

HOW TO KNOW THE MOSSES

A popular guide to the Mosses of
the Northeastern United States

ELIZABETH MARIE DUNHAM

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HOW TO KNOW THE MOSSES

HOW TO KNOW THE MOSSES

A POPULAR GUIDE TO THE MOSSES
OF THE
NORTHEASTERN UNITED STATES

*Containing keys to eighty genera
and short descriptions of over one hundred and
fifty species with special reference to the
distinguishing characteristics that are
apparent without the aid of a lens*

BY

ELIZABETH MARIE DUNHAM

MEMBER OF THE SULLIVANT MOSS SOCIETY

*With Illustrations by
the Author*



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Published May 1916

TO
MY HUSBAND

MEEK creatures! the first mercy of the earth, veiling with hushed softness the dintless rocks; creatures full of pity, covering with strange and tender honor the scarred disgrace of ruin, — laying quiet fingers on the trembling stones to teach them rest. . . . No words that I know of will say what these mosses are. None are delicate enough, none perfect enough, none rich enough. How is one to tell of rounded bosses of furred and beaming green, — the starred divisions of rubied bloom, fine filmed as if the Rock Spirits could spin porphyry as we do glass, — the tracery of intricate silver, and fringes of amber, lustrous, arborescent, burnished through every fiber into fitful brightness and glossy traverses of silken change, yet all subdued and pensive, and framed for simplest, sweetest offices of grace. They will not be gathered, like the flowers, for chaplet or love-token, but of these the wild bird will make its nest, and the wearied child his pillow.

JOHN RUSKIN, *Modern Painters*.

PREFACE

THE object of this book is to present mosses in a simple, non-technical way, so that the student may recognize at least their genera and in some cases their species without depending upon the use of a lens. The books on mosses that have been published up to the present time have required the use of a hand-lens or microscope in order to follow either the Keys or the descriptions. Wonderful and interesting detail in structure is revealed by this higher method of study, but mosses would remain unknown to many if no simpler and quicker way of learning them was presented.

When urged to undertake the work of thus simplifying the study of mosses, the author, together with most moss students, held the idea that microscopic examination was necessary in order to know mosses. It was pointed out that, while a thorough knowledge of the different species must be obtained from microscopic study and technical books, the people who are content to recognize violets, asters, and goldenrods, without knowing the specific names, would be equally interested to know the generic names of mosses. A Key only to the genera of mosses, therefore, seemed perfectly feasible, as in nearly every case there is some family or

generic character that is recognizable in the field without the aid of a lens. In the descriptions of a few genera some additional characteristics visible with a hand-lens are given. These are not necessary for the use of the Keys, but are of interest in bringing out some special points.

In arranging the Keys it seemed best not to carry them out under many headings to a single genus, but to keep them as simple as possible and group even several genera under one head. This plan requires the student to refer constantly to the illustrations and descriptions and in this way to become familiar with the names and appearances of the different mosses.

The Keys have been tested satisfactorily by several people. When they did not work out correctly, it was usually found that the trouble lay in failure either to read the explanatory chapters, to follow the Keys carefully, or to study the descriptions thoroughly.

The mosses included in the Keys are those that are commonly or occasionally collected in the northeastern part of the United States. But the Keys really cover a much larger field, many of the mosses being widely distributed, as will be seen by reading the range given with each genus or species.

Four full pages of illustrations of terms used in describing mosses accompany the chapters on "Habit and Manner of Growth," "Leaves," and "Capsules." Other illustrations occurring throughout the text, with the exception of a few in the Introduction, are drawn

natural size with an occasional enlarged plant, leaf, or capsule. Average specimens were selected for the illustrations, but allowances must be made for variations in size and branching.

The nomenclature given is that used by Dr. Brotherus in Engler and Prantl's *Die Natürlichen Pflanzenfamilien*, Teil I, Abteilung III. As the Latin name of mosses in some cases is still a matter of dispute, synonyms are given in italics where the name has recently been changed. English names are usually lacking, but in most cases the Latin names are no longer than geranium or rhododendron, and when one becomes familiar with them they will seem no harder. The generic and specific names have been accented and the former divided into syllables. The grave accent (̀) indicates the long English sound of the vowel, the acute accent (´) shows the shortened sound. It is the custom in English-speaking countries to pronounce the botanical names according to the English method of pronouncing Latin.

In the preparation of this book, the following books have been used for reference: *Mosses with a Hand-Lens and Microscope*, A. J. Grout; *Mosses of Western Pennsylvania*, O. E. Jennings; *The Bryophytes of Connecticut*, Evans and Nichols; *Handbook of British Mosses*, Dixon and Jameson; *British Moss Flora*, Braithwaite; and various other sources for derivations of generic names and explanation of abbreviations of author's names not found in the books mentioned.

I wish to take this opportunity to express my appreciation to the many friends who have assisted in the preparation of this book. Grateful acknowledgment is due to Mr. Heyward Scudder for the suggestion of making a Key to the genera of mosses to be used without a lens, for testing the Keys, for much advice in writing the preliminary chapters, for reading and correcting the manuscript, and for many valuable suggestions. Mrs. Frank E. Lowe, Mr. H. Donald Kemp, and my sister, Miss Ethel A. Pennell, have read the preliminary chapters, tested the Keys, and given helpful advice. I am indebted to Mrs. Lowe for collecting fresh mosses for study and comparison. Among others who have also patiently tried the Keys are Miss Georgia H. Emery, Miss Jane M. Furber, Miss Marie R. Felix, Miss Elizabeth A. Dike, Mrs. Frank C. Smith, Mrs. John L. Wright, and Miss Margaret Kemp. I am indebted to Mrs. Elizabeth G. Britton and Mr. Edward B. Chamberlain for answering many questions regarding nomenclature, authorities, and synonyms. Dr. A. J. Grout kindly gave me the derivation of *Cirriphyllum* and Miss Furber and Mr. Chamberlain assisted in looking up some of the other derivations. I am indebted to my husband, Mr. Horace C. Dunham, for helpful suggestions in drawing the illustrations.

While recognizing its limitations and imperfections, I trust the book will accomplish much toward introducing the mosses to those who have not known them, and

in this way partly repay Mr. Charles J. Maynard and Mr. Walter Gerritson for their kind instruction when I began to study mosses, and all other friends for their assistance, interest, and encouragement while the work was in progress.

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ABBREVIATIONS OF NAMES OF AUTHORS

NOTE. The abbreviations, or in a few cases the full names, given after the generic or specific names of the mosses refer to the botanists who named the plants. When the same botanical name was used earlier by another author in a different connection, the name of the earlier author is given in parentheses.

- Aust. Austin, Coe F.
Banks Banks, George
Beauv. (= Palis.) Beauvois, A. M. F. J., Palisot de
Bland. Blandow, Otto C.
Blytt Blytt, Matthias N.
Brid. Bridel, Samuel E.
Broth. Brotherus, Dr. V. F.
Bruch Bruch, Philipp
Bryol. Eur. Bryologia Europaea. A publication by Bruch & Schimper.
C. Müll. Müller, C.
De Not. De Notaris
Dicks. Dickson, James
Dill. Dillenius, Johann J.
E. G. B. Britton, Elizabeth G.
Ehrh. Ehrhart, Friedrich
Funck Funck, Heinrich C.
Fürnr. Fürnröhr
Grev. Greville, Robert K.
Grout Grout, Dr. A. J.
Gunn. Gunnerus, Johann E.
Hall. Haller, Albert von
Hammar Hammar, Olof
Hamp. Hampe, Ernst
Hedw. Hedwig, Johann
Hoffm. Hoffmann, George F.
Hook. Hooker, William J.
Hook. & Tayl. Hooker, W. J., & Taylor, Thomas

- Hornsch. Hornschuch, Christian F.
Hüben. Hübener, J. W. P.
Huds. Hudson
Jaeg. & Sauerb. Jaeger & Sauerbeck
James James, Thomas P.
Kaur. Kaurin
Lesq. Lesquereux, Leo
Leyss. Leysser, Friedrich W. von
L. Linnaeus, Carolus
Limpr. Limpricht
Lindb. Lindberg, Sextus O.
Loesk. Loeske
Menz. Menzies, Archibald
Michx. Michaux, André
Milde Milde, Julius
Mitt. Mitten, William
Mohr Mohr, Daniel M. H.
Müll. Müller, C.
Myr. Myrin, Claes G.
Neck. Necker, Noel Joseph de
Nichols Nichols, George E.
Palis. (= Beauv.) Palisot de Beauvois, A. M. F. J.
Paris Paris, E. G.
Rabenh. Rabenhorst, Ludwig
Ren. & Card. Renauld & Cardot
Rich. Richard, Louis C. M.
Roell Roell
Röhl Röhl, E. von
Roth Roth, Georg
Schimp. Schimper, W. P.
Schmid. Schmidel, Casimir C.
Schreb. Schreber, Johann D. C. von
Schrad. Schrader, Heinrich A.
Schwaegr. Schwaegrichen, Christian F.
Sibth. Sibthorp, John
Sm. Smith, John
Stark. Starke
Stroem Stroem, Hans
Sull. Sullivant, William S.

- Sull. & Lesq. Sullivant & Lesquereux
Sw. Swartz, Olaf
Timm Timm, Joachim C.
Turn. Turner, Dawson
Vill. Villars, Dominique
Wahl. Wahlenberg, Georg
Warnst. Warnstorf, C.
Web. Weber, Friedrich
Web. & Mohr Weber, Friedrich, & Mohr, Daniel M. H.
Weinm. Weinmann, J. A.
Weis Weis, Ludwig
Willd. Willdenow, Carl L.
Wils. Wilson, William

HOW TO KNOW THE MOSSES

INTRODUCTION

IF it were not for the mosses, it is difficult to say how barren the woods would be or how much beauty would be lost to nature. Wherever mosses occur there is an added bit of color. The eye is attracted by the green, velvety clumps of the upright plants, the delicate texture of the prostrate ones, or by the brighter color of the slender fruit-stalks.

Mosses are relatively small plants, but they often form a conspicuous part of the vegetation, owing to the extensive branching and the prolonged growth of the stems and their rapid multiplication. (See illustrations throughout the book; also parts of a moss, Plate I.) The plants are always some shade of green, often brightened by touches of red, orange, or yellow in the fruit and fruit-stalk. They consist of a stem and leaves, although either of these may be greatly reduced. The stems are erect, prostrate or ascending, branched or unbranched, reaching several inches in length in the largest species, while others are so short that there is only a tiny tuft of leaves, and the fruit and fruit-stalk are the conspicuous parts of the plants. (See chapter on "Habit and Manner of Growth," p. 12.) The leaves vary in size, the longest

measuring fully one-half inch, while many others are too small or too closely folded to be seen easily. The beginner will mistake branches for leaves at first, especially when the leaves are small and the branches numerous. (See chapter on "Leaves," p. 15.) A little experience in examining different kinds of mosses will best enable one to know what are branches and what are leaves. Mosses branch much as other plants do, and the leaves usually grow all around both the stem and the branches, sometimes thickly covering them and so closely overlapping that the outline of the leaf cannot be seen. The leaves are better seen when moist, as they usually spread then more than when dry. If the plants are held to the light, at least the tips of even the small leaves generally can be seen standing out around the stems and branches. The leaves are thin and flat, while the branches are usually cylindrical in general outline, especially when the leaves are small and closely folded.

The appearance of most mosses changes according to the amount of moisture in the leaves. When moist, the leaves are well expanded and usually spreading; when dry, they either become more erect and fold against the stem, closely overlapping, or else they are twisted and curled (crisped). Unlike dried flowering plants, mosses when dried are not past reviving, but can be restored to fresh conditions by being placed in water. This is due to difference in the structure and function of parts of the plants. Plants of the higher

orders are dependent upon roots for absorbing most of their food and moisture and this is carried up through the stem and distributed to all parts of the plant by means of conducting cells. The leaves, as well as other parts of the plant, are entirely surrounded with a special layer of cells the outer walls of which contain a substance called "cutin," which renders this coating practically water- and gas-proof. This waterproof coating prevents excessive evaporation and also absorption of water. Mosses, on the other hand, are not dependent upon roots for absorbing water, and the leaves and other parts of the plant are not provided with a waterproof coating. This structure not only causes mosses to dry easily, but also enables them to absorb water quickly through the entire surface of the leaves and all parts of the plant and so resume the appearance of fresh plants when dried specimens are placed in water.

Mosses are widely distributed, and are found in all sorts of places except in salt water. They grow on moist and on dry ground; on bare rocks and ledges and on those that are covered with soil; on trees; on decaying wood, such as old logs and stumps; on old roofs; and even in streams and ponds and in places that are sometimes submerged. They are especially abundant in cool, moist woods and luxuriant swamps where old logs are rotting, but many may be found in drier and more open places, such as old fields and meadows, and even along the roadside.

The name "moss" is commonly applied to a number of plants that do not belong to the true mosses. Only a few of these plants, especially some of the hepatics, resemble the mosses in general appearance; the others are very different in structure, growth, or color; and two belong to the flowering plants.

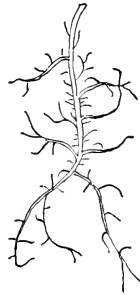
Lichens are often called mosses by those unfamiliar with the lower forms of plant-life; but the absence of



Reindeer Moss
Cladonia rangiferina



Red-tipped Moss
Cladonia cristatella



Beard Moss
Usnea barbata

LICHENS

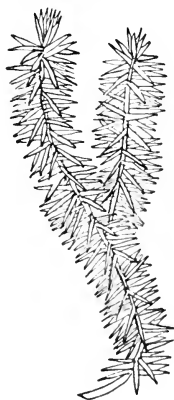
anything like leaves arranged around a stem, and of the bright green of foliage or grass, at once separates them from the mosses and other higher plants. A lichen is composed of an alga and a fungus living together in a state of mutual benefit. Although the alga supplies a little chlorophyll, or green matter, the general color of lichens, especially when dry, is usually some shade of gray or very pale green, or, if green when moist, becoming gray when dry. Some species are orange or brown. The plant-body is called a *thal-*

lus, which means without a true stem and leaves, in the sense that these terms are used in connection with the higher plants. Some lichens are flat, more or less disk-shaped; some are erect and have a hollow, stem-like structure which is often branched; while others are thread-like and hang from trees.

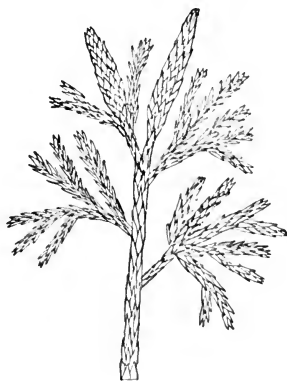
The stiff, shrubby growth called "reindeer moss," the winter food of the reindeer; the "red-tipped moss" with bright-red fruit-caps; and the "beard moss" which hangs like a gray beard from old trees, are all lichens.

Sea mosses (*Algae*) belong, with the lichens and fungi, to a lower order than the land mosses. Although the true mosses grow on cliffs by the sea, they never grow in salt water as the algae do. Irish moss used in cooking is an alga.

The so-called "club mosses" (*Lycopodiaceae*) are



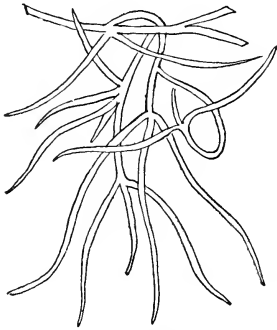
Lycopodium lucidulum
Reduced



Lycopodium obscurum
Reduced

CLUB MOSSES

larger, coarser, more robust plants than the mosses and belong to a higher order. They have woody stems and stiff, evergreen leaves. "Stag's horn moss" is a popular name for some species of *Lycopodium*, differently used in different localities.



Long Moss (*Tillandsia*)
Reduced



Flowering Moss (*Pyxidantha*)
Reduced

FLOWERING PLANTS

The "long moss" which hangs in long tufts from branches of trees in the South, and the "flowering moss" which grows prostrate in the pine barrens of New Jersey and southward, belong to the flowering plants, and will not be confused with the mosses except in name. "Florida moss" is the long moss.

The hepatics or liverworts, especially the leafy liverworts sometimes called "scale mosses" (*Jungermanniales*), somewhat resemble certain mosses, and one needs to know something of their appearance in order to recognize them. They are a rather dark green, and are

found in moist woods on rocks, trees, old logs, etc., not infrequently growing with mosses.

The true liverworts (*Marchantiales*) do not have a true stem or leaves, but are broad and flat, and cling closely to the substratum. They are less frequently



Liverwort (*Marchantia*)



Scale Moss (*Bazzania*)

HEPATICS

confused with mosses. It is in regard to the leafy liverworts, or “scale mosses” (*Jungermanniales*), that one particularly needs a word of warning.

The scale mosses have leafy stems and are prostrate, ascending, or erect. The leaves are usually rounded, lobed, or cleft, often curved under at the tips, and never have a midrib. There are two rows of leaves, one on each side of the stem, with a third row of modified leaves underneath; so that the plants are not only flattened, but have also two distinct surfaces. This flattened appearance of the stems and the peculiar shape of the leaves are good distinguishing characteristics that separate these hepatics from the mosses. The leaves of mosses are never lobed or cleft, and are usually arranged all around the stem, so that the

plants do not show a distinct upper and lower surface. A midrib may or may not be present. In many species it can be seen when the plants are held to the light. In the genus *Fissidens* (p. 97) the leaves are in only two rows and in *Homalia* (p. 186) nearly in two rows, but they do not curl under at the tips as the leaves of hepatics so often do. In some other mosses the leaves appear to be in two rows, as they turn in two opposite directions and are somewhat flattened, but in these cases the shape of the leaves or the presence of the fruit helps to distinguish the plants. The mosses are more numerous than the hepatics.

On account of the importance of distinguishing certain hepatics, the following table may be helpful: —

	LEAFY HEPATICS (<i>Jungermanniales</i>)	MOSSES
<i>Plants</i>	Always flattened, with two distinct surfaces; the lower or back surface toward which the leaves curl sometimes bearing what appear to be rootlets.	Not always flattened, usually without a lower or back surface.
<i>Leaves</i>	Arranged in two opposite rows; rounded, lobed or cleft, often curved under at tips.	Usually arranged equally around stem; never lobed or cleft and when rounded not curved under at tips.
<i>Midrib</i>	Absent.	Present or absent.

Classification and Life History

The mosses, or *Musci*, and the liverworts, or *Hepaticae*, are the two divisions of the *Bryophytes*, a Class coming between the fungi and the ferns. The mosses

are more numerous than the liverworts and are divided into three Orders: I. *Sphagnales*, or peat mosses; II. *Andreaeales*; III. *Bryales*, or true mosses. The first two Orders are described in separate chapters, as they differ in structure from the true mosses. See *Sphagnales* (p. 73) and *Andreaeales* (p. 75).

The reproduction of mosses is accomplished in two general ways, sexually and asexually. In the asexual or vegetative reproduction, that is, multiplication by other means than by the sexually formed spores, either small organisms, known as "gemmae," produced among the leaves or at the end of slender branches, become separated from the parent plant and develop new individuals, or parts of the plants, such as bits of the stem, branches, or leaves, become detached and grow into new plants. In the sexual reproduction, mosses, like ferns, start from a spore, not from a seed. The spore first produces a green thread-like growth called protonema, and upon this a tiny bud develops that grows into the leafy plant. The male and female flowers occur at the apex or on the side of the stems and branches, sometimes growing on the same plant and sometimes on separate plants. The sexual organs are microscopic, but the male buds are often conspicuous and surrounded by a rosette of bract-like leaves that are green, red, or orange. The sperms from the male flowers swim in moisture, after rains or heavy dews, to the egg-cell of the female flower. After fertilization takes place, the fruit or capsule develops, en-

closing the spores. The capsule is usually borne above the plant on a stalk of varying length, called the *seta*. When the seta is very short or lacking, the capsule is almost hidden in the surrounding leaves. At the mouth of the capsule are special parts that serve to protect the spores until they are mature and ready to be scattered to develop new plants under favorable conditions.

As special reference is made in the Keys to the character of the capsule, leaves, and stems, they are described in chapters by themselves. (See "Habit and Manner of Growth," p. 12, "Leaves," p. 15, "Capsules," p. 20.)

Some mosses are short-lived, but many are perennial, and continue their growth annually at the tips of the stems and branches, or develop new plants from underground stems. There are no true roots, but the plants are attached to their substratum by radicles, or rootlets. Radicles are not only at the base of the stem, but sometimes cover the greater part of it, forming a brown or whitish, felt-like coating, called *tomentum*.

The simple structure of mosses enables them to absorb moisture easily, and where extensive growths occur, they perform an important service to plant-life by holding back much of the rainfall, allowing the water to soak into the earth gradually instead of running off the surface. They also add to the richness of the soil through their decay, and assist in the disintegration of rocks. A few of the larger species are used as a packing material. Sometimes they are

dyed and used for decorative purposes, especially by milliners.

Mosses may be collected and grown in the house if a little care is taken to keep them moist. It is well to collect enough of the substance upon which the plants grow so as not to disturb the rootlets. A number of different kinds may be placed together in a fern globe or in an open dish. A little experience will show one how much sun and how much moisture are required. Too much sun will make the plants dry too quickly, and too much moisture without enough sun will make the plants mould. It is often of great interest to gather plants with very young fruit and then watch the capsules develop and the new shoots grow.

HABIT AND MANNER OF GROWTH

MOSSES have certain ways of growing and of branching that are important generic characteristics and these should be noticed when specimens are collected for determination.

There are two chief types of growth by which all mosses fall naturally into two main divisions. In one, the acrocarpous mosses, which often form a deep, thick growth, the stem is typically erect (Plate I, Fig. 1), not branched or with only a few branches, and the fruit is borne at the tip of the stem, sometimes appearing lateral by the new growth of the plant. (Plate I, Figs. 2, 3.) In the second type, the pleurocarpous mosses, which often form thin, flat, tangled mats, the stem is generally prostrate (Plate I, Fig. 4), or ascending (Plate I, Fig. 5), erect in only a few cases, much branched, and the fruit is borne on the side of the stem.

The plants may be scattered singly or may grow more or less crowded together. Deep mossy mats are sometimes formed when plants with erect or ascending stems grow close together and the new annual growth is added to that of the previous year. Thin flat mats occur when the plants are prostrate or creeping and the stems and branches continue to spread and interweave. In some genera, rounded cushions are formed

EXPLANATION OF PLATE I

ACROCARPOUS MOSSES

- Fig. 1. Parts of a moss; stem erect, not branched; fruit at apex of stem.
Fig. 2. Fruit appearing lateral by forking of stem.
Fig. 3. Fruit appearing lateral by new growth of plant.

PLEUROCARPOUS MOSSES

- Fig. 4. Stem prostrate; fruit on a short lateral branch.
Fig. 5. Stem ascending; fruit on side of stem.

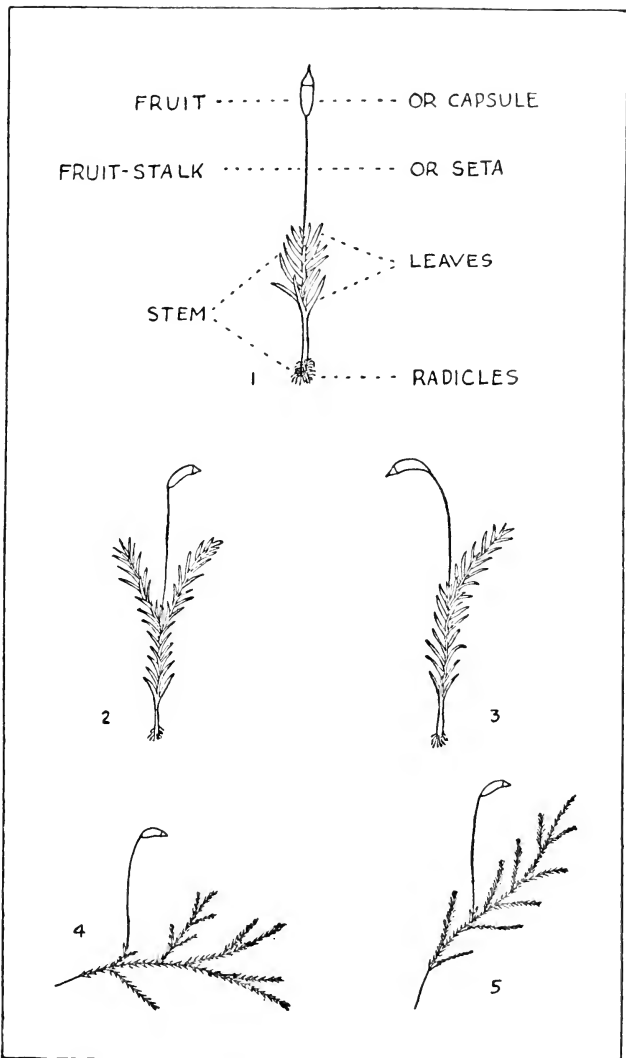


PLATE I. ILLUSTRATIONS OF TERMS

when a number of plants grow together in separated tufts instead of spreading over any extent of surface.

The stems may be not branched at all or slightly branched by forking (Plate II, Fig. 1), or with numerous lateral branches arranged pinnately (Plate II, Fig. 2), bipinnately (Plate II, Fig. 3), tripinnately (Plate II, Fig. 4), irregularly (Plate II, Fig. 6), in clusters (Plate II, Fig. 7), or like the branches of a tree (Plate II, Fig. 5).

Sometimes the primary stem is creeping and the secondary stems erect or ascending, more or less branched (Plate II, Fig. 8). In this case, care must be taken to separate the plants and not to mistake a pleurocarpous moss with prostrate stem and erect branches (Plate II, Fig. 8) for an acrocarpous moss with erect stem (Plate I, Fig. 1).

The pleurocarpous mosses, usually creeping or prostrate, grow in tangled mats with interwoven stems and branches so that no great length can be easily separated, while individual plants of the acrocarpous mosses, growing erect, are easily separated. Two or more kinds of mosses are often found growing together. When plants with erect stems (acrocarpous mosses) are mixed, it is not difficult to separate them, especially if the leaves of the different species are distinctly unlike; but one prostrate species (a pleurocarpous moss) may grow on top of another of similar growth quite concealing it, or the stems and branches of both mosses may grow together on the surface, sometimes so inter-

woven that it is almost impossible to separate them. Such mixed material is not good to study or to keep for the herbarium. It is not unusual to collect an apparently good fruited specimen and upon careful examination to find that the fruit of some moss quite hidden from view has pushed up through the conspicuous growth on the surface, giving a wrong idea of the capsule that really belongs to the moss first noticed.

The color of a moss given in descriptions is that of the leaves, as the leaves so thickly cover both the stem and branches, but sometimes when the leafy part is small, the color of the fruit-stalks is more conspicuous. In a few cases when moist plants are held to the light, the stems and branches of the new growth show conspicuously red through the leaves. (See *Pohlia*, p. 127; *Bryum*, p. 129; *Hylocomium*, p. 225; *Hypnum*, p. 229.) When this is the case it is mentioned in the descriptions; otherwise color is given only under "Plants" and repeated under "Leaves." Sometimes the lower part of the stem is covered with reddish-brown or whitish radicles, forming a felt-like coating called *tomentum*, which often mats the stems together. (See *Dicranum*, p. 87.)

EXPLANATION OF PLATE II

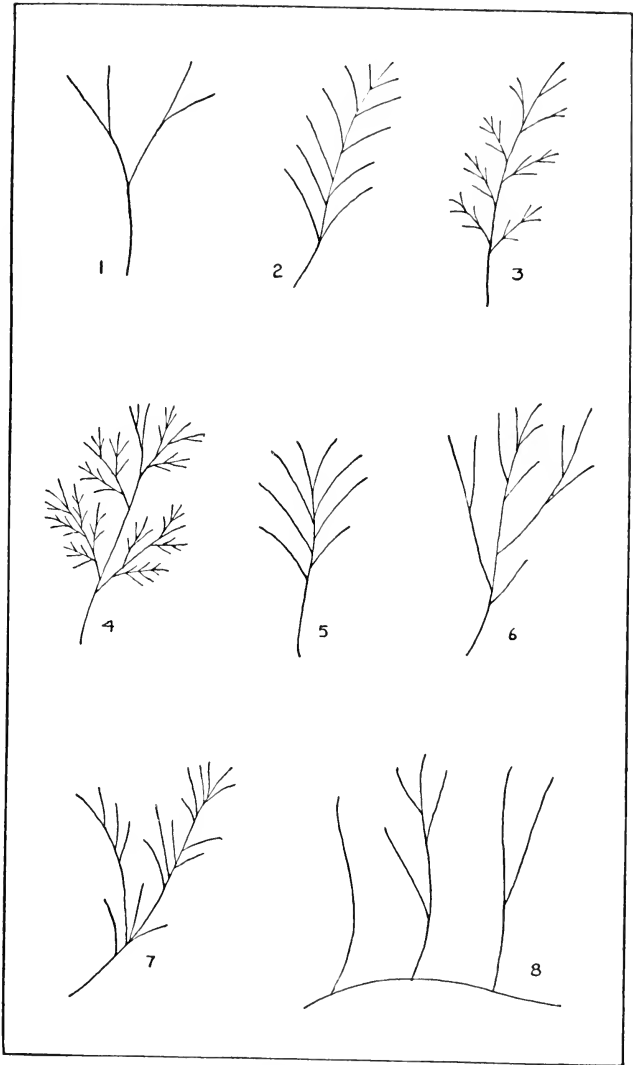
BRANCHING OF ACROCARPOUS MOSSES

(Lines represent stems and branches)

- Fig. 1. Stems forked. (The usual manner of branching; for exceptions see *Philonotis*, p. 145, and *Drummondia*, p. 116.)

BRANCHING OF PLEUROCARPOUS MOSSES

- Fig. 2. Stem pinnate. (Branches quite regularly arranged on opposite sides of stem.)
- Fig. 3. Stem bipinnate. (Some if not all of the pinnate branches branched again.)
- Fig. 4. Stem tripinnate. (Some if not all of the bipinnate branches branched again.)
- Fig. 5. Stem tree-like in branching. (Branches only toward the tip of the stem, like the branches of a tree.)
- Fig. 6. Stem irregularly branched. (Varying in many ways but not regularly pinnate, bipinnate, tripinnate, or tree-like.)
- Fig. 7. Stem with branches arranged in clusters.
- Fig. 8. Primary stem creeping, secondary stems erect or ascending, usually branched.



. PLATE II. ILLUSTRATIONS OF TERMS

LEAVES

THE leaves of mosses vary in size, shape, arrangement, position, and color, and it is necessary to train the eye to notice these variations in order to recognize the generic characteristics.

Care must be taken not to mistake branches for leaves, when the leaves are very small and the branches are more conspicuous.

Mosses branch much like other plants and the leaves are much more numerous than the branches, sometimes thickly covering both the stem and the branches. When the leaves are very small and closely folded, the branches look cylindrical, but if the plants are held to the light, at least the tips of the leaves can usually be seen sticking out around the branches.

Unlike the leaves of other plants, the leaves of mosses nearly always consist of only a single layer of cells, except where the midrib occurs or at the margin of the leaf when it is thickened. This simple structure makes the leaves dry readily and also absorb moisture readily, and adds a special interest to the study of mosses, as dried specimens can be easily restored to fresh conditions by being placed in water for a few minutes. This has been tried with plants that had remained dry for over one hundred years, and it was found that the leaves still expanded quickly. In an-

other instance, two different mosses were soaked and dried fifty times without injury to the plants except that the color of the leaves faded.

A midrib, called a *costa*, may or may not be present, and it may be single, double, or forked. In some of the largest leaves it can be seen if the plants are held to the light. (See *Mnium punctatum* var. *elatum*, Plate VI, Fig. 5.) It shows like a dark line through the center of the leaf, and is usually slender, but in the *Polytrichaceae* (p. 156) it is much wider, sometimes occupying the greater part of the leaf blade.

The leaves never have a stalk, but grow directly on the stem and branch.

Leaves on the same plant may vary in size. Those that are typical and that should be selected for study are along the middle part of the stem or branch. The leaves near the base of the stem, as well as those at the tip, are often smaller or not well developed. Plants not bearing fruit sometimes grow more luxuriantly than fruited specimens and therefore have larger leaves. When the plants are much branched (pleurocarpous mosses), the leaves on the stem are often larger than those on the branches. Many leaves are large enough to be seen easily, the longest measuring fully one-half inch; many that are smaller can be seen when the plants are held to the light or against something white; while still others are too small or too closely folded against the stem or branch to be seen without a lens.

Leaves vary in shape from hair-like to nearly round,

but they are never compound, lobed, or deeply cut. The leaves of the acrocarpous mosses, those coming under Division A in the Keys, may be divided as relatively long and narrow, or short and broad. Those that are relatively long and narrow may be hair-like throughout, or broader at the base and gradually narrowed (Plate III, Fig. 1), or about the same width throughout and then end in a hair-like tip (Plate III, Fig. 2). The leaves that are relatively short and broad may be ovate (Plate III, Fig. 3), or ovate-oblong (Plate III, Fig. 4), or elliptical (Plate III, Fig. 5), or nearly round (Plate III, Fig. 6).

The leaves of most of the pleurocarpous mosses, coming under Division B in the Keys, vary less in shape and are less easily seen, as they are so small or so closely folded. Although there are some similar to those described above, the shape that is most common is more or less ovate at the base ending in a straight tip (Plate III, Fig. 7), or in a curved tip (Plate III, Fig. 8).

The edge of the leaf may be entire or serrate, but in only a very few mosses are the serrations seen without a lens. When the cells along the margin of the leaf differ from those of the rest of the leaf, the leaf is said to be bordered. In the large leaves of *Mnium punctatum* var. *elatum* (Plate VI, Fig. 5), the thickened border can be seen like a fine, dark-green line around the leaf.

Leaves are described as "crisped" when they become crinkled, curled, or twisted in drying.

The arrangement and position of the leaves are important characteristics in determining mosses, and ones that can be easily studied.

Leaves usually grow all around the stems and branches (Plate III, Fig. 9), but in *Fissidens* (p. 97), *Distichium* (p. 83), and in a few other genera not included in this book, they are arranged in only two rows on opposite sides of the stem and lie flat like the pinnae of a fern (Plate III, Fig. 10). They are called "erect" when they lie about parallel with the stem (Plate III, Fig. 11); "wide-spreading," when they stand out nearly at right angles to the stem (Plate III, Fig. 12); "erect-spreading," or "not wide-spreading," when they are between erect and wide-spreading; and "turned to one side" (secund), when they look as if blown in one direction (Plate III, Fig. 13). In some of the pleurocarpous mosses the leaves appear in two rows when they are evenly parted and turned in two opposite directions (Plate III, Fig. 14).

There is often a difference in the position of the leaves when moist and when dry. For instance, leaves that are wide-spreading when moist may become closely folded when dry instead of becoming crisped; in other cases they are not much changed in drying.

Many shades of green are found in the mosses. Some are glaucous (whitish) or bluish, some golden or yellowish, and some bright, olive, or dark green. There is often a variation in color, even on the same plant, as the oldest leaves turn brown or dark, while the young-

EXPLANATION OF PLATE III

LEAVES OF ACROCARPOUS MOSSES

LEAVES RELATIVELY LONG AND NARROW

- Fig. 1. Broader than hair-like.
- Fig. 2. Ending in a hair-like tip.

LEAVES RELATIVELY SHORT AND BROAD

- Fig. 3. Ovate, or egg-shaped.
- Fig. 4. Ovate-oblong.
- Fig. 5. Elliptical.
- Fig. 6. Nearly round.

LEAVES OF MOST PLEUROCARPOUS MOSSES

- Fig. 7. Ovate at base, ending in a straight tip.
- Fig. 8. Ovate at base, ending in a curved tip.

ARRANGEMENT OF LEAVES

- Fig. 9. Leaves on stem and branches.
- Fig. 10. Leaves in two opposite rows, giving the plants a flattened appearance.

LEAVES ARRANGED EQUALLY AROUND STEM

- Fig. 11. Leaves erect. (Nearly parallel to stem.)
- Fig. 12. Leaves wide-spreading. (More or less at right angles to stem.)
- Fig. 13. Leaves turned to one side. (Secund.)
- Fig. 14. Leaves curved and turned in opposite directions, giving a braided appearance along the stem and branches.

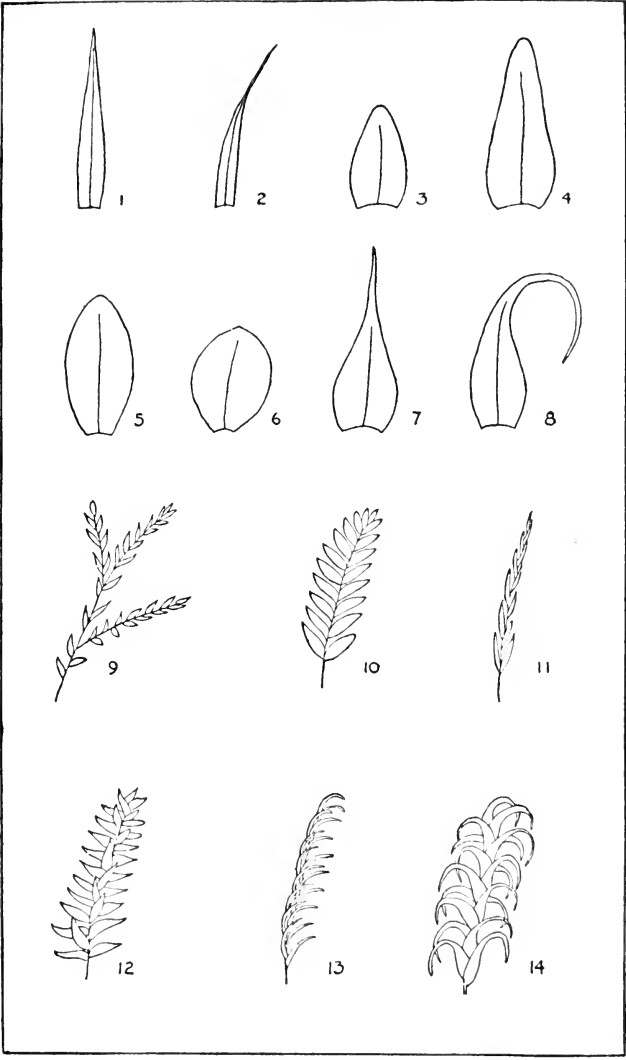


PLATE III. ILLUSTRATIONS OF TERMS

est are usually very light; the leaves along the central portion of the stem give the typical color of the plant. Although the color is quite characteristic when the plants are normal, it is rather unreliable, as it is often affected by the various conditions under which the plants may grow.

