACEÆ

Hedwigia Ehrh.

\[ Hedwigia albicans (Web.) Lindb. \]

H. ciliata Ehrh. \( \text{cx Hedw.} \)


Throughout North America, and in most quarters of the globe.

Ref. Eaton, 15, 62.

Additional \( \text{rev'd by} \) Nichols, \( \text{Rev. 15}° 6-11,1913 \)

FAMILY FONTINALACEÆ

Fontinalis (Dill.) L.

1. Stem leaves keeled...............................F. antipyretica
Leaves not keeled.............................. 2

2. Leaves 2-3 mm. long, firm, very concave throughout and incurved at the margins...............................F. dalecarlica
Leaves 3.5-7 mm. long, slightly concave.............................. 3

3. Branches obliquely spreading; leaves flaccid, plane in the upper half ........................................F. Lescurii
Branches widely spreading; leaves firmer, concave throughout ........................................F. Novæ-Angliæ
Fontinalis antipyretica L. var. gigantea Sull.
Canada and the northern United States; Europe; Asia; Africa.

Fontinalis dalecarlica Schimp.
Greenland and Labrador to Kansas, south to Alabama; Europe.

Fontinalis Novae-Angliae Sull.
Newfoundland to Ontario, and south to North Carolina.
Ref. Eaton, 15, 65. Lesquereux & James, 50, 271. Suilliant, 68, 654 (as F. biformis Sull.); 69, 54 (as F. biformis), 104; 70, 105.

Fontinalis Lescurii Sull.
On stones in streams. Summer. Litchfield: Salisbury, Nichols. Hartford: Bloomfield, Miss Lorenz; Burlington,

Nova Scotia to Alabama, westward to the Rocky Mountains.

Ref. Eaton, 15, 65;

Dichelyma Myrin

Dichelyma capillaceum (L.) Schimp.


FAMILY CRYPHÆACEÆ

Cryphæa Mohr

Cryphæa glomerata Br. & Sch.

Trunks of trees in the woods. Spring. New Haven: Hamden (1875), Young.

Connecticut to Ohio, south to the Gulf of Mexico.

Ref. Eaton, 15, 64. Rau, 63, 152. Rau & Hervey, 64, 52.

FAMILY LEUCODONTACEÆ

Leucodon Schwaegr.

Capsule exserted beyond the perichaetial leaves...L. julaceus Capsule exserted but surpassed by the perichaetial leaves..

L. brachypus

Leucodon julaceus (L.) Sull.

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**Leucodon brachypus** Brid.

**Forsstroemia** Lindb.

**Forsstroemia trichomitria** (Hedw.) Lindb. **Leptodon trichomitrion** Mohr.
On trees in the woods, rarely on rocks. Autumn. **Hartford**: Hartford, Mrs. Lowe; West Hartford, Miss Lorenz. **New Haven**: Cheshire, Eaton; Hamden, J. A. Allen; New Haven, Evans; North Haven, Eaton; Orange, J. A. Allen; Waterbury (1855), Blackman; Woodbridge, Evans. **Middlesex**: Saybrook, Eaton.

**FAMILY NECKERACEÆ**

**Neckera** Hedw.

**Neckera pennata** (L.) Hedw.
On trees and moist rocks in mountainous or hilly woods. Autumn. **Litchfield**: Salisbury, Gilman. **Hartford**: Hartford, Miss Lorenz. **Windham**: Canterbury, Mrs. Hadley. **New Haven**: Branford, East Haven, and New Haven (1855), Eaton; Southbury, Harger; Woodbridge, Evans. **Middlesex**: Chester, Nichols; Saybrook, Eaton.
Homalia (Brid.) Br. & Sch.

Homalia Jamesii Schimp.


FAMILY ENTODONTACEÆ

Schwetschkeopsis Broth.

Schwetschkeopsis denticulata (Sull.) Broth. Leskea denticulata Sull.

At the base of trees or on rocks. Fruit rare. New Haven: Orange (1880), O. D. Allen.

Connecticut and New York to Florida, west to the Mississippi River; Asia.

Platygyrium Br. & Sch.

Platygyrium repens (Brid.) Br. & Sch.


North America, west to the Rocky Mountains; Europe; Asia: Africa.

Ref. Eaton, 15, 66.

Entodon C. Müll.

Branches usually complanate; annulus clearly differentiated; teeth 12-18-articulate ................. E. cladorrhizans

Branches usually terete; annulus not clearly defined; teeth 7-10-articulate ...................... E. seductrix

Entodon cladorrhizans (Hedw.) C. Müll. Cylindrothecium cladorrhizans Schimp.

New Brunswick to Minnesota, and south to the Gulf States; Europe.

Ref. Eaton, 15, 66.

Entodon seductrix (Hedw.) C. Müll. Cylindrothecium seductrix Sull.


New England to Minnesota, south to Florida and Texas.


Ref. Eaton, 15, 66.

Pylaisia Br. & Sch.

1. Segments of inner peristome entirely free from teeth. basal membrane distinct; spores 0.008-0.012 mm. in diameter .......................... P. subdenticulata

Segments of inner peristome partially or wholly adherent to teeth, basal membrane obscure or lacking............... 2

2. Partially adherent; spores 0.016-0.024 mm. in diameter.... P. Schimperi

Wholly adherent; spores 0.025-0.032 mm. in diameter..... P. intricata

Pylaisia Schimperi Card. P. intricata of some authors.

Bark of trees or decaying wood in the woods or in the open. Autumn. Litchfield: New Milford and Salisbury, Nichols. Hartford: Canton, Nichols; Hartford, Miss Lo-
Pylaisia subdenticulata Schimp.


New Brunswick to the Gulf States, westward to the Rocky Mountains; Europe; Asia.

Ref. Eaton, 15. 66.

Pylaisia intricata (Hedw.) Br. & Sch. P. velutina Schimp.

On stumps and trees in mountainous or hilly woods. Autumn. LITCHFIELD: Salisbury, Nichols. NEW HAVEN: East Haven, O. D. Allen; Hamden, Young; Milford, Harger; New Haven (1855), Eaton.

Newfoundland to Ontario, south to North Carolina.

Ref. Eaton, 15. 66.

Homalotheicum Br. & Sch.

Homalotheicum subcapillatum (Hedw.) Sull.

Trunks of trees in the woods. Autumn. FAIRFIELD: Darien, Mrs. Lowe. NEW HAVEN: Cheshire (1855), Blackman; East Haven and New Haven, Eaton; Woodbridge, Pease.

New England to North Carolina.


Ref. Eaton, 15. 66.

FAMILY FABRONIACEÆ

Anacamptodon Brid.

Anacamptodon splachnoides (Fröhl.) Brid.

On trunks and decaying shelves of trees, in forks, around knot holes full of water, on old stumps and logs, from sea level

New England to Alabama, west to Illinois and Texas; Europe; Asia.

Ref. MRS. Lowe, 56.

FAMILY LESKEACEÆ

Thelia Sull.

1. Papillae of leaves simple..........................T. hirtella
   Papillae of leaves variously divided at the tip........... 2

2. Leaves ciliate; plants growing on trees..............T. asprella
   Leaves not ciliate; plants growing on rocks and earth....
   T. Lescurii

Thelia hirtella (Hedw.) Sull.


