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AN INITIAL INVENTORY OF THE BRYOPHYTES OF MT. DESERT ISLAND, HANCOCK COUNTY, MAINE

In partial fulfillment of degree requirements
College of the Atlantic
Bar Harbor, Maine

by Jim Senter

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Introduction

This guide is the product of my senior project and three years of field work on Mt. Desert Island, Hancock Co., Maine. The first three sections are a summary of my reseach.

The first, an annotated species list, is a catalogue of the plants in the bryophyte collection of the College of the Atlantic Herbarium, Dr. C. Greene curator. I made the bulk of these collections between the spring of 1982 and the spring of 1985. Other members of the student body have contributed two dozen specimens to the collection.

The second section is a discussion of the reproductive biology and ecophysiology of bryophytes. Population dynamics and ecophysiology have direct relevance to taxonomic questions, dealing as they do with evolutionary processes and the ability of the plants to modify their form in response to changing environmental conditions. This section demonstrates how little we know of the complexities of bryophyte ecology.

The final section is a bibliography of articles on the ecology, taxonomy, and reproductive biology of the bryophytes found on Mt. Desert Island. This is by no means a comprehensive review of the literature.

I hope that this guide, and the bryophyte collection generated during my course here, will facilitate further interest in the ecology and taxonomy of these beautiful plants. To further this, appendices are attached which may prove useful for someone trying to use this part of the herbarium as an aid to identification.

A number of human and physical factors contribute to the attractiveness of Mt. Desert Island to the student of bryology. The existence of Acadia National Park protects much of the island from the disruptive effects of real estate development. The extensive sytem of trails, carriage paths, and roads that the Park maintains facilitates easy access to all parts of the island.

The weather on the island is moderated extensively by the proximity of the ocean. Winters are warmer and summers cooler and wetter than areas as little as twenty miles inland. This local oceanic influence encourages the growth of bryophytes, which in many areas of the island are the predominant ground cover.

Geologic factors also influence the importance of bryophytes to the ecology of the island. The glaciers which covered the area 25,000 years ago scraped away soil and transformed an east-west trending mountain range into a series of north-south trending mountains. As Moore and Taylor (1927,p13) observed:

"The soils of the island were deposited by the ice sheet during the last glacial period, or, in some places below 200 feet elevation, by marine action during submergence following the retreat of the ice. Some of the soils below 200 feet, though not deposited by the sea, have been reworked by the waves. Large areas on the mountain slopes are bare of soil altogether, except for occasional shallow pockets of glacial till, a little course material from the weathered granite, and here and there an accumulation of acid humus from the vegetation in places which have escaped fire for long periods. Bare, or nearly bare, rock is, however not confined to the mountain slopes. Rock ledges of varying size are common on the more level parts of the island, possibly on account of the washing away of the mantle of till by the waves. Some of these ledges are practically bare of soil, others have a little disintegrated rock and humus. Still others are so covered with a mat of humus in which the forest has become established as to be almost indistinguishable from the neighboring areas of soil, except for the poor growth of trees." from Moore and Taylor, 1927 p13

Bryophytes are among the few plants which can survive the extremes of temperature and water availability that are found on rock ledges. Their physiological processes are geared towards taking advantage of short periods of favorable conditions. This enables them to outcompete more complex plants in such "marginal" habitats.

The bedrock of most of the island is composed of granitic and metamorphic rocks which were formed at the heart of the ancestral mountains. The intrusion of magma into this area thrust the mountains upward, and the resulting elevation enables plants like *Racomitrium lanuginosum* to exist here. (*Racomitrium lanuginosum* is an arctic/alpine species that occurrs on mountaintops into the southern Appalachians.)

Mt. Desert Island is located on the dividing line between the temperate deciduous forests to the south and the boreal conifer forest to the north. This borderline state can be seen in the presence of *Climacium americanum*, a species widely distributed in southeast North America, and *Climacium dendroides*, a

plant of the boreal forests of Canada, in the flora of the island. Other examples could be cited.