CAPSULES

THE capsule of a moss is often spoken of as the "fruit." It is the swollen case containing the spores at the end of a slender stalk called the *seta*, or partly hidden by the surrounding leaves, and develops, like all fruit, after the flower has been fertilized. (Plate IV, Fig. 1.)

Great care must be taken when studying the capsule to be sure it is old enough to show the typical form and position. A young capsule is nearly always pale green and very slender, shrinking a good deal when dry. A capsule is mature when the spores are ripe and ready to be scattered, and it is then yellowish- or reddish-brown, well filled out, and does not wholly lose its characteristic shape in drying. Sometimes a green capsule is sufficiently developed to show the typical form, but it must be at least filled out if not beginning to change color. When the spores have all been scattered, the capsule is spoken of as empty, but in many cases it retains its characteristic shape for some time. Often both old and young capsules may be found at the same time. Extremes in either case should not be used for study, as a very old capsule becomes dark and decayed or broken, or, if at first erect, it may become bent over. Most mosses mature their spores in the fall or early winter, the rest do so in the spring or summer.

The capsule is usually borne above the leafy plant on a fruit-stalk, or seta (Plate IV, Fig. 1) of varying length. In some cases the capsule is partly hidden by the surrounding leaves when the seta is very short. If the seta comes from the apex of the stem or of a well-developed branch, the fruit is spoken of as "terminal" and the moss is called "acrocarpous"; if the seta comes from the side of the stem or is on a very short lateral branch, the fruit is spoken of as "lateral" and the moss is called "pleurocarpous." The color of the seta is usually yellowish or reddish.

An erect capsule is upright like the seta; when not erect, it may be inclined, horizontal, or drooping. For the various shapes of capsules and their characteristic positions see Plate IV, Figs. 3-16.

There are interesting parts of the capsule — the *operculum* and the *peristome* — that with the *calyptra* serve as a protection while the fruit is immature. (See Plate IV, Figs. 1, 2.)

The *calyptra* is like a hood covering the young capsule. It usually falls off before the spores are ripe, but if it remains on until the capsule fills out, it is often pushed upwards and finally covers only the beak of the operculum. In a few cases the calyptra is covered with hairs. (See *Ulota*, p. 119, and *Polytrichum*, p. 162.) It may be hood-shaped (cucullate) (Plate IV, Fig. 17) or like a beaked cap (mitrate) (Plate IV, Fig. 18).

Nearly all capsules open by means of a lid, or *operculum*. It is the upper portion of the capsule that be-

comes detached and falls off when the spores are ripe. It may be convex (Plate IV, Fig. 19), cone-shaped (Plate IV, Fig. 20), short-beaked (Plate IV, Fig. 21), or long-beaked (Plate IV, Fig. 22).

Underneath the operculum surrounding the mouth of the capsule, there is usually a tiny fringe called the *peristome* which may be single or double. The outer peristome is composed of filaments called "teeth" that are sensitive to moisture; they usually shade from red to orange or yellow. The inner peristome is more delicate than the outer, and its divisions are called "segments." In wet weather the teeth are tightly closed together to prevent the spores from being washed out in masses; when dry, they separate and bend back allowing the spores to sift out. The number of teeth, and their size, shape, and character are often important points in determining species when studying mosses with a microscope. (See Plate V, Fig. 6; Plate VI, Fig. 2; Plate VII, Fig. 4.)

EXPLANATION OF PLATE IV

CAPSULES

- Fig. 1. Capsule with calyptra and operculum in their natural place.
Fig. 2. Calyptra and operculum removed to show peristome.

SHAPES AND POSITIONS OF CAPSULES

(Drawn without the operculum)

ERECT CAPSULES

- Fig. 3. Cylindrical.
Fig. 4. Angular.
Fig. 5. Top-shaped.
Fig. 6. Urn-shaped.
Fig. 7. Elliptical.
Fig. 8. Oval, or egg-shaped.
Fig. 9. Pear-shaped.

CAPSULES NOT ERECT

- Fig. 10. Cylindrical, horizontal.
Fig. 11. Cylindrical, much curved.
Fig. 12. Cylindrical, hanging down.
Fig. 13. Globular.
Fig. 14. Pear-shaped with neck distinct.
Fig. 15. Angular, horizontal.
Fig. 16. Ovate, or egg-shaped, pointed.

SHAPES OF THE CALYPTRA

- Fig. 17. Hood-shaped (cucullate).
Fig. 18. Like a beaked cap (mitrate).

SHAPES OF THE OPERCULUM

- Fig. 19. Convex.
Fig. 20. Cone-shaped (conic).
Fig. 21. Short-beaked.
Fig. 22. Long-beaked.

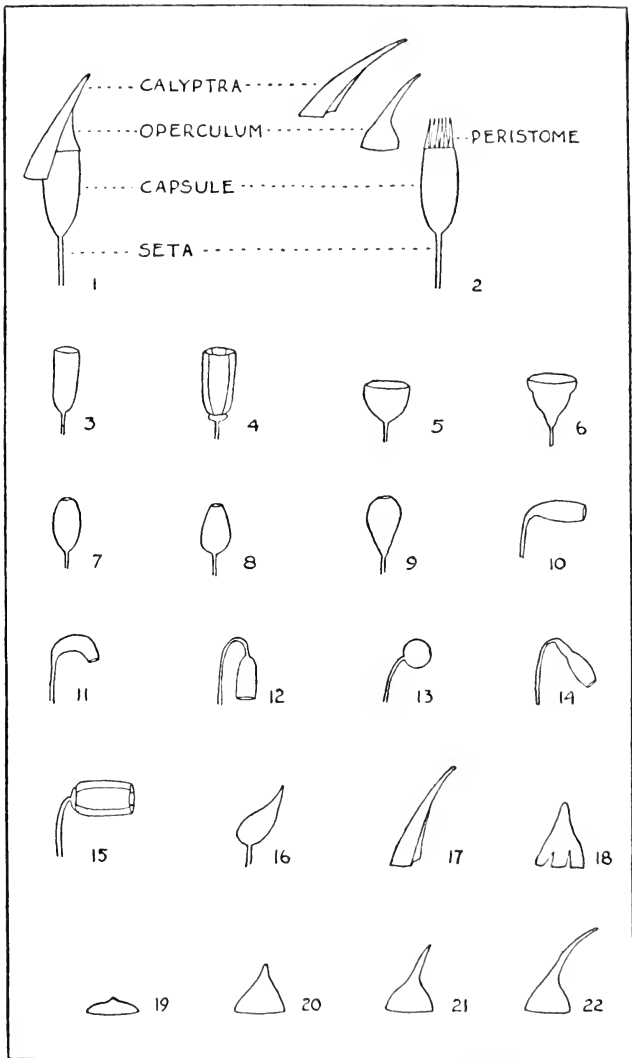


PLATE IV. ILLUSTRATIONS OF TERMS

THE KEYS EXPLAINED

THE object of the Keys is to give the student a non-technical guide to the genera and in some cases the species of the mosses he is likely to notice, and to enable him to recognize them without the aid of a lens. No preliminary knowledge of the mosses is necessary except of their habitat; that is, the natural locality of the plants, as ground, rocks, trees, etc. The numbers in the Keys refer to the genera in "List of Genera" (p. 70). Illustrations of the descriptive terms used will be found on Plates I, II, III, IV.

Two separate Keys are provided, each including all the mosses described in the book. The Leaf Key is based upon the character of the leaves with further subdivisions, and the Capsule Key is based upon the character of the capsules with further subdivisions. In some cases the leaves alone or the capsules alone are not sufficient to determine a moss, and for this reason the Leaf Key is carried out with capsules and the Capsule Key is carried out with leaves. Stem characteristics are given when helpful in dividing the mosses into groups. The length of the stem is measured from the rootlets through the leafy portion; but does not include the fruit-stalk. (See Plate I, Fig. 1.)

In both Keys the mosses are first divided in the usual way, Division A including the acrocarpous mosses with

the stems generally erect and not much branched, and the fruit at the apex of the stem; Division B including the pleurocarpous mosses with the stems generally prostrate and much branched and the fruit on the side of the stem.

As is to be expected with any key based on general characteristics, certain exceptions may be found and certain difficulties encountered. The chief of these are as follows: Mosses coming under Division A may not be strictly erect and may be more or less branched, but the fruit is terminal, although it may appear lateral by the time it is mature on account of the new growth of the stem, which is not so dark a green as the older part. The fruit of *Fissidens* (p. 97) may be terminal or lateral, but the stems are erect and little branched. The stems of the *Grimmiaceae* (p. 111) and the *Orthotrichaceae* (p. 116) may be more or less prostrate with erect branches, but the fruit is borne at the tip of the stem or branch. There are a few erect mosses that come under Division B, but the fruit is always lateral and the stems are usually much branched.

If a moss has more than one habitat it is placed in the Keys under more than one head; for instance, under "Plants growing on the ground" and "Plants growing on rocks," etc.

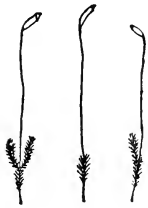
Leaves of moist plants are described. In Division A, when the leaves are so small that the relative shape cannot be estimated, the mosses are classed under "Shape of leaves when moist not easily seen." If the

leaves are large enough to show the entire outline when the plants are held to the light, the mosses are placed under the next corresponding head, "Shape of leaves when moist easily seen." In Division B the mosses are divided a little differently, as the leaves vary less in shape and in many cases the entire outline is not so necessary in determining the genera. When the leaves are large enough to show whether they are straight or curved, the mosses are placed under "Leaves when moist easily seen"; when the leaves are too small or too closely folded to show this characteristic, the mosses are placed under "Leaves when moist not easily seen."

In both the Leaf Key and the Capsule Key the position and the shape of the capsule that are given are always those of the fully developed fruit. In order to recognize when the capsule is mature see chapter on "Capsules" (p. 20).

HOW TO USE THE KEYS

SUPPOSE we have collected in late spring or early summer a moss growing on dry soil, abundantly fruiting and conspicuous for the dark-red fruit-stalks and capsules. After soaking a piece of the specimen in



water for a few minutes, keeping the remaining part dry, and separating some of the moistened individual plants, we find they look like these.

Let us use the Leaf Key first. We find that there are two main divisions, A and B. Under Division A we read, "Fruit at the apex of the stem or of a well-developed branch, sometimes appearing lateral by the new growth of the plant. Stems generally erect, and often not branched; or, if slightly branched by forking, usually with not more than two or three branches." Under Division B we read, "Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches.)" We examine our plants and find that the stems are erect with only one or two branches. The fruit on one of the plants is terminal and on the other two it appears lateral, but as the growth above the point where the fruit-stalk is attached to the stem is

lighter green than that below, we decide that it must be the new growth of the plant and that the fruit was at first at the tip of the stem. We place our plant under Division A because the erect stems only a little branched, even without the fruit, bring it there. We found the moss growing on the ground. Under "Plants growing on the ground" we find: "I. Shape of leaves when moist not easily seen" and "II. Shape of leaves when moist easily seen." The note states that the leaves must be seen well enough to estimate their relative shape. By holding our moist specimens to the light or laying them on something white, we note that most of the leaves though small are easily seen to be long and narrow. Our plant comes, then, under "II. Shape of leaves when moist easily seen. a. Leaves long and narrow." The next headings are, "Stems one-half inch long or less" and "Stems more than one-half inch long." The stems of our plant are not more than one-half inch long, so we place it under the first of these heads. The next divisions are, "Leaves hair-like throughout" and "Leaves broader, sometimes ending in a hair-like tip." The leaves of our plant look hair-like throughout, so we read further under this head, "Capsule erect" and "Capsule not erect." The capsules of our plant are not erect, so we follow the second heading to the right and come to the genus numbers 1, 2, 4, 6, 7, 8, 26, 36. Turning to the "List of Genera" (p. 70), we are referred to the page where each genus is described and illustrated. Turning to number 1. *Trema-*

todon, we see that two of the conspicuous characteristics in italics are “seta greenish-yellow” and “capsule with a long neck.” As the seta of the plant we are studying is not yellow and the illustration of the capsule does not look like the capsule of our plant, we pass to the next genus number and turn to the description. 2. *Ditrichum*, we read, has one species with hair-like leaves, and a capsule that is sometimes inclined, but the seta is again yellow and the leaves in the illustration are much longer than those on our plant, so we pass to the next description — 4. *Ceratodon*. Here the description and illustration correspond perfectly to our specimen. However, to make sure, we glance at the illustrations of the remaining numbers. 6. *Dicranella* has leaves turned to one side, unlike the leaves of our plant. 7. *Oncophorus* has leaves crisped when dry, while the leaves of our dry specimen fold straight against the stem. 8. *Dicranum* has leaves usually turned to one side. The illustration of the capsule of the two remaining genera, 26. *Leptobryum* and 36. *Webera*, are so different from the capsule of the moss we are studying that we feel reasonably sure that the plant under consideration is number 4. *Ceratodon*.

Although in every instance it is safer to study fruited specimens, about fifty per cent of the common genera can be identified without the aid of the capsule if sufficient care is taken. An illustration to show what can be done with a sterile moss is here given.

The moss used in the foregoing illustration will serve as an example. Going back to the beginning of the Key, we find that the capsule did not come under consideration until we had placed our specimen under "II. a.," and further, under "Stems one-half inch long or less," "Leaves hair-like throughout." Now, suppose we have no capsule to aid us and we cannot tell whether the plant belongs under "Capsule erect" or "Capsule not erect." We must look up all the genera coming under both these heads, which are 1, 2, 3, 4, 6, 7, 8, 11, 15, 26, 36, 38, and compare with our moss the illustrations and descriptions, especially the characteristics in italics, but omit all reference to seta and capsule. 1. *Trematodon* we throw out because the illustration shows the leaves much longer than those of our plant, and it grows on damp soil, whereas we found our plant on dry soil. 2. *Ditrichum* in one case has leaves too small to be seen easily and in the other species they are again too long. 3. *Saclania* occurs especially in limestone regions, and the leaves are bluish-green, while those of our moss are a rather dark green. 4. *Ceratodon* corresponds in both illustration and description to our specimen, but to make sure that we are not mistaken we look through the rest of the genera. 6. *Dicranella* we discard because the leaves turn to one side. 7. *Oncophorus* we discard because the leaves are too long and become crisped in drying, while those of our plant fold straight against the stem when dry. 8. *Dicranum* has leaves turned to one side. 11. *Weisia* has leaves too

long and the plants are too short. 15. *Barbula* is not common and the leaves are crisped when dry. 26. *Leptobryum* has leaves too long. 36. *Webera* has stems too short with longer leaves. 38. *Georgia* looks more like our plant but in reading the descriptions we find that it usually grows on decaying wood and less frequently on the ground; and besides, scattered among the plants are stems with larger leaves arranged in a cup-like cluster at the tip. We find nothing of this kind in our specimen, so this genus will be discarded, leaving only 4. *Ceratodon* that agrees with our plant in every way.

The following is an example of how to use the Capsule Key. We will use the same moss that we used for the Leaf Key. We have already decided that the plant belongs in Division A, under "Plants growing on the ground." The next divisions are, "I. Capsule erect," and "II. Capsule not erect." Our capsule is not erect. Under this head we find the various shapes of capsules given. Turning to the "Illustrations of Terms" (Plate IV), we decide that our capsule is cylindrical. Under "Capsule cylindrical" we come to "Leaves long and narrow" and "Leaves short and broad." In using the Leaf Key we found that the leaves of our plant were long and narrow, hair-like throughout. Following this heading to the right we find the genus numbers 1, 2, 4, 6, 7, 8. Looking through the illustrations and descriptions we find again that

4. *Ceratodon* is the only one that corresponds to our specimen.

It will readily be seen that when one arrives at the same genus number in the Capsule Key as in the Leaf Key the determination is verified.

HELPFUL SUGGESTIONS

IF in doubt what true mosses are, see Introduction p. 1, or use the Preliminary Key, p. 39.

When collecting mosses for determination it is necessary to *notice habitat*, that is, the natural locality of the plants. They are found on the ground, on rocks, on trees, on decaying wood, or in ponds and streams. In spite of the fact that earth-covered rocks and rotting logs in deep, moist woods offer practically the same soil conditions as the ground, the mosses are divided according to actual situation, for simplicity of arrangement in the Keys. For instance, if a moss is found on a rock that is covered with soil, it is placed under "Plants growing on rocks"; or if a moss is found on a piece of an old log broken off and lying on the ground, it is placed under "Plants growing on decaying wood." *Notice the way the plants are growing*; whether the single plants are growing apart from each other, or crowded together, with the stems erect, forming tufts, rounded cushions, or deep mats by prolonging their growth at the tips, or whether the stems are prostrate and interwoven, forming thin mats by continuing their growth horizontally. See chapter on "Habit and Manner of Growth," p. 12.

Care must be taken to *gather whole plants* and not merely a part of the stems. To be sure the mosses are

well developed, *select the best-looking growth for study*, the largest and greenest plants, and when possible those that are *bearing fruit*. The fruit or capsule of a moss is the swollen spore-case at the end of a slender stem called the fruit-stalk or seta. The capsule is usually borne above the leafy plant, but sometimes it is partly hidden in the surrounding leaves. *Gather generously*, at least what would be equal to two square inches, so as to allow for breaking the plants when separating them, to get the average characteristics of several plants, and to have some plants moist and others dry while studying them. Fold each specimen in a paper wrapper by itself and on the outside write habitat "on ground" or "on rock," etc., and place and date of collecting for possible future reference. If the plants are placed in a tin box tightly covered, they will keep their fresh condition for several days and it will save moistening them for study, but care must be taken to remember the habitat of each specimen.

When no fruit is found, the genus can still be determined in many cases by studying the character of the growth and the leaves, and carefully reading the descriptions of all the mosses that come under both "Capsule erect" and "Capsule not erect." There are some mosses that cannot be definitely named without the aid of the capsule. When this is the case, it will be mentioned in the descriptions of the genera. When in doubt where to place a sterile moss that is somewhat branched, try it under both Division A and Division B.

Carefully separate a few single plants in order to see the length of the stems, the average character of the leaves, and the manner of branching. It is not always easy to do this without breaking the stems, especially if one has no tweezers for the work. Fingers at best are clumsy instruments in handling the smallest mosses; possibly a wire hairpin would be of some assistance. Sometimes two or more kinds of mosses will be found growing together. If the leaves or the general characters are plainly different, the student will readily notice that he has collected more than one species. But it sometimes happens that an apparently good fruited specimen is one sterile moss growing on top of another moss that is fruited, and that the fruit-stalks are really attached to the moss growing underneath, although they have pushed up through the conspicuous growth on the surface. To avoid making a mistake in such a case, always follow the fruit-stalk down to the stem on which it is growing and carefully pull out as long a piece of the stem as possible, and compare it with the rest of the specimen. When stems with numerous branches are closely interwoven, no very great length can be separated and one must get the average characteristics from several small pieces.

Examine moist plants. If mosses are collected in a dry condition, they must be moistened for study, as otherwise leaves that can be easily seen when the plants are moist may be so closely folded against the stem when dry that they will not be noticed. For instance,

the leaves of *Pogonatum brevicaule* (p. 161) are long and narrow, easily seen when moist, though few in number, but when dry they fold against the stem and one is liable to overlook them and misplace the moss under "Leaves when moist not easily seen." Mosses may remain dry for an indefinite period and then can be restored to fresh conditions by being placed in water. Quickest results can be obtained by using hot water. This process of reviving dried mosses may be repeated as often as required, without injury to the plants. When the leaves have fully expanded, remove the plants from the water and absorb the extra moisture with soft linen. The leaves of a few species dry so quickly that it may be necessary to replace the plants in water two or three times while studying them. If plants are allowed to remain in water for a number of days, the leaves and capsules lose their natural color and turn dark.

To dry mosses, separate the individual plants and place them in sunlight or merely expose them to dry air. In case they do not dry readily, a little artificial heat may be used by taking the plants in a pair of tweezers or between the ends of a wire hairpin, or by placing them on a piece of paper and holding them near a light or over some source of heat; but if too much artificial heat is used, making the leaves dry too quickly, they do not come into the characteristic dried condition. Pressure should not be used for naturally dried plants.

To see the shape of the leaves or the color of the stem, hold the plants to the light or in strong light, or against something white. The leaves that are best developed are usually along the middle part of the stem. If the leaves conceal the stem too much, strip them off by drawing the stem from the tip toward the base through the firmly pressed tips of thumb and finger. Red stems usually show through the leaves.

Do not mistake branches for leaves. As the leaves of mosses are so much smaller than those of other plants and the branches are often more conspicuous than the leaves, care must be taken to avoid this mistake. When the plants are held to the light, in most cases the leaves, or at least the leaf-tips, can be seen sticking out around the stem and the branches. If the leaves are too small to be seen, the cylindrical appearance of the branches and their arrangement on the stem should be sufficient to distinguish them from leaves. (See Plates II, III.)

If in doubt about the length of the stem or the shape of the leaves, try the moss under each head. The length of the longest stems is given and the characteristics of the largest leaves. To see these, *examine several individual plants.*

When estimating the length of the stem, do not include the fruit-stalk. The length that is given is measured from the rootlets only through the leafy portion and does not include the seta. (See "Illustrations of Terms," Plate I, Fig. 1.)

When considering the shape and position of the capsule, do not include the operculum. (See "Illustrations of Terms," Plate IV.) The operculum is the lid that covers the mouth of the capsule. It drops off naturally when the spores are mature, and sometimes before this takes place, it is loose enough to be easily removed with tweezers or fingers.

Do not be alarmed at a long list of genus numbers. A glance at the illustration of each genus will show whether it is necessary to read the entire description. Always carefully read it if there is any doubt about the illustration being like the moss in question.

Every point in the Keys and in the descriptions is important. Follow the Keys carefully and study the descriptions thoroughly. A specimen must correspond in every point to its description. Care must be taken to gather normal plants. The beginner at times will not do this. Puzzling variations may be found in mosses as in other plants and also in animals. But one ought not to think that every doubtful case is one of these abnormal growths, for it may be due to some imperfect use of the Keys or descriptions caused by overlooking some detail. When a moss has no definite character and the fruit is lacking, one may be in doubt where to place it even after careful comparison with the illustrations and descriptions. In this case, one must sometimes wait until fruited plants are found, or possibly a compound microscope and technical books are necessary. A troublesome specimen can usually be

placed in its family if not in the exact genus. It is well when possible to verify one's determinations by comparing the specimens with authentic material, which can generally be found in Museums of Natural History.

KEY TO DISTINGUISH MOSSES FROM COMMON HEPATICS AND LICHENS

NOTE. When one is in doubt what are mosses, the following Key should be used before trying the Leaf Key or Capsule Key, as hepatics and lichens are sometimes collected for mosses. (See illustrations of lichens and hepatics, pp. 4, 7; also illustrations of mosses throughout the book.)

Plants growing flat without stem or leaves ¹

Plants usually dark green HEPATICS (*Marchantiales*),
p. 7.

Plants usually some shade of gray, or if green when moist,
becoming gray when dry, sometimes brown or orange
. . . . LICHENS, p. 4.

Plants erect, ascending, prostrate, or hanging from trees; with a true stem or, in lichens, apparently having a stem

Stems without leaves; ² usually some shade of gray, or if
green when moist, becoming gray when dry
LICHENS, p. 4.

¹ The plant-body of some hepatics belonging to the *Marchantiales* is like a broad, flat leaf, sometimes elongated, often with a midrib, and usually branched by forking. A very young plant may resemble two or three leaves, but no distinct stem will be found and the apparent leaves will not be arranged in two opposite rows or around a stem, as in the leafy hepatics (*Jungermanniales*) or the mosses coming under the next head.

² The short branches of certain lichens may be mistaken for leaves. The leaves of the hepatics and mosses coming under the next head are flat and thin, while the branches of lichens are round. When in doubt what are leaves, the color of the plants is usually a safe guide. Lichens when dry are more gray than green and are very stiff and brittle. Hepatics and mosses are more a foliage-green and do not dry gray or become as stiff and brittle.

Stems with leaves always some shade of green, never gray.

Leaves arranged in two opposite rows, rounded, lobed, or cleft, often curved under at tips, usually dark green; midrib absent; under or back side of stem toward which leaves curl sometimes bearing what appear to be rootlets HEPATICS (*Jungermanniales* or SCALE MOSSES), p. 6.

Leaves usually arranged equally around stem (in only two rows in *Fissidens*, p. 97), sometimes flattened on two opposite sides of stem, never lobed or cleft and when rounded not curved under at tips, varying from light to dark green; midrib present or absent, rarely seen without a lens.

Plants usually growing in bogs or very wet places; stems erect, much branched (branches at tip of stem forming a thick head); leaves usually light green or tinged with red SPHAGNUM or PEAT MOSS, p. 73.

Plants growing on rocks in mountainous regions; stems erect, short and inconspicuous; leaves very dark, almost black ANDREAEA, p. 75.

Plants growing in all sorts of places, on wet or dry ground, rocks, trees, decaying wood, and in streams or ponds.

Stems generally erect, and often not branched; or if slightly branched by forking, usually with not more than two or three branches; fruit at apex of stem or of well developed branch, sometimes appearing lateral by new growth of plant ACROCARPOUS MOSSES, p. 77.

Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches); fruit on side of stem or on a very short lateral branch PLEUROCARPOUS MOSSES, p. 172.

LEAF KEY TO GENERA

- A.** Fruit at the apex of the stem or of a well-developed branch, sometimes appearing lateral by the new growth of the plant. Stems generally erect, and often not branched; or, if slightly branched by forking, usually with not more than two or three branches.¹ ACROCARPOUS MOSSES, p. 77.
- B.** Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches).¹ PLEUROCARPOUS MOSSES, p. 172.

NOTE. In many cases the genus can be determined without the aid of the capsule. When in doubt where to place a sterile moss that is somewhat branched, try it under both Division A and Division B.

A

(*Fissidens*, p. 97, with fruit both terminal and lateral may be found here)

Plants growing on the ground

I. SHAPE OF LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

Stems one-half inch long or less.

Capsule erect 2, 15, 16, 38, 40.

Capsule not erect 25, 28, 34, 37.

¹ For arrangement of branches see "Illustrations of Terms," Plate II.

Stems more than one-half inch long.

Capsule erect 38, 40.

Capsule not erect 34.

II. SHAPE OF LEAVES WHEN MOIST EASILY SEEN

(Leaves must be seen well enough to estimate their relative shape)

a. Leaves long and narrow (more than four times longer than broadest part)

Stems one-half inch long or less.

Leaves hair-like throughout.

Capsule erect 2, 3, 6, 8, 11, 15, 36, 38.

Capsule not erect 1, 2, 4, 6, 7, 8, 26, 36.

Leaves broader, sometimes ending in a hair-like tip.

Capsule erect 8, 13, 39, 40, 41.

Capsule not erect 8, 9, 27, 29, 39, 41.

Stems more than one-half inch long.

Leaves hair-like throughout.

Capsule erect 3, 6, 38.

Capsule not erect 4, 6, 7, 8, 26, 32, 33, 34.

Leaves broader, sometimes ending in a hair-like tip.

Capsule erect 8, 13, 39, 40, 41.

Capsule not erect 8, 9, 27, 28, 30, 31, 35, 39, 41.

b. Leaves short and broad (less than four times longer than broadest part)

Stems one-half inch long or less.

Capsule erect 10, 16, 18, 24.

Capsule not erect 10, 25, 28, 30.

Stems more than one-half inch long.¹

Capsule erect 10, 18.

Capsule not erect 10, 28, 29, 30, 31.

¹ If No. 63 has been mistaken for an acrocarpous moss, it will apparently belong here.

Plants growing on rocks, bricks, mortar, etc.

I. SHAPE OF LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

Stems one-half inch long or less.¹

Capsule erect 2, 22, 23.

Capsule not erect 25, 28, 34.

Stems more than one-half inch long.¹

Capsule erect 21, 22, 23.

Capsule not erect 28, 34.

II. SHAPE OF LEAVES WHEN MOIST EASILY SEEN

(Leaves must be seen well enough to estimate their relative shape)

a. Leaves long and narrow (more than four times longer than broadest part)

Stems one-half inch long or less.

Leaves hair-like throughout.¹

Capsule erect 3, 6, 8, 12, 14.

Capsule not erect 4, 6, 7, 8, 26, 34.

Leaves broader, sometimes ending in a hair-like tip.

Capsule partly concealed by leaves 19.

Capsule not concealed.

Capsule erect 8, 22, 23, 41.

Capsule not erect 8, 9, 27, 28, 30, 41.

Stems more than one-half inch long.

Leaves hair-like throughout.¹

Capsule erect 3, 5, 6, 8, 12, 14.

Capsule not erect 4, 6, 7, 8, 26, 32, 33, 34.

¹ See *Andreaea*, p. 75.

Leaves broader, sometimes ending in a hair-like tip.

Capsule partly concealed by leaves 19.

Capsule not concealed.

Capsule erect 8, 13, 22, 23, 41.

Capsule not erect 8, 9, 27, 28, 30, 41.

b. Leaves short and broad (less than four times longer than broadest part)

Stems one-half inch long or less.

Capsule erect 10, 15, 18, 21.

Capsule not erect 10, 25, 28.

Stems more than one-half inch long.

Capsule erect 10, 17, 18, 20.

Capsule not erect 28, 29, 30.

Plants growing on roots or trunks of trees

I. SHAPE OF LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

Stems one-half inch long or less; capsule erect 22

Stems more than one-half inch long; capsule erect

21, 22.

II. SHAPE OF LEAVES WHEN MOIST EASILY SEEN

(Leaves must be seen well enough to estimate their relative shape)

a. Leaves long and narrow (more than four times longer than broadest part)

Stems one-half inch long or less; capsule erect

8, 13, 22, 23.

Stems more than one-half inch long; capsule erect

8, 22, 23.

b. Leaves short and broad (less than four times longer than broadest part)

Stems one-half inch long or less.

Capsule erect 10, 17.

Capsule not erect 10, 30.

Stems more than one-half inch long.

Capsule erect 10, 21.

Capsule not erect 10, 30, 31.

Plants growing on decaying wood, as old logs, stumps, etc.

I. SHAPE OF LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

Stems one-half inch long or less.

Capsule erect 38.

Capsule not erect 28.

Stems more than one-half inch long.

Capsule erect 38.

Capsule not erect 28.

II. SHAPE OF LEAVES WHEN MOIST EASILY SEEN

(Leaves must be seen well enough to estimate their relative shape)

a. Leaves long and narrow (more than four times longer than broadest part)

Stems one-half inch long or less.

Leaves hair-like throughout.

Capsule erect 6, 8, 38.

Capsule not erect 4, 6, 7, 26.

Leaves broader, sometimes ending in a hair-like tip.

Capsule erect 8, 38, 40, 41.

Capsule not erect 8, 27, 28, 41.

Stems more than one-half inch long.

Leaves hair-like throughout.

Capsule erect 6, 8, 38.

Capsule not erect 4, 6, 7, 8, 26.

Leaves broader, sometimes ending in a hair-like tip.

Capsule erect 8, 38, 41.

Capsule not erect 8, 27, 28, 41.

b. Leaves short and broad (less than four times longer
than broadest part)

Stems one-half inch long or less; capsule not erect

28, 30.

Stems more than one-half inch long; capsule not erect. . . .

28, 29, 30.

B

Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches).¹ Pleurocarpous mosses.

NOTE. In many cases the genus can be determined without the aid of the capsule. When in doubt where to place a sterile moss that is somewhat branched, try it under both Division A and Division B.

Plants growing on the ground

I. LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are straight or curved)

Stems pinnately branched; capsule not erect

57, 58, 71.

Stems bipinnately or tripinnately branched; capsule not erect 57, 68.

¹ For arrangement of branches see "Illustrations of Terms," Plate II.

Stems irregularly branched.¹

Capsule erect 50, 53, 75.

Capsule not erect 59, 71, 79.

II. LEAVES WHEN MOIST EASILY SEEN

(It is necessary only to see if the leaves are straight or curved, the entire outline need not show)

Stems pinnately branched.

Leaves straight; capsule not erect

57, 58, 64, 66, 67, 68, 69, 71, 74.

Leaves curved; capsule not erect 62, 66, 70, 71.

Stems bipinnately or tripinnately branched; leaves straight;
capsule not erect 68.

Stems tree-like in branching; leaves straight; capsule erect
. . . . 45.

Stems irregularly branched.

Leaves apparently on two opposite sides of the stem.²

Leaves straight; capsule not erect 72, 73, 75, 80.

Leaves curved; capsule not erect 71.

Leaves turned to one side,¹ more or less curved.

Capsule erect 44.

Capsule not erect 44, 62, 71.

Leaves arranged equally around stem, straight.

Leaves wide-spreading; capsule not erect

59, 61, 63, 64, 67, 73, 75, 78.

Leaves not wide-spreading.¹

Capsule erect 44, 50, 75.

Capsule not erect 44, 58, 61, 71, 74, 75, 76, 79.

¹ If No. 34 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 31 has been mistaken for a pleurocarpous moss, it will apparently belong here.

**Plants growing on rocks, sticks, etc. in or at the edge of
streams, ponds, or water-holes**

I. LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are straight or curved)

Stems less than three inches long; irregularly branched;
capsule not erect 79.

II. LEAVES WHEN MOIST EASILY SEEN

(It is necessary only to see if the leaves are straight or curved, the entire
outline need not show)

Stems less than three inches long.

Stems tree-like in branching; leaves straight; capsule
erect 45.

Stems irregularly branched.

Leaves straight, erect or spreading.¹

Capsule erect 44.

Capsule not erect 44, 59, 61, 65, 75, 77, 79.

Leaves more or less curved and turned to one side.

Capsule erect 44.

Capsule not erect 44, 65.

Stems more than three inches long, irregularly branched.

Leaves straight, erect or spreading.¹

Capsule erect 43, 44.

Capsule not erect 44, 59, 65.

Leaves more or less curved, sometimes turned to one
side.

Capsule erect 44.

Capsule not erect 44, 62, 65.

¹ If No. 19 has been mistaken for a pleurocarpous moss, it will apparently belong here.

Leaves turned to one side, curved;¹ capsule not erect
 62, 71.

Leaves arranged equally around stem, straight.

Leaves wide-spreading.

Capsule almost concealed by leaves 42.

Capsule not concealed.

Capsule erect 54, 56.

Capsule not erect 59, 61, 67, 73, 75, 78.

Leaves not wide-spreading.^{1 2 3}

Capsule erect 46, 50, 51, 75.

Capsule not erect 61, 71, 75, 76, 79.

Plants growing on roots or trunks of trees

I. LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are straight or curved)

Stems irregularly or rarely pinnately branched.³

Capsules erect 50, 51, 52, 53, 55, 56.

Capsule not erect 59, 60, 68, 71, 75.

Stems bipinnately or tripinnately branched; capsule not erect 68.

II. LEAVES WHEN MOIST EASILY SEEN

(It is necessary only to see if the leaves are straight or curved, the entire outline need not show)

Stems pinnately branched; capsule not erect

68, 69, 70.

Stems bipinnately or tripinnately branched; capsule not erect 68.

¹ If No. 34 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 19 has been mistaken for a pleurocarpous moss, it will apparently belong here.

³ If No. 21 has been mistaken for a pleurocarpous moss, it will apparently belong here.

Stems irregularly or rarely pinnately branched.

Leaves apparently on two opposite sides of stem.¹

Leaves straight.

Capsule partly concealed by leaves 47.

Capsule not concealed.

Capsule erect 48, 55.

Capsule not erect 80.

Leaves curved; capsule not erect 71.

Leaves turned to one side, curved; capsule erect 52.

Leaves arranged equally around stem, straight.²

Capsule erect 46, 50, 51, 52, 56, 75.

Capsule not erect 75, 78.

**Plants growing on decaying wood, as old logs,
stumps, etc.**

I. LEAVES WHEN MOIST NOT EASILY SEEN

(Leaves too small or too closely folded to show if they are straight or curved)

Stems pinnately branched.

Capsule erect 51, 52.

Capsule not erect 71.

Stems bipinnately or tripinnately branched; capsule not erect 57, 68.

Stems irregularly branched.

Capsule erect 50, 51, 52, 53, 56.

Capsule not erect 59, 71, 75.

¹ If No. 31 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 21 has been mistaken for a pleurocarpous moss, it will apparently belong here.

II. LEAVES WHEN MOIST EASILY SEEN

(It is necessary only to see if the leaves are straight or curved, the entire outline need not show)

Stems pinnately branched.

Leaves straight.

Capsule erect 51, 52.

Capsule not erect 67, 68, 69, 71.

Leaves curved.

Capsule erect 52.

Capsule not erect 62, 70, 71.

Stems bipinnately or tripinnately branched; leaves straight;
capsule not erect 68.

Stems irregularly branched.

Leaves apparently on two opposite sides of stem.

Leaves straight; capsule not erect 72, 73, 75, 80.

Leaves curved; capsule not erect 71.

Leaves turned to one side, curved.

Capsule erect 52.

Capsule not erect 62.

Leaves arranged equally around stem, straight.

Leaves wide-spreading.

Capsule erect 51, 52.

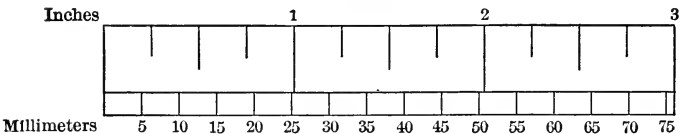
Capsule not erect 67, 73, 75, 78.

Leaves not wide-spreading.

Capsule erect 50, 75.

Capsule not erect 71, 75.

SCALE



CAPSULE KEY TO GENERA

- A.** Fruit at the apex of the stem or of a well developed branch, sometimes appearing lateral by the new growth of the plant. Stems generally erect, and often not branched; or if slightly branched by forking, usually with not more than two or three branches.¹ ACROCARPOUS MOSSES, p. 77.
- B.** Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches¹) PLEUROCARPOUS MOSSES, p. 172.

NOTE. When in doubt where to place a moss that is somewhat branched, try it under both Division A and Division B.

A

(*Fissidens*, p. 97, with fruit both terminal and lateral may be found here)

Plants growing on the ground

I. CAPSULE ERECT

a. *Capsule cylindrical*

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

2, 15, 38, 40.

¹ For arrangement of branches see "Illustrations of Terms," Plate II.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 2, 3, 6, 8, 11, 15, 38.

Leaves broader, sometimes ending in a hair-like tip
. . . . 8, 13, 39, 40, 41.