Ontario and New England to Kansas, south to the Gulf States.

Ref. Eaton, 15, 65. MRS. Hadley, 41.

Thelia asprella (Schimp.) Sull.


Ontario and New England to Florida, west to Minnesota and Texas.

Thelia Lescurii Sull.
Massachusetts to Missouri, south to the Gulf States.

**Myurella** Br. & Sch.

Leaves serrulate, obtuse, rarely short-apiculate......**M. julacea**
Leaves spinulose-dentate, abruptly long-acuminate...**M. gracilis**

**Myurella julacea** (Vill.) Br. & Sch.
On rocky banks and in shady fissures of rocks, especially limestone, in mountainous or hilly districts. Fruit rare, July-Aug. **NEW HAVEN**: Branford and Woodbridge (1880), J. A. Allen.
Arctic America, Canada, and the northern United States; Europe; Asia.

**Myurella gracilis** (Weinm.) Lindb. **M. Caryana**. Sull.
Crevices of moist rocks, usually limestone, in mountainous or hilly regions. Fruit rare, spring. **LITCHFIELD**: Norfolk (1903), Miss Lorenz; Salisbury, Evans. **HARTFORD**: Windsor, Miss Lorenz. **FAIRFIELD**: Sherman, Nichols.
Nova Scotia to Minnesota, south to North Carolina; Europe; Asia.

**Haplohymenium** Doz. & Molk.

**Haplohymenium triste** (Cesati) Kindb. **Leskea tristis**

Cesati. **Anomodon tristis** Sull.
On steep sunny rocks and at the base of trees. Not yet found fruiting in North America. **LITCHFIELD**: New Milford, Nichols. **NEW HAVEN**: East Haven (1856), Hamden, and New Haven, Eaton; North Branford, Evans; Woodbridge, Eaton.
Eastern United States; Europe; Asia.
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Anomodon Hook. & Tayl.

1. Upper half of leaves lingulate, obtuse or short-apiculate.
   leaves spreading when moist..........................  2
   Upper half of leaves more or less tapering.............  3

2. Leaves apiculate and with large auricles at the base....
   A. apiculatus
   Leaves rounded at apex, base not auriculate........ A. minor

3. Leaves blunt, apiculate, subsecund; branches tapering....
   A. attenuatus
   Leaves narrowly acuminate, spreading when moist;
   branches blunt ........................................ A. rostratus

Anomodon apiculatus Br. & Sch.
   On shaded rocks and at the base of trees. Autumn. Litchfield: Salisbury (1900), Gilman.
   Ontario and New England, south to Georgia; Europe; Asia.

Anomodon minor (Beauv.) Fürn.  A. obtusifolius Br. & Sch.
   On trees and rocks in the woods. Fruit rare, autumn.
   Litchfield: Salisbury, Nichols. Fairfield: Darien, Mrs. Lowe; Sherman, Nichols.
   New Haven: Cheshire, Evans; Orange (1875), Eaton; Oxford, Harger.
   New Brunswick to South Dakota, south to Virginia; Asia.

Anomodon attenuatus (Schreb.) Hüben.
   Rocks, stumps, and trees in the woods. Autumn. Litchfield: New Milford, Nichols; Salisbury, Gilman.
   Hartford: West Hartford, Miss Lorenz. Tolland: Stafford, Nichols.
   Windham: Canterbury, Mrs. Hadley. Fairfield: Danbury, Nichols; Darien, Mrs. Lowe.
   New Haven: Beacon Falls and Cheshire, Nichols; Hamden, Eaton; Meriden, Nichols;
   New London: Ledyard, Nichols.
   Newfoundland to Florida, west to British Columbia and Kansas; Cuba; Europe; Asia.
Anomodon rostratus (Hedw.) Schimp.
At the base of trees and on rocks in the woods. Autumn.
Canada to the Gulf of Mexico; Europe; Asia.
Ref. Eaton, 15, 65. Mrs. Hadley, 42.

Leskea Hedw.
Leaves ovate-oblong, obtuse, not plicate............L. obscura
Leaves ovate-lanceolate, acute to acuminate, biplicate....
L. polycarpa

Leskea polycarpa Ehrh.
Newfoundland to British Columbia, and southward; Europe; Asia.

Leskea obscura Hedw.
New Brunswick, Ontario, and the United States east of the Rocky Mountains; Japan.

**Rauia Aust.**

At the base of trees and on stones in the woods. Autumn.
Ontario and New England, south to North Carolina and Missouri.

**Haplocladium C. Müll.**

Stem leaves roundish-ovate, abruptly short-acuminate....

*H. virginianum*

Stem leaves ovate, gradually acuminate.......*H. microphyllum*


Massachusetts to Wisconsin, south to Mexico; Europe.
Exsic. Grout, N. Amer. Musci Pleuro. No. 172 (as *Thuidium virginianum*).
Ref. Mrs. Lowe, 55; 58.

On rotten wood, bases of trees, stones, and the ground. Summer. New Haven; Woodbridge (1879), J. A. Allen.
New Brunswick to British Columbia, and southward to the Gulf of Mexico; Cuba; Jamaica; Europe; Asia.
Ref. Limpricht. 51², 828.

**Claopodium** (Lesq. & James) Ren. & Card.
**Claopodium pellucinerve** (Mitt.) Best.
"On an old log in a swamp." Fairfield: Darien (1903), Mrs. Lowe.
Known from but two other localities—North India and Yukon Territory.
Ref. Miss Wheeler, 80.

**Thuidium** Br. & Sch.

1. Monoicous; plants small ........................................ 2
   Dioicous; plants large, stems 6-10 cm. long................. 3

2. Stem 1-2 cm. long; branches papillose............. **T. pygmaeum**
   Stem 2-4 cm. long; branches smooth................. **T. minutulum**

3. Stem pinnately branched; plants ascending........ **T. abietinum**
   Stems mostly bipinnately branched; plants prostrate..... 4

4. Stem leaves abruptly acuminate, margin plane, midrib
   percurrent; perichaetial leaves not ciliate..... **T. recognitum**
   Margin of stem leaves revolute, midrib vanishing below
   the apex ........................................................... 5

5. Branches densely paraphyllose; stem leaves gradually
   acuminate, coarsely papillose; perichaetial leaves ciliate
   **T. delicatum**
   Branches with few or no paraphyllia; stem leaves minutely
   papillose; perichaetial leaves not ciliate.............. **T. Alleni**

**Thuidium pygmaeum** Br. & Sch. *Hypnum pygmaeum* Sull.
Rocks or earth in the woods. Summer. New Haven:
Cheshire (1879), J. A. Allen.
New England to Ohio; Canada; Asia.

**Thuidium minutulum** (Hedw.) Br. & Sch. *Hypnum minutulum* Hedw.
At the base of trees and on rotten logs in the woods.
Autumn. New Haven: New Haven (1855) and Orange,
Eaton; Oxford, Harger; Woodbridge, Evans.
New Brunswick to Minnesota, south to Florida and Mexico; Europe.

**Thuidium recognitum** (Hedw.) Lindb. *Hypnum recognitum* Hedw.
Labrador to Yukon Territory, south in the east to Florida; Europe; Asia; Africa.