What strikes one in walking through the forests of MDI is the tremendous lushness and variety of form and color of the bryophyte groundcover. This work is far from being a comprehensive description of this variety. Rand and Redfield (1894) -- in the only comprehensive treatment of the bryophyte vegetation of Maine that I am aware of -- listed over two hundred species in their flora of the island. This is significantly greater than the 120 species in the COA herbarium collection. The mountaintops and seashores are areas that need more coverage. Epiphytes of all sorts need further collection. The work has just begun.

The Bryophyte Flora of Mt. Desert Island, Maine
as of 4-21-85
Musci arranged according to Crum and Andersom,1981

Sphagnaceae
Sphagnum acuminatum
S. subsecundum Nees ex Sturm
S. nemoreum
S. girgensohnii Russ.
S. palustre L.
S. centrale C. Jens. ex Arn. + C. Jens.
S. pulchrum (Lindb. ex Braithw.) Warnst.
S. magellanicum Brid.
S. subnitens Russ.+ Warnst. ex Warnst.
S. quinquefarium (Lindb. ex Braithw.) Warnst
S. fuscum (Schimp.) Klingrr.
S. compactum DC ex Lam. + DC
S. cuspidatum Ehrh. ex Hoffm.
S.capillifolium var.*tenellum* (Schimp.) Crum

Awaiting verification of the Peat mosses by Dr. R. Andrus of SUNY Binghamton

Andreaeaceae

Andreaea rupestris Hedw.; on bare rock of xeric to mesic sites, common

A. rothii Web.+ Mohr; on bare rock of fairly mesic sites, in ledge seeps and under hardwood canopy

Fissidentaceae

Fissidens osmundioides Hedw.; in crack of rock in Duck Brook, S of The Park Loop Bridge

F. bushii Card. + Ther.; facultive epiphyte on *Thuja*,Salisbury Cove; in seep of horizontal rock face, W of The Precipice Parkinglot

Schistostegaceae

Schistostega pennata (Hedw.) Web.; & Mohr; in tunnel above the cobble beach, E side of Bald Porcupine Island

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid.; on soil and over rock in open, disturbed sites

Ditrichum lineare (Sw.) Lindb.; on soil between ledges, off Norway Dr.

Dicranaceae

Dicranum undulatum Brid.; in bog mats with various Sphagnum spp. Sunken Heath, Big Heath, Jones Marsh Bog

D. scoparium Hedw.; on soil and over rocks, in hardwood and coniferous forests, common

D. majus Sm.; on shaded humus in coniferous woods; S of Jones Marsh Bog, End of Spring St Bar Harbor

D. flagellare Hedw.; on rotted logs and stumps, in fairly mesic sites; N of Great Head, E of Norway Dr., S of Jones Marsh Bog, W of Eagle Lake

D. montanum Hedw.; at the bases of trees, common

D. polysetum Sw.; on soil and humus in open fairly xeric sites N side of COA campus, NE of Adams Bridge Bass Harbor, E of Norway Dr., E of the Syndicate Rd.

D. fuscescens Turn.; on rotten stump, E of Norway Dr.

D. ontariense Peters.; on soil and humus and in mounds over rock and on ledges in mesic sitesE of the Syndicate Rd. Hulls Cove, Beech Mnt. Valley trail, E of Witch Hole Pond

Dicranella heteromalla (Hedw.) Schimp.; on rotten wood and disturbed soil E of Norway Dr.

Oncophorus wahlenbergii Brid.; on roots above wet place, Beech Mtn. Valley trail

Rhabdoweisia crispata (With.) Lindb.; on rock under overhang, seaside COA campus

Dicranodontium denudatum (Brid.) E.G. Britt. ex Williams; on rock under various canopies, S of Jones Marsh Bog, NE flank of Dorr Mtn.