Leaves short and broad (less than four times longer than broadest part) 10, 18.

b. Capsule angular (four- to six-sided)

Leaves long and narrow (more than four times longer than broadest part) 41.

c. Capsule top-shaped or urn-shaped

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad) 16.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves short and broad (less than four times longer than broadest part) 16, 24.

d. Capsule egg-shaped, pointed

Leaves long and narrow (more than four times longer than broadest part) 36.

II. CAPSULE NOT ERECT

a. Capsule cylindrical

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 1, 2, 4, 6, 7, 8.

- Leaves broader, sometimes ending in a hair-like tip
 8, 9, 30, 31, 35, 39, 41.
 Leaves short and broad¹ (less than four times longer
 than broadest part) 10, 29, 30, 31.

b. Capsule angular (four- to six-sided)

- Leaves long and narrow (more than four times longer
 than broadest part) 41.

c. Capsule pear-shaped

Shape of leaves when moist not easily seen. (Leaves too
 small or too closely folded to show if they are rela-
 tively long and narrow or short and broad

25, 28.

Shape of leaves when moist easily seen. (Leaves must be
 seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer
 than broadest part) 26, 27, 28.

Leaves short and broad (less than four times longer than
 broadest part) 25, 28.

d. Capsule globular

Shape of leaves when moist not easily seen. (Leaves too
 small or too closely folded to show if they are rela-
 tively long and narrow or short and broad) 34.

Shape of leaves when moist easily seen. (Leaves must be
 seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer
 than broadest part) 32, 33.

Leaves short and broad (less than four times longer than
 broadest part) 34.

¹ If No. 63 has been mistaken for an acrocarpous moss, it will apparently belong here.

e. Capsule egg-shaped, pointed

Leaves absent 37.

Leaves long and narrow (more than four times longer than broadest part) 36.

Plants growing on rocks, bricks, mortar, etc.

I. CAPSULE ERECT

a. Capsule cylindrical

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad)

2, 22, 23.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 3, 5, 6, 8, 14.

Leaves broader, sometimes ending in a hair-like tip 8, 13, 22, 23, 41.

Leaves short and broad (less than four times longer than broadest part) 10, 15, 17, 18.

b. Capsule angular (four- to six-sided)

Leaves long and narrow (more than four times longer than broadest part) 41.

c. Capsule elliptical, oval, or pear-shaped

Shape of leaves when moist not easily seen.¹ (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad.)

¹ See *Andreaea*, p. 75.

Capsule partly concealed by leaves 19.

Capsule not concealed by leaves 21.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow ¹ (more than four times longer than broadest part) 12, 10, 23.

Leaves short and broad (less than four times longer than broadest part) 20, 21.

II. CAPSULE NOT ERECT

a. Capsule cylindrical

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 4, 6, 7, 8.

Leaves broader, sometimes ending in a hair-like tip
. . . . 8, 9, 30, 41.

Leaves short and broad (less than four times longer than broadest part) 10, 29, 30.

b. Capsule angular (four- to six-sided)

Leaves long and narrow (more than four times longer than broadest part) 41.

c. Capsule pear-shaped

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad.) . . .

25, 28.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

¹ See *Andreaea*, p. 75.

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 26.

Leaves broader, sometimes ending in a hair-like tip
 27, 28.

Leaves short and broad (less than four times longer than broadest part) 25, 28.

d. Capsule globular

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad) 34.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part) 32, 33.

Leaves short and broad (less than four times longer than broadest part) 34.

Plants growing on roots or trunks of trees

I. CAPSULE ERECT

a. Capsule cylindrical

Leaves long and narrow (more than four times longer than broadest part) 8, 13, 22, 23.

Leaves short and broad (less than four times longer than broadest part) 10, 17.

b. Capsule elliptical, oval, or pear-shaped

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad) 21, 22.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part) 22, 23.

Leaves short and broad (less than four times longer than broadest part) 21.

II. CAPSULE NOT ERECT

Capsule cylindrical

Leaves short and broad (less than four times longer than broadest part) 10, 30, 31.

Plants growing on decaying wood, as old logs, stumps, etc.

I. CAPSULE ERECT

a. Capsule cylindrical

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad) 38.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 6, 8, 38.

Leaves broader, sometimes ending in a hair-like tip
. . . . 8, 38, 41.

b. Capsule angular (four- to six-sided)

Leaves long and narrow (more than four times longer than broadest part) 41.

II. CAPSULE NOT ERECT

a. Capsule cylindrical

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 4, 6, 7, 8.

Leaves broader, sometimes ending in a hair-like tip
 8, 41.

Leaves short and broad (less than four times longer than broadest part) 29, 30.

b. Capsule angular (four- to six-sided)

Leaves long and narrow (more than four times longer than broadest part) 41.

c. Capsule pear-shaped

Shape of leaves when moist not easily seen. (Leaves too small or too closely folded to show if they are relatively long and narrow or short and broad) 28.

Shape of leaves when moist easily seen. (Leaves must be seen well enough to estimate their relative shape.)

Leaves long and narrow (more than four times longer than broadest part).

Leaves hair-like throughout 26.

Leaves broader, sometimes ending in a hair-like tip
 27, 28.

Leaves short and broad (less than four times longer than broadest part) 28.

B

Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches).¹
 PLEUROCARPOUS MOSSES, p. 172.

NOTE. When in doubt where to place a moss that is somewhat branched, try it under both Division A and Division B.

Plants growing on the ground

I. CAPSULE ERECT

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved); stems irregularly branched . . . 50, 53, 75.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Leaves more or less curved; stems irregularly branched . . . 44.

Leaves straight.

Stems irregularly branched . . . 44, 50, 75.

Stems tree-like in branching . . . 45.

II. CAPSULE NOT ERECT

a. *Capsule long-cylindrical* (at least four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved).

Stems pinnately branched . . . 57, 58, 71.

¹ For arrangement of branches see "Illustrations of Terms," Plate II.

Stems bipinnately or tripinnately branched 57.

Stems irregularly branched 59, 71.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched.

Leaves straight 57, 58, 64, 71, 74.

Leaves curved 62, 70, 71.

Stems irregularly branched.

Leaves apparently on two opposite sides of the stem.¹

Leaves straight 72, 73, 80.

Leaves curved 71.

Leaves turned to one side, curved 44, 62, 71.

Leaves arranged equally around stem, straight.

Leaves wide-spreading 59, 61, 64, 73, 78.

Leaves not wide-spreading 44, 58, 61, 71, 76.

b. Capsule short-cylindrical (less than four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved).

Stems pinnately or irregularly branched . . . 71, 79.

Stems bipinnately or tripinnately branched 68.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched.

Leaves straight 66, 67, 68, 69, 71.

Leaves curved 62, 66, 71.

Stems bipinnately or tripinnately branched; leaves straight 68.

¹ If No. 31 has been mistaken for a pleurocarpous moss, it will apparently belong here.

Stems irregularly branched.

Leaves straight¹ 63, 67, 75.

Leaves curved 62.

**Plants growing on rocks, sticks, etc., in or at the edge of
streams, ponds, or water-holes**

I. CAPSULE ERECT

Leaves when moist easily seen. (It is necessary only to see
if the leaves are straight or curved, the entire
outline need not show.)

Leaves straight, erect or spreading.²

Capsule partly concealed by leaves; stems long,
floating, irregularly branched 43.

Capsule not concealed.

Stems tree-like in branching 45.

Stems irregularly branched 44.

Leaves more or less curved and turned to one side

. . . . 44.

II. CAPSULE NOT ERECT

a. Capsule long-cylindrical (at least four times longer
than broad)

Leaves when moist easily seen (it is necessary only to see
if the leaves are straight or curved, the entire out-
line need not show); stems irregularly branched.

Leaves straight, spreading 44, 59, 61.

Leaves more or less curved and turned to one side

. . . . 44, 62.

¹ If No. 34 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 19 has been mistaken for a pleurocarpous moss, it will apparently belong here.

b. Capsule short-cylindrical (less than four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved); stems irregularly branched 79.

Leaves when moist easily seen (it is necessary only to see if the leaves are straight or curved, the entire outline need not show); stems irregularly branched.

Leaves straight, erect or spreading

65, 75, 77, 79.

Leaves more or less curved and turned to one side

. . . . 65.

Plants growing on rocks not in streams, ponds, or water-holes

I. CAPSULE ERECT

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved); stems irregularly branched¹

50, 53, 54, 55, 56.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Capsule partly concealed by leaves;² stems irregularly branched; leaves straight 42.

Capsule not concealed.

Stems irregularly branched.

Leaves apparently on two opposite sides of stem, straight 48, 55.

¹ If No. 21 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 19 has been mistaken for a pleurocarpous moss, it will apparently belong here.

Leaves arranged equally around stem, straight.

Leaves wide-spreading 54, 56.

Leaves not wide-spreading ¹ 46, 50, 51, 75.

II. CAPSULE NOT ERECT

a. Capsule long-cylindrical (at least four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved)

Stems pinnately branched 57, 71.

Stems bipinnately or tripinnately branched 57.

Stems irregularly branched 59, 60, 71.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched.

Leaves straight 57, 71.

Leaves curved 62, 70, 71.

Stems somewhat tree-like in branching; leaves straight 49.

Stems irregularly branched.

Leaves apparently on two opposite sides of stem.

Leaves straight 72, 73.

Leaves curved 71.

Leaves turned to one side, curved 62, 71.

Leaves arranged equally around stem, straight.

Leaves wide-spreading 59, 61, 73.

Leaves not wide-spreading 61, 71, 76.

¹ If No. 21 has been mistaken for a pleurocarpous moss it will apparently belong here.

b. Capsule short-cylindrical (less than four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved).

Stems bipinnately or tripinnately branched 68.

Stems irregularly branched¹ 75, 79.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched.

Leaves straight 66, 67, 68, 69.

Leaves curved 62, 66.

Stems bipinnately or tripinnately branched; leaves straight 68.

Stems irregularly branched.

Leaves turned to one side, curved 62.

Leaves arranged equally around stem, straight.

Leaves wide-spreading 67, 75, 78.

Leaves not wide-spreading¹ 75, 79.

Plants growing on roots or trunks of trees

I. CAPSULE ERECT

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved); stems irregularly or pinnately branched²
. . . . 50, 51, 52, 53, 55, 56.

Leaves when moist easily seen (it is necessary only to see if the leaves are straight or curved, the entire outline need not show); stems irregularly or pinnately branched.

¹ If No. 34 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 21 has been mistaken for a pleurocarpous moss, it will apparently belong here.

Leaves apparently on two opposite sides of stem,
straight.

Capsule partly concealed by leaves 47.

Capsule not concealed 48, 55.

Leaves slightly turned to one side, straight or curved
. . . . 52.

Leaves arranged equally around stem, straight¹
. . . . 46, 50, 51, 52, 56.

II. CAPSULE NOT ERECT

a. Capsule long-cylindrical (at least four times longer
than broad)

Leaves when moist not easily seen (too small or too closely
folded to show if they are straight or curved).

Stems pinnately branched 71.

Stems irregularly branched 59, 60, 71.

Leaves when moist easily seen. (It is necessary only to
see if the leaves are straight or curved, the entire
outline need not show.)

Stems pinnately branched; leaves curved 70, 71.

Stems irregularly branched;² leaves curved 71.

b. Capsule short-cylindrical (less than four times longer
than broad)

Leaves when moist not easily seen (too small or too closely
folded to show if they are straight or curved).

Stems pinnately or irregularly branched

68, 71, 75.

Stems bipinnately or tripinnately branched 68.

Leaves when moist easily seen. (It is necessary only to

¹ If No. 21 has been mistaken for a pleurocarpous moss, it will apparently belong here.

² If No. 31 has been mistaken for a pleurocarpous moss, it will apparently belong here.

see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately or irregularly branched.

Leaves apparently on two opposite sides of stem.

Leaves straight 75, 80.

Leaves curved 71.

Leaves arranged equally around stem, straight
 68, 69, 75, 78.

Stems bipinnately or tripinnately branched; leaves straight 68.

**Plants growing on decaying wood, as old logs,
 stumps, etc.**

I. CAPSULE ERECT

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved); stems irregularly or pinnately branched
 50, 51, 52, 53, 56.

Leaves when moist easily seen (it is necessary only to see if the leaves are straight or curved, the entire outline need not show); stems irregularly or pinnately branched.

Leaves straight 50, 51, 52.

Leaves curved 52.

II. CAPSULE NOT ERECT

a. Capsule long-cylindrical (at least four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved).

Stems pinnately branched 71.

Stems bipinnately or tripinnately branched 57.

Stems irregularly branched 59, 71, 75.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched, leaves curved

62, 70, 71.

Stems irregularly branched.

Leaves apparently on two opposite sides of stem.

Leaves straight 72, 73, 80.

Leaves curved 71.

Leaves turned to one side, curved 62.

Leaves arranged equally around stem, straight.

Leaves wide-spreading 73.

Leaves not wide-spreading 71.

b. Capsule short-cylindrical (less than four times longer than broad)

Leaves when moist not easily seen (too small or too closely folded to show if they are straight or curved).

Stems pinnately branched 68, 71.

Stems bipinnately or tripinnately branched 68.

Stems irregularly branched 71, 75.

Leaves when moist easily seen. (It is necessary only to see if the leaves are straight or curved, the entire outline need not show.)

Stems pinnately branched.

Leaves straight 67, 68, 69, 71.

Leaves curved 62, 71.

Stems bipinnately or tripinnately branched; leaves straight 68.

Stems irregularly branched.

Leaves straight 67, 75, 78.

Leaves curved 62.

LIST OF GENERA

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CLASS BRYOPHYTES

SUB-CLASS MUSCI

ORDER I. SPHAGNALES (PEAT MOSSES)

FAMILY SPHAGNACEAE

A FAMILY containing but a single genus.

SPHAGNUM (Dill.) Ehrh. (Sphág-num)

A genus containing a great many species found in bogs and swampy woods, along the margins of ponds, sometimes submerged, on moist banks by streams, and more rarely in drier situations. An old Greek name for some plant.

Plants crowded together, sometimes forming dense, extensive growths; varying in color from pale to bright green, and in some species from pink to deep red; fruit not common.

Stems usually *erect*, continuing growth at the tips, sometimes reaching several feet in length, but, as a rule, the older portions becoming so decayed and fragile, that only a few inches of the plants can be gathered; *much branched*; *branches arranged in clusters along the stem*, shorter and more crowded at the tips forming a conspicuous head.



*Sphagnum
cymbifolium*

Seta absent, but represented by an outgrowth called a *pseudopodium*.

Leaves sharp-pointed or spoon-shaped, closely folded and overlapping, or spreading; *especially adapted for holding water*.

Capsule oval; brown; on a pale stalk; wrapped in leaves until mature; without a peristome; mature in summer.

Operculum convex.

Range, cosmopolitan in suitable habitats, more abundant in the cooler bogs of North America and Europe.

In economic value, the *Sphagnum*s are the most important of the *Bryophytes*. The peat of commerce is obtained from the firm, compressed mass of the older portions of the plants that is formed at the bottom of bogs. This mass is cut into bricks and, when dried, is used for fuel, especially in Scotland and Ireland.

Sphagnum is also valuable as a packing material. In certain localities it is used as a filling for mattresses and pillows, and, as a non-conducting substance, it is wrapped around steam-pipes or packed in the walls of houses. When moist, it is used by gardeners and florists for packing vegetables and plants, as the peculiar structure of the leaves enables them to absorb and hold moisture like a sponge.

It has been discovered in Germany, England, and Scotland that, owing to its absorbing qualities, *Sphagnum* can be successfully used for surgical dressings as a substitute for prepared cotton wool.

ORDER II. ANDREAEALES

FAMILY ANDREAEACEAE

A FAMILY containing only one genus.

ANDREAEA Ehrh. (An-dre-aè-a)

A genus containing many species, growing on rock, but not on limestone, usually in mountainous regions; three species occurring in our range; not common. Named after Andreä, an apothecary of Hanover, Germany.

Plants small and fine, growing in dense or lax tufts on rocks; reddish-brown to almost black.

Stems erect, slender, short, usually about $\frac{1}{2}$ inch long; very brittle.

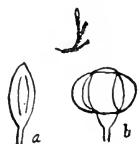
Leaves small, fine, spreading when moist; closely folded when dry; sometimes too small to be seen; reddish-brown to almost black.

Seta absent, but represented by a very short stalk of different origin.

Capsule at apex of stem, very small, erect, oval; dark brown or blackish; without peristome or operculum; splitting along four longitudinal lines, but united at the apex.

Operculum absent.

Range, almost cosmopolitan.



Andreaea petrophila

a. moist capsule;
b. dry capsule; enlarged.

Andreaea is separated from the true mosses on account of the structure of the capsule, which is inconspicuous because it is about the same dark color as the rest of the plants and is raised only a little above the end of the stem or branch. It can best be seen, when dry, by looking across the plants to the light. When dry, the four parts of the capsule are spread apart; when moist, they are closed and resemble the end of a branch. *Andreaea* forms a close, dark growth on rocks somewhat similar to that of *Grimmia* (p. 111), *Orthotrichum* (p. 117), and *Hedwigia* (p. 172). It is much less frequent than any of these, as it occurs only in mountainous regions, and the stems and branches as a rule are shorter and much more slender. The tufts are less compact than in *Orthotrichum*, and the stems usually much shorter than in *Grimmia* and *Hedwigia*. The presence of the fruit in any case will distinguish the genus.

ORDER III. BRYALES (TRUE MOSSES)

ACROCARPI

THE acrocarpous mosses are generally erect and often not branched; or, if slightly branched by forking, usually with only two or three branches. The fruit is borne at the tip of the stem, or of a well-developed branch, sometimes appearing lateral by the new growth of the plant.

FAMILY DICRANACEAE

A very large family containing many genera and several hundred species.

I. TREMATODON Michx. (Tre-mát-o-don)

A genus containing a number of species; one of which, *Trematodon ambiguus* (Hedw.) Hornsch., occurs especially in the northern part of our range. Name derived from the Greek for "perforated" and "tooth," referring to the teeth of the peristome.

Plants growing close together in old fields, in wet, swampy places, or on damp, clayey soil; light green or brownish; fruiting abundantly; not common.

Stems erect, short, usually less than $\frac{1}{2}$ inch long.



*Trematodon
ambiguus*

Leaf and capsule
enlarged.

Leaves long and hair-like, erect or somewhat spreading; light green or brownish.

Seta greenish-yellow; shining; ½–1½ inches long; conspicuous.

Capsule inclined, cylindrical, with a long neck, giving the appearance of a very long slender fruit; reddish-brown; mature in summer.

Operculum long-beaked.

Range, Canada and the northern United States; Europe.

The *long slender fruit* of *Trematodon* and the *shining, yellow fruit-stalks* first attract the eye and are the important characteristics for determination. The moss is not conspicuous when not fruited.

Two other mosses with short stems and hair-like leaves are *Ditrichum pallidum* (p. 80), and *Leptobryum* (p. 126), but the capsules are very different, and as none of these plants are likely to be collected except when fruited, there is no danger of confusing them.

2. DITRICHUM Timm (Dí-tri-chum)

A cosmopolitan genus of many species, three of which are common. Name derived from the Greek for "two," and "hair," referring to the divided teeth of the peristome.

Plants crowded together, growing on the ground, rarely on rocks; bright or yellowish-green; fruiting abundantly; not conspicuous unless in fruit; common.

Stems erect, short, usually less than ½ inch long.

- a. *Leaves too small to show outline; closely folded when dry; a rather bright green.*

Seta usually less than 1 inch long; *reddish-brown*.

Capsule erect, cylindrical, slender; reddish-brown; mature in autumn.

Operculum short-beaked. *D. tortile.*

D. vaginans.

- b. *Leaves easily seen, long, hair-like, spreading; yellowish-green.*

Seta usually 1-1 1/2 inches long; *yellowish*.

Capsule erect or slightly inclined, long, cylindrical; yellowish; mature in June.

Operculum short-beaked. *D. pallidum.*

a

Ditrichum tórtile (Schrad.) Lindb. and **Ditrichum vaginans** (Sull.) Hamp. are both found in the eastern half of North America and in Europe, the former also in Asia and Africa. They resemble each other too closely for the beginner to identify them easily. They grow on moist banks, often along roadsides, very rarely on rocks. The *stems and capsules are very slender*, and the leaves are so small and so closely folded, especially when dry, that one is hardly conscious that there are any leaves at all, as the plants look as though they consisted of tiny green stems with the fruit and fruit-stalks. No other small mosses with small erect capsules are commonly found on moist soil. *Barbula* (p. 105) has erect capsules, but usually grows on drier soil, is less com-



Ditrichum tortile

Capsule enlarged.

mon, and the leaves are crisped when dry, so that the stems do not look smooth and slender. *Georgia pellucida* (p. 154) also has small erect capsules and slender stems, but its favorite habitat is decaying wood; it less frequently grows on the ground, and mixed with the fruited plants are usually sterile stems with larger leaves arranged at the tip of the stem in a cup-like cluster containing gemmae, or brood bodies capable of reproducing the plants.

b

Ditrichum pallidum (Schrad.) Hamp. can be recognized by the long *yellow seta* and *slender capsule*, erect, or slightly inclined, sometimes becoming horizontal when old, and by the long *hair-like leaves*. It usually is found on bare ground in woods. For comparison with other mosses having hair-like leaves see *Trematodon* (p. 77), *Dicranella* (p. 84), *Weisia* (p. 100), and *Leptobryum* (p. 126).



*Ditrichum
pallidum*

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

3. SAELANIA Lindb. (Sae-làn-i-a)

A genus containing but one species found on earth and in crevices of rocks, especially limestone, in mountainous or hilly regions; rare. Named after Saelan, a Scandinavian moss student.

Plants thickly crowded together; *glaucous* or *light bluish-green* above, brown below; fruit occasional.

Stems usually less than 1 inch long, erect, slender, slightly branched.

Leaves long, hair-like, erect; some at least showing the characteristic *glaucous* or *light bluish-green* color.

Seta about $\frac{1}{2}$ inch long; yellowish or pale reddish.

Capsule erect, cylindrical; reddish; mature in early autumn.

Operculum cone-shaped, not easily seen.

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



*Saelania
glaucescens*

Saelania glaucéscens (Hedw.) Broth. (*S. caesia* Lindb.) is to be expected only in elevated regions, especially in limestone country. It is at once distinguished by the *glaucous bluish-green* of the upper leaves. No other moss has this peculiar color. The plants first impress one as being coated with some foreign matter, and a hand-lens shows the back of the leaves covered with a white substance.

4. **CERATODON** Brid. (Ce-rát-o-don)

A genus of many species widely distributed. Name derived from the Greek for "horn" and "tooth," referring to the teeth of the peristome.

Ceratodon purpùreus (L.) Brid. is found all over the world, growing on barren soil, burnt-over places, rocks,

old roofs, and even on the sand at the seashore. It is very common and fruits abundantly.

Plants crowded together; fruiting abundantly; most conspicuous when in fruit; a rather dark green.



*Ceratodon
purpureus*

Leaf and
capsule en-
larged.

Stems erect, usually about $\frac{1}{2}$ inch high; often slightly branched by forking at tip of old growth.

Leaves short, hair-like, spreading when moist; somewhat folded when dry; a rather dark green.

Seta about 1 inch long; becoming dark red when fruit is mature.

Capsule cylindrical, inclined; dark red like seta and grooved when mature, turning brown when very old; sometimes appearing lateral by new growth of stem; mature in spring.

Operculum cone-shaped.

Range, a cosmopolitan species.

Ceratodon purpureus is one of our commonest mosses and one of the first to attract the eye in early spring. In March, when the snow disappears, the slender young fruit-stalks have already reached nearly their full height and are beginning to turn from green to red; although the capsules are still so spear-like that one can hardly tell where the seta ends and the capsule begins. By late May or early June both have become the characteristic dark red that suggested the name *purpureus*. Often the new growth starts at the tip of the stem, sometimes forking before the fruit is mature, causing the seta to look as if it came from the side of

the stem; but when this occurs, the new leaves are lighter green than the old ones and one readily sees what has taken place.

The distinguishing characteristics of *Ceratodon* are the *dark-red capsule and seta* combined with the *short erect stems* and *short hair-like leaves*. When the plants are not fruited they are not conspicuous, unless the growth is quite extensive, and are not easily recognized. One can bear in mind that *Ceratodon* grows in dry, barren places and that the leaves are short, hair-like, and wide-spreading when moist. Sterile plants of *Pohlia nutans* (p. 127) often grow quite extensively, and this moss is also a very common one; but it is found in damper places, having leaves wider, larger, and more erect than in *Ceratodon* and the stems generally red, especially in the young plants.

5. DISTICHIUM Bryol. Eur. (Di-stích-i-um)

A small genus. Name derived from the Greek for a "double row," referring to the leaves arranged in two rows.

Distichium capillàceum (Sw.) Bryol. Eur. (*Swartzia montana* Lindb.) is found in mountainous regions, growing on rocks and ledges, especially limestone; not common; fruit occasional.

Plants thickly crowded together; glossy; bright or dark green above, reddish-brown below.

Stems very slender, usually 1-4 inches long; branched.

Leaves long, hair-like, spreading when moist; more erect when dry; arranged in only two rows; bright or dark green.

Seta about 1 inch long; reddish.

Capsule erect, cylindrical, slender; reddish-brown; mature in summer.

Operculum cone-shaped, not conspicuous.

Range, Europe, North America, Tasmania, New Zealand.



Distichium capillaceum

Portion of branch enlarged.

This species is usually found on rocks in the mountains, especially in limestone regions. The distinguishing characters are the *long slender stems* and the *long hair-like leaves*.

The plants are soft and silky in appearance. The leaves are in two opposite rows, but this is not always clearly seen, especially if the leaves are crowded. Sometimes they are separated enough to show this arrangement and also the white sheathing bases which make the stems appear white and shining.

6. DICRANELLA Schimp. (Di-cra-nél-la)

A genus of over one hundred species, only two of which are at all common in our range. The name means a "little" *Dicranum*; *Dicranum* is from the Greek, referring to the shape of the teeth of the peristome.

Plants growing close together on damp soil and upturned roots, rarely on earth-covered rocks; common; freely fruiting.

Stems erect, slender, usually less than 1 inch high.

Leaves long, narrow, hair-like, usually turned to one side; not much changed when dry; bright to dark green.

Seta less than 1 inch long; *yellowish* in the two common species, reddish in the others.

Capsule cylindrical, *symmetrical* and *erect*, or *unsymmetrical* and *slightly inclined*; reddish-brown; mature in autumn.

Operculum long-beaked.

Range, Newfoundland to Florida, west to the Pacific; Europe; Asia.



Dicranella heteromalla

Leaf and capsule enlarged.

Dicranella heteromalla (Dill., L.) Schimp. has the *unsymmetrical capsule*, *slightly inclined*, and when dry and empty it suddenly curves in just below the mouth.

Var. ***orthocárpa*** (Hedw.) E. G. B. has the *capsule erect and symmetrical*, not curved in below the mouth.

These two small mosses are typical little *Dicranums*. Their *long hair-like leaves*, usually *turned to one side*, and the *long-beaked operculum* are very characteristic. *Dicranum flagellare* (p. 89) somewhat resembles *Dicranella*, is next to these in size, and has erect capsules; but it commonly grows on decaying logs, and the stems are longer, thicker, and matted together with radicles; the leaves are coarser, usually crisped when dry; and if the tiny branchlets (*flagella*) can be seen sticking up above the upper leaves, one may be sure that the moss is *Dicranum flagellare* and not *Dicranella*. *Ditrichum pallidum* (p. 80) has hair-like leaves, yellow seta, and erect capsule; but leaves, seta, and capsule are all longer than in *Dicranella*. See also *Weisia* (p. 100).

7. ONCOPHORUS Brid. (On-có-pho-rus)

A genus of several species widely distributed, one of which occurs in certain parts of our range. Name derived from the Greek for "something puffed out," referring to the swelling at the base of the capsule.

Oncophorus Wahlenbergii Brid. (*Cynodontium virens* var. *Wahlenbergii* Schimp.) grows on the ground, on rocks, and on decaying logs, in mountainous and hilly woods; not common; fruit occasional.



*Oncophorus
Wahlenbergii*

Capsule enlarged.

Plants growing close together forming small bright-green tufts, dark below.

Stems erect, up to $1\frac{1}{2}$ inches long; sometimes forked.

Leaves long, hair-like; spreading when moist; loosely curled when dry, giving the plants a woolly appearance; bright green.

Seta $\frac{1}{2}$ –1 inch high; yellowish or pale reddish.

Capsule cylindrical, much curved and inclined; orange-yellow in spring, with a tiny red swollen spot at the base and the peristome showing like a red band around the mouth; when past maturity, darker and about the same color throughout; mature in spring.

Operculum long-beaked.

Range, Canada and the northern United States; Europe; Asia.

One needs to collect *Oncophorus* in the spring to see the leaves and capsules in their best color. By fall, the

fruit has become dark and broken, while the new capsules are merely slender spears. The plants have a characteristic curly appearance when dry, due to the long leaves slightly curling. Two other mosses with similar growth, leaves, and habitat, are *Dicranum fuscescens* (p. 93) and *Bartramia pomiformis* (p. 144). The leaves of these two species become somewhat crisped in drying, but they are not so distinctly *curled* as in *Oncophorus*, and in the *Dicranum* they are more or less turned to one side. The lower part of the stems of both *Dicranum* and *Bartramia* is usually covered with a felted mass of brown radicles, called *tomentum*, which is not found on the stems of *Oncophorus*. The fruit of *Bartramia*, if present, distinguishes the genus at once, as it is round instead of cylindrical; but the fruit of *Dicranum* is similar to that of *Oncophorus* in general appearance, although usually not so curved.

With a hand-lens the small projection at the base of the capsule can be seen, which suggested the name of the genus.

8. DICRANUM Hedw. (Di-crà-num)

A large cosmopolitan genus comprising several of our common mosses. Name derived from the Greek for a "two-pronged fork," referring to the teeth of the peristome.

Plants varying in size, often robust, growing close together, forming mats or tufts, on damp soil, rocks, decaying

logs, and rarely on living trees; bright to dark green; fruit of most species common.

Stems erect or ascending, usually $\frac{1}{2}$ -3 inches long; branched by forking, or unbranched; often covered with brown or whitish radicles forming a felt-like coating called *tomentum*.

Leaves long and narrow, often curved and turned to one side (secund), more rarely equally spreading; in some species crisped when dry; bright to dark green.

Seta $\frac{1}{2}$ -2 inches long; sometimes two or more setae together; often appearing to come from the side of the stem on account of the new growth of the plant; usually reddish; yellowish when not solitary.

Capsule cylindrical, erect and symmetrical, or inclined and curved; yellowish or reddish; mature in summer or autumn.

Operculum long-beaked.

Peristome red, easily seen in some of the larger species, appearing like a red band at the mouth of the capsule.

For comparison with *Catharinaea* and *Polytrichum*, which also have long narrow leaves, see p. 171.

The different species are divided as follows: —

- | | | |
|---------------------------|-----------------------|------------------------|
| a. Capsule erect. | <i>D. fulvum.</i> | <i>D. longifolium.</i> |
| | <i>D. flagellare.</i> | <i>D. viride.</i> |
| | <i>D. montanum.</i> | |
| b. Capsule not erect. . . | <i>D. scoparium.</i> | <i>D. Drummondii.</i> |
| | <i>D. fuscescens.</i> | <i>D. majus.</i> |
| | <i>D. undulatum.</i> | |

EXPLANATION OF PLATE V

DICRANUM

- Fig. 1. *D. fulvum*.
- Fig. 2. *D. flagellare*.
- Fig. 2a. Branch of *D. flagellare* showing flagella, enlarged.
- Fig. 3. *D. fuscescens*.
- Fig. 4. *D. scoparium*.
- Fig. 5. *D. undulatum*.
- Fig. 5a. Leaf of *D. undulatum*, enlarged.
- Fig. 6. Peristome of *Dicranum*, enlarged.

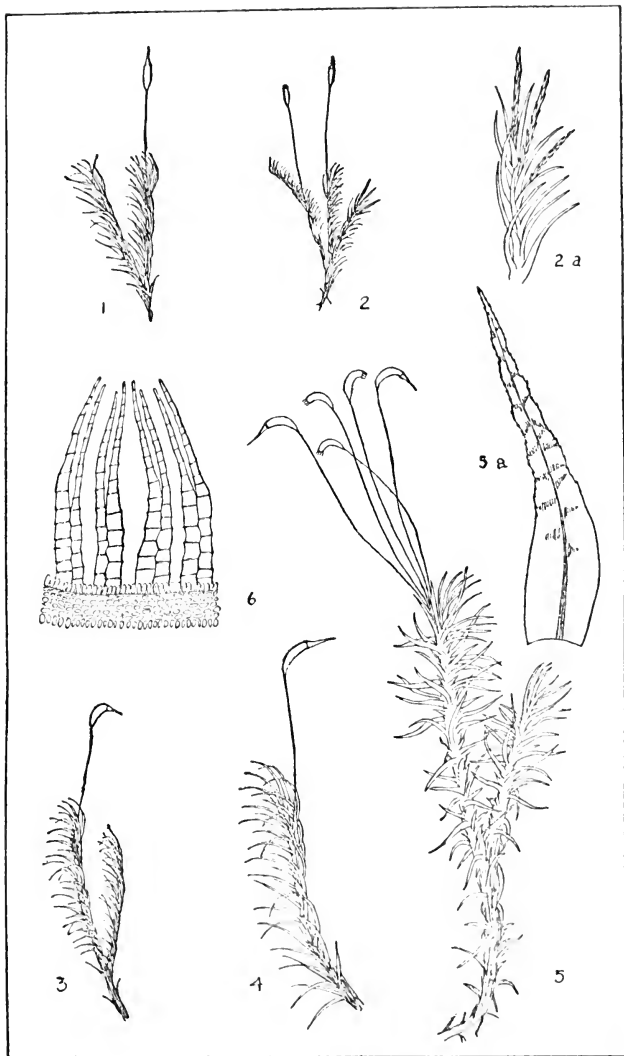


PLATE V. DICRANUM

a. Capsule erect

Dicranum fùlvum Hook. (Plate V, Fig. 1) is a common species *growing only on rocks*. The plants are medium in size, dark green above, dark brown below. The lower part of the stems is often covered with radicles. The leaves are more or less turned to one side; somewhat crisped when dry; usually rather dark green. The fruit matures in autumn.

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

When this species is not fruited it somewhat resembles certain forms of *D. scoparium* (p. 91), which also grows on rocks. Typical plants of *D. scoparium* are taller and the leaves are more turned to one side, not changing much when dry. When the plants are fruited, they are easily distinguished by the position of the capsule. See also *D. fuscescens* (p. 93).

Dicranum flagellàre Hedw. (Plate V, Fig. 2) is *usually found on old logs and stumps* in moist woods. It is a common species, generally fruiting freely, maturing in summer.

Range, Nova Scotia to North Carolina; Mexico; Europe; Asia.

A small species with stems about 1 inch long, the lower part covered with felt-like tomentum, or radicles. The leaves are somewhat curved and turned to one side; usually crisped when dry; bright or yellowish-

green. Fine branchlets, called *flagella* (Plate V, Fig. 2a), are often present and should be looked for at the tips of the stems. They are erect, rather stiff in appearance, sometimes numerous, and about the same size and color as the leaves, although they themselves are covered with very minute leaves. Care must be taken not to mistake very young capsules or new leaves for the flagella. The leaves are usually slightly curved and more hair-like at the tips and the young capsule is covered with the yellowish calyptra. *D. flagellare* when fruited most closely resembles *Dicranella heteromalla* var. *orthocarpa* (p. 85), as both have erect capsules. See under that species for comparison. Sterile plants, unless the flagella can be seen, may be mistaken for *D. fuscescens* (p. 93), and both occur on decaying wood, but *D. flagellare* is more frequent and has a wider range, as *D. fuscescens* is found chiefly at a higher altitude. It is safest always to name species only from fruited specimens.

There are three other *Dicranums* with erect capsules that occur *on living trees*, but they are *rare*; **Dicranum montanum** Hedw., **Dicranum longifolium** (Ehrh.) Hedw., and **Dicranum viride** (Sull. & Lesq.) Lindb. The fruit is very rare.

Dicranum montanum is a very small species with stems usually not more than $\frac{1}{2}$ inch long, found on trees and decaying logs. The *leaves are shorter* and *more hair-*

like than other species and become *much crisped when dry*. They are yellowish to dark green.

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

Dicranum longifolium occurs on rocks and trees in mountainous or hilly woods. The stems are usually 1–2 inches long and the *leaves about* $\frac{1}{2}$ *inch*, often longer; curved and turned to one side; not much changed when dry; light green, and glossy.

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

Dicranum viride is found on decaying logs as well as on living trees. It is a small species, usually not more than 1 inch high. The leaves are yellowish to dark green, spreading when moist, a little crisped when dry and the *tips are usually broken off*, which is the distinguishing characteristic, but not always easily seen without a lens.

Range, Newfoundland to the Rocky Mountains, south to Pennsylvania and Ohio.

b. Capsule not erect

1. *Seta solitary*

Dicranum scoparium (L.) Hedw. (Plate V, Fig. 4) is by far the *most common species* and is very variable. It grows on soil, rocks, or decaying wood in dry or

moist woods. The fruit is frequent and matures in August or September.

Range, Canada and the United States; Europe; Asia.

Often large clumps of this species occur not bearing fruit; then again the plants will be well fruited. The stems are sometimes very long, up to 4 inches, as they continue growth at the tips, dying down below. The older parts are thickly covered with brown radicles. The leaves are often more than $\frac{1}{4}$ inch long, usually slightly curved and turned to one side, but sometimes shorter and equally spreading, little changed when dry; yellowish-green. It is the *Dicranum* most frequently collected, but varies so in size and general appearance that puzzling forms are often found. The *usual large size of the plants, the long leaves more or less turned to one side, not much changed when dry*, are typical characteristics.

There are two other *Dicranums*, *D. Bergeri* Bland. (*D. Schraderi* Web. & Mohr), and *D. Bonjeani* De Not., that grow in sub-alpine bogs and marshes and closely resemble certain forms of *D. scoparium*, but they are not so common and are too difficult for the beginner to identify as species, although the generic characters are easily recognized in leaves and capsule. The leaves are shorter with broader tips and are more erect than the typical leaves of *D. scoparium*.

See *D. fulvum* (p. 89) and *D. fuscescens* (the following species).

Dicranum fuscéscens Turn. (Plate V, Fig. 3) is found on rocks and decaying wood in mountainous regions. The plants are usually well fruited, and mature in the autumn. The stems are about $1\frac{1}{2}$ inches long, often branched, brown below, and matted together with radicles. The leaves are more or less curved and turned to one side, crisped when dry, especially in the upper part.