**Thuidium delicatulum** (L.) Br. & Sch. *Hypnum delicatulum* L.
Labrador to the Rocky Mountains, south to the Gulf States and Mexico; West Indies; Central and South America; Europe; Asia.

Connecticut to Louisiana.
Ref. Austin, 4, 15, 16. Grout, 37, 240. Lesquereux &
Thuidium abietinum (L.) Br. & Sch. *Hypnum abietinum* L.

On rocks and the ground in dry, open woods, especially in calcareous districts. Spring; not yet found fruiting in the eastern United States. *Litchfield*: Salisbury (1907), *Nichols*.

Greenland to Virginia, westward to Alaska and the Rocky Mountains; Europe; Asia.

**Elodium** (Sull.) Warnst.


Ontario and New England, south to Delaware and Illinois; Asia.

Exsic. Grout, N. Amer. Musci Pleuro. No. 156 (as *Thuidium paludosum*).


**FAMILY HYPNACEÆ**

**Camptothecium** Br. & Sch.

**Camptothecium nitens** (Schreb.) Schimp. *Hypnum nitens* Schreb.


Arctic America, Canada, and the northern United States; Europe; Asia.

Brachythecium Br. & Sch.

1. Stalk smooth throughout ............................... 2
   Stalk more or less roughened ............................ 5

2. Dioicous ................................................. 3
   Monoicous ................................................ 4

3. Capsules erect and symmetrical .................. B. acuminatum
   Capsules unsymmetrical, more or less inclined .... B. oxycladon

4. Stem leaves gradually narrowed from base to slender apex .................................. B. acutum
   Stem leaves ovate-lanceolate ................................ B. salebrosum

5. Stalk rough above, nearly smooth below; monoicous 6
   Stalk rough throughout with large, crowded papillae ........ 8

6. Midrib extending nearly to apex of leaf ............ B. populeum
   Midrib extending to middle of leaf or a little beyond ... 7

7. Cilia appendiculate .................................. B. plumosum
   Cilia not appendiculate .................................. B. campestre

8. Dioicous .................................................. 9
   Monoicous .................................................. 10

9. Cells of branch leaves about 5 times as long as broad, unipapillate ........................................ B. Novæ-Anglæ
   Cells of branch leaves at least 8 times as long as broad, smooth ............................................ B. rivulare

10. Stem leaves lanceolate; cilia not appendiculate.. B. velutinum
    Stem leaves ovate to triangular-ovate ................... 11

11. Cilia not appendiculate ................................ B. Rutabulum
    Cilia appendiculate ...................................... B. Starkei

Brachythecium salebrosum (Hoffm.) Br. & Sch. Hypnum salebrosum Hoffm.


Arctic America, Canada, and southward to South Carolina and Missouri; Europe; Asia; Africa.

Ref. Eaton, 15, 66.
Brachythecium campestre (C. Müll.) Br. & Sch. *Hypnum campestre* Bruch.


Canada and the northern United States, south to the mountains of Alabama and Colorado; Europe; Asia; Africa. **Ref.** Eaton, 15, 66.

Brachythecium acutum (Mitt.) Sull. *Hypnum acutum* Mitt.

On rotten logs and earth in moist places. Autumn. **New Haven**: New Haven (1875), Pease.

Canada and the northern United States, south to Arkansas.


Newfoundland to Florida, westward to the Rocky Mountains; Europe. **Ref.** Eaton, 15, 66.

Brachythecium Rutabulum (L.) Br. & Sch. *Hypnum Rutabulum* L.

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Newfoundland to Michigan, south to Maryland and Missouri, and on the Pacific slope; Greenland; Europe; Asia; Africa.

Ref. Eaton, 15, 66.

Brachythecium rivulare Br. & Sch.  Hypnum rivulare Bruch.

Wet rocks in brooks, swamps, and ravines. Winter.

Windham: Windham, Nichols. New Haven: Beacon Falls, Nichols; Bethany (1876), Eaton; Cheshire, Nichols; Hamden, J. A. Allen; Woodbridge, Brewster.

Northern North America, south to North Carolina and Missouri; Europe; Asia.

Exsic. Renauld & Cardot, Musci Amer. Sept. No. 244.
Ref. Eaton, 15, 66.

Brachythecium acuminatum (Hedw.) Kindb.  Hypnum acuminatum Beauv.

On roots of trees, decaying logs, and rocks in moist woods. Autumn.


Nova Scotia to Minnesota and Colorado, south to the Gulf States.

Brachythecium plumosum (Sw.) Br. & Sch.  Hypnum plumosum Sw.

Wet non-calcareous rocks in brooks. Autumn.


Newfoundland to British Columbia, south in the east to Alabama; Europe; Asia; Hawaiian Islands.


Brachythecium populeum (Hedw.) Br. & Sch. Hypnum populeum Hedw.


On trap rock. New Haven: New Haven (1876), Pease. The only American locality for the variety.

Nova Scotia to Ontario, south to North Carolina; British Columbia; Europe; Africa.


Brachythecium Starkei (Brid.) Br. & Sch. Hypnum Starkei Hedw.

At the base of trees, on rotting stumps and earth, in moist mountainous or hilly woods. Winter. Fairfield: Darien, Mrs. Lowe. New Haven: Woodbridge (1877), O. D. Allen. Arctic America, Canada, and the northern United States; Europe.


Canada southward to North Carolina and Missouri; Europe; Asia.

Ref. Eaton, 15, 66.

**Brachythecium velutinum** (L.) Br. & Sch. *Hypnum velutinum* L.


Canada and the northern United States; Europe; Asia.

Ref. Eaton, 15, 66.

**Cirriphyllum Grout**

Stalk smooth ...........................................C. Boscii
Stalk rough .............................................C. piliferum

**Cirriphyllum piliferum** (Schreb.) Grout. *Hypnum piliferum* Schreb. *Eurynchium piliferum* Br. & Sch.


Newfoundland to Maryland and Ohio; Montana to California; Greenland; Europe; Asia.

Ref. Eaton, 15, 66.


Vermont to Florida, westward to Colorado and Arkansas.

Eurynchium Br. & Sch.

1. Stalk smooth ........................................ 2
   Stalk rough ........................................ 4

2. Mosses growing on earth, rocks, or logs in moist woods 3
   Mosses growing on wet rocks in brooks or springs......
   E. rusciforme

3. Leaves spreading; branches attenuate........... E. strigosum
   Leaves appressed-imbricated; branches short, julaceous..
   E. diversifolium

4. Leaves distinctly papillose; median cells 4-6 times as long as broad ............. E. graminicolor
   Leaves smooth or only slightly papillose; median cells
   6-10 times as long as broad...................... E. hians

Eurynchium strigosum (Hoffm.) Br. & Sch. Hypnum strigosum Hoffm.

Gravelly soil or rocks, roots and old logs, in open woods.

Arctic America, Canada, and the northern United States: Europe; Asia; Africa.
Ref. Eaton, 15, 66.

Eurynchium diversifolium Br. & Sch. Hypnum diversifolium Schimp.

Soil and rocks in mountainous woods. Late autumn.

Ontario and New England to British Columbia, south to Louisiana; Greenland; Europe; Asia.
Ref. Eaton, 15, 66.