Leucobryaceae

Leucobryum glaucum (Hedw.) Angstr. ex Fries; on duff in conifer

woods, E of the Syndicate Rd. Hulls Cove, E of Witch Hole Pond

L. albidum(Brid.) Lindb.; on duff under conifers; SE flank of McFarland's Hill, E of the Syndicate Rd. Hulls Cove, W shore of The Tarn

Pottiaceae

Weissia controversa Hedw.; on mineral soil of disturbed habitats, common

Tortula ruralis (Hedw.) Gaertn., Meyer, + Scherb.; on concrete of walls and burned out foundations; Mt. Desert+ Holland Av. Bar Harbor, Cleftstone + Rte 233

Didymodon rigidulus Hedw.; small crack in ledge above the ocean Great Head

D. asperifolius (Mitt.) Crumm, Steere + Anders.; W shore of The Tarn

Grimmiaceae

Grimmia apocarpa Hedw.; in mats on bare acidic rock, widespread but scattered

G. alpicola Hedw.; on concrete of burned out buildings, also on punky grout on buildings of the COA campus

Racomitrium aciculare (Hedw.) Brid.; epilith in streambeds, at or just below spring high water level; Breakneck Brook, Duck Brook, Bubble Brook, Sieur duMonts Spring

R. heterostichum (Hedw.) Brid.; on rock of xeric ledges, as well as more mesic sites

R. lanuginosum (Hedw.) Brid.; on mineral soil, E face of Cadillac Summit, just below the parkinglot

R. fasciculare (Hedw.) Brid.; in crack of exposed rock ledge just above the splash zone, S of the Gorham Mtn. parkinglot off the Park Loop Rd.

Funariaceae

Funaria hygrometrica Hedw.; on burned over soils, COA campus, SW flank of McFarland's Hill, E edge of Jones Marsh

Hedwigiaceae

Hedwigia ciliata (Hedw.) P.-Beauv.; on bare rock in the open

Bryaceae

Leptobryum pyriforme (Hedw.) Wils.; on shallow mineral soil of rock ledges, from xeric to mesic sites; common

Pohlia nutans (Hedw.) Lindb.; on bare rock, mineral and humic soils, and rotten wood; common

Bryum miniatum Lesq.; on exposed rock of drainage, E face of Cadillac Summit, just below the parkinglot

B. weigelii Spreng.; on mineral soil in shaded crevass of boulder field on the W shore of the Tarn

B. caespiticum Hedw.; on concrete rubble of burned out building, NW of the Cleftstone Rd. Rte 233 intersection

B. uliginosum (Brid.) BSG; on concrete of joints of stone wall seaside of The Turrets, COA campus

B. stenotrichum C.M.; on concrete rubble of burned out building, NW of the Cleftstone Rd. and Rte.233 intersection

B. turbinatum (Hedw.) Turn.; on concrete rubble of abandoned reservior New Eagle Lake and the Park Loop intersection, and on the steps of the shrine on the COA campus

Mniaceae

Mnium hornum Hedw.; on mineral soil and over rocks under canopy, commonly on the edges of streams; common

M. punctatum Hedw.; on humic and mineral soils at mesic sites, usually under canopy

M. cuspidatum Hedw.; on shaded soils and moist ledges

Aulacomniaceae

Aulacomnium palustre (Hedw.) Schwaegr.; on mineral soil in cracks of mesic ledges and on humus in small basin wetlands.common

A. androgynum (Hedw.) Schwaegr.; on mineral and humic soils

under various conifer/hardwood canopies; scattered but locally abundant; E of the Syndicate Rd., Hulls Cove, E of Norway Dr., SE of Kebo summit

Bartramiaceae

Bartramia pomiformis Hedw.; in cracks of ledges in seeps or other moist areas usually under heavy canopy, common