Range, Labrador to South Carolina, Alaska to California; Europe; Asia.

D. fuscescens may be distinguished from *D. scoparium* by its *smaller size*, and *narrower, somewhat shorter, leaves, more crisped when dry*. It is also much less frequent. If sterile plants are found on rocks they may be confused with *D. fulvum* (p. 89), but the *stems of D. fuscescens* are *lighter brown below and thickly covered with radicles*, and the leaves are more curled when dry.

2. *Setae clustered*

Dicranum undulâtum Ehrh. (Plate V, Fig. 5) is easily recognized by the *wavy leaves* and *clustered setae*, 2-5 on one plant. It grows on moist soil and earth-covered rocks in hilly woods. Fruit mature in summer.

Range, Canada and the northern United States; Europe; Asia.

The stems of *D. undulatum* are stout, often 3-4 inches long, sometimes prostrate in the lower part, and

thickly covered with brown or whitish radicles. The *wavy leaves* (Plate V, Fig. 5a) are *very long, glossy, and bright yellow-green*; wide-spreading or slightly turned to one side, the uppermost erect; *not much altered when dry*. *Catharinaea undulata* (p. 157) also has wavy leaves, but they become very crisped when dry, and the stems are not covered with radicles.

Dicranum Drummóndii C. Müll. has clustered setae and is found in localities with *D. undulatum*, but less frequently. It may be easily distinguished from the latter by the *leaves*, which are *never wavy* and become *crisped when dry*.

Range, northern United States, south to New Jersey and Colorado.

There is one other *Dicranum* with clustered setae, but it is very rarely found. **Dicranum majus** Smith. This species occurs in the mountains and again along the coast in the northern part of our range. The stems are long as in the two preceding species and the *leaves are very long, usually regularly turned to one side*; light to dark green, and glossy; *not wavy, and not crisped when dry*. The stems are only slightly covered with radicles in the lower part.

Range, Greenland to Maine; Alaska; Europe; Asia.

FAMILY LEUCOBRYACEAE

A SMALL family occurring chiefly in the tropics with the exception of the following genus which is almost cosmopolitan.

9. LEUCOBRYUM Hamp. (Leu-co-bry-um)

A genus containing several species, mostly tropical. The name is derived from two Greek words meaning "white moss," referring to the typical color of the leaves.

Leucobryum glaucum (L.) Schimp., sometimes called "white moss," is found on the ground and on rocks in the woods. It is very common in most regions, but rarely fruits.

Plants growing in cushions of varying size; *glaucous* or *whitish-green* above when dry; sometimes darker green when moist; grayish-brown beneath.

Stems erect, usually 1-3 inches long, *thick, but easily broken*; branched by forking.

Leaves long, narrow, tubular from the incurved margins, erect or spreading; *glaucous* or *whitish-green*, darker when moist in the early spring, but becoming very pale when dry.



Leucobryum glaucum

Leaf enlarged.

Seta usually 1 inch long or less, dark brown.

Capsule cylindrical, curved, inclined; dark brown; mature in autumn.

Operculum long-beaked.

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

The pale-green cushions of *Leucobryum* are familiar to nearly every one who frequents the woods. Sometimes only the surface of the cushions protrudes above the ground, and sometimes the stems seem quite, if not wholly, unattached, and the rounded tufts are lying on the top of the ground. On account of its characteristic color, *Leucobryum* will not be confused with any other moss except *Sphagnum* (p. 73). The two plants resemble each other in color and erect growth, but the manner of branching and the leaves are very different. The branches of *Sphagnum* are very numerous, arranged in a close head at the tip of the stem, but long, clustered, and drooping below; the leaves vary somewhat in size, and are erect and closely folded or sometimes spreading. The stiff, erect leaves of *Leucobryum* might be mistaken for the short branches that form the heads of *Sphagnum*, but by separating a few of the plants and comparing the illustrations no mistake will be made.

FAMILY FISSIDENTACEAE

THE plants of this family belong, with only a few exceptions, to the following genus.

10. FISSIDENS Hedw. (Físs-i-dens)

A genus of wide distribution, containing many species. Name derived from the Latin for “split,” and a “tooth,” referring to the teeth of the peristome.

Fissidens is found in damp places, growing on the ground in moist woods or on shaded earth in greenhouses, on wet rocks often along streams, and more rarely at the base of trees or on decaying wood. A few species occur fairly frequently in our range, but rarely fruit, and are not easily separated.

Plants growing close together, sometimes forming thin mats; bright to dark green.

Stems erect or ascending, usually less than 1 inch long, sometimes taller; not branched or with a few branches.

Leaves relatively short and broad, arranged in only two rows on opposite sides of stem; lying flat when moist, but becoming *crisped* when dry; most of the upper half double; bright to dark green.

Seta terminal or lateral, $\frac{1}{4}$ -1 inch long; reddish.

Capsule cylindrical, erect or inclined; reddish-brown; maturing from summer to winter.



*Fissidens
adiantoides*

Leaf enlarged.

Operculum conical or short-beaked, not easily seen.

Range, throughout North America; Europe; Asia; Africa.

The leaves of *Fissidens* differ from those of other mosses in having a double part that clasps the stem. In the larger plants it can usually be seen with the unaided eye when the plants are held to the light. It is the lower part of the upper side of the leaf and will look thicker and darker than the rest of the leaf.

The conspicuous characteristic of *Fissidens* is the *flattened appearance of the plants*, due to the *leaves arranged in only two rows*, one on either side of the stem. Only one other moss described in this book has this arrangement of leaves, *Distichium* (p. 83); but there are several that have a flattened appearance, and the leaves must be examined closely to notice that they are really in more than two rows; sometimes they distinctly show that there is more than one layer. See *Mnium* (p. 138) and *Aulacomnium heterostichum* (p. 140). Among the pleurocarpous mosses the flattened appearance is more common, but the manner of growth and the branching is very different from that of *Fissidens*. See especially *Neckera* (p. 185) and *Homalia* (p. 186).

Fissidens more closely resembles some of the leafy hepatics than any of the mosses. Both the hepatics and *Fissidens* grow on rocks and moist banks, especially along streams, and it is often necessary to gather the plants and carefully examine them to tell them apart. The leaves of *Fissidens* lie flat when moist, are

pointed, and when held to the light the midrib can usually be seen even if the double portion does not clearly show; while the leaves of hepatics are rounded or lobed, usually curled under at the tips, and there is no midrib. See Introduction (p. 6). The stems of leafy hepatics are usually much branched and often interweave, forming tangled mats, while the stems of *Fissidens* are not much branched and can be easily separated.

FAMILY POTTIACEAE

A VERY large family, occurring chiefly in the temperate zones. Our common genera are found on the ground and on rocks.

II. WEISIA Hedw. (Weis-i-a)

A genus containing many species. Named after Weis, a botanist of Göttingen, Germany.

The only species of this genus found in our range is *Weisia viridula* (L.) Hedw. It grows on bare earth along roadsides, on banks, or in fields, sometimes on soil newly turned over in woods, but it is rarely collected. The fruit is abundant.



*Weisia
viridula*

Natural
size and en-
larged.

Plants crowded together; yellow-green; thickly covered with fruit.

Stems erect, very short, less than ½ inch long, usually about ¼ inch.

Leaves long, narrow, hair-like, spreading when moist; somewhat crisped when dry; yellow-green.

Seta ½ inch long or less, greenish-yellow.

Capsule short cylindrical, oval or elliptical, erect; reddish-brown; mature in spring.

Operculum long-beaked, not easily seen.

Range, Canada; United States; Europe; Asia; Africa; New Zealand; Tasmania.

The stems of *Weisia* are so short that it is not likely to be collected except when in fruit. The *small size* of the plants, *long hair-like leaves*, *short seta*, and *short capsule*, all help to distinguish *Weisia* from other mosses. It is nearest in size to *Pottia* (p. 106), but the leaves of *Pottia* are much broader and the capsule is top-shaped. *Ditrichum pallidum* (p. 80) has short stems, hair-like leaves, and yellow seta, but the seta is much longer and the capsule is larger. In *Dicranella* (p. 84) the hair-like leaves are turned to one side. *Tortella caespitosa* (p. 103) is another short-stemmed moss, but the leaves are much broader, more crisped when dry, and the capsule is longer.

12. HYMENOSTYLIUM Brid.

(Hÿ-men-o-stÿ-li-um)

A genus of wide distribution, containing several species occurring chiefly in limestone regions. Name derived from the Greek, referring to the structure of the capsule.

Hymenostylium curviróstre (Ehrh.)
Lindb. (*Gymnostomum curvirostre* Hedw.)
is found in our range.

Plants thickly crowded together, growing on moist rocks, usually limestone, in mountainous or hilly regions, and along the coast; bright green above, brownish below; not common; fruit sometimes abundant.

Stems erect, very slender, ½-4 inches long; branched.



*Hymenostylium
curvirostre*

Capsule en-
larged.

Leaves hair-like, but short; erect or somewhat spreading when moist; only slightly twisted and more erect when dry; usually bright green in the new growth, brown below.

Seta not more than 1/2 inch long; yellowish or light reddish-brown.

Capsule erect, symmetrical, oval, very small; reddish-brown; mature in summer.

Operculum with a long oblique beak, not easily seen without a lens.

Range, Labrador to Alaska, south to California and South Carolina; Europe; Asia; Africa.

Hymenostylium curvirostre occurs chiefly on wet cliffs in limestone regions. The plants often form a deep, dense growth, *conspicuously green* for about one-quarter of an inch, and then *brown below*. The fruit is sometimes abundant. If the capsule is examined under a lens it will be seen that there is no peristome. See *Didymodon* (p. 104).

13. TORTELLA (C. Müll.) Limpr. (Tor-tél-la)

A cosmopolitan genus containing many species. Name derived from the Greek for "twisted," referring to the twisted teeth of the peristome.

The two species occurring in our range are found on earth, rocks, and roots of trees; not common; fruit occasional.

Plants crowded together; green or yellowish-green.

Leaves long and narrow; much crisped when dry; green or yellowish-green.

Seta more than $\frac{1}{2}$ inch long; orange-brown.

Capsule long-cylindrical, erect; orange-brown; mature in June.

Operculum long-beaked.

Stems erect, more than $\frac{1}{2}$ inch long. *T. tortuosa*.

Stems erect, less than $\frac{1}{2}$ inch long. *T. caespitosa*.



Tortella tortuosa

Leaf and peristome enlarged.



Tortella caespitosa

Leaf enlarged.

Tortella tortuosa (L.) Limpr. is found on rocks in mountainous or hilly regions.

Range, Greenland; Canada; northern United States; Europe; Asia; Africa.

The stems of this species are usually 1 or 2 inches long, robust, yellowish-green above, brown below, and covered with brown radicles.

Tortella caespitosa (Schwaegr.) Limpr. (*Barbula caespitosa* Schwaegr.) is a much smaller species than *T. tortuosa*. It grows on earth and roots of trees in the woods.

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

The two species described above are not among our common mosses. The *long slender leaves*, becoming *much curled and crisped when dry*, and the *long, slender, erect capsule* are distinguishing characteristics. If the plants are found in fruit, the student will be well repaid to examine the peristome with a lens. The long teeth are shaded from orange-red to yellow, and are spirally twisted. The peristome of *Barbula* (p. 105) and *Tortula* (p. 107) is similar to that of *Tortella*.

14. DIDYMODON Hedw. (Di-dým-o-don)

A genus of many species occurring in limestone regions. Name derived from the Greek for "twin" and "tooth," referring to the divided teeth of the peristome.

Didymodon rubellus (Hoffm.) Bryol. Eur. is found on wet ledges and rocks, usually limestone, in mountainous or hilly regions; not common; fruit sometimes abundant.



*Didymodon
rubellus*

Leaf and capsule enlarged.

Plants growing close together; bright or dark green above, *rusty-red* below.

Stems usually less than 1 inch long; branched.

Leaves hair-like; wide-spreading when moist; somewhat *crisped* when dry; bright or dark green above, *rusty-red* on lower part of stem.

Seta about $\frac{3}{4}$ inch long; reddish.

Capsule erect, cylindrical; reddish-brown; mature in summer.

Operculum long-beaked.

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

Didymodon is to be expected on the hills and mountains of limestone regions. The conspicuous characteristic is the *rusty-red* color of the lower leaves, which distinguishes this species from other mosses of the same locality.

15. BARBULA Hedw. (Bâr-bu-la)

A large genus widely distributed. But two species are described here and they are not common. Name derived from the Latin for "beard," referring to the peristome.

Barbula unguiculâta (Huds.) Hedw. is found on the ground and on stones; sometimes on stone walls.

Barbula convolûta Hedw. grows on the ground in rather dry places.



Barbula unguiculata

Leaf enlarged.

Plants growing close together; yellow-green; fruit often abundant.

Stems erect, short, usually less than $\frac{1}{2}$ inch long.

Leaves, if large enough to be seen, short and hair-like; *much crisped when dry*.

Seta about $\frac{1}{2}$ inch long; reddish-brown in *B. unguiculata*; yellowish in *B. convoluta*, becoming reddish with age.

Capsule long-cylindrical, erect.

Peristome twisted as in *Tortella* (p. 102), and *Tortula* (p. 107).

Operculum long-beaked.

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

The beginner will not be likely to collect the *Barbula*s, unless fruited, as even moist plants are so small and inconspicuous; and when dry, they look very much dried-up on account of the tightly curled leaves. When not fruited, the *short stems* and the *leaves crisped when dry* are the only distinguishing characteristics. *Barbula* is common south and west of our range. See *Ditrichum* (p. 78), *Georgia* (p. 154), and *Encalypta* (p. 108).

16. POTTIA Ehrh. (Pótt-i-a)

A large genus widely distributed. But one species occurs in our range. Named after Pott, a professor of botany in Brunswick, Germany.

Pottia truncatula (L.) Lindb. grows on the ground in moist places; not common; fruit usually abundant.

Plants growing close together; dull green.

Stems erect, very short, about $\frac{1}{4}$ inch long.

Leaves short and broad; usually easily seen when moist; slightly crisped when dry; dull green.



Pottia truncatula

Leaf and capsule enlarged.

Seta short, $\frac{1}{4}$ to $\frac{3}{8}$ inch long; yellow-brown.

Capsule top-shaped, erect; reddish-brown; mature in autumn.

Operculum short-beaked, not easily seen.

Range, Quebec and New England to Pennsylvania; Nevada; Europe; Asia; Africa.

Pottia is not very common, but is easily recognized by the *top-shaped capsules*. The only other moss with a

similar capsule is *Physcomitrium*, which is a little larger and more common than *Pottia*. It also has short stems and leaves similar in shape, but lighter colored; the seta is longer and the capsule is larger, lighter colored, and more urn-shaped; that is, with the outline more curved. See illustration of *Physcomitrium* (p. 122). *Weisia* (p. 100) resembles *Pottia* in size, but the leaves are hair-like and the capsule is cylindrical and more slender than that of *Pottia*.

17. TORTULA Hedw. (Tór-tu-la)

A large genus widely distributed. But two species are described here, and they are very rare. Name derived from the Latin for "twisted," referring to the peristome.

Plants growing close together on rocks and on trees in dense cushions or patches; light or dark green; fruit sometimes abundant in *T. muralis*.

Stems erect, short, about $\frac{1}{2}$ inch long, or less.

Leaves broad and short in *T. papillosa*; longer in *T. muralis*, with the midrib extending beyond the leaf in a hair-like tip, not easily seen without a lens; only slightly crisped when dry; light or dark green.

Seta in *T. muralis* about $\frac{3}{4}$ inch long; yellowish to reddish.

Capsule in *T. muralis* long-cylindrical, erect; yellowish or reddish; mature in spring.

Peristome twisted as in *Tortella* (p. 102) and *Barbula* (p. 105). Seen with a lens.

Operculum long-beaked.

Tortula muràlis (L.) Hedw. is a rare species in the eastern United States, *growing on walls and sunny rocks*. The leaves of this species are four or five times longer than the broadest part, slightly *crisped when dry*; *dull or brighter green*; *hoary* from white, hair-like tips. The seta is orange when young, growing darker with age; the fruit, sometimes abundant, is mature in the spring. Compare *Encalypta* (p. 110).



Tortula muralis
Leaf enlarged.

Range, throughout North America, a cosmopolitan.

Tortula papillòsa Wils. is also a very rare species. *It grows on the bark of trees*, less frequently on rocks. The fruit has not been reported from America. The leaves are *dark or olive-green*, short and broad, and *fold against the stem when dry*, much like those of *Orthotrichum* (p. 117). *Orthotrichum* occurs much more frequently, the stems are usually longer, the leaves longer and more gradually pointed, and the fruit can usually be found.



Tortula papillosa

Range, throughout the northern Atlantic States; South America; Europe; Australia; New Zealand; Tasmania.

18. ENCALYPTA Schreb. (En-ca-lýp-ta)

A cosmopolitan genus containing many species, two of which, rarely collected, are described below. Name from the Greek, meaning "to cover with a veil," referring to the large calyptra.

Plants growing close together on rocks or soil in mountainous or hilly regions, especially limestone country; green above, brownish below; sometimes well fruited in *E. ciliata*; *rare*.

Stems erect, *robust*, usually $\frac{1}{2}$ –3 inches long; branched.

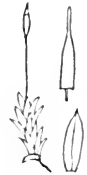
Leaves relatively *short and broad*, usually at least $\frac{1}{8}$ inch long; spreading when moist; *somewhat crisped when dry with tips incurved*; green above, brownish below.

Seta usually about $\frac{1}{2}$ inch long; yellowish or reddish.

Capsule in *E. ciliata erect*, long-cylindrical; reddish-brown; mature in summer.

Calyptra long-cylindrical, closely covering the entire capsule; straw-colored.

Operculum long-beaked.



Encalypta ciliata

Leaf and calyptra enlarged.

Encalypta ciliata (Hedw.) Hoffm. has stems about $\frac{1}{2}$ inch long. The plants are sometimes well fruited when found, but are less common than the following species.

Range, Arctic America, Canada, and the northern United States; Europe; Asia; Africa; Australia; Hawaiian Islands.

Encalypta contorta (Wulf.) Lindb. (*E. streptocarpa* Hedw.) is a larger species with stems 1–3 inches long. *Sterile plants are frequent in limestone regions*, but the fruit has not been reported from America.

Range, Ontario to Virginia, westward to the Rocky Mountains; Europe; Asia.

Encalypta may be expected only in the *higher altitudes, especially in limestone regions*. The distinguishing characteristics are the *leaf-tips curving in when dry*, and especially the *cylindrical calyptra*, when present, *closely covering the capsule*. The leaves are short and broad as in *Barbula* (p. 105) and *Tortula* (p. 107), but they are larger and less strongly crisped. The stems are also more robust.

FAMILY GRIMMIACEAE

A FAMILY containing only a few genera, two of which are given below.

19. GRIMMIA Ehrh. (Grímm-i-a)

A genus containing a great many species widely distributed, growing only on rocks and stones. The stems branch by forking much more freely than most of the acrocarpous mosses and they are often ascending instead of erect, so that, unless one can find the capsules almost hidden at the tips of the stems and branches, the moss is likely to be mistaken for pleurocarpous. Named after Grimm, a physician and botanist of Gotha, Germany.

Grimmia apocârpa (L.) Hedw. and **G. conférta** Funck are the two species most frequently collected, but as they are difficult to distinguish, only general characteristics are given.

Grimmia apocarpa var. **rivulâris** (Brid.) Web. & Mohr is found on rocks in and along streams and occurs in our range. The *stems* are *longer* than the more common species, reaching from 2-4 inches, freely branched, and *leafless in the lower part*. Other

characteristics are the same as those given below. This form of *Grimmia* may be confused with *Rhacomitrium*, the following genus, and the pleurocarpous mosses growing on rocks in streams and having the lower part of the stem leafless. See *Hygroamblystegium* (p. 211). Like all acrocarpous mosses single plants are easily separated, while the pleurocarpous mosses usually form such tangled mats that no great length of the stem can be pulled out.

Plants growing in rather loose tufts, on rocks; dull olive-green or brownish except at the young tips, which are a brighter green; common; fruit common.



Grimmia
apocarpa

Capsule
enlarged.

Stems erect or ascending; usually not more than 1 inch long, except in var. rivularis; branching somewhat freely; stiff when dry.

Leaves long and narrow, about five times longer than broadest part, sometimes ending in a white hair-point giving the plants a hoary appearance; spreading when moist; closely folded when dry; dull olive-green, or brownish.

Seta very short, hidden in leaves.

Capsule almost hidden at the tips of the branches, oval, erect; mature in late spring.

Operculum short-beaked; bright red, appearing like a red tip to the branch, as the rest of the capsule is so hidden by the leaves.

Range, almost cosmopolitan.

The *Grimmias* grow in such *small dark patches* that they do not often attract the eye except after rain, when the leaves are well spread and lighter colored, and

especially when the plants are well fruited and the *operculum* shows bright red at the tips of the branches. The stems are more branched than any of the acrocarpous mosses except *Rhacomitrium* (p. 114) and the *Orthotrichaceae* (p. 116), but the fruit is always terminal, which shows the plants are not pleurocarpous mosses. The common species of *Orthotrichum* (p. 117) and *Ulota* (p. 119), that grow on rocks and most closely resemble *Grimmia*, have the capsule more exserted, but if the plants are not in fruit the looser, darker growth of *Grimmia*, with stems usually longer and more slender, are the only distinguishing characteristics. In the pleurocarpous mosses, *Hedwigia* (p. 172) grows on rocks and has the capsule almost concealed by leaves, but it is lateral instead of terminal as in *Grimmia*, and the plants usually occur in larger patches, are more branched, and are a grayer green. See *Andreaea* (p. 75).

20. RHACOMITRIUM Brid. (Rha-co-mí-tri-um)

A large cosmopolitan genus. Named from the Greek for a "frayed cap," referring to the calyptra, which is often ragged at the base.

Rhacomitrium aciculàre (L.) Brid. is the common species of this genus, and is found *on rocks along streams*, especially in mountainous or hilly regions. The fruit is not common.

Plants growing in wide, loose patches; dull dark green, often becoming blackish.



*Rhacomitrium
aciculare*

Leaf enlarged.

Stems usually 1-2 inches long; stout; prostrate to ascending, with ends of branches erect; the lower part of the stem leafless; branched by forking.

Leaves short and broad; wide-spreading when moist; closely folded when dry; very dark except at tips of branches.

Seta about $\frac{1}{2}$ inch long; dark brown; sometimes appearing lateral by the new growth of the plant.

Capsule erect, elliptical; red-brown; mature in spring.

Operculum long-beaked.

Range, Alaska, Canada, south to California and Alabama; Europe; Africa.

Rhacomitrium resembles *Grimmia*, the preceding genus, in manner of growth and branching, but the common species described above is found on rocks along streams, sometimes overflowed, while the common *Grimmias* usually grow on rocks in woods. The stems and branches are stouter and longer, except in *G. apocarpha* var. *rivulare*, the leaves broader, and more separated, and if the plants are fruited there is no difficulty in distinguishing the two genera. The species of *Orthotrichum* and *Ulota* (pp. 117, 119) that occur on rocks are dark and somewhat branched; but like *Grimmia* they are also found in woods instead of along streams; the stems are shorter, and the plants grow in closer tufts. Associated with *Rhacomitrium* is

sometimes found a pleurocarpous moss, *Hygrohypnum eugyrium* (p. 220). The leaves of *Hygrohypnum* are lighter green, more or less curved and turned to one side, and do not closely fold against the stem when dry; the stems are more branched, and the capsule is lateral, curved and inclined, instead of terminal, symmetrical, and erect as in *Rhacomitrium*.

FAMILY ORTHOTRICHACEAE

A FAMILY containing several genera, two of which, *Orthotrichum* and *Ulota*, are widely distributed and a third, *Drummondia*, is occasionally found in our range.

21. DRUMMONDIA Hook. (Drum-mónd-i-a)

A small genus, but one species occurring in our range. Named after Thomas Drummond, an American botanist and collector.

Drummondia clavellata Hook. grows on trunks of trees — very rarely on rocks — in the woods, but is *only occasionally found*. It is the one species of the acrocarpous mosses most likely to be mistaken for a pleurocarpous moss, as the *stems are creeping with numerous erect branches; but the fruit is always terminal*.

Plants growing on trunks of trees in flat, often dense, mats; rather dark green above, blackish below; fruit sometimes abundant.



Drummondia clavellata

Stems, long, creeping; with numerous stout, erect branches usually $\frac{1}{8}$ – $\frac{1}{2}$ inch long, so thickly set that the stem is almost wholly concealed.

Leaves short and broad, often too small to show entire outline; somewhat spreading when moist; closely folded when dry.

Seta about $\frac{1}{4}$ inch long; yellowish-brown.

Capsule short, oval, erect; light brown; mature in summer.

Operculum long-beaked.

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

Drummondia, when collected fruiting, will both interest and puzzle the beginner, as the stems are creeping and much branched, while the fruit is terminal. The stems adhere so closely to the bark of the tree that it is not easy to remove much of the specimen unless the bark is cut. If only tufts of branches are removed, the creeping stem is not noticed and the moss will most likely be mistaken for *Orthotrichum*, the following genus, as the leaves fold in much the same way. But when long creeping stems covered with short erect branches run out from the dense mats, the growth is much like that of a pleurocarpous moss, except that when the fruit is found it will be at the tips of the branches. No pleurocarpous moss growing on trees has such short thick branches, and the fruit is always lateral.

22. ORTHOTRICHUM Hedw. (Or-thó-tri-chum)

A large and cosmopolitan genus occurring on trees and on rocks. Several species are found in our range. Name derived from two Greek words for "upright" and "hair," referring to the erect hairs on the calyptra.

Plants growing on trees, often apple trees, and on rocks, in small dark-green tufts; common; fruit common.

Stems erect or ascending; short, usually about $\frac{1}{2}$ inch long; sometimes branched.



a. *O. sordidum*.

b. *O. anomalum*.

c. Capsule of *O. Braunii*,
enlarged.

Leaves about four or five times longer than broadest part, sometimes too small to show outline; *wide-spreading when moist; folded straight against stem when dry.*

Seta so short that it rarely shows above leaves, except in one of the common rock-inhabiting species, *O. anomalum*, when it is longer and yellowish.

Capsule erect, cylindrical or elliptical, with a tapering neck, usually partly concealed by leaves; yellowish or reddish; mature in spring.

Calyptra thinly covered with hairs.

Operculum cone-shaped or short-beaked, not easily seen.

Range, a cosmopolitan genus.

The *Orthotrichums* will be found on trees or rocks in the open as well as in the woods. The species are not easily distinguished, but the generic characters, the *partially concealed capsule*, except in *O. anomalum*, which grows on rocks, and the *leaves folding straight when dry*, can be readily recognized. These mosses most closely resemble the *Ulotas* (p. 120), but in *Ulotas* the leaves are strongly crisped when dry, except in *U. americana*; the seta is longer so that the capsule is not partly concealed by leaves, and the calyptra is conspicuously covered with hairs. The exceptions to the characteristics given above, *Orthotrichum anomalum*

Hedw. and *Ulota americana*, both grow on rocks and closely resemble each other, as in both species the capsule is raised above the leaves, and the leaves are not crisped when dry. If the plants are not fruited, the beginner will not be able to identify them, but if the fruit can be found there is one character that differs slightly. In the *Orthotrichum*, when the capsule is dry and empty, it suddenly tapers at the base, while in the *Ulota* it tapers more gradually. The *Ulota* will probably be more frequently collected.

See also *Andreaea* (p. 75), *Grimmia* (p. 111), and *Drummondia* (p. 116).

Orthotrichum Braúnii Bryol. Eur. (*O. strangulatum* Sull.) is a fairly common species and can be easily recognized when fruited, by the capsule greatly contracted below the mouth when dry and empty, so that it resembles a vase in outline. The other species have the capsule only slightly or not at all contracted.

23. ULOTA Mohr (Û-lo-ta)

A genus containing many species, four of which can be found in our range. The name is derived from the Greek for "something curled," referring to the leaves curled or crisped when dry.

Plants growing on trees and on rocks, usually forming small rounded cushions; yellow-green to dark green; com-

mon in mountainous or hilly regions and along the coast; often fruiting abundantly.

Stems erect or ascending; stout; short, less than 1 inch, usually about $\frac{1}{2}$ inch long; sparingly branched.



Uloa ulophylla

Calyptra enlarged.

Leaves long and narrow, five to seven times longer than broadest part; spreading when moist; *strongly crisped when dry, except in U. americana*, which grows on rocks and has leaves folded straight when dry.

Seta short, $\frac{1}{4}$ – $\frac{1}{2}$ inch long; yellowish.

Capsule erect, cylindrical, elliptical, or pear-shaped, with tapering neck; yellowish; mature in spring or summer.

Calyptra large, covering the capsule; corn-colored; hairy.

Operculum cone-shaped or short-beaked, not easily seen.

Range, a cosmopolitan genus.

Additional characteristics seen with hand-lens; erect hairs on calyptra; capsule grooved (striate); peristome double, outer row of teeth short and broad, recurved when dry except in *U. Ludwigii*.

The compact, rounded cushions of *Uloa* will be found especially in sub-alpine woods. One species *Uloa americana* (Palis.) Limpr. (*U. Hutchinsiae* (Sm.) Hammar) grows only on rocks, while three other species, occurring in our range, *Uloa Ludwigii* Brid., *Uloa ulophylla* (Ehrh.) Broth. (*U. crispa* Brid.), and *Uloa phyllantha* Brid. are found on trees. Very rarely *U. ulophylla* and *U. phyllantha* occur on rocks.

The *Ulotas* are similar to the *Orthotrichums* in habitat and growth, but differ from them in having the *calyptra* more hairy and the *leaves crisped when dry*,

except in *U. americana*, which grows on rocks and has the leaves folded straight when dry, and cannot be easily distinguished from *Orthotrichum anomalum*. For comparison with that species see p. 118. *U. Ludwigii* and *U. ulophylla* are the common species found on trees. They are distinguished from each other by certain characteristics of the capsules that are not always clearly defined. Typically the capsule of *U. Ludwigii* is pear-shaped, with a very narrow mouth, while in *U. ulophylla* the capsule is contracted below a much wider mouth, then gradually narrowed toward the base. *Ulota phyllantha*, which also grows on trees, more rarely on rocks, is a larger, more robust species than the preceding, is less frequent, and very rarely fruits.

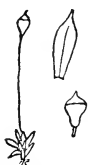
FAMILY FUNARIACEAE

A FAMILY containing several genera, two of which are common in our range.

24. **PHYSCOMITRIUM** (Brid.) Fűrnr. (Phys-co-mí-tri-um)

A genus containing many species, only one of which is common. Name derived from the Greek for a " bladder " and a " cap," referring to the calyptra.

Physcomitrium turbinatum (Michx.) Brid., given as *P. pyriforme* by some authors, is found on damp soil in fields and gardens and along roadsides; common; fruit abundant.



*Physcomitrium
turbinatum*

Leaf and cap-
sule enlarged.

Plants growing close together or somewhat scattered; light green.

Stems erect; very short, less than $\frac{1}{2}$ inch, often only $\frac{1}{8}$ inch long.

Leaves broad and flat; spreading when moist; a little crisped when dry; light green.

Seta usually not much more than $\frac{1}{2}$ inch high; yellowish in spring, becoming reddish-brown with age.

Capsule erect, urn-shaped; light colored in spring, becoming darker; mature in May or June.

Operculum cone-shaped.

Range, Quebec to Florida, west to the Rocky Mountains.

Physcomitrium turbinatum is conspicuous, especially in the spring, on account of the *light color of the leaves and fruit*. The capsule is the *distinguishing character*. It is contracted below the mouth and again at the base making it *urn-shaped*. In some specimens this is much more clearly seen than in others. There will be no difficulty in distinguishing *Physcomitrium* when fruited from other mosses except *Pottia*. For comparison with that genus see p. 106. If the plants are not fruited, they are not likely to be collected. The light color of the leaves is not a sufficient characteristic to go by, as the very young growth of any moss may be light green. For instance, the early sterile growth of *Catharinaca* (p. 158), when the stems are short and the leaves broader and lighter green than when well developed, might be mistaken for *Physcomitrium*, but *Catharinaca* occurs much more frequently and grows more extensively, and the leaves have a broader midrib, which can usually be seen when the plants are held to the light.

25. FUNARIA Schreb. (Fu-nà-ri-a)

A cosmopolitan genus of a great many species. Name derived from the Latin for "cord," referring to the twisted seta.

Funaria hygrométrica (L.) Sibth. is very common and fruits abundantly.

Plants growing close together, rarely scattered, on the ground in woods or in the open, especially on burnt-over places; sometimes found in crevices of rock; light yellow-green.



*Funaria
hygrometrica*

Capsule with
calyptra; leaf
enlarged.

Stems erect; very short, less than $\frac{1}{2}$ inch long.

Leaves short and broad; light yellow-green; folding so close in a bulb-like tuft at tip of stem that the outline cannot be seen unless the leaves are separated by pressing the tuft between the finger-tips.

Seta long, 1-2 inches; shining; greenish-yellow when young, finally becoming reddish-brown; curved and twisted when dry, quickly untwisting when moistened.

Capsule pear-shaped, unsymmetrical, curved on the upper side; in various positions; when young, light green, yellow or orange, becoming reddish-brown and grooved with age; mouth on one side; when not too old, with a bright-red ring around it; mature in May or June.

Operculum convex.

Range, a cosmopolitan species.

Funaria hygrometrica often covers a large patch of ground, especially in burnt-over places. The abundant, tall, shining, bright-colored setae make the plants very conspicuous. The characteristic capsule is easily recognized even before maturity, with the mouth so decidedly on one side that it often becomes quite parallel to the axis of the capsule, and the seta so variously curved that no two capsules seem to be in the same position. When the fruit is very young, *Funaria* may be known by the much-curved seta and the long pointed calyptra

that nearly covers the then slender capsule, all pale yellow-green, and by the round cluster of light-green leaves. The leaves fold so closely, even when moist, that the outline cannot be seen unless the bulb-like tuft is pressed and the leaves spread apart. The leafy part of the plant is so small that it is doubtful if *Funaria* is ever collected except when fruited. Mixed with *Funaria* is often a taller, sterile growth of some other moss with long narrow leaves, so that care must be taken to separate the fruited plants to see the character of the leaves.

FAMILY BRYACEAE

A COSMOPOLITAN family containing a great many species, only a few of which are common and easily recognized.

26. LEPTOBRYUM (Bryol. Eur.) Wils. (Lep-to-brÿ-um)

A genus of only three species. Name derived from the Greek for "slender," and Bryum.

Leptobryum pyriforme (L.) Wils. is found on the ground, on rocks or stone walls, and on rotten wood.

It is fairly common and usually fruits abundantly; sometimes plants with unfertilized flowers are collected. (See below.)



*Leptobryum
pyriforme*

Leaf and
capsule en-
larged.

Plants crowded together; light green or yellowish-green.

Stems erect, *very slender*; usually $\frac{1}{2}$ -1 inch long.

Leaves *very fine*, long, hair-like; spreading, forming a tuft at tip of stem; below scattered and shorter.

Seta 1-2 inches long; orange-brown; shining.

Capsule inclined or drooping; pear-shaped with a distinct, slender neck; reddish-brown; mature in early summer.

Operculum convex, not easily seen.

Range, throughout North America; South America; Europe; Asia; Tasmania; New Zealand.

Leptobryum is especially conspicuous when fruited, as the long setae and capsules shine like burnished copper. The combination of *long hair-like leaves* and *pear-shaped capsules* with the *orange-brown setae* easily distinguish *Leptobryum* from other mosses which have only one of these characteristics. *Funaria*, the preceding genus, and the two following genera, *Pohlia* and *Bryum*, have capsules similar to those of *Leptobryum*, though usually not so small or with the neck so distinct, and the leaves are not hair-like. Other mosses with spreading, hair-like leaves have a yellowish seta and cylindrical capsule. See *Trematodon* (p. 77) and *Ditrichum pallidum* (p. 80).

It is not uncommon to find *Leptobryum* not fruited, but with unfertilized flowers appearing like tiny dark dots at the tips of the stems surrounded by the long hair-like leaves. These barren plants are also often mixed with the fruited ones.

27. POHLIA Hedw. (Pöhl-i-a)

A genus of world-wide distribution containing many species. Named after Pohl, a professor of botany in Dresden, Germany.

Pohlia nutans (Schreb.) Lindb. (*Webera nutans* Hedw.) is *very common*, and found almost everywhere, *often fruiting abundantly*.

Plants thickly crowded together, growing on soil, on rocks, or on decaying wood in the woods or in the open; usually rather dark green above, brownish below.



Pohlia nutans
Leaf and capsule enlarged.

Stems erect, slender; about $\frac{1}{2}$ –1 inch long; sometimes branched and often reddish.

Leaves long and narrow, erect; usually forming a tuft at tip of stem; below smaller and more scattered; rather dark green.

Seta varying in length from $\frac{3}{4}$ –1 $\frac{1}{2}$ inches; reddish-brown.

Capsule inclined, horizontal or drooping; pear-shaped or club-shaped, with neck not very distinct; still green even when well filled out, finally becoming reddish-brown; mature in early summer.

Operculum convex.

Range, a cosmopolitan species.

Pohlia nutans is one of our most common mosses, especially conspicuous in spring when the capsules are light green or yellowish, changing to brown. Its favorite habitat is a moist, shaded bank, where quite an extensive growth is often seen, sometimes thickly covered with fruit. The capsule of *Pohlia* resembles that of *Bryum*, the following genus, with the neck less distinctly marked than in *Leptobryum*, the preceding genus. *Pohlia* can usually be distinguished from *Bryum* by the longer leaves more gradually narrowed from the base. In some species of *Bryum* the leaves are longer than in others, but they are widest above the base and never look so long and slender as in *Pohlia*. *Pohlia* is

by far much more common than *Bryum*, and therefore more frequently collected. It grows in larger patches and fruits more abundantly. The red stems are not conspicuous and can be seen in the taller plants only by holding them in a good light; the young, sterile growth shows this characteristic as well as any. The leaves at this stage are lighter green than in the older plants. For comparison of sterile growth with another common moss see under *Ceratodon* (p. 83).

28. BRYUM Dill. (Brÿ-um)

A widely distributed genus of several hundred species, only a few of which are fairly frequent. Name derived from the Greek for some Cryptogamic plant.

Plants growing close together on the ground or on rocks, rarely on decaying wood; yellowish-green to dark green, sometimes brownish; silvery in *B. argenteum*; *fruit* sometimes abundant.