New Brunswick to Minnesota, south to Georgia.

**Exsic.** Renauld & Cardot, Musci Amer. Sept. No. 196 (as *E. Sullivanii*).


**Eurynchium hians** (Hedw.) Jaeg. & Sauerb. *Hypnum hians* Hedw.

Moist earth in open woods. Late autumn. **Litchfield**: Salisbury, Nichols. **Hartford**: Burlington and Canton, Nichols; Manchester, Cheney. **Tolland**: Bolton and Stafford, Nichols. **Windham**: Windham, Nichols. **New Haven**: Cheshire (1855), Blackman; East Haven, Eaton; Hamden, J. A. Allen; Meriden, Miss Lorenz; New Haven, Eaton; Woodbridge, Evans. **Middlesex**: Killingworth, Nichols.

Nova Scotia to British Columbia, south in the east to Alabama; Europe.

**Ref.** Eaton, 15, 66.


Newfoundland to Ontario, south to Georgia, and on the Pacific slope; Europe; Asia; Africa.

**Exsic.** Renauld & Cardot, Musci Amer. Sept. No. 197 (as *Rhynchostegium rusciforme*).

**Ref.** Eaton, 15, 67.
Rhynchostegium Br. & Sch.

Rhynchostegium serrulatum (Hedw.) Jaeg. & Sauerb. Hypnum serrulatum Hedw.


Newfoundland to Wisconsin, south to the Gulf of Mexico; Alaska; British Columbia.


Sematophyllum Mitt.

1. Plants growing on wet rocks; monoicous; leaves entire; cilia one or two, short and imperfect.........S. carolinianum

Plants growing on trees, decayed logs, or shaded banks; dioicus ........................................ 2

2. Cilia two, well developed; leaves serrulate at apex........

S. recurvans

Cilia none or rudimentary; leaves sharply serrate at apex

S. tenuirostre


Var. squarrosa (Michx.) E. G. Britton. Leskea squarrosa Michx.

New Haven: New Haven (1890), Chatterton.
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Newfoundland to Manitoba, south to North Carolina and Missouri; Mexico.

Sematophyllum tenuirostre (Br. & Sch.) E. G. Britton. 
_Hypnum cylindrocarpum_ C. Müll. Rhynchostegium cylindro-
carpum Aust.
On rocks and decaying logs in the woods. Autumn. New
Haven: Hamden (1878), _J. A. Allen._
Labrador and Newfoundland, south to Georgia.

Sematophyllum carolinianum (C. Müll.) E. G. Britton. 
_Hypnum demissum_ Wils. var. carolinianum Sull. & Lesq.
Wet, non-calcareous rocks in mountain or hill ravines. 
Autumn. _Litchfield:_ Salisbury, _Nichols._ _Hartford:_ Hartford, 
_Mrs. Lowe._ _Fairfield:_ Darien, _Mrs. Lowe._ New
Haven: Orange (1875), _Young_; Woodbridge, _J. A. Allen._
Middlesex: Killingworth, _Nichols._
Newfoundland to the Gulf States; Asia.
_Exsic._ Grout, N. Amer. Musci Pleuro. No. 307 (as 
_Raphidostegium carolinianum_).

**Isopterygium Mitt.**

1. Leaves distinctly serrulate, at least in the apical half...... 2
    Leaves entire, or nearly so............................. 3

2. Plants monoicous; leaves serrulate to the middle......

**I. turfaceum**

Plants dioicous; leaves serrulate to the base... _I. deplanatum_.

3. Leaves perfectly entire, without axillary propagula;
    branchlets tending to become flagelliform at the tips

**I. Muellerianum**

Leaves slightly serrulate at apex, and frequently producing 
numerous leafy propagula in the axils; branchlets never 
flagelliform .................................................. _I. elegans_

**Isopterygium deplanatum** (Schimp.) Jaeg. & Sauerb. 
_Hypnum deplanatum_ Schimp. Rhynchostegium deplanatum 
Sull.
On earth, flat stones, or rotten wood in moist woods.
Fruit rare, autumn. **Tolland:** Stafford, **Nichols.** New Haven: Cheshire, **Evans;** Hamden (1876), **Pease.**

**Isopterygium turfaceum** Lindb. *Hypnum turfaceum* Lindb.

In peat bogs or on moist rich soil in the woods. Early summer. **Litchfield:** Salisbury, **Nichols.** New Haven: East Haven, **Nichols;** Woodbridge (1880), *J. A. Allen.*

Canada south to Georgia and Texas; Europe.

**Isopterygium Muellerianum** (Schimp.) Lindb. *Hypnum Muellerianum* Hook. f.

Moist rocks and earth in mountainous or hilly ravines. Fruit rare, late summer. **Litchfield:** Salisbury, **Miss Lorenz.** Hartford: Manchester, **Miss Lorenz.** New Haven: Beacon Falls, **Nichols;** Hamden (1880), *J. A. Allen.* Middlesex: Killingworth, **Nichols.**

New England to North Carolina and Ohio; Europe; Asia.

**Isopterygium elegans** (Hook.) Lindb. *Hypnum elegans* Hook.

On the ground and rocks in mountainous or hilly woods. Summer. **New Haven:** Beacon Falls, **Nichols;** Woodbridge (1879), *J. A. Allen.*

Throughout northern North America, and south along the mountains to Alabama; Europe; Asia.

**Plagiothecium** Br. & Sch.

1. Leaves equally spreading, alar cells greatly enlarged;
   branches erect ........................................... *P. striatellum*
   Leaves more or less complanate.......................... 2
2. Teeth of peristome not confluent at base and without cross
   striations on outer surface; cilia lacking....... *P. latebricola*
   Teeth of peristome confluent at base and distinctly trans-
   versely striate on outer surface; cilia present..... 3
3. Monoicous; stems depressed; leaves distinctly complanate,
   pale green, very glossy............................... *P. denticulatum*
   Dioicous .................................................. 4
4. Stems depressed: leaves distinctly complanate, acute to acuminate, dark green, scarcely glossy .......\textit{P. sylvaticum}
Stems ascending: leaves obscurely complanate or spreading, distinctly acuminate, pale green, glossy .......\textit{P. Roeseanum}

\textbf{Plagiothecium latebricola} (Wils.) Br. & Sch. \textit{Hypnum latebricola} Lindb.

Roots, stumps, and hummocks in swamps. Late summer.
\textbf{New Haven}: East Haven (1879), J. A. Allen.
Nova Scotia to Ontario, south to Alabama; Europe.

\textbf{Plagiothecium sylvaticum} (Huds.) Br. & Sch. \textit{Hypnum sylvaticum} Huds.

On soil, rocks, and decaying logs in the woods. Summer.
\textbf{Litchfield}: New Milford, \textit{Nichols}; Salisbury, \textit{Gilman}.
\textbf{Hartford}: Hartford, \textit{Miss Lorenz}. \textbf{Tolland}: Stafford, \textit{Nichols}.
Nova Scotia to Minnesota, south to Alabama; Alaska to Oregon; Europe; Asia; Africa.

\textbf{Plagiothecium Roeseanum} Br. & Sch. \textit{Hypnum Sullivaniae} Schimp.

Nova Scotia to Alaska and British Columbia, south in the east to Florida; Europe; Asia.

\textbf{Plagiothecium denticulatum} (L.) Br. & Sch. \textit{Hypnum denticulatum} L.

Decayed logs, stones, and humus in moist woods. Summer.
East Haven, Eaton; Hamden, Pease; New Haven, J. A. Allen; North Haven, Nichols; Orange (1874), Young. Middlesex: Killingworth, Nichols.

Var. laetum (Br. & Sch.) Lindb.


Arctic America, Canada, and the northern United States, southward along the mountains; South America; Europe; Asia; Africa; New Zealand; Tasmania.


Greenland and Newfoundland to Minnesota, south to North Carolina; Alaska; Europe.


Amblystegiella Loeske

Plants minute (0.5-1 cm. long); leaves 0.2-0.4 mm. long...

A. confervoides

Plants larger (2-4 cm. long); leaves 0.8-1.2 mm. long...

A. adnata

Amblystegiella confervoides (Brid.) Loeske. Hypnum confervoides Brid.


New Brunswick to Connecticut and Ohio, westward to the Rocky Mountains; Europe; Asia.
No. 11.] THE BRYOPHYES OF CONNECTICUT. 155


Amblystegiella adnata (Hedw.) Nichols. Hypnum adnatum Hedw. Amblystegium adnatum Aust.

On rocks and at the base of trees in the woods. Autumn.

New Brunswick to British Columbia, south to North Carolina and Texas; Asia.

Amblystegium Br. & Sch.
1. Leaves with a distinct border, midrib joining border at apex ............................................................... A. Lescurii
   Leaves not bordered ................................................ 2
2. Midrib extending nearly or quite to apex ......................... 3
   Midrib disappearing at the middle or above .................... 6
3. Leaves not acuminate, apex blunt ................................ A. fluviatile
   Leaves acuminate, apex acute .................................... 4
4. Basal cells abruptly enlarged .................................... A. irriguum
   Basal cells not enlarged ........................................ 5
5. Midrib ceasing below apex, 0.024-0.035 mm. wide at base...
   A. varium
   Midrib commonly strong, excurrent, 0.065-0.225 mm. wide at base .................................................. A. noterophilum
6. Cells near middle of leaf 10-15 times as long as broad...
   A. riparium
   Cells near middle of leaf 8 times as long as broad, or less 7
7. Alar cells quadrate or transversely elongated .............. A. serpens
   Alar cells oblong .................................................. 8
8. Stem leaves 0.9-1.2 mm. long .................................. A. Juratzkanum
   Stem leaves 1.2-1.6 mm. long .................................. A. Kochii

Amblystegium serpens (L.) Br. & Sch. Hypnum serpens L.

On the roots and at the base of trees, on decaying logs, soil, and rocks in moist woods. Early summer. Litchfield:
Amblystegium Juratzkanum Schimp.


Temperate North America; Europe; Asia.


Southern Canada to the Gulf of Mexico; Europe.


Amblystegium irriguum (Wils.) Br. & Sch. Hypnum irriguum Wils.

On earth or stones, not on limestone, in wet places, frequently in the water. Late spring. Hartford: Hartford and Windsor, Mrs. Lowe.

Ontario southward to North Carolina and Missouri; Europe; Asia; Africa.

Ref. Mrs. Lowe, 58.

Amblystegium noterophilum (Sull.) Holzing. Hypnum irriguum var. spinifolium Lesq. & James.
In or at the margins of springs and streams in calcareous regions. Rarely fruiting; summer. **Litchfield**: Salisbury, (1907), **Nichols**.

New England to Pennsylvania, westward to Montana and Oregon.

**Amblystegium fluviatile** (Sw.) Br. & Sch. *Hypnum fluviatile* Sw.

Rocks or earth in and along streams in non-calcareous districts. Early summer. **Litchfield**: Salisbury, **Nichols**. **Hartford**: Berlin, **Coleman**; Plainville and Southington, **Chamberlain**. **Tolland**: Ellington, **Pease**; Stafford, **Nichols**. **Windham**: Canterbury, **Mrs. Hadley**. **New Haven**: Cheshire, **Eaton**; East Haven, **O. D. Allen**; Hamden, **Nichols**; Meriden (1856), **Eaton**; North Branford, **Evans**. **Middlesex**: Killingworth, **Nichols**.

Newfoundland to Wisconsin, south to New Jersey and Missouri; Europe.

**Exsic.** Renauld & Cardot, Musci Amer. Sept. No. 246 (as *A. orthoclodon*).

**Ref.** Eaton, 15, 67.

**Amblystegium Lescurii** (Sull.) Aust. *Hypnum Lescurii* Sull.

Wet rocks in mountain or hill streams. Late spring. **Tolland**: Ellington, **Pease**; Stafford, **Nichols**. **New Haven**: Ansonia, **O. D. Allen**; Beacon Falls, **Nichols**; Hamden, **J. A. Allen**; Orange (1874), **Kleeberger**. **New London**: Groton, **C. B. Graves**; Ledyard, **Nichols**.

Ontario and New England, south to Georgia.

**Amblystegium riparium** (L.) Br. & Sch. *Hypnum riparium* L.

On earth, stones, and roots of trees, in swamps, springs, or running water. Late spring. **Litchfield**: Litchfield, **Mrs. E. G. Britton**; Salisbury, **Nichols**. **Hartford**: Hartford, **Mrs. Lowe**; Southington, **Nichols**. **Tolland**: Bolton, **Nichols**; Ellington, **Pease**. **New Haven**: East Haven, Hamden, and New Haven (1856), **Eaton**. **New London**: Waterford, **C. B. Graves**.
Var. longifolium (Schultz) Br. & Sch.

FAIRFIELD: Darien (1903), Mrs. Lowe.
Throughout North America, and in most parts of the world.

Amblystegium Kochii Br. & Sch.
On earth in moist woods. Early summer. New Haven:
New Haven (1906), Nichols.
Probably throughout temperate North America; Europe; Asia.

Chrysohypnum (Hampe) G. Roth

1. Midrib wanting, or very short and double............ 2
   Midrib distinct, single.............................. 4

2. Monoicous; plants small (1-4 cm. long); leaves finely ser-
   rulate all around................................. C. hispidulum
   Dioicous; plants larger (5-10 cm. long); leaves entire.... 3

3. Stems erect or ascending; leaves gradually acuminate...
   C. stellatum
   Stems procumbent; leaves suddenly ending in a long piliform acumen ................. C. protensum

4. Leaves squarrose, alar cells scarcely enlarged........
   C. chrysophyllum
   Leaves erect, spreading; alar cells enlarged... C. polygamum

Chrysohypnum hispidulum (Brid.) G. Roth. Hypnum hispidulum Brid.

Canada southward to North Carolina and Missouri; Europe; Asia.

Chrysohypnum chrysophyllum (Brid.) Loeske. Hypnum chrysophyllum Brid.
Rocks, earth, roots, and stumps, in moist places. Summer.

Var. tenellum Schimp. Hypnum bergenense Aust.

Canada and the northern United States, south to Louisiana; Europe; Asia.


Chrysohypnum protensum (Brid.) Loeske. Hypnum stellatum var. protensum Röhl.