Stems erect; about $\frac{1}{2}$ inch long except in *B. binum*, when they may reach 2 inches; often reddish; somewhat branched.

Leaves erect or spreading, about four to five times longer than broadest part; sometimes too small to be seen easily; often tufted at tip of stem; yellowish-green to dark green, sometimes brownish; silvery in *B. argenteum*.

Seta $\frac{1}{2}$ -2 inches long; reddish-brown.

Capsule inclined, horizontal or drooping; pear-shaped or



*Bryum
caespitium*

Leaf and capsule enlarged.

club-shaped, with neck not decidedly marked; reddish-brown; mature in summer or autumn.

Operculum convex, or cone-shaped.

Range: The following species are cosmopolitan.

Bryum bimum Schreb. is the largest of the common *Bryums* and is found in moist places and on wet ledges. The stems are sometimes 2 inches long and often conspicuously red, covered in the lower part with reddish-brown radicles. The leaves are four to five times longer than broadest part; the upper ones are sometimes red at the base like the stem; the lower ones are brown. The seta is very long, $1\frac{1}{2}$ -2 inches, and the capsule is long and slender, maturing in early summer.

Bryum caespitium L., probably the most common species, is found on dry ground and on rocks. The stems are about $\frac{1}{2}$ inch high, and the leaves are usually yellowish-green, about four to five times longer than broad. The seta is 1-2 inches long. Fruit mature in early summer.

Bryum argenteum L., commonly called the "silvery



*Bryum
argenteum*

Bryum," is known at once by the *silvery appearance* of the older plants when dry, due to the lack of green coloring matter in the upper part of the leaves. The stems are usually less than $\frac{1}{2}$ inch high and are smoothly cylindrical, with the very small leaves, too small to be seen, folding closely and overlapping. It is

found on dry ground, on rocks, and sometimes in the crevices of brick walls or stone walls. The seta is short, about $\frac{1}{2}$ inch long, and the capsule small, maturing in the fall. This species sometimes fruits abundantly.

Other species of *Bryum* are likely to be collected occasionally and are not easily identified, but the *Bryum* capsule is readily distinguished from all others except that of *Pohlia*. See under that genus (p. 128) for comparison. The capsule of *Mnium* (p. 134) is horizontal or drooping like that of *Bryum*, but the *Mnium* capsule is cylindrical throughout,—that is, the same width throughout, while the *Bryum* capsule has a more or less distinct neck, making the lower part narrower than the upper portion; yet this character is not so marked as in *Leptobryum* (p. 126).

29. RHODOBRYUM (Schimp.) Hamp.
(Rho-do-brÿ-um)

A genus containing many species, one of which is frequent and so strikingly characteristic that it is easily recognized. Name derived from the Greek for "rose," and *Bryum*, referring to the leaves forming a rosette.

Rhodobryum ontariense (Lindb.) Paris is usually given as *R. roseum* (Weis) Limpr. (*Bryum roseum* Schreb.); but the plants commonly collected in our range have a longer midrib than is described under *R. roseum*.

Plants growing loosely together or scattered, sometimes singly with other mosses; found in moist woods on the ground, on decaying logs, and on earth-covered rocks; dark green; frequent; fruit occasional.



*Rhodobryum
ontariense*

Stems erect, $\frac{1}{2}$ - $1\frac{1}{2}$ inches long; growing from underground runners (stolons); *apparently leafless below the tip*, as the lower leaves are small and scale-like.

Leaves broad, flat; dark green; when moist, forming a large rosette at the end of the stem; when dry, somewhat crisped and folded together, so that the rosette becomes more like a thick bud.

Seta usually $1-1\frac{1}{2}$ inches long; sometimes two or three on one plant; reddish.

Capsule large, cylindrical, horizontal or drooping; yellowish- or reddish-brown, with red band at mouth when young; mature in autumn.

Operculum cone-shaped.

Range, southeastern Canada and northeastern United States.

Additional characteristics seen with hand-lens. Leaves toothed in upper part, midrib extending a little beyond tip, tip often twisted, leaf-cells large; peristome-teeth long, large.

If one has become familiar with the illustration of *Rhodobryum* it will be easy to recognize this moss without having to use the Key. The broad, flat rosettes when moist and wide open, often measuring fully $\frac{1}{2}$ inch across, quickly attract the eye. No other moss forms such conspicuous rosettes except possibly *Mnium*, the following genus. The rosettes of *Mnium*

are smaller and are most noticeable in the male plants, the male reproductive organs showing in the center. The stems of *Mnium* below the rosettes bear leaves similar to those of the rosette instead of being apparently leafless as in *Rhodobryum*.

FAMILY MNIACEAE

A FAMILY containing only four genera, one of which is common and conspicuous.

30. MNIUM (Dill.) L. (Mnì-um)

A genus containing many species, several of which are common and easily distinguished by the broad, flat leaves. Name derived from the Greek for "moss."

Plants usually growing close together, sometimes singly and mixed with other mosses; found in moist places on the ground, on rocks, on decaying logs, and rarely on trees; light to dark green; often fruiting abundantly; some species common.

Stems erect, in sterile plants sometimes *prostrate or arched*; varying in length from $\frac{1}{2}$ inch in the smallest species to 3 inches or more in the largest species; *lower part often thickly covered with a felt-like coating of reddish-brown radicles called tomentum.*

Leaves of most species large, *flat and broad, rounded or more or less elliptical*; narrower in *M. hornum*; of a *thin, gauzy texture*; often separated, sometimes clustered in a rosette at tip of stem; usually much crisped when dry; bright to dark green; midrib and sometimes a thickened border can be seen in the largest leaves when moist plants are held to the light.

Seta long, generally 1-2 inches; sometimes two or three on a single plant; yellow or reddish.

EXPLANATION OF PLATE VI

MNIUM

- Fig. 1. *M. cuspidatum*.
- Fig. 1a. Leaves of *M. cuspidatum*, enlarged.
- Fig. 2. Double peristome of *Mnium*, enlarged.
- Fig. 3. *M. cinclidioides*.
- Fig. 3a. Leaf of *M. cinclidioides*, enlarged.
- Fig. 4. *M. hornum*.
- Fig. 4a. Leaf of *M. hornum*, enlarged.
- Fig. 5. *M. punctatum* var. *elatum*.
- Fig. 5a. Leaf of *M. punctatum* var. *elatum*, enlarged.
- Fig. 5b. Tip of leaf of *M. punctatum* var. *elatum* showing cell-structure, enlarged.

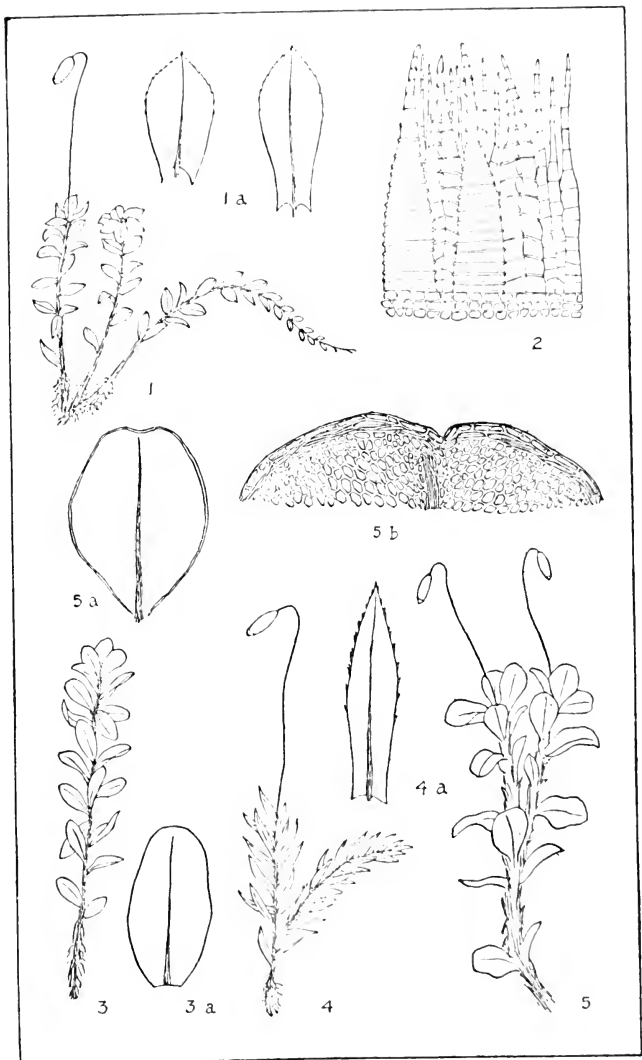


PLATE VI. MNIMUM

Capsule inclined, horizontal or drooping; cylindrical; about the same width throughout, without the smaller neck portion as in Bryum (p. 129), Pohlia (p. 128), and Leptobryum (p. 126); usually yellowish when mature in May or June, sometimes growing darker with age, in some species with a red band around the mouth.

Operculum varying from convex to long-beaked.

Range, a cosmopolitan genus.

Additional characteristics seen with hand-lens: Leaves sometimes bordered or toothed; teeth in some species double; midrib occasionally extending beyond leaf; leaf-cells large, nearly round; teeth of peristome long, slender. (See Plate VI.)

Mnium cuspidatum (L.) Leyss. (*M. sylvaticum* Lindb.) (Plate VI, Fig. 1) is a *very common* species found in moist, shady places *on lawns as well as in woods*; also on decaying logs and earth-covered rocks; often fruiting freely. The leaves are medium-sized for the genus, much crisped when dry, and vary in color from light to dark green. The sterile shoots of this species as well as of some others are sometimes long, slender, and prostrate or inclined, often arched and rooting at the tips. The fruit is borne singly.

Additional characteristics seen with a hand-lens: Leaves toothed only in the upper half; teeth single.

Range, Newfoundland to Florida and west to the Pacific; Europe; Asia.

Other species of *Mnium*, less frequent and occurring only in moist woods, resemble *M. cuspidatum* in gen-

eral appearance, having erect, fertile stems and prostrate or arched sterile shoots (Plate VI, Fig. 1); but the different species cannot be determined without the use of a lens which will show if the teeth are single or double, long or short, and how far they extend around the leaf. Certain species will often bear clustered fruit. It is not unusual to find plants with the leaves forming conspicuous rosettes at the end of the stems. (Plate VI, Fig. 1.) These are usually the male plants and the male reproductive organs can be seen in the center of the rosette. See end of this genus for comparison with *Rhodobryum*, which also has conspicuous rosettes.

Mnium hórnium L. (Plate VI, Fig. 4) is frequently found on *moist banks and rocks, especially along streams in woods*. It often grows extensively in wide patches, but the fruit is not common. The *leaves of this species*, unlike those of other *Mniums*, are *long and narrow*, usually *closely set and erect*, sometimes more or less flattened and *not much crisped* when dry. They are usually a rather dark green. See *Fissidens* (p. 97) and *Aulacomnium heterostichum* (p. 140), that have leaves flattened, and *Catharinaea* (p. 156), that has leaves crisped when dry.

Range, Newfoundland to Wyoming, south to Georgia; Europe; Asia; Africa.

The two following species are the largest *Mniums*. They will be found in swamps and very wet woods,

sometimes even in water in the early spring. The stems are often 3 inches or more in length, and the leaves are larger than those of most mosses.

Mnium punctatum var. **elatum** Schimp. (Plate VI, Fig. 5) is a common moss found in swamps and wet woods, and may be known by the *very large, broadly egg-shaped leaves*; bright to dark green; with a *midrib and thickened border* easily seen when the plants are held to the light. (Plate VI, Fig. 5a.) The stems are stout, sometimes branched, and usually *thickly covered with reddish-brown radicles*, called *tomentum*. The fruit is not common.

The species **Mnium punctatum** (L.) Hedw. is smaller and not so frequently collected. It occurs on rocks as well as on the ground. The leaves are the same shape as those of the variety, only smaller.

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

Mnium cinclidioides (Blytt) Hübén. (Plate VI, Fig. 3) is sometimes found in the same swamp with the preceding species, but is not so common and the fruit is very rare. *The leaves are bright green, oblong, rounded at the end*, and the midrib can be seen; but they are *not bordered* as in *Mnium punctatum*, and the stems are *not covered with radicles*.

Range, northern North America, south in the East to Pennsylvania; Europe; Asia.

The distinguishing characteristic of the *Mniums* is the *broad, flat leaf* of a thin, gauzy texture, which enables the student quickly to learn to recognize the genus. The rosettes resemble *Rhodobryum*, the preceding genus, but the leaves grow on the lower part of the stem as well as at the tip. Sometimes the leaves appear to be on opposite sides of the stem, as in *Fissidens* (p. 97), but the leaves are larger, more separated, and a careful examination will show that they are arranged in more than two rows. *Aulacomnium heterostichum* (p. 140) somewhat resembles certain *Mniums*; for comparison see under that species. Care must be taken not to mistake the round leaves of certain hepatics for those of *Mnium*. The conspicuous leaves of the hepatics are arranged in only two rows, are somewhat thicker, usually smaller than in most of the *Mniums*, and are not so flat, as they often curl under at the tip. (See Introduction, p. 6.)

FAMILY AULACOMNIACEAE

A FAMILY containing only two genera, one of which is common and widely distributed.

31. AULACOMNIUM Schwaegr. (Au-la-có-mni-um)

A small genus, two species of which occur in our range. Name derived from the Greek for "furrowed" and "moss," referring to the grooved capsule.

The two common species of *Aulacomnium* are unlike in growth and habitat and without microscopic examination resemble each other only in the capsule.

a. Leaves short and broad *A. heterostichum.*

b. Leaves long and narrow *A. palustre.*

a

Aulacomnium heteróstichum (Hedw.) Bryol. Eur. is occasionally found on moist banks and at the base of trees in the woods. The fruit is not uncommon.

Plants growing close together, often forming a somewhat flattened mat; *yellowish-green* above, olive-green or brown below.

Stems prostrate or ascending; branched by the terminal annual growth; the lower part covered with brown radicles (tomentum).

Leaves relatively short and broad; sometimes flat as though pressed, and sometimes turned to one side, especially in the new growth; not much changed when dry; yellowish-green or olive-green.



Aulacomnium heterostichum

Leaf and capsule enlarged.

Seta usually about 1 inch long; reddish-brown.

Capsule inclined; long-cylindrical; reddish-brown when mature; grooved when dry; mature in May or June.

Operculum short-beaked.

Range, the eastern part of the United States to Wisconsin and Texas; Asia.

Aulacomnium heterostichum has leaves similar in shape to those of *Fissidens* (p. 97) and some of the *Mniums*, the preceding genus. It is distinguished at once from *Fissidens* by having more than two rows of leaves, and from *Mnium* by the leaves being closer-set, and not changing much when dry. When the leaves turn to one side this moss does not suggest either *Fissidens* or *Mnium*; the manner of branching and the capsule are also different.

Two pleurocarpous mosses, *Neckera* (p. 185) and *Homalia* (p. 186), grow on trees and have broad leaves lying flat, but the stems are more branched and the capsules are not terminal.

The somewhat flattened appearance of this *Aulacomnium* may resemble some of the leafy hepatics, but the leaves are more pointed and are a lighter green. (See Introduction, p. 6.)

b

Aulacomnium palústre (L.) Swaegr. is common in moist and swampy places, but is sometimes found where the ground has become dry; fruit quite common.

Plants growing close together; usually light yellowish-green.

Stems varying in length, usually 1-4 inches long; thickly covered with brown radicles (tomentum); frequently terminating in thread-like leafless shoots (pseudopodia), bearing a cluster of brood bodies (gemmae) at the tips.

Leaves long and narrow; erect, or somewhat spreading when moist; slightly curled when dry; usually light yellowish-green.

Seta 1-1½ inches long; reddish-brown.

Capsule inclined, long-cylindrical; reddish-brown when mature; grooved when dry; mature in June.

Operculum short-beaked.

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

Aulacomnium palustre is most frequently found in *Sphagnum* bogs. The plants are *variable both in length and in robustness*, but can usually be distinguished by the *light yellowish-green leaves*, often separated enough to show the stems covered with the *reddish-brown tomentum*. *The thread-like shoots at the tips of the stems* are also very characteristic.



*Aulacomnium
palustre*

Leaf enlarged.

This species will not be confused with other mosses growing in boggy places, except possibly with certain *Dicranums* that are rarely found. See *D. Bergeri* and *D. Bonjcani* (p. 92). The leaves of *Aulacomnium palustre* are not so long as those of *Dicranum*, nor so thickly set, and never turn to one side.

FAMILY BARTRAMIACEAE

A FAMILY containing only a few genera, two of which are common in most localities. A third occurs only in limestone regions.

32. PLAGIOPUS Brid. (Pla-gí-o-pus)

A genus containing only three species. Name derived from the Greek for "oblique" and "stalk," referring to the way the seta joins the capsule.

Plagiopus Oèderi (Gunn.) Limpr. (*Bartramia Oederi* (Gunn.) Schwaegr.) is found in mountainous and hilly woods of limestone regions growing on rocks or soil; not common; fruit not common.

In order to recognize *Plagiopus* without the use of a compound microscope, the student needs to be familiar with *Bartramia pomiformis*, the following species, as the plants are best described by comparison.



*Plagiopus
Oederi*

The general characters of stems, leaves, and capsule are similar to those of *Bartramia pomiformis*, but the stems are *more slender*, usually 1-2 inches long, the *leaves shorter and less crowded*, and the *capsule smaller*.

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

33. **BARTRAMIA** Hedw. (Bar-trám-i-a)

A cosmopolitan genus containing many species, only one of which is common. Named after Bartram, an American botanist.

Bartramia pomifórmis (L.) Hedw. is frequently found in moist woods, on the ground, or on rocks, often freely fruiting.

Plants growing close together, forming thick, light- or yellowish-green mats.



*Bartramia
pomiformis*

Stems usually 1–2 inches long, *thickly covered with reddish-brown radicles* (tomentum) in the lower part.

Leaves long, narrow, hair-like throughout; spreading when moist; more erect and slightly crisped when dry.

Seta $\frac{1}{2}$ –1 inch long; reddish-brown.

Capsule nearly globular, inclined; yellowish-brown when mature in late spring.

Operculum convex, usually red, and, though small, conspicuous, especially when the capsule is young.

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

The striking character of *Bartramia*, as well as of *Plagiopus* and *Philonotis*, the two related genera, is the *globular capsule*, which, when green, with the operculum red, looks like a tiny apple, with a red cheek. No other common moss has the capsule so nearly round.

Bartramia may be distinguished from *Philonotis* by the long hair-like leaves becoming somewhat crisped when dry; from *Plagiopus*, which is not common and found only in limestone regions, by the larger size, more robust stems, longer leaves, and larger capsule.

When *Bartramia* is not fruited it resembles *Oncophorus* (p. 86), in general appearance, but *Bartramia* is much more common, grows more extensively, the leaves are not so decidedly curled when dry, and the brown radicles found on the stems are not found on the stems of *Oncophorus*. *Bartramia* may be known from *Dicranum*, when both are sterile, by the leaves equally spreading instead of more or less turning to one side. See Plate V.

34. PHILONOTIS Brid. (Phi-ló-no-tis)

A very large genus with one species generally common. Name derived from the Greek for "loving" and "moisture," referring to the favorite habitat of the plants.

Philonotis fontána (L.) Brid. is found on the ground in swamps and wet places and on rocks where water is dripping; fruit occasional.

Plants growing close together; light yellowish-green; often forming thick mats.

Stems erect or ascending, usually 1-3 inches long, slender; red; the lower part covered with brown radicles (tomen-

tum); *the new growth forming a whorl of branches at the tip of the stem, giving the plants the appearance of being pleurocarpous.*

Leaves, in the very young growth, too small to show outline, in the more robust growth, short and apparently hair-like; erect, or slightly turned to one side when moist; closely folded when dry.

Seta usually 1-2 inches long; yellowish or reddish.

Capsule nearly globular, inclined; yellowish- or reddish-brown when mature in June.

Operculum convex; red, and conspicuous, especially when the capsule is green.

Male flowers often conspicuous in a *rosette of leaves* at tip of stem.

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



Philonotis fontana

Old and young plant. Leaf enlarged.

Philonotis is especially fond of wet places where water is slowly running or dripping. The *slender stems, short leaves, and the peculiar manner of branching* are distinguishing characteristics when the *globular capsules* are not found. The only other common moss with similar capsule is the preceding genus, *Bartramia*. See under that genus for comparison.

Philonotis resembles *Aulacomnium* in color, but the stems are more slender, the leaves are much smaller, and the branching differs. See p. 141.

When the whorled branches at the tip of the stem become long, the plants have the appearance of being pleurocarpous. The only pleurocarpous mosses with branches only toward the tip of the stem are *Climacium* (p. 179) and *Thamnum* (p. 188).

FAMILY TIMMIACEAE

A FAMILY containing a single genus of only a few species.

35. TIMMIA Hedw. (Timm-i-a)

A small genus. Named after Timm, a botanist of Mecklenburg, Germany.

Timmia cucullata Michx. (given by some American authors as *T. megapolitana* Hedw.) occurs especially in limestone regions on moist banks; not commonly collected; fruit rare.



*Timmia
cucullata*

Plants growing in loose patches; green above, brown below.

Stems erect, usually 1-2 inches long, slightly branched.

Leaves long and narrow; erect; spreading when moist; slightly curled when dry.

Seta about 1 inch long; reddish.

Capsule inclined or horizontal, short-cylindrical, tapering to the seta; yellowish; mature in May.

Operculum convex.

Range, Newfoundland to Pennsylvania, west to the Pacific; Europe.

Timmia is not found in all localities and is rarely collected. Sterile plants when moist resemble *Poly-*

trichum, as the stems are robust and the leaves somewhat stiff in appearance; but when dry the leaves do not fold, but are somewhat curled and suggest *Catharinaca*, though they are more opaque, and much less crisped. The short capsule, with its tapering neck and convex operculum, would suggest the fruit of *Mnium* or *Bryum* rather than that of *Catharinaca* or *Polytrichum*. See Plates VI, VII; also pp. 129, 157.

FAMILY WEBERACEAE

A FAMILY containing only one genus.

36. WEBERA Ehrh. (Wé-ber-a)

A small genus, only one species of which is found in North America. Named after Weber, a botanist of Göttingen, Germany.

Webera séssilis (Schmid.) Lindb. (*Diphyscium foliosum* Mohr) is found on moist, shaded earth, sometimes by roadsides; not uncommon.

Plants growing close together, *only those bearing fruit conspicuous*; brownish; freely fruiting.



Webera sessilis

Plant, natural size
and enlarged.

Stems so very short that the capsules appear to grow directly on the ground.

Leaves on the stem too small to be seen; those surrounding the capsule long, hair-like; brownish.

Seta too short to be seen without dissecting the plants.

Capsule erect or oblique, egg-shaped, with narrow end pointed; light brown, growing close to the ground apparently without a seta (sessile); mature in summer.

Operculum cone-shaped.

Range, Nova Scotia to Ontario, south to Alabama; Europe; Asia; Madeira Islands.

One has carefully to search moist, barren ground in order to find *Webera sessilis*, as there is nothing con-

spicuous about the plants to attract the eye except the light-brown capsules, and these might easily be mistaken for bits of gravel at a distance. The sterile plants are mixed with the fruited ones, forming a low, dark growth, sometimes thickly dotted with the lighter capsules.

Only the following genus, *Buxbaumia*, has a capsule of similar shape, but the plants do not resemble each other in any other way.

FAMILY BUXBAUMIACEAE

A FAMILY containing but one genus.

37. BUXBAUMIA Hall. (Bux-baùm-i-a)

A widely distributed genus of five species, one of which is more frequently found than the others. Named after Buxbaum, a German botanist.

Buxbaumia aphylla L. grows on moist, barren soil in open woods. It is rarely collected and does not resemble other mosses. Only fruited plants are noticeable.

Plants very small, scattered, growing from a brownish-green coating (protonema) on the surface of the ground.



Buxbaumia
aphylla

Stems practically absent. The seta grows directly from the radicles and has the appearance of being a leafless stem, so that only fruited plants are noticeable.

Leaves not distinguishable, almost obsolete; brownish; serving only to protect the young reproductive organs, and disappearing long before the capsule is mature; found at base of seta.

Seta stout, about $\frac{1}{2}$ inch long; brownish-red.

Capsule oblique; egg-shaped, with narrow end pointed, flattened on the upper surface; when mature rich brownish-red, glossy; mature in spring.

Operculum cone-shaped.

Range, Nova Scotia to Ontario and West Virginia, Yukon Territory to Washington; Europe; Asia.

This curious little plant was first found by Buxbaum, a German botanist, in 1712, on the banks of the Volga. For some time it was regarded as a fungus, but after careful examination it was referred to the mosses on account of the structure of the fruit.

Buxbaumia is not a common moss and is collected only when fruited. It is very inconspicuous, especially when the capsules are mature and dark colored. In the fall and early winter the capsules are bright green, and if the ground is bare one can more easily locate the plants, as the capsules are more conspicuous than when brown, and then wait for the fruit to develop before collecting. One needs carefully to examine barren soil in open woods and look for the brownish-green coating from which the plants grow. This coating on the surface of the ground is the felted mass of protonema that performs the work of leaves in nourishing the plants. The first appearance of the plants looks like minute buds from which the seta and capsule grow. For some time the young capsule is only slightly larger around than the seta, but the seta is already red, while the capsule remains green until nearly mature. One can sometimes find different stages of development of the capsule on a few square inches of soil, and it will be of great interest to watch week by week the change that takes place.

No other moss resembles *Buxbaumia*, although *Webera*, the preceding genus, has a capsule similar in shape.

FAMILY GEORGIACEAE

A FAMILY containing only two genera, one of which is common.

38. GEORGIA Ehrh. (Geórg-i-a)

A small genus, one species of which is found in almost every locality. Named in honor of King George III of England.

Georgia pellucida (L.) Rabenh. (*Tetraphis pellucida* Hedw.) is found most frequently on decaying logs and old stumps and sometimes on the ground in the woods; fruit abundant.



Georgia pellucida

Leaf, peristome, and cup-like cluster of leaves enlarged.

Plants crowded thickly together; brownish-green above, reddish-brown below; matted together at the base. Mixed with the fertile plants are usually stems with a cup-like cluster of leaves at the tip containing brood bodies (gemmae), which are sometimes large enough to be seen with a hand-lens.

Stems erect, slender, about 1/2 inch long, sometimes branched.

Leaves of two kinds, those of the fertile plants erect, short, hair-like, or a little broader, rarely too small to show outline; those of the gemmae-bearing stems broader, more spreading, and arranged in a cup-like cluster at the tip of the stem.

Seta 1/2-3/4 inch long; yellowish- or reddish-brown.

Capsule erect, long-cylindrical; reddish-brown; mature in spring.

Operculum short-beaked.

Peristome of only four teeth, sometimes large enough to be seen with the unaided eye when plants are held to the light.

Range, Canada and the northern United States; Europe; Asia.

Georgia pellucida is one of the most common mosses. Its favorite habitat is decaying logs and old stumps. It is distinguished from other mosses of similar location by the *slender stems with very small erect leaves*. If the stems, with terminal leaves forming a *cup-like cluster*, are present, or if the *peristome of four teeth* can be made out, no other characters are necessary for identification. If the plants are found on the ground compare *Ditrichum* (p. 78) and *Barbula* (p. 105).

FAMILY POLYTRICHACEAE

A FAMILY containing several genera and a great many species, some of which are among our largest and most common mosses.

39. CATHARINAEA Ehrh. (Cath-a-rin-aè-a)

A cosmopolitan genus containing many species, two of which are very common and usually grow extensively, and a third is occasionally found. Named in honor of Empress Catherine II of Russia.

Plants growing in dense or loose patches on dry or moist soil; usually dull green; sometimes fruiting freely.

Stems erect, usually $\frac{1}{2}$ -2 inches long; often reddish.

Leaves long and narrow; erect or spreading when moist; strongly crisped when dry; transversely wavy (undulate), in *C. undulata*; midrib conspicuous when plants are held to the light; usually dull green.

Seta $\frac{1}{2}$ -2 inches long, sometimes two or more together; yellowish- or reddish-brown.

Capsule long-cylindrical, slender, erect or slightly inclined, sometimes curved; dark reddish-brown; mature in autumn.

A white disk-like membrane across the mouth, united at the edge to the teeth of the peristome, as in *Pogonatum* and *Polytrichum*, the two related genera. (Plate VII, Fig. 4.)

Operculum long-beaked.

a. Surface of leaf distinctly wavy (undulate); midrib narrow, about $\frac{1}{8}$ width of leaf *C. undulata*.

b. Surface of leaf not distinctly wavy, but flat or nearly so.

1. Midrib broad, $\frac{1}{4}$ - $\frac{1}{3}$ width of leaf

C. angustata.

2. Midrib narrow, $\frac{1}{8}$ width of leaf *C. crispa*.

a

Catharinaea undulata (L.) Web. & Mohr is common on moist ground in open woods. It is the most robust species, but varies in size. The *stems* are usually 1-2 inches long, sometimes longer when the new growth starts from the tip of the old, and the *leaves* often reach $\frac{3}{8}$ inch in length. They are dull or dark green. The surface of the leaf on either side of the midrib, even when moist, is distinctly transversely wavy, or undulate, instead of flat. See *Dicranum undulatum* (p. 93). The *seta* is long, often two or more growing from the same plant. The *capsule* is long, slender, and usually curved. The distinguishing characteristics are the *strongly undulate leaves* with a *narrow midrib*. For comparison with *C. angustata* and *C. crispa* see under those species.



Catharinaea undulata
Leaf enlarged.

Range, throughout temperate North America; Europe; Asia; Africa.

b. 1

Catharinaea angustata Brid. is one of our commonest mosses. It often grows quite extensively on lawns or banks, in a low, close mat, sometimes with a reddish tinge. It is smaller than *C. undulata* and usually grows on drier, more sandy soil, although the two may be found not far apart. The stems are about $\frac{1}{2}$ -1 inch long. The leaves are generally $\frac{1}{8}$ - $\frac{1}{4}$ inch long, sometimes forming a rosette at tip of stem, *not at all or only slightly wavy*; usually dull green, sometimes with a reddish tinge. The midrib is wide, occupying $\frac{1}{4}$ - $\frac{1}{3}$ width of leaf. The capsule is usually shorter and narrower than in *C. undulata*, more nearly erect, and less curved.



*Catharinaea
angustata*

Leaf enlarged.

In their distinct typical forms *C. angustata* and *C. undulata* are easily distinguished, but puzzling varieties sometimes occur; for instance, one may find a tall growth of *C. angustata* with leaves slightly wavy and midrib narrow for the species, or a short growth of *C. undulata* with leaves not so wavy as usual and midrib broad for the species. In such cases it is safest for the beginner not to try to determine species.

Range, throughout temperate North America; Europe; Asia.

b. 2

Catharinaea críspa James occurs much less frequently than the preceding species. Its favorite locality, like *C. undulata*, is moist soil, especially banks of streams. The leaves are usually light or yellowish-green, somewhat separated, hardly at all wavy, and the midrib is narrow, about $\frac{1}{8}$ the width of the leaf.

Range, Canada and the northern United States; Europe.

Catharinaea crispa most closely resembles *C. undulata* on account of the narrow midrib, but the leaves are more separated, shorter and broader, and not at all or only very slightly wavy, and they are usually a lighter green.

The *Catharinaeas* may be distinguished from other mosses that have long narrow leaves by the conspicuous midrib and the leaves becoming strongly crisped when dry. *Tortella* (p. 102) and *Mnium hornum* (p. 136) have the leaves crisped when dry, but the midrib is not so conspicuous, and the stems are thickly covered with reddish-brown radicles which are not found on the stems of *Catharinaea*. For comparison with *Dicranum* and *Polytrichum* (two common genera having long narrow leaves) see p. 171.

If the leaves of *Catharinaea* are examined with a lens, dark lines will be seen along the midrib. These are thin strips of tissue called *lamellae*, characteristic of the leaves of the *Polytrichaceae*, but not seen in other genera without a compound microscope. See Plate VII, Fig. 3.

40. POGONATUM Palis. (Po-gon-à-tum)

A genus containing many species widely distributed, only a few of which occur in the eastern United States. Four are described here. Name derived from the Greek for "beard," referring to the hairy calyptra.

Plants growing on the ground, more or less scattered; olive or dark green; *in two species growing from a green substance, called protonema, covering the soil.*

Stems erect, mostly not branched, rarely forked; $\frac{1}{4}$ -2 inches long.

Leaves long and narrow, stiff, opaque; somewhat *spreading when moist; erect* and slightly incurved, or *closely folded when dry*; only very few in number and not always easily seen when the plants grow from the persistent protonema; olive or dark green.

Seta about 1 inch long; reddish.

Capsule erect, cylindrical, symmetrical; yellowish- or reddish-brown; mature in autumn. A white disk-like membrane across the mouth, as in *Catharinaea* and *Polytrichum*. (Plate VII, Fig. 4.)

Operculum more or less long-beaked.

Calyptra covered with corn-colored hairs.

a. Plants growing from persistent protonema, leaves few

. . . . *P. brevicaule.*

. . . . *P. brachyphyllum.*

b. Plants not growing from persistent protonema, leaves numerous

P. capillare.

P. urnigerum.

a.

Pogonatum brevicáule Brid. (*P. tenue* (Menz.) E. G. B.) is common on moist clay banks and roadsides in open woods. The leaves are olive or dark green. The plants are scattered and *grow from a green substance*, called *protonema*, which forms a thin coating on the surface of the soil. All mosses first start from protonema, but it usually disappears when the leaves are developed. In *P. brevicaule* and *P. brachyphyllum* the protonema is persistent and assists in nourishing the plants, as the leaves are greatly reduced in number. *The stems are very short, and the leaves are so few and often so closely folded that they are likely to be overlooked unless the plants are thoroughly moistened and closely examined.*



Pogonatum brevicáule
Calyptra enlarged.

Range, Nova Scotia to Alabama and west to Missouri.

Pogonatum brachyphýllum (Michx.) Palis. occurs in New Jersey and southward. It grows from persistent protonema, and has olive, or dark-green leaves like *P. brevicaule*, and cannot be distinguished from it without microscopic examination.

b.

Pogonatum urnígerum (L.) Palis. and **Pogonatum capillàre** (Rich.) Brid. are found in mountainous regions and occur in the northern part of both hemi-

spheres. The protonema is not persistent, and the stems are longer and the leaves more numerous than in the preceding species. *P. urnigerum* is from 1-3 inches high, sometimes branched, and usually the leaves thickly cover most of the stem, while *P. capillare* is much smaller, 1 inch high or less, unbranched, with the leaves often clustered at the tip of the stem. The color of the leaves in both species is olive or dark green.



*Pogonatum
capillare*

Leaf en-
larged.

The *cylindrical capsule* separates *Pogonatum* from *Polytrichum*, the following genus, except *Polytrichum alpinum* var. *arcticum*; for comparison see under that species (p. 167). The leaves and calyptra resemble those of *Polytrichum* in general character, but a little experience will enable one to note that the leaves of *Polytrichum* are less rigid and the calyptra is longer in most cases. The common *Pogonatum brevicaulis* is readily distinguished by the presence of protonema, which is not found in *Polytrichum*, and by the smaller size. *Pogonatum* is distinguished from *Catharinaea* (p. 156) by the *opaque leaves, folding when dry and not crisped*.

41. POLYTRICHUM Dill. (Po-ly'-tri-chum)

A genus containing over one hundred species, some of which are our commonest mosses, found chiefly on soil in the cooler regions. Commonly called "hair-cap

EXPLANATION OF PLATE VII

POLYTRICHUM

- Fig. 1. *P. commune* var. *perigoniale*.
Fig. 1a. Male plant of *P. commune* var. *perigoniale* showing the new growth of the stem continued through the old male disk.
Fig. 1b. Calyptra covering capsule of *P. commune* var. *perigoniale* enlarged.
Fig. 2. *P. piliferum*.
Fig. 2a. Leaf of *P. piliferum*, enlarged.
Fig. 2b. Cross-section of leaf of *P. piliferum* showing lamellae and leaf-margins folded in, enlarged.
Fig. 3. Cross-section of leaf of *P. commune* showing lamellae and leaf-margins not folded in, enlarged.
Fig. 4. Peristome of *Polytrichum*, showing the membrane at the mouth of the capsule joined at the edge to the tip of the teeth, enlarged.
Fig. 5. Capsule of *P. commune*, enlarged.
Fig. 6. Capsule of *P. juniperinum*, enlarged.
Fig. 7. Capsule of *P. ohioense*, enlarged.
Fig. 8. Capsule of *P. gracile*, enlarged.
Fig. 9. Capsule of *P. alpinum* var. *arcticum*, enlarged.

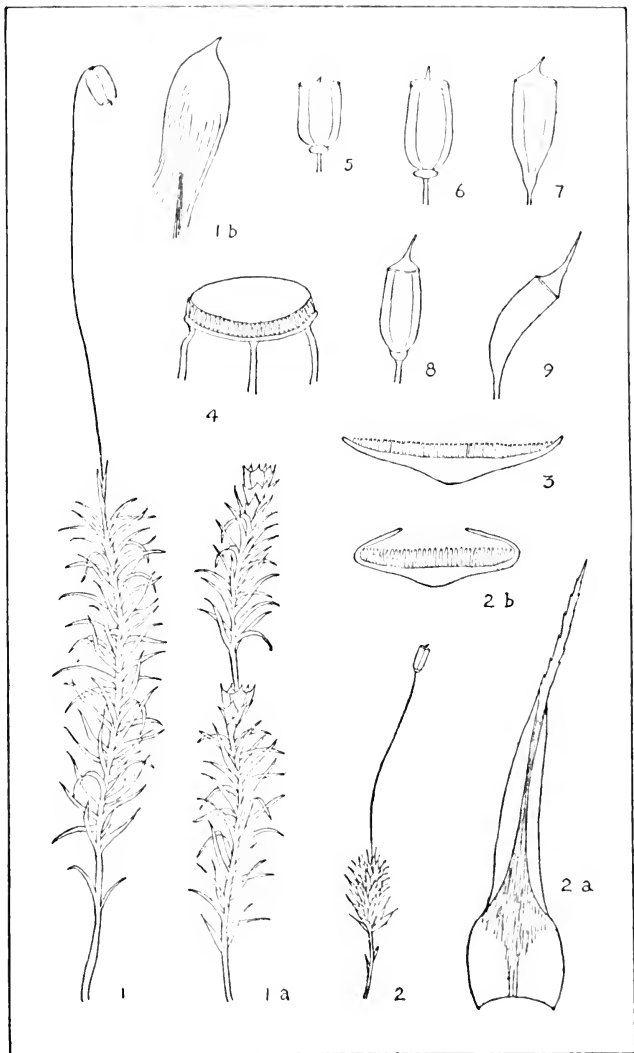


PLATE VII. POLYTRICHUM

Mosses," on account of the hairy calyptra. In some localities known as "bird wheat." Name derived from the Greek for "many" and "hair," referring to the hairy calyptra.