Canada and the northern United States; Europe; Asia.

Chrysohypnum stellatum (Schreb.) Loeske. Hypnum stellatum Schreb.

Arctic America, south to Virginia; Europe; Asia.

Chrysohypnum polygamum (Br. & Sch.) Loeske. Hypnum polygamum Wils.

Arctic America, Canada, and the northern United States; Europe; Asia.

Cratoneuron (Sull.) G. Roth

Cratoneuron filicinum (L.) G. Roth. Hypnum filicinum L.

On wet limestone rocks, frequently in springs or swamps.
Fruit rare, spring. **Litchfield**: Salisbury (1905), *Nichols*. **Fairfield**: Sherman, *Nichols*.

Arctic America, Canada, and the northern United States, south to the mountains of Utah; Europe; Asia; Africa.

**Rhytidiadelphus** (Lindb.) Warnst.

Stem leaves multiplicate, rough at back..........*R. triquetrus*

Stem leaves not plicate, smooth at back..........*R. squarrosus*


Arctic America, Canada, and the northern United States; south in the east to North Carolina; Europe; Asia; Africa.

Ref. Eaton. 15, 68.

**Rhytidiadelphus squarrosus** (L.) Warnst. *Hypnum squarrosum* L.

Meadows and wet grassy places. Fruit rare, spring. **New Haven**: Hamden (1880), *J. A. Allen*.

Arctic America, Canada, and the northern United States; Europe; Asia; Azores.

**Rhytidium** (Sull.) Kindb.

**Rhytidium rugosum** (Ehrh.) Kindb. *Hypnum rugosum* Ehrh.

In dry grassy places and on sunny rocks, usually calcareous, in mountainous or hilly regions. Fruit very rare, summer. **Litchfield**: Salisbury, *Mrs. Phelps*. **Fairfield**: Sherman, *Nichols*. **New Haven**: Meriden (1873), *Eaton*.

Arctic America, Canada, and the northern United States; Europe; Asia.

Hylacomium Br. & Sch.
Stem regularly bi-tripinnate; stem leaves gradually acuminate, not auricled
H. splendens
Stem irregularly pinnate; stem leaves abruptly acuminate, auricled at the base
H. brevirostre

Hylacomium splendens (Hedw.) Br. & Sch. Hypnum splendens Hedw.
Moist mountain or hill woods. Fruit occasional, spring.
Arctic America, Canada, and the northern United States; Europe; Asia; Africa.
Ref. Eaton, 15, 68.

Hylacomium brevirostre (Ehrh.) Br. & Sch. Hypnum brevirostre Ehrh.
On rocks and at the base of trees in wet ravines. Spring.
Nova Scotia to Ontario, south to North Carolina; Europe; Asia; Africa.
Ref. Eaton, 15, 68.

Ctenidium (Schimp.) Mitt.
Ctenidium molluscum (Hedw.) Mitt. Hypnum molluscum Hedw.
Moist rocks and earth in mountainous or hilly woods. Fruit occasional, summer.
Ptilium (Sull.) DeNot.

Ptilium Crista-castrensis (L.) DeNot. Hypnum Crista-castrensis L.


Arctic America, Canada, and the northern United States, south in the east to North Carolina; Europe; Asia.

Ref. Eaton, 15, 68.

Stereodon (Brid.) Mitt.

1. Alar cells more or less enlarged, often inflated, hyaline or colored ......................................................... 2
   Alar cells quadrate, not enlarged........................................ 6

2. Capsule plicate when dry; leaves serrulate above............. 3
   Capsule not plicate when dry........................................ 4

3. Alar cells scarcely inflated, yellow, thick-walled. .S. curvifolius
   Alar cells inflated, hyaline, thin-walled......................S. Lindbergii

4. Capsule suberect; leaves serrulate all around, alar cells orange; paraphyllia numerous ......................S. imponens
   Capsule cernuous; leaves serrulate only above, alar cells green, hyaline, or yellow-brown; paraphyllia few....... 5

5. Mosses growing on bark or logs in the woods..............S. fertilis
   Mosses growing on the ground in swamps.................S. pratensis

6. Quadrate cells numerous; midrib absent or very short....S. cupressiformis

   Quadrate cells few; midrib usually reaching to middle of leaf ................................................................. 7
7. Branch leaves long-acuminate, serrulate to near the base
   S. pallescens
   Branch leaves subulate to short-acuminate, serrulate only
   above the middle ......................... S. reptilis

Stereodon fertilis (Sendt.) Lindb. Hypnum fertile Sendt.
Rotten logs and stumps in mountainous or hilly woods.
Summer. WINDHAM: Canterbury, Mrs. Hadley. NEW
HAVEN: Oxford (1888), Harger.
Canada and the northern United States, south in the east
to Georgia; Europe; Asia.

Stereodon pallescens (Hedw.) Lindb. Hypnum palles-
On rocks and stumps and at the base of trees in hilly woods.
Summer. LITCHFIELD: Salisbury, Nichols. WINDHAM: Can-
terbury, Mrs. Hadley. NEW HAVEN: East Haven and Wood-
bridge (1866), Eaton. NEW LONDON: East Lyme, New
Canada and the northern United States, south in the east
to North Carolina; Europe; Asia.

Stereodon reptilis (Michx.) Mitt. Hypnum reptile
Michx.
On roots, logs, and at the base of trees, especially spruce,
in mountainous or hilly woods. Autumn. LITCHFIELD: Salis-
bury, Gilman. HARTFORD: Hartford, Mrs. Lowe. TOLLAND:
Stafford, Nichols. WINDHAM: Canterbury, Mrs. Hadley.
FAIRFIELD: Danbury, Nichols; Darien, Mrs. Lowe. NEW
HAVEN: New Haven (1876), J. A. Allen; Orange, O. D. Allen.
MIDDLESEX: Killingworth, Nichols.
Canada south to North Carolina and Utah; Europe; Asia.

Stereodon imponens (Hedw.) Lindb. Hypnum imponens
Hedw.
On stones, earth, roots, and stumps in moist woods. Late
autumn. LITCHFIELD: Salisbury, Gilman. HARTFORD: Can-
ton, Nichols; West Hartford, Miss Lorenz; Windsor, W. E.
Stereodon cupressiformis (L.) Lindb. *Hypnum cupressiforme* L.


Arctic America, Canada, and south to the Gulf States; a cosmopolitan.


Arctic America, Canada, and the northern United States, south in the east to Florida; Europe; Asia.

Exsic. Grout, N. Amer. Musci Pleuro. No. 141 (as *H. Patientiae*).


On decaying logs, rarely on rocks, in moist woods. Early summer. **Litchfield**: Salisbury, Nichols. **Tolland**: Elling-
Stereodon pratensis (Koch) E. G. Britton. Hypnum pratense Koch.


Arctic America, Canada, and the northern United States, south in the east to Florida; Europe; Asia.

Heterophyllum Kindb.


Nova Scotia to Montana, and south to Alabama and Missouri; Europe; Asia.


Ref. Eaton, 15, 68.
Hypnum (Dill.) L.

Hypnum Schreberi Willd.

Dry, open woods, banks, bogs, etc. Fruit occasional, spring.


Arctic America, Canada, and the northern United States; Europe; Asia.

Ref. Eaton, 15, 68.

Calliergon (Sull.) Kindb.

Plants monoicus (autoicus), sparingly branched; alar cells enlarged, but passing gradually into the normal cells of the leaf.................C. cordifolium

Plants dioicus, profusely branched; alar cells inflated, forming a sharply defined group.............C. giganteum

Calliergon giganteum (Schimp.) Kindb. Hypnum giganteum Schimp.

Bogs, swamps, and wet places, especially in calcareous districts. Fruit rare, May-June. Litchfield: Salisbury, Mrs. Phelps. Fairfield: Danbury (1907), Nichols.

Greenland to Pennsylvania and westward to the Pacific coast: Europe; Asia.

Calliergon cordifolium (Hedw.) Kindb. Hypnum cordifolium Hedw.


Arctic America, Canada, and the northern United States; Europe; Asia.

Ref. Eaton, 15, 68.
Acrocladium Mitt.

**Acrocladium cuspidatum** (L.) Lindb. *Hypnum cuspidatum* L.


Canada and the northern United States; Europe; Asia; Africa.

Ref. Eaton, 15, 68.

**Drepanocladus** (C. Müll.) G. Roth

1. Stem with a cortical layer of large, hyaline cells.................. 2
   Stem lacking a distinct cortical layer........................... 3
2. Leaves distinctly plicate when moist, and usually minutely serrulate; plants monoicous (autoicous)........... **D. aduncus**
   Leaves not plicate when moist, entire; plants dioicous.
   **D. intermedius**
3. Leaves serrulate, at least near the apex; annulus lacking;
   plants monoicous (autoicous)......................... **D. fluitans**
   Leaves entire; annulus distinct; plants dioicous........... 4
4. Alar cells enlarged and forming a well-defined group which extends from the margin of the leaf to the midrib........ **D. Kneiffii**
   Alar cells enlarged, but not extending more than half-way from the margin to the midrib.......................... 5
5. Alar cells hyaline, becoming brown with age, and forming a clearly defined group; midrib 0.05-0.06 mm. wide at base ............. **D. subaduncus**
   Alar cells yellowish brown, enlarged, but showing a gradual transition into the normal cells of the leaf;
   midrib 0.07-0.11 mm. wide at base.................... **D. Sendtneri**

**Drepanocladus** Kneiffii (Schimp.) Warnst. *Hypnum aduncum* var. Kneiffii Schimp.


Arctic America, Canada, and the northern United States; Europe; Africa.
Drepanocladus subaduncus Warnst. *Hypnum aduncum* var. *gracilesens* Br. & Sch.

Swamps and wet places, especially in limestone regions. Rarely fruiting, May-June. **Litchfield**: Salisbury (1907), *Nichols*. **Fairfield**: Danbury, *Nichols*.

Northern North America; Europe.


Arctic America, Canada, and the northern United States, south in the west to Utah; Europe; Asia.

**Ref.** Eaton, 15, 67. Rau & Hervey, 64, 45.

Drepanocladus intermedius (Lindb.) Warnst. *Hypnum revolvens* Sw. var. *intermedium* Ren.


Northern North America; Europe.


Arctic America, Canada, and the United States, south to North Carolina and Nevada; Europe; Asia.

**Ref.** Eaton, 15, 67.

Drepanocladus fluitans (L.) Warnst. *Hypnum fluitans* L.


Arctic America, Canada, and the northern United States,
south in the west to Utah; Europe; Asia; Africa; New Zealand.

Hygrohypnum (Lindb.) Loeske
1. Leaves suborbicular; alar cells yellow; midrib faint, short, furcate ........................................... H. dilatatum
Leaves ovate or ovate-lanceolate.......................... 2
2. Dioicus; alar cells hyaline or yellowish; midrib reaching middle of leaf or beyond, simple or furcate; perichaetial leaves not plicate ........................................ H. ochraceum
Monoicus; alar cells golden yellow to yellow-brown, rarely hyaline; perichaetial leaves plicate............... 3
3. Midrib absent, or short and furcate.................... 4
   Midrib single, reaching above middle of leaf....... H. palustre
4. Leaves broad (2:1), minutely serrulate to the base..... H. Mackayi
   Leaves narrower (3:1), serrulate only at the apex. .... H. eugyrium

Hygrohypnum palustre (Huds.) Loeske. Hypnum palustre Huds.
Canada and the northern United States; Europe; Asia.

Hygrohypnum dilatatum (Wils.) Loeske. Hypnum molle of some authors.
Arctic America and Canada, south to North Carolina and Colorado; Europe; Asia.

Hygrohypnum eugyrium (Br. & Sch.) Loeske. Hypnum eugyrium Schimp.
On wet non-calcareous rocks in or near mountain or hill brooks. Summer. Litchfield: Salisbury, Gilman. New Haven: Beacon Falls, Nichols; Hamden (1878) and Woodbridge, J. A. Allen.
Newfoundland to Alaska, south to Georgia and Colorado; Europe.

**Hygrohypnum Mackayi** (Schimp.) Loeske.
Shaded stones in hill streams. Summer. New Haven: Beacon Falls (1907), Nichols.
Probably has same range as *H. eugyrium*.

**Hygrohypnum ochraceum** (Turn.) Loeske. *Hypnum ochraceum* Turn.
Arctic America, Canada, and the northern United States; Europe; Asia.

**FAMILY DENDROIDACEÆ**

**Climacium** Web. f. & Mohr

**Climacium americanum** Brid.
New Brunswick to Alabama, west to the Rocky Mountains.


**Thamnium Br. & Sch.**

**Thamnium alleghaniense** (C. Müll.) Br. & Sch. *Hypnum alleghaniense* C. Müll.


Nova Scotia to Minnesota, south to the Gulf States.


**FAMILY WEBERACEÆ**

*Webera Ehrh.*

\[\text{Webera sessilis} (\text{Schmid.}) \text{Lindb.} \]

\[\text{Diphyscium foliosum} \]

Mohr. 1853

Moist, shaded earth and banks. Summer. **Litchfield**: New Milford, Nichols; Salisbury, Gilman. **Hartford**: Hartford, Mrs. Lowe; Southington, Chamberlain; West Hartford, Miss Lorenz. **Tolland**: Bolton, Nichols. **Windham**: Canterbury, Mrs. Hadley; Windham, Nichols. **Fairfield**: Danbury and Huntington, Nichols; Redding, Evans. **New Haven**: Ansonia, O. D. Allen; Beacon Falls, Nichols; Meriden, Nichols; New Haven (1855), Orange, and Woodbridge, Eaton. **Middlesex**: Killingworth, Nichols. **New London**: Montville, C. B. Graves.

Nova Scotia to Ontario, south to Alabama; Europe; Asia; Madeira Islands.

Exsic. Holzinger, Musci Acro. Bor.-Amer. No. 121* (as *Diphyscium foliosum*).

Ref. Collins, 14, 131. Eaton, 15, 64.
FAMILY BUXBAUMIACEÆ

Buxbaumia Haller

Buxbaumia aphylla L.

Clayey banks and turfy soil in open woods. Spring.