Plants growing in dense or loose patches on moist or dry soil, earth-covered rocks, old stumps, and upturned roots; bright to dark green, or bluish-green; often fruiting abundantly.

Stems erect, $\frac{1}{2}$ -10 inches long, stiff, rarely branched, sometimes coated toward the base with whitish or brown radicles (tomentum).

Leaves long and narrow, in one species ending in a long, whitish, hair-like tip; *wide-spreading when moist; closely folded when dry*; bright to dark green, or bluish-green; *opaque*. The *male flowers* at the tip of the stem surrounded by modified leaves called "bracts," in the form of a *rosette*. These bracts are *red or deep orange*. (Plate VII, Fig. 1a.)

Seta 1-4 inches long; orange or reddish; shining.

Capsule erect at first, finally inclined, horizontal or drooping; usually 4-6 angled; cylindrical in one species; yellowish or reddish-brown; mature in summer. A whitish membrane across the mouth of the capsule joined at the edge to the tip of the teeth as in the related genera, *Catharinaca* and *Pogonatum*. (Plate VII, Fig. 4.)

Calyptra covered with corn-colored or light golden-brown hairs, wholly or partly covering the capsule. (Plate VII, Fig. 1b.)

Operculum short or long-beaked; sometimes red or orange, or with a red or orange rim.

- a. Leaves glaucous or bluish-green; leaf-margins folded in (more easily seen toward base of leaf). (Plate VII, Fig. 2a.)

1. Leaves ending in a long, whitish, hair-like tip
P. piliferum.
2. Leaves not ending in a long, whitish, hair-like tip
. . . . *P. juniperinum.*
P. strictum.
- b. Leaves yellowish-green to olive or dark green; leaf-
margins not folded in. (Plate VII, Fig. 3.)
 1. Capsule cylindrical
P. alpinum var. *arcticum.*
 2. Capsule angled *P. commune.*
P. ohioense.
P. gracile.

a. 1

Polytrichum piliferum Schreb. (Plate VII, Fig. 2) is the *smallest Polytrichum*, with stems usually not more than 1 inch long, and leaves and capsule much smaller than in the other species. It is very common on gravelly soil and around the edges or in the hollows and crevices of rocks and ledges. The *leaves* are a rather dark green, crowded at the end of the stem, and end in a *long, whitish, hair-like tip*, which gives the plants a hoary appearance. (Plate VII, Fig. 2a.) The margins of the leaves fold in, but this character is not easily seen in this small species. (Plate VII, Fig. 2b.) The capsule is angled, erect at first, and finally becoming horizontal or drooping. The operculum is red or orange, with a short beak. The plants fruit abundantly and are conspicuous in the spring with the *red fruit-stalks* and *pale-yellow hoods* that cover the fruit.

Male plants are often numerous, and when the leaves are moist and well expanded the bright-red bracts of the rosettes look like tiny flowers.

Range, northern North America, south to Alabama and California; Greenland; Europe; Asia; South America.

a. 2

Polytrichum juniperinum Willd. (Plate VII, Fig. 6) is a common species, found in thin woods and in open places. The stems are 1-4 inches high, rarely branched. The *margins of the leaves are folded in*. This folding in can generally be seen, in this species, at least, toward the base of the largest leaves. The leaves are a *bluer-green* than in the other large common species; the *capsule is oblong, sharply four-angled*; the operculum is red and has a short beak; the calyptra covers the capsule, and the seta is red and shining.

Range, Arctic and temperate North America; a cosmopolitan.

Polytrichum juniperinum can usually be distinguished by the bluish-green of the leaves, which, together with the size of the plants, will serve as a good field characteristic when the folded leaf-margins cannot be readily seen. The plants are larger in every way than *P. piliferum*, the preceding species, also having bluish- or gray-green leaves with folded margins. Compared with other common species, besides the color of the leaves, the oblong capsule separates *P. juniperi-*

num from *P. commune* with a capsule almost cubic, and from *P. ohioense* with a capsule tapering at the base. See also the following species. A peculiar annual growth sometimes occurring in the male plants is described under *P. commune*. See Plate VII, Fig 1a.

Polytrichum strictum Banks. is found in peat-bogs and moist woods, especially in the higher altitudes. The typical form is not common, although gradations between the type and *P. juniperinum* are more frequently collected. Typically the stems are over 3 inches long, slender, and covered for a great part of their length with a thick mass of whitish radicles. The leaves are dull green or olive, shorter than in most of the other *Polytrichums*, more erect when moist and more closely folded when dry, so that the leaves have to be bent back to see the folded margins. The capsule is sharply four-angled, very little longer than broad.

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

The very slender stems of *Polytrichum strictum* matted together with whitish radicles, and the closely folded leaves, are usually very noticeable, but the gradating forms are sometimes difficult to distinguish from *P. juniperinum*. *P. juniperinum* may be expected in drier localities and is a more common species, with less slender stems and leaves more spreading when moist.

b. 1

Polytrichum alpinum var. **árcticum** (Sw.) Wahl. (*Pogonatum alpinum* var. *arcticum* (Sw.) Brid.) (Plate VII, Fig. 9) is found in mountainous or hilly regions and along the coast. The stems are up to 3 inches long, often slightly branched; the *leaves are a rather dark green*; the margins are not folded in; the *capsule is cylindrical, slightly inclined and curved* when mature; the *operculum is long-beaked*; and the calyptra only partly covers the capsule.

Range, northern part of North America and northern Europe.

This species is not to be expected except in the higher altitudes. It is distinguished from other *Polytrichums* when in fruit by the cylindrical capsule, and from the *Pogonatum*s by the larger size, and larger, curved capsule. See p. 160.

b. 2

Polytrichum ohioéense Ren. & Card. (Plate VII, Fig. 7) is a common species. The stems are up to 3 inches long; the leaves are olive or dark green; the *leaf-margins are not folded in*; the *capsule is angled, gradually tapering to the seta*; the seta is usually reddish below and yellow above; the operculum has a beak of medium length, longer than in *P. commune*, but not

so long as in *P. gracile*; and the calyptra only partly covers the capsule.

Range, Newfoundland to Alaska, south to Alabama, Missouri, and Oregon; Europe.

Polytrichum ohioense, when not in fruit, cannot be distinguished from *P. commune* and *P. gracile*, as the leaves are similar, but it may be expected in moist, shady places, usually in woods, while *P. commune*, although occurring in woods, is the common species in more open places and grows more extensively, and *P. gracile* is a rare species of elevated regions. See also *P. juniperinum*, p. 165.

Polytrichum commune L. typically has stems 6-10 inches long, with leaves very long, often $\frac{1}{2}$ inch, rather separated, wide-spreading when moist, folded when dry, but having the tips recurved and the shining leaf-bases conspicuous. The plants grow in moist, shaded places and are a rather bright green. The plants commonly found in drier, more exposed places are probably **P. commune** var. **perigoniæ** (Michx.) Bryol. Eur. (Plate VII, Fig. 1). The stems of this variety are shorter, usually 2-4 inches long, the leaves are a little smaller and more crowded, so that when dry and folded the leaf-bases do not generally show, and the leaves are often a darker green or olive, with only the young growth at the tip of the stems bright yellowish-green. The capsule in both mosses is sharply four-angled, almost

cubical, only a little longer than broad; the operculum is short-beaked; and the *calyptra* is long, wholly covering the capsule and extending a little below.

Range, throughout North America, a cosmopolitan species.

The large sterile patches of *Polytrichum*, with stems longer than in *P. piliferum*, conspicuous on banks and in open places, especially in the spring when the new growth first starts, are most likely to be the var. *perigoniale*. This variety is not mentioned by most moss students, as both the short and tall plants are spoken of as *P. commune*. Fruited specimens are frequently found and are sometimes abundant, but they rarely grow so extensively as the sterile plants. It is not unusual to find male plants with one year's growth starting from the middle of the rosette, and again developing the male heads at the tip, then the next year's growth starting in the same way. (Plate VII, Fig. 1a.) This growth occurs in other species also. *P. commune* and this variety are distinguished from other common *Polytrichums* by the *almost cubical capsule*, with the *short-beaked operculum*, and *long calyptra* and by the *leaves without the margins folded in, yellowish-green or darker*, but *not the bluish-green* of *P. juniperinum*, which in some localities is a very common species growing extensively. Other species have a longer capsule and some have a longer beak to the operculum. *P. piliferum* often grows in large patches, but the plants are much smaller in every way.

P. commune is used in Lapland for beds and pillows and occasionally in certain parts of England for stuffing mattresses and for brooms.

Polytrichum grácile Dicks. (Plate VII, Fig. 8) is a rare species found especially in higher altitudes. The capsule is obscurely 5-6 angled, the operculum has a long beak, and the calyptra does not wholly cover the capsule. This species most closely resembles *P. ohioense*, but it is not so common, the growth is somewhat more slender, and the capsule does not gradually taper to the seta as in *P. ohioense*. The leaves are dark green or olive-green.

Range, northern part of North America, eastern United States; Europe.

The *Polytrichums* are among our commonest mosses and are easily recognized as a genus, although the species cannot always be determined unless fruited. The opaque character of the leaves is due to thin, longitudinal strips of tissue called *lamellae*, standing on edge and running parallel to one another along the leaf, forming what appears to be a wide midrib. This interesting characteristic is best seen in cross-section of the leaves under a compound microscope (Plate VII, Fig. 3). The lamellae also occur on the leaves of *Pogonatum* and *Catharinaea*, though much reduced in number in *Catharinaea*. They are easily seen with the aid of a hand-lens on the leaves of *C. angustata*, p. 158.

The following Key may help to separate *Polytrichum*, *Catharinaea*, and *Dicranum*, the three commonest genera of the acrocarpous mosses having long narrow leaves.

Leaves more or less turned to one side (secund), both when moist and when dry *Dicranum* (p. 87).

Leaves equally spreading when moist; folded or crisped when dry.

Leaves folded straight against the stem when dry; stems not conspicuously covered with radicles except in *P. strictum* *Polytrichum* (p. 162).

Leaves strongly crisped when dry; stems not covered with radicles *Catharinaea* (p. 156).

Leaves more or less crisped or not much changed when dry; stems covered with radicles, especially in the lower part *Dicranum* (p. 87).

PLEUROCARPI

THE pleurocarpous mosses are prostrate or ascending, rarely erect, and usually much branched (with more than two or three branches). The fruit is borne on the side of the stem or on a very short lateral branch.

FAMILY HEDWIGIACEAE

A small family widely distributed; only one genus common in our range.

42. HEDWIGIA Ehrh. (Hed-wíg-i-a)

A cosmopolitan genus containing only a few species, only one of which occurs in our range. Named after Hedwig, Professor of Botany at Leipzig in the eighteenth century, called the "Father of Bryology."

Hedwigia álbicans (Web.) Lindb. (*H. ciliata* Ehrh.) is found on rocks, boulders, and stone walls, but never on limestone; common in most localities; fruit occasional.

Plants growing in patches of varying size; *glaucous or grayish-green*, brownish or blackish below; especially hoary when dry, due to the colorless tips of the leaves.

Stems prostrate, sometimes ascending and curved at tips, varying in length; slightly forked with shorter lateral branches; when dry, stiff and easily broken.

Leaves straight, easily seen; when moist, wide-spreading, and bright green in new growth; when dry, erect and folded, sometimes turned to one side, and gray-green or hoary, due to the colorless tips.

Seta so short that it is *completely concealed*.

Capsule on the side of the stem, *almost completely concealed* by surrounding leaves; mature in spring.

Operculum convex.

Range, throughout North America; almost a cosmopolitan species.

Additional characteristics seen with hand-lens: Leaves ending in a white tip; capsule yellowish, with a wide, red-rimmed mouth; peristome lacking.

Hedwigia will be found growing in rather flat patches varying in size. The plants when moist present an entirely different appearance from that when dry. When moist, the branches are straight and stout; the leaves are wide-spreading and quite a bright green in the new growth, much darker below; and if the plants are fruited, the light-brown capsules with a red rim at the mouth can be seen above the leaves. When dry, the branches often curl upwards at the tips, and are much more slender, as the leaves are closely folded; the plants are darker in color, often hoary from the colorless tips of the leaves; the new growth is not so conspicuous; and the capsule is concealed by the leaves



Hedwigia albicans

Plant when moist; and when dry;
leaf and capsule enlarged.

folding around it, so that it looks like a swollen end of a branch.

Hedwigia most closely resembles *Grimmia*, an acrocarpous moss. For comparison see under that genus (p. 113).

FAMILY FONTINALACEAE

A SMALL family containing only a few genera; two occurring in our range.

43. FONTINALIS (Dill.) L. (Font-i-nà-lis)

A genus of many species found chiefly in running water. A Latin name, meaning "belonging to water."

Plants attached to stones or wood in cool streams; quite common, but rarely fruiting.



Fontinalis antipyretica
var. *gigantea*

Capsule enlarged.



Fontinalis novae-angliae

Stems very long, usually over 3 inches, attached only at the base; irregularly branched, *branches long, floating*; lower part of stem leafless.

Leaves straight, long, erect-spreading, narrow and slender or large, *broad, and concave*; of various shades of green, commonly rather dark or olive-green.

Seta so short that it is usually concealed by leaves.

Capsule partially concealed by leaves, *long-cylindrical, erect*; mature in summer.

Operculum cone-shaped.

Range, temperate and cooler parts of the Northern Hemisphere.

Fontinalis antipyretica var. **gigantèa** Sull. is quite a common species in cool brooks. The distinguishing characteristics are the *large deeply concave leaves arranged in three rows*, which give a three-sided appearance to the long stems. The leaves are usually dark or olive-green, sometimes golden-green or copper-colored.

Other species of *Fontinalis* resemble the accompanying illustration. The *stems* are much *more slender* than in the species described above and the *leaves are smaller and narrower*, but there are no striking specific characteristics for easy determination.

As a genus, *Fontinalis* is easily distinguished by the *long floating stems, with straight leaves erect or slightly spreading*. Other mosses with long stems commonly found in water have finer leaves, wide-spreading or more or less curved. See following genus; also *Drepanocladus* (p. 213) and *Amblystegium* (p. 208).

The fresh-water *Algae*, often found in the same streams with *Fontinalis*, are long and thread-like, somewhat slimy, and do not have leaves.

44. DICHELYMA Myr. (Di-che-ly-ma)

A small genus of wide distribution. Name derived from two Greek words, "to halve" and "a covering," referring to the one-sided calyptra.

Dichelyma capillaceum (Dill.) Schimp. is the common species, found on bushes, sticks, etc., in or around the edges of ponds, and on the ground in swamps; fruit common.

Plants matted together, commonly found on sticks or dead leaves in water or at edge of water; yellowish-green above, brownish below.

Stems long, slender, often over 3 inches; branched.

Leaves long, hair-like, straight or curved, especially at ends of branches, erect or spreading, sometimes turned to one side; yellowish-green; usually glossy in new growth.

Seta less than $\frac{1}{2}$ inch long, wrapped in long leaves.

Capsule long-cylindrical, inclined or erect; yellowish-brown; mature in summer.

Operculum cone-shaped.

Range, New Brunswick to Ontario and Pennsylvania; Europe.



Dichelyma capillaceum

Capsule enlarged.

Dichelyma capillaceum is usually found at the edge of ponds and in very wet, swampy places. The distinguishing characteristics are the *long hair-like leaves*, sometimes turned to one side, usually *curved at the tips of the branches*, with the *capsule protruding from the long leaves that wrap around the seta*. If this species is fruited, the above character of the capsule and seta at once separate it from other mosses growing in similar situations. Sterile plants may be distinguished from *Fontinalis* by the curved leaves, giving the ends of the branches a hooked appearance. *Dichelyma* is found in stagnant water, while *Fontinalis* grows in flowing water. See *Drepanocladus* (p. 213) and *Amblystegium* (p. 208).

FAMILY CLIMACIACEAE

A FAMILY of only two genera, one occurring in our range.

45. CLIMACIUM Web. & Mohr (Cli-mà-ci-um)

A widely distributed genus, commonly called "Tree-Moss," containing only a few species, three of which are found in our region. Name derived from the Greek for "staircase," referring to the appearance of the inner peristome.

Plants growing separately or in compact clumps on wet ground, especially borders of streams and ponds, one species frequently occurring in water; bright to dark green; quite common; fruit occasional.

Primary stems creeping under ground like stolons; *secondary stems* erect, robust, usually *tree-like in branching*, the branches longer and more numerous at the end of the stem, sometimes showing red through the leaves.

Leaves large, crowded, straight, erect or spreading; rather dark green.



Climacium dendroides

Seta reddish, often 1-1½ inches long, usually several on one plant.

Capsule erect, long-cylindrical; reddish; mature in autumn.

Operculum short-beaked.

Climacium dendroïdes (L.) Web. & Mohr is the species most common in the northern part of our range, especially in mountainous regions. The capsule is about ⅛ inch long, shorter and stouter than in the following species, and the leaves are more spreading.

Range, northern and western North America, south to New Jersey, Colorado, and California; Europe.

Climacium americanum Brid. has a more southern range. The capsules are longer and more slender than in *C. dendroïdes*, measuring about ⅜ inch, and the leaves are more erect.

Range, New Brunswick to Alabama, west to the Rocky Mountains.

Climacium Kindbërgii (Ren. & Card.) Grout is the species that grows in close clumps, with branches more irregular and less frequently tree-like. It is sometimes found in water at the edge of ponds and lakes. The capsule is like that of *C. americanum*.

Range, New Brunswick to Alabama; west to the Rocky Mountains.

The distinguishing characteristic of *Climacium* is the manner of branching, which gives it the popular name of "Tree-Moss." If a number of plants are examined, some are quite sure to be found that at once suggest tiny trees, as the *branches spread all around the stem* and point upwards. *C. Kindbergii* is less tree-like and will be more easily recognized if one has first become familiar with one of the other species. See *Thamnium* (p. 187).

FAMILY LEUCODONTACEAE

A FAMILY containing several genera, one of which is occasional in our range.

46. LEUCODON Schwaegr. (Leuc-o-don)

A genus of many species, three of which occur in the Middle and Eastern States. Name derived from the Greek for "white" and a "tooth," referring to the pale peristome.

Plants growing in loose patches on trees in the woods, very rarely on rocks; yellowish, brownish, bright or olive-green; not common; fruit rare.

Primary stems slender, *creeping*, often horizontal or drooping, with numerous, erect, *secondary stems* $\frac{1}{2}$ – $1\frac{1}{2}$ inches long, branched or unbranched; when dry usually *curved upwards* at the ends, and *smoothly cylindrical*.

Leaves straight, easily seen when moist and spreading; not always seen when dry and closely folded; sometimes slightly turned to one side; varying from bright to olive-green, or brownish.

Seta short, $\frac{1}{8}$ – $\frac{3}{8}$ inch long, *more or less wrapped in long leaves*.

Capsule short-cylindrical, erect; brownish; mature in autumn.

Operculum cone-shaped.

Leucodon is to be looked for on living trees at least four or five feet from the base. The distinguishing

characteristic is the *smooth, cylindrical appearance of the secondary stems and branches, when dry, curved outwards and upwards*; when moist, the branches are straight and the leaves wide-spreading.

Leucodon julâceus (L.) Sull. is a southern species, extending north to Michigan and southern New England.



Leucodon julaceus

Plant when moist; and when dry;
leaf and capsule enlarged.



Leucodon brachypus

Plant when moist; and when dry;
leaf and capsule enlarged.

The *secondary stems are short*, rarely more than $\frac{3}{4}$ inch long, slightly branched, *perfectly cylindrical when dry*, without the leaves being at all turned to one side. The leaves are yellowish- to olive-green. Only the *base of the seta is wrapped in leaves*.

Leucodon bráchypus Brid. is found in mountainous or hilly woods from Nova Scotia to Kansas, south to the Gulf States. The *secondary stems are long*, sometimes reaching $1\frac{1}{2}$ inches. The *leaves are bright to olive-*

green, or brownish, sometimes slightly turned to one side so that the branches are not so smooth and cylindrical as in the preceding species. The seta is wholly wrapped in leaves.

Leucodon sciuroïdes (L.) Schwaegr. has a range similar to the last species, and is also found in Europe. The *secondary stems are short*, usually not more than $\frac{1}{2}$ inch. The *leaves are olive or dark green, and show only a slight tendency to turn to one side.* Fruit very rare. This species so closely resembles *L. julaceus* that it is difficult to point out any distinguishing characteristic save that the *tips of the leaves are longer and more slender*, and the plants occur farther north.

Although the species of *Leucodon* are not always easily separated, the generic character of the stems and branches, when dry, smoothly cylindrical with ends curved upwards, is usually distinct.

FAMILY NECKERACEAE

A FAMILY containing many genera, three of which occur in the eastern United States.

47. NECKERA Hedw. (Néck-er-a)

A very large genus, one species of which is common and found in most temperate regions of the world. Named after Necker, an eighteenth-century botanist and bryologist.

Plants growing in large loose patches on trees in moist, cool woods, *light or yellowish-green*; common; fruit abundant.

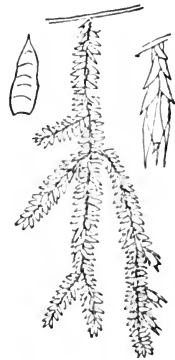
Primary stems creeping; *secondary stems erect, horizontal or drooping*, irregularly pinnate or only slightly branched, *usually flattened*, and broad.

Leaves straight, easily seen, *lying flat, apparently on two opposite sides of the stems and branches*, more or less transversely undulate or wavy, not changed when dry; light or yellowish-green.

Seta concealed by leaves.

Capsule long-cylindrical, *usually partly wrapped in leaves*, erect, sometimes on the underside of the stems; yellowish-brown with an orange band around the mouth; mature in autumn.

Operculum cone-shaped.



Neckera pennata
Leaf and capsule enlarged.

Range, Nova Scotia to Manitoba and Yukon Territory, south to North Carolina; found in most temperate regions.

Neckera pennata (L.) Hedw. is common in mountainous or hilly woods. It grows chiefly on deciduous trees, usually a few feet above the base, often extending well up the trunk. It is easily recognized by the *flattened appearance* of the stems and branches, the *wavy leaves lying flat* on either side of the stems and branches as though pressed, and the *capsule almost hidden* in the surrounding leaves. See following genus.

48. HOMALIA (Brid.) Bryol. Eur. (Ho-mà-li-a)

A large genus, with only one species occurring in our region. Name derived from the Greek for "flattened," referring to the flattened appearance of the moss.

Plants growing in flattened mats on rocks; more rarely at the base of trees in mountainous or hilly districts; *light or yellowish-green; often glossy; fruit rare.*



Homalia Jamesii

Portion of branch
enlarged.

Stems slender, branched, branches flattened or curved; stems easily seen through the thin leaves.

Leaves straight, rounded at the ends, apparently in two opposite rows, and in only one layer; flattened or depressed on either side of the stems and branches, with leaf-edges often so closely and evenly overlapping that the separate leaves are hardly distinguishable; light or yellowish-green; glossy; not changed when dry.

Seta less than 1 inch long; reddish.

Capsule cylindrical, erect; reddish-brown; mature in autumn.

Operculum long-beaked.

Range, Newfoundland to Pennsylvania, Washington.

Homalia Jamèsii Schimp. is our American species, closely resembling the European *H. trichomanoides* (Schreb.) Bryol. Eur. The single layer of leaves on opposite sides of the stems and branches gives *Homalia* the general appearance of *Fissidens* (p. 97), and some of the hepatics (p. 7), but the leaves of *Homalia* are much lighter colored, and they do not become crisped in drying. The stems are more branched than in *Fissidens*. Other mosses with a flattened appearance, commonly growing on rocks, have fine, pointed leaves, usually in more than a single layer. The wavy surface of the leaves of *Neckera*, the preceding genus, the larger plants growing in larger patches, distinguish it from *Homalia*.

49. **THAMNIUM** Bryol. Eur. (Thám-ni-um)

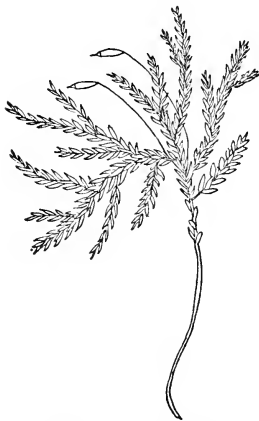
A genus of many species, one of which occurs in the Middle and Eastern States. Name derived from the Greek for "bush" or "tree," referring to the tree-like branching.

Thamnum alleghaniense (C. Müll.) Bryol. Eur. (*Porotrichum alleghaniense* (C. Müll.) Grout) grows on damp rocks, shaded ravines, and ledges, usually

along mountain and hill streams. It has been found in Worcester County, Massachusetts, growing on rocks in an old well in the woods; not common.

Plants large, growing in loose clusters; rather bright green; fruit rare.

Primary stems creeping; *secondary stems erect or ascending*, 2-3 inches long; branches only toward the ends of the stems;



Thamnium alleghaniense

somewhat *tree-like* in arrangement; spreading when moist; more erect when dry, and often curved and turned to one side.

Leaves easily seen, straight; spreading when moist; more erect when dry; rather bright green.

Seta short, curved; reddish-brown.

Capsule long-cylindrical, inclined; reddish-brown; mature in autumn.

Operculum short-beaked.

Range, Nova Scotia to Minnesota, south to the Gulf States.

Thamnium alleghaniense is a conspicuous moss, rarely found, but easily known from the illustration and description. The erect tree-like growth is somewhat like *Climacium* (p. 179), but the *branches when moist spread out* on either side of the stem; *when dry, turn to one side* instead of remaining equally spread all around the stem, as in *Climacium*. *Thamnium* grows on rocks and is rare, while *Climacium* grows on the ground, and is common.

FAMILY ENTODONTACEAE

A FAMILY of several genera, found in most temperate and warmer regions.

50. ENTODON C. Müll. (Ént-o-don)

A very large genus, two species of which are occasional in most localities. Name derived from the Greek for "within" and "tooth," referring to the insertion of the peristome.

Plants growing in low, close mats on decaying wood, roots of trees, rocks, or ground; *glossy; light or yellow-green, sometimes golden*, rarely darker; not rare; fruit occasional.

Stems prostrate, irregularly branched, branches usually $\frac{1}{4}$ - $\frac{1}{2}$ inch long; *cylindrical* in *E. seductrix*; more or less flattened in *E. cladorrhizans*.

Leaves, straight, usually large enough to be seen when moist; in *E. cladorrhizans* *flat and spreading*; in *E. seductrix* *erect and closely folded*; *glossy*; usually light or yellowish-green.

Seta $\frac{1}{2}$ -1 inch long; reddish-brown.

Capsule *erect*, long-cylindrical; reddish-brown; mature in autumn.

Operculum short-beaked.

a. Branches usually flattened, leaves flattened and spreading *E. cladorrhizans*.

b. Branches cylindrical, leaves erect and closely folded *E. seductrix*.

a

Entodon cladorrhizans (Hedw.) C. Müll. usually grows on old logs or at the base of trees. It is *light green or yellow-green and glossy, but not golden*. The leaves are usually large enough to be seen when moist. The stems nearly always have a *flattened, pressed appearance*, making them rather broad, although the leaves do not appear to be in only two rows, as in other flattened mosses. This species does not fruit so freely as *E. seductrix*, and is not so common.

*Entodon cladorrhizans*

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

b

Entodon seductrix (Hedw.) C. Müll. is frequent in moist woods on decaying logs, earth, rocks, and roots of trees, sometimes fruiting abundantly. The stems are usually *smoothly cylindrical*, especially when dry. The leaves are not easily seen, are closely folded, and are usually *glossy; yellowish-green, often golden*, very rarely dark green.

*Entodon seductrix*

Range, New England to Minnesota, south to Florida and Texas.

The *Entodons* can generally be distinguished by the *very glossy, light or yellow-green leaves*, closely folded in *E. seductrix*, and more or less flattened in *E. cladorrhizans*. They are not so common as several other mosses; for instance, *Stereodon Haldanianus* (p. 237) and some of the *Brachytheciums* (p. 244), which may sometimes be a rather light green, slightly glossy, and have nearly cylindrical branches. But these characteristics are not so decided as in the common *Entodon*, and in nearly all cases, where there is a question about the color or the cylindrical branches, it will be safe to say that *Entodon seductrix* has not been collected. By holding dry plants to the light, leaves will be seen sticking out around the branches in *Stereodon* and *Brachythecium*, but will not be seen in *E. seductrix*.

51. PLATYGYRIUM Bryol. Eur. (Pla-ty-gy-ri-um)

A genus of several species, one of which is found in North America. Name derived from the Greek for "large" and "ring," referring to the row of cells at the mouth of the capsule.

Platygyrium rèpens (Brid.) Bryol. Eur. is found in most localities on decaying wood, and on roots and trunks of trees, especially chestnut and beech; rarely on rocks; fruit frequent.

Plants forming dense, flat mats, usually *rather dark green*.

Stems prostrate, creeping; irregularly or sometimes

pinnately branched; branches short, usually about $\frac{3}{16}$ inch long, straight or very slightly curved.



Platygyrium repens
Branch enlarged.

Leaves straight, small, usually large enough to be seen when moist and spreading; closely folded when dry; a rather dark green.

Seta reddish; $\frac{3}{4}$ –1 inch long.

Capsule erect, cylindrical, slender; reddish-brown; mature in autumn.

Operculum long-beaked.

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

The favorite habitat of *Platygyrium* is on decaying logs. When the plants are moist, they very closely resemble *Pylaisia*, the following genus, but the latter is more commonly found on trees. As a rule, *Platygyrium* is a darker green, the branches are a little longer, and straighter when dry, and the leaves fold straight and evenly around the stems and branches, instead of turning to one side, as in *Pylaisia*.

The erect capsule, and the stems usually less regularly pinnate, distinguish *Platygyrium* from other mosses with short branches found in similar habitats.

52. PYLAISIA Bruch & Schimp. (Py-lai-si-a)

A genus of many species growing chiefly on trees in the woods or in the open. Four species are found in our region, but they are distinguished from each other by

microscopic characteristics of the peristome. Named after De La Pylaie, a noted moss student.

Plants growing in flat, dense mats on trees, less frequently on decaying logs; *light green* or *yellowish-green*; common; fruit often abundant.

Stems prostrate, creeping, irregularly pinnate; *branches erect, short*, about $\frac{1}{8}$ inch long, *usually curved*.

Leaves straight or curved, small, often large enough to be seen when moist and spreading, usually *turned in one direction*, especially when dry; light or yellowish-green.

Seta about $\frac{1}{2}$ inch long; reddish.

Capsule erect, cylindrical, slender; yellowish- or reddish-brown; mature in autumn.

Operculum cone-shaped.

Range, Eastern and Middle States; one of our species, *P. Schimperii* Card., also found in Europe and Asia.



Pylaisia Schimperii
Branch enlarged.

The distinguishing generic characteristics of *Pylaisia* are the *erect capsules*, the rather *light-green leaves*, usually somewhat turned in one direction, especially when dry, and the *short, erect, curved branches*, which give the plants a *soft, curly appearance*. These last two characteristics — leaves turned in one direction and branches curved — are *better seen when the plants are dry*, as in moist plants both leaves and branches are straighter and more spreading. Old apple trees and willows are favorite habitats of *Pylaisia*. See *Platygyrium*, the preceding genus, for comparison, which it most closely

resembles. If only sterile plants are found, *Pylaisia* can usually be distinguished from other similar mosses growing on trees by the short, erect branches, curved when the plants are dry. *Leucodon* (p. 182) also has branches curved when dry, but the leaves are a much darker green.

FAMILY LESKEACEAE

A LARGE family occurring in temperate and tropical regions, chiefly on trees and rocks, more rarely on the ground. Several genera are found in the United States.

53. THELIA Sull. (Thè-li-a)

A North American genus of only a few species, three of which are found in our range. Name derived from the Greek for "papilla," referring to the tiny projections on the leaves.

Plants growing in close, flat, intricate mats; two species found on stumps and at the base of trees in the woods; a third occurring on ledges and flat rocks or dry, sandy soil; light, grayish-green, or gray blue-green, rarely darker; dull; common; fruit occasional.



Thelia hirtella

Stems creeping, sometimes horizontally, the *under side thickly covered with brown radicles*, pinnately or irregularly branched; *branches numerous, short*, usually about $\frac{1}{8}$ inch long, *straight, erect, smoothly cylindrical*.

Leaves closely folded, too small to be seen even when moist; light or grayish blue-green, rarely darker.

Seta about $\frac{1}{2}$ inch long; reddish.

Capsule erect, cylindrical, slender; yellowish-brown; mature in autumn.

Operculum short-beaked.

Peristome white.

Range, Eastern and Middle United States.

Thelia hirtélla (Hedw.) Sull. and ***Thelia asprélla*** Sull. are most frequently found in New England at the *base of trees*. These two species often fruit abundantly. They cannot be easily distinguished without the use of a compound microscope.

Thelia Lescùrii Sull. is found *on ledges, flat rocks, and dry, sandy soil*. It occurs from Connecticut southward and westward. The branches are stouter than in the two preceding species and are arranged in clusters. The fruit is rare.

The distinguishing characteristics of *Thelia* are the numerous *short cylindrical branches*, with the stems so interwoven that the *plants form a close mat*, the *brown radicles on the under side of the mat*, and the *long, slender, erect capsule with white peristome*. The color is also characteristic, as it is a *grayer green or more bluish-green* than most mosses. The stems running horizontally are especially noticeable in young, thin mats. See *Leskea* (p. 201).

54. MYURELLA Bryol. Eur. (My-u-rél-la)

A genus of only a few species, two of which occur in our range. Name derived from the Latin for "mouse-tail," referring to the slender, cylindrical branches.

Plants growing in crevices of moist rocks, especially limestone, in mountainous and hilly woods; *often mixed with other mosses or forming only small patches*; light bluish-green; not common; fruit rare.

Stems very slender, cylindrical, irregularly branched; branches straight, up to $\frac{3}{8}$ inch long.

Leaves straight, *very small*; closely folded or sometimes spreading; rarely large enough to be seen; light or bluish-green.

Seta about $\frac{1}{2}$ inch long; reddish.

Capsule small, *erect, cylindrical*; yellowish-brown; mature in spring or summer.

Operculum cone-shaped.

Range, Canada and the northern United States; Europe; Asia.

Myurella gracilis (Weinm.) Lindb. (*M. careyana* Sull.) is the species most frequently collected. The leaves are spreading and somewhat separated, and, although so very small, can sometimes be seen when the plants are held to the light.

Myurella julæcea (Vill.) Bryol. Eur. is a rare species. The leaves fold so closely that they cannot be seen without a lens. The stems and branches are very slender and smoothly cylindrical.

Large specimens of *Myurella* are rarely found, as it more often grows mixed with other limestone-loving mosses or in very small patches. It can usually be distinguished by the *pale bluish-green* color and the *very slender stems and branches*.



Myurella gracilis

Branch enlarged.

55. ANOMODON Hook. & Tayl. (A-nóm-o-don)

A genus containing many species confined to the Northern Hemisphere. Name derived from the Greek for "not," "law," and "tooth," referring to the peristome, which was at first considered abnormal.

Plants usually growing in *thick mats*; found chiefly at the base of trees, more rarely on rocks; bright, olive, or dark green, becoming yellowish or brownish with age; common; fruit rare.

Primary stems creeping, usually leafless; *secondary stems erect or ascending*, irregularly branched; branches $\frac{1}{8}$ -1 inch long.

Leaves straight; generally *spreading when moist*; *more or less folded when dry*; sometimes too small to be seen easily; bright, olive, or dark green.

Seta $\frac{1}{2}$ -1 inch long; reddish or yellowish.

Capsule erect, cylindrical; reddish- or yellowish-brown; mature in autumn.

Operculum short or long-beaked.

a. Leaves usually *too small to be seen*; *closely folded*, especially when dry; usually *bright green*, except when very old *A. rostratus*.

b. Leaves usually *easily seen*; *wide-spreading* when moist; somewhat folded when dry; usually *olive or dark green*, except when very old

A. attenuatus.

A. minor.

A. apiculatus.

a

Anomodon rostratus (Hedw.) Schimp. is one of the common species, and is usually a *rather bright green*. The leaves are much smaller and more closely folded, both when moist and when dry, than those of the other species. The branches are often not more than $\frac{1}{2}$ inch long, and usually arranged in clusters. The beak of the operculum is long, which suggested the name *rostratus* for the species.



*Anomodon
rostratus*

Range, Canada to the Gulf of Mexico; Europe; Asia.

b

Anomodon minor (Palis.) Förn. (*A. obtusifolius* Bryol. Eur.) has *blunt, wide-spreading leaves* that fold only a little when dry. It is olive or dark green, becoming browner with age. The secondary stems sometimes reach 2 inches in length, with branches about 1 inch long. Parts of the plant often have a *flattened appearance* where the leaves are the largest and most spreading.



Anomodon minor

Range, New Brunswick to South Dakota and Virginia; Asia.

Anomodon apiculatus Bryol. Eur. closely resembles *A. minor* in general appearance, but is not so common, and occurs chiefly in mountainous districts.

Range, Ontario and New England south to Georgia; Europe; Asia.

Anomodon attenuatus (Schreb.) Hüben. is the common species in most localities. It is olive-green or brownish, sometimes becoming yellow-brown with age. The leaves are *more finely pointed* than those of *A. minor* and *A. apiculatus*, *less spreading* when moist, sometimes slightly turned to one side, and more closely



Anomodon attenuatus folded when dry. Some of the *branches are long and very slender at the ends*, almost hair-like, which suggested the name *attenuatus* for the species. In the spring the plants are covered with numerous short young branches, rounded and curved at the ends.

Range, Newfoundland to Florida, west to British Columbia and Kansas; Cuba; Europe; Asia.

Anomodon forms rather loose, thick mats at the base of trees and on rocks, and is usually olive-green or quite brown, except in *A. rostratus*. When it has a flattened appearance it suggests *Fissidens* (p. 97) and some of the hepatics (p. 7), but the growth of *Anomodon* is often thicker, with leafless, creeping stems, and the color is browner. See *Leskea*, the following genus.

56. LESKEA Hedw. (Lés-ke-a)

A widely distributed genus of several species, not easily distinguished. Named after Leske, a professor at Leipsic.