Nova Scotia to Ontario and West Virginia; Yukon Territory to Washington; Europe; Asia.

Ref. Collins, 14, 131. Eaton, 15, 64; 17, 126.

FAMILY GEORGIACEÆ

. Georgia Ehrh.

Georgia pellucida (L.) Rabenh. Tetraphis pellucida Hedw.

Rotten stumps, roots, and banks in the woods. Spring.


Canada and the northern United States; Europe; Asia.

FAMILY POLYTRICHACEÆ

Catharinæa Ehrh.

1. Leaf cells distinctly papillose......................... C. Macmillani
   Leaf cells smooth, not papillose.......................... 2

2. Leaves strongly undulate, serrate nearly to base; capsules borne singly or in small clusters.................. C. undulata
   Leaves scarcely, if at all, undulate, serrate only above middle; capsules borne singly........................... 3
3. Plants rarely 5 cm. high; midrib and lamina sharply toothed at back, lamella 4-8. 
C. angustata
Sterile plants 5-10 cm. high; midrib and lamina smooth at back; lamella 1-4. 
C. crispa

Throughout temperate North America; Europe; Asia; Africa.
Ref. Collins, 14, 131. Eaton, 15, 64. Miss Lorenz, 53, 46, 47.

Catharinæa Macmillani Holzing.
New England to Minnesota and Missouri: range not definitely known.
Ref. Chamberlain, 13, 100.

Catharinæa crispa James. Atrichum crispum James.
Grassy banks of streams, and in wet sandy soil. Autumn.
Hartford: East Hartford, Weatherby.
Probably throughout Canada and the northern United States; Europe.
Ref. Miss Lorenz, 53, 46, 47.

Catharinæa angustata Brid. Atrichum angustatum Br. & Sch.
Clayey banks and sandy soil in open woods. Autumn.

Throughout temperate North America; Europe; Asia.
Ref. Collins, 14, 131. Eaton, 15, 64. Miss Lorenz, 53, 46, 47.

Pogonatum Beauv.

Pogonatum tenue (Menz.) E. G. Britton. P. brevicaule (Brid.) Beauv. P. pennsylvanicum (Hedw.) Par.

Clay banks and roadsides in open woods. Autumn.

Nova Scotia to Alabama, and west to Missouri.
Exsic. Holzinger, Musci Acro. Bor.-Amer. No. 123 (as P. pennsylvanicum).

Polytrichum (Dill.) L.

1. Epidermis of capsule with a large pit in the outer wall of each cell, neck distinctly marked off by a constriction; capsule little longer than broad. 3
   Epidermis of capsule not pitted, neck indistinctly defined; capsule much longer than broad. 2

2. Capsule cylindrical ............................... P. alpinum
   Capsule prismatic ............................... P. ohioense
3. Leaves awned, margins entire, inflexed.  P. commune

4. Awn long and hyaline.  P. piliferum
Awn short and red, rarely colorless at the point.  5

5. Stem densely tomentose, leaves erect.  P. strictum
Stem not tomentose, leaves spreading.  P. juniperinum

Polytrichum alpinum L. var. arcticum (Sw.) Wahl.
Pogonatum alpinum Röhl. var. arcticum Brid.

Stony and grassy mountain slopes. Summer. Litchfield: Salisbury (1906), Collins.
Throughout northern North America; Europe.

Polytrichum ohioense Ren. & Card. P. formosum of some authors.


Newfoundland to Alaska, south to Alabama, Missouri, and Oregon; Europe.
Ref. Collins, 14, 131. Eaton, 15, 64.

Polytrichum piliferum Schreb.
Northern North America and southward to Alabama and California; found in most quarters of the globe.
Ref. Collins, 14, 131. Eaton, 15, 64.

Polytrichum juniperinum Willd.
Arctic and temperate North America; a cosmopolitan.
Ref. Collins, 14, 131. Eaton, 15, 64.

Polytrichum strictum Banks. = P. juniperinum var. strictum
In peat bogs and wet woods. Summer. New Haven: Orange (1874), Young.
Arctic America, Canada, and the northern United States; South America; Europe; Asia.
Ref. Collins, 14, 131. Eaton, 15, 64.

Polytrichum commune L.
Throughout North America; a cosmopolitan.
Ref. Collins, 14, 131. Eaton, 15, 64.
SUMMARY

An analysis of the bryophytic flora of Connecticut brings out the interesting fact that only about 18 per cent. of the species are peculiar to America. Over 62 per cent., on the other hand, are common to Europe and Asia, a proportion which is sure to be increased when the Asiatic flora has been more thoroughly explored. Of the remaining species 16 per cent. have been found in Europe but not in Asia, while 4 per cent. have been found in Asia but not in Europe. These relationships may be clearly shown by the following table, in which the species are arranged by orders. One species of Sphagnum which is common to Africa (but not to either Europe or Asia), is included in the first column.

<table>
<thead>
<tr>
<th>Order</th>
<th>Peculiar to America</th>
<th>Common to Europe and Asia</th>
<th>Common to Europe (but not to Asia)</th>
<th>Common to Asia (but not to Europe)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marchantiales</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Jungermanniales</td>
<td>17</td>
<td>62</td>
<td>12</td>
<td>1</td>
<td>92</td>
</tr>
<tr>
<td>Anthocerotales</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Sphagnales</td>
<td>2</td>
<td>17</td>
<td>12</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Andreaeales</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Bryales</td>
<td>46</td>
<td>154</td>
<td>34</td>
<td>13</td>
<td>247</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>68</strong></td>
<td><strong>214</strong></td>
<td><strong>61</strong></td>
<td><strong>14</strong></td>
<td><strong>387</strong></td>
</tr>
</tbody>
</table>

The table shows also that about 3 per cent. of our species are Marchantiales, about 23 per cent. Jungermanniales, less than 1 per cent. Anthocerotales, about 8 per cent. Sphagnales, less than 1 per cent. Andreaeales, and about 64 per cent. Bryales.

The following table, based on the specimens at hand, gives some idea of the extent to which Connecticut has been explored for Bryophytes. Such a table is merely of historical interest. The discrepancies which apparently exist between the moss floras of the different counties are largely of a temporary nature, and will become less as the exploration of
the state proceeds. There is little probability, for example, that New Haven County is richer in Bryophytes than New London County. It simply represents the part of the state where bryologists have been most numerous and active.

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<th>Marchantiales</th>
<th>Litchfield</th>
<th>Hartford</th>
<th>Tolland</th>
<th>Windham</th>
<th>Fairfield</th>
<th>New Haven</th>
<th>Middlesex</th>
<th>New London</th>
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<td>4</td>
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<td>31</td>
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<td>35</td>
<td>12</td>
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<td>0</td>
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<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
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<td>2</td>
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<td>3</td>
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<td>Andreæales</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
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<td>Total</td>
<td>243</td>
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<td>142</td>
<td>138</td>
<td>160</td>
<td>346</td>
<td>136</td>
<td>112</td>
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</table>

The last column shows the comparatively small number of species known from each county of the state. All of these species are exceedingly common, and the present figures will probably be soon increased by the addition of other species which must be equally common. Even the majority of the species which are known at present from only one or two localities in the state are undoubtedly much more widely distributed than these scanty records would seem to indicate.
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