Plants forming rather thin mats, usually at the base of trees, less frequently on stones and decaying wood; dark or yellowish-green; not common; sometimes fruiting abundantly.

Stems prostrate, irregularly branched; branches erect or ascending; usually less than $\frac{1}{2}$ inch long.



Leskea polycarpa

Leaves straight, very small, sometimes large enough to be seen when moist and spreading; dark or yellowish-green.

Seta about $\frac{1}{2}$ inch long; yellowish or reddish.

Capsule erect, cylindrical; yellowish; maturing in early summer or autumn.

Operculum cone-shaped.

Range, Canada and the United States; Europe; Asia.

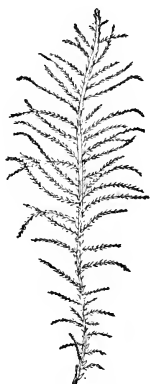
The favorite habitat of *Leskea*, like that of *Thelia* (p. 195) and *Anomodon*, the preceding genus, is at the base of trees.

Leskea forms thinner, flatter mats than *Anomodon*, the growth is finer, the leaves smaller, and the plants often bear fruit quite abundantly. *Leskea* also grows in thinner mats than *Thelia*. It is a browner or darker green, the branches are longer and more slender, the plants are not coated with brown radicles on the under side, and the peristome does not show white as in

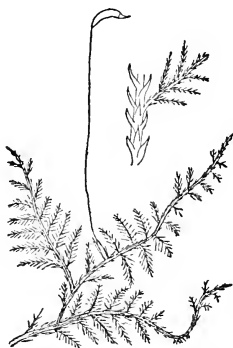
Thelia. Other mosses commonly growing at the base of trees are a lighter green, with larger leaves, and curved capsules.

57. THUIDIUM Bryol. Eur. (Thu-íd-i-um)

A genus containing a great many species, widely distributed. The three most frequent species are given below. Name derived from the Latin for a "small feathery branched tree," referring to the delicate branching of the plants.



Thuidium abietinum



Thuidium delicatulum

Portion of stem and
branches enlarged.

a. Stems regularly pinnate *T. abietinum*.

b. Stems regularly bipinnate or tripinnate

T. delicatulum.

T. recognitum.

NOTE. Care must be taken not to mistake the bipinnate or tripinnate branches for leaves. The leaves on the branches are too small to be seen without a lens. Stem leaves can sometimes be seen.

a

Plants growing in dense tufts on rocks, or on the ground, in dry, open woods, especially in limestone regions; rather dark green, or olive-green; not common; not yet found fruiting in our range.

Stems erect, usually regularly pinnately branched; stiff, harsh to the touch, especially when dry.

Leaves small, straight; sometimes not easily seen; closely folded when dry; rather dark green, or olive-green; dull.

Seta long.

Capsule long-cylindrical, curved; mature in spring; not yet found in our range.

Operculum cone-shaped.

Range, Greenland to Virginia, west to Alaska and the Rocky Mountains; Europe; Asia.

Thuidium abietinum (Dill., L.) Bryol. Eur. may be distinguished by the *erect, pinnate stems*, the *straight leaves, dark dull green* in color, and by the *stiff, harsh feeling when dry*. Other mosses with similar growth are lighter in color and grow in wetter places (*Hclodium lanatum*, p. 206); or have curved leaves, also lighter green (*Ptilium*, p. 230); or are more common and have glossy leaves (*Hypnum*, p. 229). It is also well to remember that *T. abietinum* occurs chiefly in limestone countries.

b

Thuidium delicatulum (Dill., L.) Mitt. and **Thuidium recognitum** (L., Hedw.) Lindb. are two of the largest species, and are found in most localities.

Plants fern-like, growing in *intricate mats* on the ground, decaying wood, and rocks in moist woods; bright green or yellow-green; common; fruit occasional.

Stems long, prostrate, or often *alternately arched and rooting*; *regularly bipinnately branched*; occasionally some branches are tripinnate, especially toward the base near the main stem, giving a triangular appearance to the branch as a whole.

Leaves straight, too small to be seen.

Seta long, 1-1½ inches; reddish.

Capsule long-cylindrical, inclined, curved; reddish-brown; mature in winter.

Operculum short- or long-beaked.

Range, almost cosmopolitan.

The *regular bipinnate* branching of these two *Thuidiums* gives them a delicate, *fern-like appearance*, which is a conspicuous characteristic.

Another fern-like moss is *Hylocomium* (p. 225), but it is much larger than *Thuidium*, and is more often tripinnate in branching. An unusually large growth of *Thuidium*, especially if the tripinnate branching is conspicuous, may be mistaken for *Hylocomium*. In this case the general manner of growth must be carefully examined. In *Thuidium* the stems interweave and often arch and root again at the tips, then continue growth, arching and rooting and so on, forming a tangled mat, so that it is difficult to pull out a long piece of the stem. The new growth does not regularly start from the center of the shoot of the previous year, as in *Hylocomium*. On the other hand, the tips of the

stems in *Hylocomium* do not root and then continue growth, as in *Thuidium*, and long portions of the stems can be pulled out, as the plants grow in looser mats. The leaves on the stems of *Hylocomium* are large enough to be seen easily, while those on the stems of *Thuidium* are too small to be seen without the aid of a lens.

58. HELODIUM (Sull.) Warnst. (He-lò-di-um)

A very small genus; two species occur in the Northern and Middle States. Name derived from the Greek for "swamp," referring to the natural locality of the plants.

Plants growing on the ground in swamps and bogs; light or yellowish-green; not very common; fruit rare.

Seta long, 1-1½ inches; reddish.

Capsule long-cylindrical, curved, inclined; mature in summer.

Operculum cone-shaped.

a. *Stems* erect, stiff, regularly and closely pinnate.

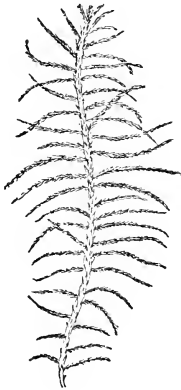
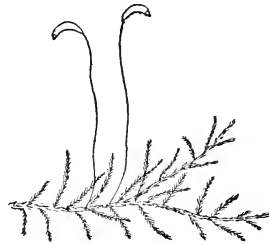
Leaves straight, erect; usually too small to be seen easily . . . *H. lanatum*.

b. *Stems* prostrate, soft, slender, irregularly and distantly pinnate.

Leaves small, but easily seen, straight, spreading . . .
H. paludosum.

a

Helodium lanatum (Stroem) Broth. (*Thuidium Blandowii* (Web. & Mohr) Bryol. Eur.) has a northern range, — Greenland, Labrador, and the northern

*Helodium lanatum**Helodium paludosum*

United States. The plants grow close together; the stems are *erect and stiff*; the branches are *closely and regularly pinnate*; the leaves are usually too small to be seen easily; and the color is generally *light green*.

b

Helodium paludosum (Sull.) Aust. (*Thuidium paludosum* (Sull.) Rau. & Herv.) is the more frequent species occurring in the Northern and Middle States. The plants form *loose spreading mats*; the *stems are prostrate, irregularly and distantly pinnate*; the leaves are

easily seen and wide-spreading, and are a rather dark yellowish-green.

Both species of *Helodium* are to be expected only in *very wet places*, and both have *small leaves*. The *erect, close growth* of *H. lanatum*, with *stout stems regularly pinnate*, and the *thin, straggling mats* of *H. paludosum*, with *prostrate, slender stems and distant branches*, are distinguishing characteristics.

FAMILY HYPNACEAE

A LARGE family widely distributed, found in all kinds of places.

59. AMBLYSTEGIUM Bryol. Eur. (Am-bly-stè-gi-um)

A genus of many species occurring chiefly in temperate regions. Name derived from the Greek for "blunt" and "roof," referring to the operculum.

a. Plants fine, leaves very small, erect-spreading

A. serpens, *A. varium*, etc.

b. Plants coarser, leaves long, narrow, wide-spreading

. . . . *A. riparium* and varieties.

a

Plants growing in very thin mats at the base of trees, on decaying logs, soil, and rocks in moist woods; dull or yellowish-green; common; fruit common.



Amblystegium serpens

Stems very slender, prostrate, irregularly branched.

Leaves straight, small and fine; erect-spreading when moist, and usually large enough to be seen; folded against the stem when dry; dull or yellowish-green.

Seta usually $\frac{1}{2}$ -1 inch long; reddish.

Capsule long-cylindrical, inclined, slender, usually much curved; reddish- or yellowish-brown; mature in summer.

Operculum cone-shaped.

Range, almost a cosmopolitan species.

Amblystegium sérpens (L.) Bryol. Eur. is the smallest species and is a very common one. It not infrequently grows mixed with other mosses, but it is distinguished by the very slender, delicate stems, often abundantly fruited. **Amblystegium vârium** (Hedw.) Lindb. somewhat resembles *A. serpens*, except that it is a little larger in every way. Other small species of *Amblystegium* are sometimes found, but they are not easily separated. All are characterized by the *very slender stems* and branches and by the *capsule strongly curved* when mature.

b

Plants growing in soft, flat mats on earth, stones, or roots of trees in swamps, sometimes floating in running water; bright or yellowish-green; not common, and not often fruiting.

Stems slender, usually 3-5 inches long; *branches horizontally spreading*.

Leaves straight, long, narrow, ending in a fine tip; *wide-spreading, somewhat separated*; bright or yellowish-green.

Seta about 1 inch long; reddish.

Capsule long-cylindrical, inclined, curved; mature in late spring.

Operculum cone-shaped.

Range, almost a cosmopolitan species.



Amblystegium riparium

Amblystegium riparium (L.) Bryol. Eur. and the varieties occur in very wet places, or even in streams. They are distinguished from other mosses growing in

similar localities by the *horizontal branches*, and the *long narrow leaves, straight, rather distant, and wide-spreading*, both when moist and when dry. See *Fontinalis* (p. 175), *Dichelyma* (p. 177), and *Drepanocladus* (p. 213).

60. HOMOMALLIUM (Schimp.) Loesk.
(Ho-mo-mál-li-um)

A small genus, but one species occurring in our range. Name derived from the Greek for "same" and "to rise," referring to the slight tendency of the branches and leaves to turn to one side.

Plants growing in thin, closely adherent mats on rocks and at the base of trees in woods; yellowish- or olive-green; not very common; fruit occasional.



Homomallium adnatum

Stems very slender, creeping, irregularly branched.

Leaves small, sometimes large enough to be seen; straight, closely folded; yellowish- or olive-green.

Seta about 1/2 inch long; reddish.

Capsule short-cylindrical, inclined, curved; yellowish- or reddish-brown; mature in autumn.

Operculum short-beaked.

Range, New Brunswick to British Columbia, south to North Carolina and Texas; Asia.

Homomallium adnatum (Hedw.) Broth. (*Amblystegiella adnata* (Hedw.) Nichols) somewhat resembles small forms of *Amblystegium* (p. 208), and especially

Stereodon reptilis (p. 233). It is less frequent than either of these two mosses and has smaller leaves and shorter capsules. The stems are slender like *Amblystegium serpens*, and less regularly branched than in *Stereodon reptilis*. When moist plants are held to the light, the leaves of *Amblystegium*, and at least the tips of the leaves of *Stereodon*, can be seen sticking out around the branches, while in *Homomallium* the leaves fold so closely that they can hardly be seen, and the branches look smooth and cylindrical.

61. HYGROAMBLYSTEGIUM Loesk.

(Hy-gro-am-bly-stè-gi-um)

A genus containing several species, occurring in temperate or cooler regions, only two of which are included below. Name derived from the Greek for "wet" and *Amblystegium*, referring to the *Amblystegiums* that grow in wet places.

Plants growing in mats or tufts on rocks or earth in wet places, especially in and along streams; dark or olive-green, the new shoots bright green in spring; fairly common, but not always fruiting.

Stems prostrate, long; the lower part leafless; irregularly branched; *branches straight, erect, or parallel*; rather harsh to the touch when dry.

Leaves straight, fine; large enough to be seen; erect or spreading when moist; more folded when dry; bright green when young, becoming dark or olive-green.

Seta $\frac{3}{4}$ -1 inch long; reddish.

Capsule long-cylindrical, inclined, much curved, especially when dry and empty; yellowish- or reddish-brown; mature in late spring or early summer.

Operculum cone-shaped.

Hygroamblystegium irriguum (Wils.) Loesk. (*Am-*



*Hygroamblystegium
irriguum*

blystegium irriguum (Wils.) Bryol. Eur.) is frequently found in large mats on stones along streams. The stems have erect, crowded branches. In the spring the young shoots are erect and bright green, but darken with age.

Range, Ontario south to North Carolina and Missouri; Europe; Asia; Africa.

Hygroamblystegium fluviatile (Sw.) Loesk. (*Am-*
blystegium fluviatile (Sw.) Bryol. Eur.) is generally found floating in streams. *The branches are long and parallel*, less crowded than in *H. irriguum*.

Range, Newfoundland to Wisconsin, south to New Jersey and Missouri; Europe.



*Hygroamblystegium
fluviatile*

Hygroamblystegium may be distinguished from other water-loving mosses by the combination of *small leaves, long slender capsule, and stems leafless in the lower part*. The species of *Brachythecium* that grow on rocks in brooks, *B. rivulare* (p. 247), *B. plumosum* (p. 247) and *Bryhnia novae-angliae*

(p. 254) have short thick capsules and the lower part of the stems is not leafless. The leaves of the *Brachytheciums* are large and easily seen, while those of *Bryhnia* are sometimes too small to be seen, but the branches of *Bryhnia* usually curl a little when dry, while those of *Hygroamblystegium* remain straight. *Oxyrhynchium* (p. 251) grows on rocks in brooks, but is a coarse, robust moss.

Other mosses growing on rocks in water and having the lower part of stems leafless, are *Fontinalis* (p. 175), and the acrocarpous mosses *Rhacomitrium* (p. 113) and *Grimmia apocarpa* var. *rivularis* (p. 111). *Fontinalis* has much longer stems and branches and larger leaves. *Rhacomitrium* and *Grimmia*, which have the capsule at the apex of the stem, branch by forking, and have larger, coarser leaves that are very wide-spreading when moist, and closely folded when dry, and are a very dark green, almost black on the older part of the plants. Individual plants of the acrocarpous mosses are easily separated, but the pleurocarpous mosses form more tangled mats, so that it is not always easy to separate a long piece of the stem.

62. DREPANOCLADUS (C. Müll.) Roth (Dre-pa-nó-cla-dus)

A genus of many species widely distributed; the two of most frequent occurrence are given below. Name derived from the Greek for "sickle" and "plant,"

referring to the branches hooked at the tips from the curved leaves.

a. Leaves short, mostly turned to one side and strongly curved *D. uncinatus*.

b. Leaves longer, equally spreading; curved, chiefly at tips of stems; plants often floating

D. fluitans and varieties.

a

Plants growing in loose mats on the ground, on decaying logs, and on stones in moist woods; light green; common; fruit occasional.



Drepanocladus uncinatus

Branch enlarged.

Stems prostrate or ascending, 1-3 inches long; irregularly or distantly pinnately branched; *hooked at tips*, from curved leaves.

Leaves usually *strongly curved and turned to one side*; light green.

Seta about 1 inch long; reddish.

Capsule long- or short-cylindrical, inclined and curved; reddish-brown;

mature in summer.

Operculum cone-shaped.

Range, almost a cosmopolitan species.

Drepanocladus uncinatus (Hedw.) Warnst. (*Hypnum uncinatum* Hedw., *Hypnum aduncum* L.) is frequently found in moist woods of mountainous or hilly regions. It varies a good deal, but at least some of the branches will show the *strongly curved leaves turned to one side*. It is the commonest pleurocarpous moss with

leaves of this character and with stems nearly prostrate and irregularly or distantly pinnately branched. It may be distinguished from *Stercodon arcuatus* (p. 236), which also has leaves turned to one side, by its smaller size, shorter branches, leaves more strongly curved, and more frequent fruit.

b

Plants growing in loose, soft mats on the ground in swamps, or floating in stagnant pools, light green or brownish; common; fruit not common.

Stems prostrate, slender, sometimes floating; variable in length, reaching several inches; irregularly branched, *hooked at tips*, from curved leaves.

Leaves long, hair-like, spreading; mostly straight; curved chiefly at ends of stems and branches; light green or brownish.

Seta 2-3 inches long; reddish-brown.

Capsule long-cylindrical, inclined, curved; yellowish- or reddish-brown; mature in summer.

Range, almost a cosmopolitan species.



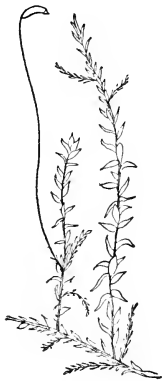
Drepanocladus fluitans (Dill.) *Drepanocladus fluitans*

Warnst. (*Hypnum fluitans* L., *Amblystegium fluitans* De Not.) and the varieties vary in length of stem and leaves; also in the number of branches. The long forms with long leaves may be confused with *Dichelyma* (p. 177). The stems of *Dichelyma* are more

slender, the leaves more separated, and the ends of the stems and branches are less strongly hooked. Floating forms of *Drepanocladus* resemble certain fine species of *Fontinalis* (p. 175), but are found in stagnant water, while *Fontinalis* occurs in running water. The ends of the stems and branches of *Fontinalis* are never hooked.

63. CALLIERGON (Sull.) Kindb. (Cal-li-ér-gon)

A genus containing several species; one of which is common in most localities, and one is found chiefly in limestone countries. Name derived from the Greek for "something beautifully made."



Calliergon cordifolium

Plants growing on the ground in swamps or wet, marshy places, or at the margins of pools; bright green; fruit occasional.

Stems slender, usually 3-5 inches long; more or less erect or sometimes prostrate; sparingly or pinnately branched.

Leaves straight, large, spreading, separated or crowded; light green.

Seta about 2 inches long; reddish-brown.

Capsule short-cylindrical, inclined, curved; reddish-brown; mature in summer.

Operculum cone-shaped.

Calliergon cordifolium (Hedw.) Kindb. (*Hypnum cordifolium* Hedw.) is the common species and often

forms large bright-green patches in very wet, swampy places. When the *stems are more or less erect and little branched*, the plants might be mistaken for an acrocarpous moss unless the fruit can be found. The acrocarpous moss which grows erect in swampy places is *Aulacomnium palustre* (p. 141). Its leaves are long, narrow and crowded, while in *Calliergon cordifolium* the *leaves are broad at the base and separated*.

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

Calliergon giganteum (Schimp.) Kindb. (*Hypnum giganteum* Schimp.) is found in swamps in limestone countries. It resembles *C. cordifolium* in general growth, but it is much more branched and the leaves are more crowded.

Range, Greenland to Pennsylvania, west to the Pacific Coast; Europe; Asia.

64. ACROCLADIUM Mitt. (A-cro-clà-di-um)

A small genus, one species of which is found in our range. Name derived from the Greek for "top" or "summit" and "branch," referring to the pointed tips of the branches.

Plants growing in loose tufts in swamps, bogs, and wet meadows; bright green, yellowish- or golden-brown; glossy; not common; fruit rare.

Stems stout, rigid, *erect or ascending*; 1-4 inches long; pinnately or irregularly branched; ends of stems and branches *pointed by the leaves rolled together* (cuspidate).

Leaves *straight, large, erect or spreading*; bright green, yellowish- or golden-brown; glossy.

Seta 1-3 inches long; reddish.

Capsule long-cylindrical, inclined and curved; mature in summer.

Operculum cone-shaped.

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



Acrocladium cuspidatum

End of branch enlarged.

***Acrocladium cuspidatum* (L.) Lindb.**

(*Hypnum cuspidatum* L., *Calliargon cuspidatum* Kindb.) is not found commonly in all localities. The *cuspidate or*

pointed stems and branches are the distinguishing characteristics. In general

growth it resembles *Hypnum Schreberi* (p. 229), but it usually grows in wetter places and does not have reddish stems as does *H. Schreberi*. The stems are more rigid and more erect than other mosses growing in similar places.

65. HYGROHYPNUM Lindb.

(Hÿ-gro-hÿp-num)

A genus of several species found chiefly in mountain or hill streams; four of most frequent occurrence are given below. Name derived from the Greek for "wet"

and *Hypnum*, referring to the *Hypnums* that grow in wet places.

Plants growing in flat mats on rocks in beds of streams; bright green or golden-green, often brownish below.

Stems prostrate, 1-4 inches long; irregularly branched; sometimes leafless below.

Leaves pointed or rounded, erect or spreading, straight, or curved (especially at tips of stems and branches); sometimes turned to one side; bright green or golden-green in new growth.

Seta about 1 inch long; reddish.

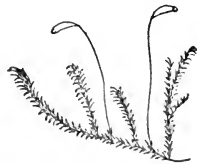
Capsule short-cylindrical, inclined, curved; reddish- or yellowish-brown; mature in summer.

Operculum cone-shaped.

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



Hygrohypnum dilatatum



Hygrohypnum eugyrium
var. *Mackayi*

a. Leaves rounded, somewhat separated

H. dilatatum.

b. Leaves pointed, crowded

H. palustre.

H. eugyrium and variety.

H. ochraceum.

a

Hygrohypnum dilatatum (Wils.) Loesk. (*Hypnum dilatatum* Wils.) may be known from other water-loving mosses by the rounded, somewhat separated, leaves. It occurs only in mountain streams and is not common. The fruit is rare.

b

Hygrohypnum eugyrium var. **Mackayi** (Schimp.) Broth. (*Hypnum eugyrium* var. *Mackayi* Schimp.) is probably the most common form in our range. The leaves of this variety are not so strongly curved and turned to one side as in the less frequent species *H. eugyrium*, but this characteristic is often noticeable at least at the ends of the branches. It often grows in large patches on rocks in mountain streams, occurring again in similar places along the coast. The fruit is fairly common, sometimes abundant. The new growth in the spring is bright green in contrast to the brownish-green of the older parts, and the leaves, at least at the ends of the branches, are slightly curved and turned to one side.

Hygrohypnum ochraceum (Turn.) Broth. (*Hypnum ochraceum* Turn.) is variable in size, but usually has the longest stems of the genus, sometimes reaching 4 inches. The leaves are generally curved and turned to

one side; most frequently yellowish-green, more rarely bright green or brownish. The fruit is rare.

Hygrohypnum palústre (Huds.) Loesk. (*Hypnum palustre* Huds.) resembles *H. ochraceum* in a general way, but is much less frequent, and the stems are shorter and the leaves less curved and turned to one side; duller in color. The lower part of the stems is often leafless. The fruit is rare.

Hygrohypnum, with the exception of *H. dilatatum*, may be distinguished from other mosses growing on rocks in the beds of brooks by the *leaves being more or less curved and turned to one side*. Plants with numerous short branches will most likely be *H. eugyrium* var. *Mackayi*. Mixed with it will sometimes be found *Rhacomitrium* (p. 113), with leaves broader, equally spreading when moist, and closely folded when dry. Plants with longer stems will most likely be *H. ochraceum*. Compare *Hygroamblystegium* (p. 211), *Brachythecium plumosum* (p. 247), and *B. rivulare* (p. 247), *Oxyrhynchium* (p. 251) and *Bryhnia* (p. 254).

66. CTENIDIUM (Schimp.) Mitt. (Cte-ní-di-um)

A genus containing several species, one occurring in our range. Name derived from the Greek for "diminutive" and a "comb," referring to the very regular pinnate branching.

Plants growing in soft, closely interwoven mats on moist rocks and earth in mountainous and hilly woods; yellowish-green or olive; not common; fruit occasional.



Ctenidium molluscum

Stems prostrate or ascending; variable in length, up to 3 inches long; pinnately branched.

Leaves fine, but large enough to be seen; curved or straight, wide-spreading, somewhat separated; yellowish-green or olive.

Seta less than 1 inch long; reddish-brown.

Capsule short-cylindrical, inclined; mature in summer.

Operculum cone-shaped.

Range, Newfoundland to Georgia, west to the Rocky Mountains; Europe; Asia; Africa.

Ctenidium molluscum (Hedw.) Mitt. (*Hypnum molluscum* Hedw.) has a soft, feathery appearance due to the pinnate branches and the slender leaves, somewhat curved, wide-spreading, and a little separated. The general growth resembles *Stereodon imponens* (p. 233) and *Ptilium* (p. 230), but both of these mosses have strongly curved leaves and closer branches. Mosses with pinnate branches and straight leaves, growing in similar places, have leaves more erect and more closely folded when dry, as in *Helodium* (p. 205) and *Hypnum* (p. 229), or much coarser leaves, as in *Rhytidiadelphus* (p. 223). *Acrocladium* (p. 217) grows in more swampy places.

67. RHYTIDIADELPHUS (Lindb.) Warnst.
(Rhy-tíd-i-a-dél-phas)

A small genus, two species occurring in our range. Name derived from the Greek for "wrinkled" and "brotherhood," possibly referring to this group having the leaves more wrinkled than other members of the sub-family.

a. Plants very robust, rigid; common *R. triquetrus.*

b. Plants slender, less rigid; not common

R. squarrosus.

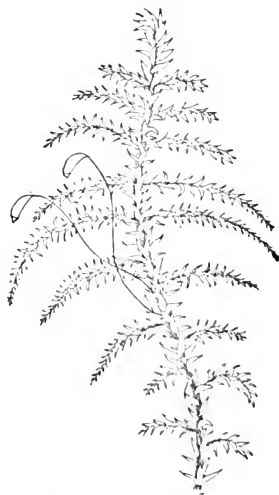
a

Plants shaggy, growing singly or together on the ground, more rarely on earth-covered rocks and decaying logs; bright or yellowish-green; frequent in moist woods; fruit occasional.

Stems very robust, stiff, erect or ascending; variable in length, usually 2-4 inches long; irregularly and unequally branched or sometimes pinnate; stems of young branches showing red through leaves.

Leaves straight, large, stiff, wide-spreading; bright or yellowish-green.

Seta about 1 inch long; reddish-brown.



Rhytidiadelphus triquetrus

Capsule short-cylindrical, inclined; reddish-brown; mature in early spring.

Operculum cone-shaped.

Range, Arctic America, Canada, and the northern United States; south to North Carolina; Europe; Asia; Africa.

Rhytidiadelphus triquètrus (L.) Warnst. (*Hylacomium triquetrum* (L.) Bryol. Eur.) is by far the most common species, sometimes growing quite abundantly on the ground in rich, moist woods. The usual tall growth is easily recognized by the *stiff, shaggy appearance*. Sometimes very short plants are found in dry, open places, with only a few short, unequal branches, but the *stiff, wide-spreading leaves* still give a shaggy look to the moss. This species is sometimes used as a packing material for china.

b

Rhytidiadelphus squarròsus (L.) Warnst. (*Hylacomium squarrosum* (L.) Bryol. Eur.) is found in meadows and swampy places. It is not common. The general growth, the manner of branching, and the wide-spreading leaves are similar in character to *R. triquètrus*, except that the plants are much more slender, and the leaves are much smaller, with longer, finer points. The stem-leaves stand out at right angles to the stem, but this characteristic is not always seen unless the leaves are removed from the stem and examined with a lens.

68. **HYLOCOMIUM** Bryol. Eur. (Hy-lo-có-mi-um)

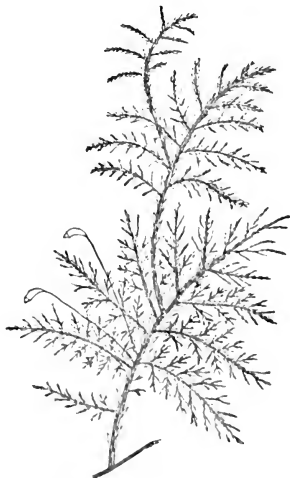
A small genus, three species occurring in our range. Name derived from the Greek for an "inhabitant of the woods."

- a.* Leaves erect, usually too small to be seen easily, except on the main stem.
1. Stems regularly bipinnate or tripinnate, young shoots at first only pinnate *H. proliferum*.
 2. Stems pinnate or irregularly bipinnate
H. umbratum.
- b.* Leaves wide-spreading, easily seen; irregularly pinnate, or occasionally bipinnate *H. brevirostre*.

a. I

Plants large, growing in loose mats on the ground, on decaying logs, on earth-covered rocks, and at the base of trees in moist mountainous or hilly woods; bright, yellowish- or olive-green; common; fruit occasional.

Stems prostrate or ascending, 2-8 inches long; *bipinnately* or *tripinnately* branched; *young shoots at first only pinnate, the new growth ascending from the middle of the shoot of the previous year.* Stems

*Hylocomium proliferum*

showing red through the leaves in the new growth when moist plants are held to the light.

Leaves straight, small on short branches; larger on stems and longer branches; erect.

Seta about 1 inch long; reddish-brown.

Capsule short-cylindrical, inclined; reddish-brown; mature in spring.

Operculum short-beaked.

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

***Hylocomium proliferum* (L.) Lindb.** (*Hylocomium splendens* (Hedw.) Bryol. Eur.) is the most frequent and most conspicuous species of this genus. An extensive growth sometimes carpets the ground in cool, moist woods or covers the surface of large boulders or ledges. It more rarely occurs at the base of trees. If carefully collected, the stems will show each year's growth starting from the center of the shoot of the previous year. This is less distinct in the fruited specimens. Very young shoots are bright green, stiff, erect, at first only pinnately branched, eventually becoming bipinnate and tripinnate, with leaves large enough to be seen easily. This growth usually starts from the center of the shoot of the previous year, but sometimes it develops on an older part of the stem, and then the stem becomes divided. The most distinguishing characteristic of this species is the *bipinnate or tripinnate branching*, which gives the moss a *fern-like appearance*. For comparison with *Thu-*

idium, another fern-like moss, see under that genus (p. 204).

a. 2

Plants growing in thin, loose mats on the ground and on stones in mountainous woods; bright green; not uncommon; fruit rare.

Stems slender; prostrate or ascending; up to 6 inches long; pinnately or irregularly bipinnately branched, occasionally tripinnate; branches unequal, frequently drooping; tips very slender.

Leaves small, straight, erect; sometimes too small to be seen; bright green.

Seta 1-2 inches long; reddish.

Capsule short-cylindrical, inclined; mature in spring.

Operculum cone-shaped.

Range, Newfoundland to Alaska, the northern United States and southward in the mountains; Europe; Asia.

Hylocomium umbratum

(Ehrh.) Bryol. Eur. (*Hypnum umbratum* Ehrh.) occurs much less frequently than *H. proliferum*.

The stems are more slender, less regularly bipinnate, and the tips of the branches are very fine, often drooping, and sometimes rooting.



Hylocomium umbratum

b

Plants growing chiefly on rocks in shaded ravines in mountainous regions; dull green; not common; fruit occasional.

Stems rigid, usually prostrate or arched; irregularly branched.

Leaves quite large, straight, spreading, dull green.

Seta about 1 inch long; reddish.

Capsule short-cylindrical, inclined; mature in spring.

Operculum short-beaked.

Range, Nova Scotia to Ontario, south to North Carolina; Europe; Asia; Africa.

Hylocomium brevirostre (Ehrh.) Bryol. Eur. (*Hypnum brevirostre* Ehrh.) is less frequently found than the two preceding species and is confined to the cool ravines of mountainous regions. The stems are more robust than in *H. umbratum* and the leaves larger and wider-spreading, giving the plants a coarser appearance. In general growth *H. brevirostre* more closely resembles *Rhytidiadelphus squarrosus* (p. 224), but the latter is found more often on the ground in swamps, and has wider-spreading leaves. *H. brevirostre* may be distinguished from *Rhytidiadelphus triquetrus* (p. 223), which also occurs on rocks, by the less shaggy appearance, the less robust stems, and the smaller, less spreading leaves. *R. triquetrus* is much more common.

69. HYPNUM Dill. (Hýp-num)

A genus containing but one species. Name derived from the Greek for "moss" or some cryptogamic plant.

Plants growing loosely together, usually on the ground in woods, more rarely on earth-covered rocks and decaying logs, or at the base of trees; yellowish-green; glossy; common; fruit occasional.

Stems ascending or erect, rigid; usually 4-5 inches long; *usually red*; *somewhat distantly pinnately branched*.

Leaves *straight*; easily seen when moist and spreading; when dry, more erect and folded; *yellowish-green*; *glossy*.

Seta 1-1½ inches long; reddish.

Capsule short-cylindrical, inclined; mature in spring.

Operculum cone-shaped.

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



Hypnum Schreberi

Hypnum Schréberi Willd. is one of the commonest mosses of *dry, open woods*. The distinguishing characteristics are the *bright-red stems, with the pinnate branches somewhat separated, and straight, glossy leaves*. The plants sometimes grow quite extensively. If the sterile patches are examined carefully, an occasional

fruited specimen can be found, but the fruit is not often found abundant. See *Camptothecium* (p. 243), *Thuidium abietinum* (p. 203), and *Helodium* (p. 205).

70. PTILIUM (Sull.) De Not. (Ptí-li-um)

A genus containing only one species. Name derived from the Greek for "feather," referring to the appearance of the plants.

Plants usually growing in loose mats on the ground, on decaying logs, on earth-covered rocks, or at the base of trees in mountainous or hilly woods; *plume-like*; light green or yellowish-green; fairly common; fruit occasional.



Ptilium crista-castrensis

Branch enlarged.

Stems ascending or erect, sometimes reaching 5 inches in length; *regularly and closely pinnately branched*; branches nearly equal in length except at the end of the stems, where they gradually shorten.

Leaves strongly curved, small and fine, but large enough to be seen when plants are held to the light; not much changed when dry; light or yellowish-green.

Seta 1-1½ inches long; yellowish- or reddish-brown.

Capsule long-cylindrical, inclined; yellowish- or reddish-brown; mature in autumn.

Operculum cone-shaped.

Range, Arctic America, Canada, and the northern United States, south in the East to North Carolina; Europe; Asia.

Ptilium crista-castrénsis (L.) De Not. (*Hypnum crista-castrénsis* L.) is readily distinguished by its *plume-like character*, due to the *regularly and closely pinnate branching* extending to the tip of the stem, and the *strongly curved and crowded leaves*. The plants are often found mixed with other mosses, but are always striking and conspicuous. The poorer growth may somewhat resemble *Stereodon imponens* (p. 233). *Stereodon* usually grows more prostrate, and the branches are shorter, more irregularly and unequally pinnate. See *Stereodon curvifolius* (p. 234).

71. STERODON (Brid.) Mitt. (Ste-ré-o-don)

A very large genus, confined chiefly to temperate regions; a few species occurring commonly in our range. Name derived from the Greek for "firm" or "stiff," and "tooth," referring to the structure of the peristome.

- a. Leaves curved, spreading, in most species turned in two opposite directions, and apparently in two rows, giving a flattened, braided appearance along the stem and branches, turned in one direction in *S. arcuatus*; usually large enough to be seen

S. reptilis. *S. cupressiformis.*

S. imponens. *S. recurvans.*

S. curvifolius. *S. arcuatus.*

- b. Leaves straight, erect, arranged equally around stem and branches, easily seen *S. Haldanianus.*

a

Plants growing in mats on the ground, on rocks, on trees, and on decaying wood; light, dark or yellowish-green; sometimes glossy; fruit common in some species.

Stems usually prostrate or creeping; ascending in *S. arcuatus*; pinnately or irregularly branched; *branches lying flat on opposite sides of stem; not cylindrical.*

Leaves curved, crowded; usually large enough to be seen except in S. reptilis; in most species turned in two opposite directions, apparently in two rows, giving a flattened, braided appearance along the stem and branches; in S. arcuatus turned in one direction; light, dark or yellowish-green; sometimes glossy.

Seta $\frac{1}{2}$ - $1\frac{1}{2}$ inches long; reddish-brown.

Capsule long-cylindrical, except in *S. curvifolius* and *S. recurvans*, inclined or nearly straight; mature in summer or autumn.

Operculum cone-shaped or short-beaked.

The distinguishing characteristic of the mosses of this group, with the exception of *S. arcuatus*, is the way the *leaves seem to part and curl in opposite directions*, as though growing in only two rows, giving a *braided appearance along the stem and branches*, which is very different from mosses with straight leaves arranged equally, and with cylindrical branches. This generic characteristic can usually be seen readily, but it is not so easy to separate the species.

In *S. arcuatus* the leaves are curved and turned to one side.

Stereodon réptilis (Rich.) Mitt. (*Hypnum reptile* Michx.) is the commonest small species. The leaves are sometimes large enough to be seen when the plants are held to the light, and the curling of the leaf-tips can usually be made out. The leaves are spreading and give the branches a flattened, rather than a cylindrical, appearance.



Stereodon réptilis

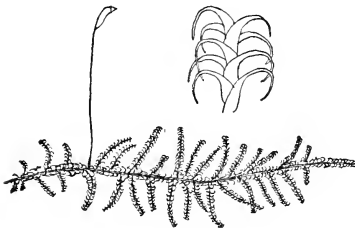
Portion of branch enlarged.

The plants are found on stones, at the base of trees, and on decaying logs. They are rather dark green, and are usually fruiting, often abundantly. The stems are more or less pinnately or irregularly branched, closely interwoven. Some shoots that run out from the general matted growth often are regularly pinnate. Small forms resemble *Homomallium* (p. 210), but *Stereodon réptilis* is much more frequent and grows in larger mats, more often fruiting than *Homomallium*. When the curved tips of the leaves can be seen in *Stereodon*, the branches do not look smoothly cylindrical, as in *Homomallium*.

Range, Canada south to North Carolina and Utah; Europe; Asia.

Stereodon impònens (Hedw.) Brid. (*Hypnum imponens* Hedw.) is a common species, larger than *S. réptilis*, growing in loose mats on earth, rocks, decaying logs, and at the base of trees, in moist woods. The leaves are yellowish-green. The fruit is not common.

The stems are usually irregular in branching; when pinnate, the branching does not continue to the ends of



Stereodon imponens

Portion of branch enlarged.

the stems, as in *Ptilium* (p. 230). For comparison see under that genus. *S. imponens* resembles *Ctenidium* in color and general growth, but the plants lack the soft, feathery appearance characteristic of *Ctenidium*.

See p. 222; also the next species.

***Stereodon curvifolius* (Hedw.) Brid.** (*Hypnum curvifolium* Hedw.) is the most robust species. It occurs chiefly on decaying logs in moist woods, growing in loose mats. The leaves are light or yellowish-green. The fruit is occasionally found. The capsules are large, short-cylindrical, and curved. The stems are usually quite regularly pinnate, with rather stout branches, and the leaves distinctly show the parting and curling so characteristic of this group. The plants are larger than *S. imponens*, with thicker, more regularly pinnate branches, more closely resembling the flatter forms of *Ptilium* (p. 230), but in *Stereodon* the stems are more prostrate and the branches less crowded.

Range, Arctic America and Canada, south to Florida and Colorado; Asia.

Stereodon cupressifórmis (L.) Brid. (*Hypnum cupressiforme* L.) has many varieties, and the typical form is not often collected in our range. The plants grow on rocks, roots, and at the base of trees in moist woods, forming thickly interwoven mats; rarely fruiting. The leaves are dull yellowish- or brownish-green. The plants are not so robust as in *S. curvifolius*, and the stems are more matted together and more irregularly branched than in either *S. imponens* or *S. curvifolius*. The distinguishing leaf-character of the group is usually noticeable.

The var. **filifórmis** Brid. is a very slender form occasionally found at the base of trees. The stems are pendant and the branches long, straight, parallel, and very slender, giving the matted plants a smooth appearance as if water had run over them, turning the branches in one direction.

Range, Arctic America, Canada, south to the Gulf States; a cosmopolitan.

Stereodon recúrvens (Schwaegr.) Broth. (*Hypnum recurvens* Beauv., *Sematophyllum recurvens* (Michx.) E. G. B.) is frequently found in mountainous and hilly woods, growing at the base of trees, on decaying logs, and on the ground, in flat, densely interwoven mats. It is *bright yellowish-green* and *more glossy* than other species of this group, *somewhat smaller* than any except *S. reptilis*, and *fruits more abundantly*. The stems are closely interwoven, irregularly

branched, and the branches rather short but stout. The leaves are shining yellowish-green, and show the characteristic curving in two opposite directions. Sometimes the matted plants are quite thickly covered with the reddish-brown fruit. The seta is about $\frac{1}{2}$ inch long, and the capsule is short-cylindrical.

Range, Newfoundland to Manitoba, south to North Carolina and Missouri; Mexico.

Stereodon arcuatus Lindb. (*S. Lindbergii* (Mitt.) Warnst., *Hypnum Patientiae* Lindb.) is found in moist



Stereodon arcuatus
Branch enlarged.

woods, swamps, and meadows, often growing in the grass, in light- or yellowish-green tufts. The plants are *more erect* than other mosses of this group, the *stems* are *less branched*, and more ascending, and the *leaves* are *larger and turned to one side*, instead of in two opposite directions. A rare variety more or less pinnate grows on rocks.

Range, Arctic America, Canada, and the northern United States, south in the East to Florida; Europe; Asia.

See *Drepanocladus uncinatus* (p. 214) for comparison with that species.

b

Plants growing in rather loose mats on the ground, on rocks, and on decaying wood; yellowish-green to dark green; common; fruit sometimes abundant.

Stems prostrate, irregularly branched; rarely some shoots are pinnate; branches unequal in length and quite straight.

Leaves straight, erect-spreading, not much changed when dry; yellowish-green to dark green.



Stereodon Haldanianus

Branch enlarged.

Seta 1-2 inches long; reddish-brown.

Capsule long-cylindrical, slender, only slightly curved and inclined; mature in autumn.

Operculum short-beaked.

Range, Nova Scotia to Montana, south to Alabama and Missouri; Europe; Asia.

Stereodon Haldanianus (Grev.) Lindb. (*Hypnum Haldanianum* Grev.) is one of the commonest of the pleurocarpous mosses. It is the only species of *Stereodon* with straight, erect-spreading leaves. It so closely resembles certain species of *Brachythecium* (p. 244) that it cannot be distinguished except when fruited; then, the long capsule is the distinguishing characteristic in contrast with the short capsule of *Brachythecium*.

72. ISOPTERYGIUM Mitt. (I-sop-te-rý-gi-um)

A very large genus widely distributed. A few of the most frequent species are given below. Name derived from the Greek for "equal" and a "little wing," probably referring to the leaves lying flat on either side of the stem.

Plants small, growing in thin, flat mats on rocks, soil, and decaying wood, usually in mountainous or hilly woods; light or yellowish-green; often glossy; not common; fruit rare except in *I. turfaceum*.

Stems prostrate, irregularly branched, *branches flattened*.

Leaves straight; large enough to be seen, except sometimes in *I. micans*; rather *separated, wide-spreading; flattened on either side of the stem, apparently in two rows*; light or yellowish-green; sometimes glossy.



Isopterygium turfaceum

Portion of branch
enlarged.

Seta up to 1 inch long; reddish-brown.

Capsule long-cylindrical, inclined, curved; reddish-brown; mature in summer.

Operculum cone-shaped or short-beaked.

Range, Canada, and south in the East to the Southern States; Europe.

The distinguishing characteristic of *Isopterygium* is the *flattened appearance* of the plants due to the *wide-spread leaves lying flat, apparently in two rows on opposite sides of the stem*. This flattened appearance is also

characteristic of *Plagiothecium*, the following genus, *Brachythecium Starkei* (p. 248), and *Rhynchostegium* (p. 256), but *Isopterygium* occurs less frequently than any of these, — some species being found only in mountainous regions, — and the plants are smaller.

Isopterygium turfâceum Lindb. (*Plagiothecium turfâceum* Lindb.) appears to be the species most commonly collected in our range. It grows on moist, rich soil or on decaying wood, sometimes in peat-bogs. The plants are usually yellowish-green and often well fruited.

Isopterygium élegans (Hook.) Lindb. (*Plagiothecium elegans* (Hook.) Sull.) occurs on the ground or on rocks in moist woods. The plants rarely fruit; the branches usually point one way; and the leaves are especially glossy, and quite a bright green.

Isopterygium Mülleriànum (Schimp.) Lindb. (*Plagiothecium Müllertianum* Schimp.) is found on moist rocks and soil in mountainous regions, rarely fruited. It grows in rather small tufts, and the branches are often long, slender, and frequently taper at the ends.

Isopterygium micans (Sw.) Broth. (*Hypnum micans* Sw.) is a very small species occurring from New York southward. The leaves are very small and slender, but the branches still have a flattened look.

Plagiothecium denticulatum (L.) Bryol. Eur. and **Plagiothecium sylvaticum** (Huds.) Bryol. Eur. very closely resemble each other. *P. denticulatum* is probably more frequently collected. The plants are much larger than most of the species of *Isopterygium*, the preceding genus. The leaves are usually glossy. *P. sylvaticum* has been described as less glossy than *P. denticulatum*, but this characteristic alone is not sufficient for field identification. The moss that most closely resembles these two *Plagiotheciums* is *Rhynchostegium serrulatum* (p. 256). The leaves of that species are less glossy, but the only satisfactory field-mark is the beak of the operculum. In *Rhynchostegium* it is noticeably long, slender, and curved, while in *Plagiothecium* it is shorter, and often the operculum is only cone-shaped. *Brachythecium Starkei* (p. 248) has a flattened appearance, but this is not so conspicuous as in *Plagiothecium*, as the leaves of the former are smaller and narrower. Fruited specimens can be easily distinguished, as the capsule of *Brachythecium* is short and stout and that of *Plagiothecium* is long and slender.

b

Plants small, growing in close mats on the ground, on rocks (but not on limestone), and on decaying logs in moist woods; rather dark green or yellowish-green; common in swamps; fruit frequent, often abundant.

Stems prostrate, irregularly branched; branches short, about $\frac{1}{4}$ of an inch long; *erect, crowded*.

Leaves small, but easily seen, spreading, equally arranged around stem; dark or yellowish-green.



*Plagiothecium
striatellum*

Seta $\frac{1}{2}$ – $\frac{3}{4}$ inch long; reddish-brown.

Capsule long-cylindrical, inclined; reddish-brown; mature in summer.

Range, Greenland and Newfoundland to Minnesota, south to North Carolina; Alaska; Europe.

Plagiothecium striatellum (Brid.)

Lindb. (*Plagiothecium Mühlenbeckii* Bryol. Eur.) is usually found on decaying logs in swamps. The distinguishing characteristics are the *short, crowded, erect branches* and the *spreading leaves* arranged equally around the stems and branches. See *Eurhynchium* (p. 252) and *Brachythecium velutinum* (p. 248).

FAMILY BRACHIYTHECIACEAE

A VERY large cosmopolitan family, found in various places.

74. CAMPTOTHECIUM Bryol. Eur. (Camp-to-thè-ci-um)

A genus containing several species, but one occurring in our range. Name derived from the Greek for "bent" and a "little vessel," referring to the curved capsule.

Plants growing in swamps and wet meadows; *yellowish-green; shining*; not common; fruit rare.

Stems erect, thickly covered with brown radicles; more or less regularly pinnate; branches rather separated.

Leaves straight, long and narrow, erect, crowded; yellowish-green; shining.

Seta reddish-brown.

Capsule long-cylindrical, inclined; reddish-brown; mature in early summer.

Operculum short-beaked.

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



Camptothecium nitens

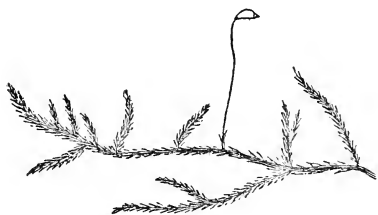
Camptothecium nitens (Schreb.) Schimp. is occasionally found in cool northern swamps. The distinguishing characteristics are the *erect stems thickly*

coated with dark-brown radicles and the shining, yellowish-green leaves. *Hypnum Schreberi* (p. 229) also has erect stems more or less pinnately branched, but it grows in drier locations and the stems lack the coating of radicles.

75. BRACHYTHECIUM Bryol. Eur. (Bra-chy-thè-ci-um)

A genus containing a great many species, several of which frequently occur in our range. Name derived from the Greek for "short" and a "little vessel," referring to the short capsule.

Plants growing in loose or dense mats on earth, rocks, trees, decaying wood, and in streams; light, dark, or yellowish-green; common; fruit frequent.



Brachythecium salebrosum

Stems prostrate, irregularly branched; branches prostrate, ascending or erect.

Leaves straight; large enough to be seen, except in *B. reflexum*;

usually *erect* or *erect-spreading*; more closely folded when dry; in *B. Starkei*, wide-spreading both when moist and when dry; light to dark green; sometimes slightly glossy.

Seta usually nearly 1 inch long; red or reddish-brown.

Capsule cylindrical, usually *short and stout, inclined*; straight in *B. acuminatum*; reddish-brown; mature in autumn or winter.

Operculum cone-shaped.

The general characteristics of *Brachythecium*, which hold for most species, are the *prostrate stems, irregularly branched, leaves straight, equally arranged around the stem and branches, erect or erect-spreading*, and the usually *short, thick capsule*. The capsule in some species is more slender than in others, but never so long and slender as in *Stereodon Haldanianus* (p. 237). Some of the common species of *Brachythecium* (*B. salebrosum* and others) so closely resemble *Stereodon Haldanianus* in growth and leaf-character that they cannot be distinguished except when fruited.

The following table, giving usual habitats, may be helpful in looking up different species: —

Plants growing on moist ground

<i>B. salebrosum.</i>	<i>B. Starkei.</i>
<i>B. oxycladon.</i>	<i>B. velutinum.</i>
<i>B. rutabulum.</i>	<i>B. acuminatum.</i>
<i>B. rivulare</i> on moist banks by streams.	

Plants growing on rocks in beds of streams

<i>B. rivulare.</i>	<i>B. plumosum.</i>
---------------------	---------------------

Plants growing on rocks not in streams

<i>B. salebrosum.</i>	<i>B. Starkei.</i>
<i>B. oxycladon.</i>	<i>B. reflexum.</i>
<i>B. rutabulum.</i>	<i>B. velutinum.</i>
<i>B. populeum.</i>	<i>B. acuminatum.</i>

Plants growing on roots or trunks of trees

<i>B. salebrosum.</i>	<i>B. populeum.</i>
<i>B. oxycladon.</i>	<i>B. velutinum.</i>
<i>B. rutabulum.</i>	<i>B. acuminatum.</i>

Plants growing on decaying logs or old stumps

B. salebrosum.

B. Starkei.

B. rutabulum.

B. reflexum.

B. acuminatum.

Brachythecium salebrosum (Hoffm.) Bryol. Eur. is one of the commonest species, and is found on earth, rocks, trees, and decaying logs. It is usually bright or yellowish-green; somewhat glossy.

Range, Canada and the Northern and Eastern States; Europe; Asia; Africa.

Brachythecium oxycladon (Brid.) Jaeg. (*B. laetum* (Brid.) Bryol. Eur.) is closely related to *B. salebrosum*. Some specimens have longer, more tapering branches, and a capsule slightly more slender and more erect. It grows on earth, rocks, and roots of trees, but is less frequent on decaying logs. The leaves are quite a bright green.

Range, Newfoundland to Florida, west to the Rocky Mountains; Europe.

Brachythecium rutabulum (L.) Bryol. Eur. is a more robust species with thicker branches, larger leaves, and stouter capsule. It grows more commonly on the ground and on stones in wet places, less frequently on trees and old logs. It is usually yellowish-green and quite glossy.

Range, Newfoundland to Michigan and south to Maryland and Missouri; Europe; Asia; Africa.

Brachythecium popùleum (Hedw.) Bryol. Eur. resembles *B. salebrosum* in general appearance, but is often smaller and darker. It grows chiefly on rocks, less frequently on roots or trunks of trees. The leaves are a rather dark green.

Range, Nova Scotia to Ontario, south to North Carolina; British Columbia; Europe; Africa.

Brachythecium plumòsum (Sw.) Bryol. Eur. is found chiefly on rocks in brooks, growing in thick, rather dark-green mats, with shorter branches than the following species. See *Hygrohypnum* (p. 218) and *Bryhnia* (p. 254).

Range, Newfoundland to British Columbia, south in the East to Alabama; Europe; Asia; Hawaiian Islands.

Brachythecium rivulàre Bryol. Eur. grows on rocks in brooks and streams or on the ground in very wet places that are sometimes submerged. The stems are creeping with very long, erect secondary stems that are often branched, and the leaves are light green or yellowish-green, somewhat glossy. See *Hygrohypnum* (p. 218) *Bryhnia* (p. 254) and preceding species.



Brachythecium rivulare

Range, northern North America, south to North Carolina and Missouri; Europe; Asia.

Brachythecium Stårkei (Brid.) Bryol. Eur. is the species with wide-spreading, rather separated, leaves, flattened on either side of the stem, apparently in two rows. The plants grow on the ground, on rocks, and on decaying wood; usually forming rather thin mats; quite dark green. The growth is similar to that of *Plagiothecium denticulatum* (p. 240) and *Rhynchostegium* (p. 256), but as a rule the leaves are narrower and shorter, giving the branches a more slender appearance, and the capsules are stouter without the very long beak to the operculum that is characteristic of *Rhynchostegium*.

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

Brachythecium refléxum (Stark.) Bryol. Eur. is a very slender species with leaves closely folded and too small to be seen. It grows chiefly on rocks and decaying logs, more rarely at the base of trees in mountainous regions. It is usually a rather dark green. The stems and branches are very slender and tapering, sometimes slightly curved at the ends.

Range, Canada and south to Maryland and Missouri; Europe; Asia.

Brachythecium velutînum (L.) Bryol. Eur. is not often collected. It grows on earth, and on stones, but most frequently at the base of trees. The plants are

slender, and the leaves small but easily seen, as they are quite wide-spreading even when dry. The color is usually dark green or olive-green. The branches are numerous and short, resembling those of *Plagiothecium striatellum* (p. 242), but the capsule is not so slender as in *Plagiothecium*. See also *Eurhynchium* (p. 252).

Range, Canada and the northern United States; Europe; Asia.

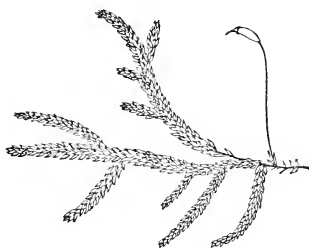
Brachythecium acuminatum (Hedw.) Kindb. is the one species with an *erect capsule*. It is rare in New England, but more common in the South. It grows in close mats on roots of trees, rocks, and decaying logs. The general growth when dry is much like *Entodon seductrix* (p. 190), but it is much less frequent, and usually the branches are not so smoothly cylindrical, and the general color is not so golden-green, although somewhat light or yellowish-green. The leaves are straight, closely folded, and too small to be seen easily without a lens.

The above descriptions are not given with the expectation that the student will be able to determine species, except possibly *B. Starkei* and *B. reflexum* when fruited, but rather to show the variations in the general generic characteristics.

76. CIRRIPHYLLUM Grout (Cir-ri-phýl-lum)

A genus containing several species. One is fairly common in our region. Name derived from the Latin for "curly hair," and "leaf," referring to the curled tip of the leaves.

Plants robust, growing in loose mats on the ground and on earth-covered rocks in open woods, or in thin grass in open fields; yellowish- or golden-green, rarely bright green; glossy; common in some localities; fruit rare.



Cirriphyllum Boscii

Stems prostrate, irregularly branched; branches cylindrical, with a swollen appearance due to the very concave leaves loosely folded.

Leaves straight, large, very concave; broad, with a short, fine, curled tip; closely or loosely folded; yellow- or golden-green, rarely bright green; glossy.

Seta about $\frac{3}{4}$ inch long; reddish-brown.

Capsule long-cylindrical, inclined; reddish-brown; mature in autumn.

Operculum long-beaked.

Range, Vermont to Florida, west to Colorado and Arkansas.

Cirriphyllum Boscii (Schwaegr.) Grout (*Hypnum Boscii* Schwaegr.) when well developed is conspicuous on account of the *bright, glossy color* and the *large*

cylindrical branches, with the *concave leaves* distinctly showing, although folded against each other. Other mosses with cylindrical branches are much smaller and the leaves are not clearly seen when folded, while those mosses with equally distinct leaves have more slender or flatter branches, as the leaves are not spoon-shaped or concave as in *Cirriphyllum*. The curled tip of the leaves can be seen in the larger growths; it is very conspicuous when seen with a hand-lens.

77. OXYRHYNCHIUM (Bryol. Eur.) Warnst.
(Ox-y-rhýn-chi-um)

A genus of several species; the common one given below. Name derived from the Greek for "sharp," "well," and "beak," referring to the long beak of the operculum.

Plants large, growing in loose mats on stones in streams; olive or dark green, rarely yellowish-green, black below; common; fruit quite common.

Stems prostrate; often leafless in the lower part; irregularly branched; branches ascending; *thick*.

Leaves straight, large, broad, wide-spreading; olive or dark green.

Seta $\frac{1}{2}$ – $\frac{3}{4}$ inch long; reddish-brown.

Capsule short-cylindrical, inclined; mature in autumn.



Oxyrhygium rusciforme

Operculum long-beaked.

Range, Newfoundland to Ontario, south to Georgia; Europe; Asia; Africa.

Oxyrhygium rusciforme (Neck.) Warnst. (*Eurhygium rusciforme* (Neck.) Milde, *Rhynchostegium rusciforme* Bryol. Eur.) is a robust moss common on rocks often overflowed in beds of streams. It is usually well fruited, which helps to distinguish it from the acrocarpous moss, *Rhacomitrium* (p. 113), which it most resembles and which is found in similar places. Although the capsule of *Rhacomitrium* sometimes appears lateral, it is always erect, while in *Oxyrhygium* it is inclined. The leaves of *Rhacomitrium* are not so large as in *Oxyrhygium*, and fold more closely when dry, giving the branches a more slender appearance. Other pleurocarpous mosses growing in brooks have leaves smaller or more or less curved and turned to one side, and lack the stout appearance of the branches characteristic of *Oxyrhygium*. See *Hygroamblystegium* (p. 211), *Hygrohypnum* (p. 218), *Brachythecium* (p. 244), and *Bryhnia* (p. 254).

78. EURHYNCIUM Bryol. Eur. (Eu-rhýn-chi-um)

A genus containing several species, one of which is occasional in our region. Name derived from the Greek for "well" and "beak," referring to the long beak of the operculum.

Plants growing in mats, commonly on the ground, on decaying logs or at the base of trees, more rarely on rocks; bright green or somewhat yellowish-green; not very common; sometimes fruiting.

Stems prostrate, irregularly branched; branches short, usually $\frac{1}{4}$ or $\frac{3}{8}$ inch long; erect or ascending; sometimes in clusters.

Leaves small, straight, wide-spreading, even when dry; usually bright green.

Seta $\frac{1}{2}$ – $\frac{3}{4}$ inch long; reddish-brown.

Capsule short-cylindrical, inclined; mature in autumn.

Operculum long-beaked.

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

Eurhynchium strigosum (Hoffm.) Bryol. Eur. is not commonly found in our range, as the var. ***robustum*** Roell is the form usually collected. The general character of the growth, *prostrate stems, with numerous short, erect branches and small wide-spreading leaves*, somewhat resembles that of *Plagiothecium striatellum* (p. 242) and *Brachythecium velutinum* (p. 248), but the branches of *Eurhynchium* are longer, often in clusters, and the leaves are a brighter green. If the specimens are fruited and the long beak of the operculum of *Eurhynchium* can be seen, it is the best field-character. The capsule is longer as a rule than in *Brachythecium*,



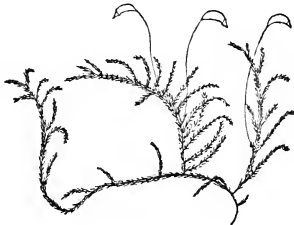
Eurhynchium strigosum
var. *robustum*

but about the same size as in *Plagiothecium*. The other small moss with spreading leaves growing in similar places is *Amblystegium serpens* (p. 208), which is much more delicate and forms much thinner mats.

79. BRYHНИЯ Kaur. (Brýhn-i-a)

A small genus, found only in the Northern Hemisphere. One species is commonly found in our range. Named after Dr. Nils Bryhn, of Norway

Plants growing in loose mats on wet ground and on stones, often in beds of streams; bright or dull green; not glossy; common; fruit frequent.



Bryhnia novae-angliae

Stems prostrate or ascending; irregularly branched; branches often ascending; ends of branches sometimes curved, especially when dry.

Leaves short, straight, erect-spreading when moist; more closely folded when dry; sometimes too small to be seen easily; bright or dull green; not glossy.

Seta $\frac{1}{2}$ – $\frac{3}{4}$ inch long; dark reddish-brown.

Capsule short-cylindrical, stout; dark reddish-brown; mature in winter.

Operculum cone-shaped.

Range, Canada, south to North Carolina and Missouri; Europe; Asia.

Bryhnia novae-angliae (Sull. & Lesq.) Grout (*Brachythecium novae-angliae* (Sull. & Lesq.) Jaeg. & Sauerb.) is most frequently found on stones in beds of brooks or in wet, shady woods. The distinguishing characteristics are best seen in dry plants: the slight curl of the ends of the stems and branches, and the small leaves not tightly folded, which give the stems and branches rather a rough appearance. When the plants are fruited, the short, stout capsule distinguishes *Bryhnia* from other mosses, except *Brachythecium* (p. 244), growing in similar places. *Brachythecium rivulare* (p. 247) and *Brachythecium plumosum* (p. 247) are also found in brooks, but they have larger leaves, not folded when dry, and straighter branches. This distinction is also true of other *Brachytheciums* growing on wet ground. *Hygroamblystegium* (p. 211) also has straighter branches without the numerous lateral branches found in *Bryhnia*. *Bryhnia* is much larger than *Amblystegium serpens* (p. 209), and the leaves are much shorter than in *A. riparium* (p. 209). *Bryhnia* may be known from *Stereodon* (p. 231) by the less creeping stems, without the flattened branches or curved leaves. *Stereodon Haldanianus* (p. 237) has straighter branches and larger leaves. *Oxyrhygium* (p. 251) is a much stouter moss, with larger leaves, darker green than *Bryhnia*.

80. RHYNCHOSTEGIUM Bryol. Eur.
(Rhyn-cho-stè-gi-um)

A genus containing a great many species, one of which occurs in our range. Name derived from the Greek for "beak" and "roofed chamber," referring to the long beak of the operculum.

Plants growing in loose, flattened mats on the ground, on logs, and on roots of trees in the woods; bright or yellowish-green; quite common; fruit frequent.



Rhynchostegium serrulatum
Portion of branch enlarged.

Stems prostrate, irregularly branched; branches flattened; broad.

Leaves large, straight, wide-spreading both when moist and when

dry; *apparently in two opposite rows*; usually yellowish-green; slightly glossy.

Seta about 1 inch long; reddish-brown.

Capsule long-cylindrical, inclined, curved; mature in autumn.

Operculum long-beaked.

Range, Newfoundland to Wisconsin, south to the Gulf of Mexico; Alaska; British Columbia.

Rhynchostegium serrulatum (Hedw.) Jaeg. (*Eurhynchium serrulatum* (Hedw.) Kindb., *Hypnum serrulatum* Hedw.) has the *flattened appearance* of *Plagiothecium* (p. 240), *Isopterygium* (p. 238), and *Brachy-*

thecium Starkei (p. 248), with the leaves wide-spreading and lying flat on either side of the stem, apparently in two rows. If the plants are fruited, and the operculum has not fallen off, the long beak of the operculum is the distinguishing characteristic. The plants are larger than *Isopterygium*, and appear larger than *Brachythecium Starkei*, as the longer leaves make the branches look broader, but they so closely resemble *Plagiothecium* that they cannot be distinguished in the field except when in fruit, and before the operculum has fallen off. The capsule is more slender than in *Brachythecium*, but resembles that of *Plagiothecium* and *Isopterygium*.

APPENDIX

APPENDIX

HELPS TO IDENTIFICATION OF THE MOST COMMON AND CONSPICUOUS MOSSES

NOTE. Only the conspicuous characteristics are given here. These may vary at different seasons of the year.

- A. Fruit at the apex of the stem or of a well-developed branch, sometimes appearing lateral by the new growth of the plant. Stems generally erect, and often not branched; or, if slightly branched by forking, usually with not more than two or three branches.¹ ACROCARPOUS MOSSES, p. 77.
- B. Fruit on the side of the stem or on a very short lateral branch. Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches).¹ PLEUROCARPOUS MOSSES, p. 172.

A (ACROCARPOUS MOSSES)

Manner of growth

Individual plants of the acrocarpous mosses can nearly always be *easily separated*, as the stems are erect and do not interweave. In some cases the stems are matted together below with a felt-like mass of radicles, called *tomentum*.

Stems of most acrocarpous mosses are *erect, and often not branched*; or *slightly branched by forking, usually with not more than two or three branches*.¹

¹ For arrangement of branches see Illustrations of Terms, Plate II.

Stems *ascending to erect, usually much branched by forking*; plants growing on rock; leaves dark or olive-green, except in the young growth at the tip of the stem, which is lighter 19.

Stems *erect, not branched, or with branches whorled at tip of stem*; plants growing on wet ground or on rocks; leaves usually light or yellowish-green 34.

Looked at from above, *has the outline of a star* with many rays, or looked at from the side, *resembles tiny spruce or pine trees*; stems erect, usually not branched; leaves bright green or grayish-green to dark green; plants growing on the ground, on earth-covered rocks, old stumps and upturned roots 39, 41.

Plants *growing from protonema*, a green or brownish coating on the surface of the soil 37, 40.

Color of stem

Stems of most mosses are either covered with leaves, and show only the color of the leaves, or are brown and inconspicuous.

Stems showing *red* through the leaves, especially in the new growth when moist plants are held to the light 27, 28.

Stems at least in the lower part *covered with tomentum*, a felt-like mass of brown or whitish radicles
8, 30, 31, 33, 34, 41.

Shape of leaves

Leaves too small or too closely folded to be seen easily.

Capsule almost concealed by surrounding leaves 19.

Capsule erect 2, 22, 38, 40.

Capsule not erect 25, 28, 34.

Leaves *conspicuously long and narrow*.

Capsule erect 2, 6, 8, 23, 39, 40, 41.

Capsule not erect 6, 8, 9, 31, 33, 39, 41.

Leaves *conspicuously short and broad*.

Capsule erect 10, 20, 24.

Capsule not erect 10, 29, 30.

Position of leaves

Leaves of most mosses are *arranged equally around the stem* and branches and are *erect or spreading*.

Leaves more or less *turned to one side* (secund)

. . . . 6, 8.

Leaves *in two rows* on opposite sides of stem, giving the plants a flattened appearance 10. See also hepatics (p. 6).

Leaves *forming a rosette* at tip of stem 26, 29, 30, 39, 41. See also *Sphagnum* (p. 73).

Leaves *forming a cup* at the tip of the stem 38.

Leaves *undulate or wavy* 8, 39.

Leaves *conspicuously crisped when dry*.

Capsule erect 8, 10, 13, 15, 23, 39.

Capsule not erect 8, 10, 29, 30, 33, 39.

Leaves *conspicuously folded straight when dry*.

Capsule partly concealed by surrounding leaves

. . . . 19, 22.

Capsule erect 2, 20, 22, 23, 38.

Capsule not erect 4, 27, 28, 40, 41.

Midrib

The midrib when present is usually not seen without the aid of a lens.

Midrib seen when moist plants are held to the light

. . . . 29, 30, 39.

Color of leaves

The color of the leaves of most mosses varies from light or yellowish-green to dark green.

Leaves usually conspicuously *light or yellowish-green*

. . . . 24, 25, 31, 34.

Leaves *glaucous or whitish green* especially when dry 9. See also *Sphagnum* (p. 73).

Leaves *bluish-green* 3, 41.

Leaves usually conspicuously *dark or olive-green*

19, 20, 21, 22, 28, 36, 38.

Leaves sometimes with a *reddish tinge* 39. See also *Sphagnum* (p. 73).

Color of seta

The seta of most mosses is reddish-brown.

Seta *yellowish* 1, 2, 6, 8, 24, 25, 30.

Seta *dark red* 4, 27, 41.

Setae clustered 8, 29, 30, 39.

Most mosses have a single seta.

Seta very short or apparently absent, so that the capsule is partially concealed by surrounding leaves 19, 22, 36.

Position of capsule

Capsule *erect* 2, 6, 8, 10, 20, 22, 23, 24, 38, 39, 40, 41.

Capsule *inclined* (between erect and horizontal)

1, 2, 4, 6, 8, 9, 31, 33, 34, 39, 41.

Capsule *horizontal* 27, 28, 29, 30, 35, 41.

Capsule *hanging down* 25, 26, 27, 28, 29, 30, 41.

25 and 27 are especially conspicuous in the spring and early summer on account of the capsules being thickly crowded together; they are bright green at first and then change to brown.

Capsule *partly concealed* by leaves 19, 22.

Shape of operculum

The operculum of most mosses is convex, cone-shaped, or short-beaked, and not especially conspicuous.

Operculum *conspicuously long-beaked* . . . 1, 2, 6, 8, 39, 41.

Calyptra hairy and conspicuous . . . 22, 23, 40, 41.

The calyptra of most mosses is smooth and inconspicuous, often falling off long before the capsule is mature.

B (PLEUROCARPOUS MOSSES)

Fruit on the side of the stem or on a very short lateral branch.

Stems prostrate or ascending, rarely erect, usually much branched (with more than two or three branches).

Manner of growth

Pleurocarpous mosses usually grow in rather *flat mats* with stems and branches prostrate or creeping and often *closely interwoven*, so that *no great length of stem can be easily separated*.

Plants with stems usually *ascending or erect* and easily separated . . . 45, 58, 62, 63, 67, 68, 69, 70, 71.

Plants *tree-like* (with erect stems and erect or spreading branches only toward the tip of the stem) . . . 45, 49.

Plants *fern-like* (branches bipinnate, tripinnate, or closely pinnate) . . . 57, 68, 70.

Plants *plume-like* (branches closely and regularly pinnate) . . . 70.

Plants with long stems *floating in streams or ponds*
. . . . 43, 62.

Color of stem

Stems of most mosses are either *covered with leaves, and show only the color of the leaves, or are brown and inconspicuous*.

Stems and branches showing *red* through the leaves when moist plants are held to the light . . . 45, 68, 69.

Position and shape of leaves

The leaves of most of the pleurocarpous mosses are more or less ovate at the base and end in a straight or curved tip, but they are often too small or too closely folded to show the entire outline. They are erect or spreading and usually arranged equally around the stem and branches, sometimes flattened and apparently in two rows.

Leaves *straight and flattened* on two opposite sides of the stem, *apparently in only two rows*, giving the plants a *pressed appearance* . . . 47, 48, 72, 73, 75, 80.

Leaves *curved and turned in two opposite directions*, apparently in only two rows, giving a *braided appearance* along the stems and branches . . . 71.

Leaves *strongly curved and more or less turned in one direction* . . . 62, 66, 70, 71.

Color of leaves

The color of the leaves of most mosses varies from light or yellowish-green to dark green.

Leaves usually *light, yellowish-, or golden-green*.

Capsule erect . . . 44, 47, 50, 52.

Capsule not erect . . . 58, 63, 67, 69, 70, 76.

Leaves usually *very dark or olive-green*.

Capsule almost concealed by the surrounding leaves . . . 42.

Capsule erect . . . 43, 55, 56.

Capsule not erect . . . 77.

Color of seta

The seta of the pleurocarpous mosses is nearly always *reddish-brown*.

Position of capsule

Capsules of most genera are more or less inclined.

Capsule *erect* . . . 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54.

Capsule *partially concealed by leaves* . . . 42, 43, 46, 47.

Shape of operculum

The operculum of most mosses is convex, cone-shaped,
or short-beaked, and not especially conspicuous.

Operculum *conspicuously long-beaked*

73, 76, 77, 78, 80.

GLOSSARY

GLOSSARY

- Acrocarpi.** Acrocarpous mosses.
- Acrocarpous.** Having the fruit at the tip of the stem or of a well-developed branch. (Plate I, Figs. 1, 2, 3.)
- Barren.** Not bearing fruit.
- Bipinnate.** Twice pinnate. Having the pinnate branches branched again. (Plate II, Fig. 3.)
- Calyptra.** The thin veil or hood covering the operculum or lid of the capsule. (Plate IV, Fig. 1.)
- Capsule.** The small sack containing the spores, often spoken of as the fruit. (Plate I, Fig. 1; Plate IV, Fig. 1.)
- Cleft.** Cut into or divided.
- Clustered.** Collected into a bunch. When two or more setae arise from the same perichaetium they are described as clustered.
- Costa.** Midrib of a moss leaf.
- Crisped.** Curled up, twisted or wrinkled.
- Cucullate.** Hood-shaped. (Plate IV, Fig. 17.)
- Drooping.** Hanging down.
- Erect.** Upright. Leaves are described as erect when they are nearly parallel to the stem.
- Exserted.** Projecting beyond some other part.
- Fertile.** Bearing fruit.
- Flagella.** Very fine string-like branchlets. (See *Dicranum flagellare*, Plate V, Fig. 2a.)
- Forked.** Divided at the tip. (Plate II, Fig. 1.)
- Fruit.** Same as capsule, the sack containing the spores.
- Fruited.** Bearing fruit.
- Fruit-stalk.** The seta or stem of the fruit. (Plate I, Fig. 1.)

- Gemmae.** Small bud-like bodies capable of reproducing the plant.
- Glaucous.** Whitish, covered with a bloom.
- Habitat.** The natural locality of a plant.
- Hair-like.** Without perceptible width.
- Inclined.** Between erect and horizontal.
- Irregularly-branched.** Not regularly pinnate, bipinnate, tripinnate, or tree-like. (Plate II, Fig. 6.)
- Lamellae.** Thin plates of tissue. (Plate VII, Figs. 2b, 3.)
- Lateral.** Coming from the side.
- Lobed.** Divided into broad parts.
- Mature.** Ripe. A plant, capsule, or fruit is described as mature when the spores are ready to be dispersed to develop new plants.
- Mitrate.** Like a beaked cap, symmetrical. (Plate IV, Fig. 18.)
- Mouth.** In reference to the capsule, the opening under the operculum.
- Neck.** In reference to the capsule, the lower portion just before it joins the seta.
- Obsolete.** Not distinct, rudimental.
- Operculum.** The lid or cap of the capsule that covers the peristome and that becomes separated and falls off when the spores are mature. (Plate IV, Fig. 1.)
- Perichaetium.** Special leaves or bracts enclosing the fertile flower and often surrounding the base of the seta.
- Peristome.** The fringe surrounding the mouth of the capsule beneath the operculum. (Plate IV, Fig. 2; Plate V, Fig. 6; Plate VI, Fig. 2; Plate VII, Fig. 4.)
- Pinnate.** With branches on either side of the stem in two opposite rows. (Plate II, Fig. 2.)
- Pleurocarpi.** Pleurocarpous mosses.
- Pleurocarpous.** Having the fruit lateral on the stem or branch. (Plate I, Figs. 4, 5.)

- Primary.** In reference to the stem, the first growth that is usually prostrate, with more or less erect branches called secondary stems that are usually again branched. (Plate II, Fig. 8.)
- Protonema.** The first growth that is produced from the spore. A felted mass of green threads that sometimes forms a conspicuous coating on the surface of the soil. (See *Pogonatum brevicaulis*, p. 161.)
- Pseudopodium.** Leafless branch resembling a fruit-stalk, often producing brood bodies or gemmae (see *Aulacomnium palustre*, p. 141); in *Sphagnum* taking the place of the seta, p. 73.
- Radicles.** Rootlets growing on the stem.
- Regularly-branched.** With branches on both sides of the stem, quite evenly arranged.
- Secondary.** In reference to the stem, the more or less ascending or erect branches that arise from the prostrate primary stem. (Plate II, Fig. 8.)
- Secund.** Turned to one side. (Plate III, Fig. 13.)
- Sessile.** Without a stem, or stalk.
- Seta.** The stem or stalk of the capsule. (Plate I, Fig. 1.)
- Setae.** Plural of seta.
- Spore.** A minute, dust-like body produced in the fruit of the lower plants and taking the place of the seed of the higher plants.
- Spreading.** In reference to leaves, standing more or less at right angles to the stem. (Plate III, Fig. 12.)
- Sterile.** Not producing fruit.
- Substratum.** The substance upon which a plant grows.
- Symmetrical.** Both sides alike.
- Teeth.** The outer divisions of the peristome. (Plate IV, Fig. 2; Plate V, Fig. 6; Plate VI, Fig. 2.)
- Terminal.** In reference to the fruit or capsule, coming at the end of the stem or branch.

Tomentum. A felted mass of radicles that sometimes covers a considerable part of the stem.

Tripinnate. Three times pinnate. When the bipinnate branches are again branched. (Plate II, Fig. 4.)

Undulate. Waved up and down, same as wavy.

Vegetative. Growing in some way other than from the spore.

Wavy. Same as undulate. In reference to leaves, with the surface not flat and smooth, but with more or less regular depressions. (See *Dicranum undulatum*, p. 93, and *Catharinaea undulata*, p. 157.)

Whorled. In reference to branches, arranged in a circle about the stem. (See *Philonotis*, p. 145.)

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