Plagiopus oederiana (Sw.) n. comb.; on mineral soil of exposed ledges

Orthotrichaceae

Ulota coarctata (P.-Beauv.) Hamm.; as an epiphyte at various heights (up to three meters) on *Populus, Betula* and *Alnus*, S flank of McFarland's Hill S of Hamilton Station, Salisbury Cove; W flank of Cadillac above Eagle Lake

U. crispa (Hedw.) Brid.; an epiphyte on *Acer, Quercus*, and *Fagus*, at various heights;common

U. hutchinsae (Sm.) Hamm.; as an epilith in fairly well-shaded areas; common

Orthotrichum stellatum Brid.; on *Fagus* on the COA campus

O. sordidum Sull. & Lesq. ex Aust.; as an epiphtye on an Acer platanoides on West St., Bar Harbor

O. anomalum Hedw.; on concrete rubble of landfills and of burned-out foundations; CLeftstone Rd and Rte 233, Eden + West Sts. Bar Harbor, COA campus Turrets grounds, Mt. Desert + Holland Ave

O. strangulatum P.- Beauv.; on concrete of ruins with various amounts of canopy; Cleftstone Rd and Rte 233, seaside of Turrets COA campus, West and Eden Sts. Bar Harbor, NW corner Rte 233 + New Eagle Lake Rd.

O. pumilum Sw.; on concrete joints of the Turrets, COA campus

Fontinalaceae

Fontinalis antipyretica Hedw.; in streambed on south flank of McFarlands Hills

F. flaccida Ren.& Card.; submerged in streams and lakes widespread

Neckeraceae

Neckera pennata Hedw.; epiphyte on deciduous trees; Beech Mnt. Valley trail, Lurvey Springs, Breakneck Rd S of Hulls Cove

N. complanata (Hedw.) Hub.; in crack of rocklede E of Norway Dr.

Fabroniaceae

Anacamptodon splachnoides (Froel. ex Brid.) Brid.; epiphyte on beech tree in front of Turrets, COA campus

Thuidiaceae

Thuidium delicatulum (Hedw.) BSG; in mats over humus and rocks under various canopies, common

T. recognitum (Hedw.) Lindb.; in lawn, E side Thompson's Island

Amblystegiaceae

Drepanocladus fluitans (Hedw.) Warnst.; on ledges and humus in wet places, E of Norway Dr., SW of Kebo Mtn. summit, N edge of Jones Marsh Bog

D. uncinatus (Hedw.) Warnst.; epiphyte on *Thuja*, in mats over humus and on the edges of ledges, S of Hamilton Station Salisbury Cove, NE of The Whitecap

Amblystegium riparium (Hedw.) BSG; in drainage of ledge, seaside of COA campus

A. tenax (Hedw.) C. Jens.; on stone of wellhead, Cleftstone Rd. and West St., Bar Harbor

A. serpens var. *juratzkanum* (Schimp.) Rau + Herv.; on humus between clumps of *Carex* stems, S of Hamilton Station Salisbury Cove

Cratoneuron filicinum (Hedw.) Spruce; at the edge of Lurvey Spring, S of Echo Lake

Sciaromium lescurii (Sull.) Broth.; on rocks in Duck Brook

Brachytheciaceae

Brachythecium erythrorrhizon BSG; on stone steps in the open, seaside of the Main Building, COA campus

B. digastrum (M. & Kindb.) ex Macoun & Kindb.; on concrete foundation, COA campus

B. campestre (C.M.) BSG; on rocks of bridge over Jordan Stream, N of Jordan Pond

B. curtum (Lindb.) Limpr.; an epiphyte on *Thuja*, S of Hamilton Station Salisbury Cove

B. velutinum (Hedw.) BSG; an epiphyte on hardwoods, Breakneck Rd. S of Hills Cove, W of Lurvey Spring Rd.

B. salebrosum (Web.+ Mohr) BSG; on stone steps, COA campus

Bryhnia novae-angliae (Sull.+ Lesq. ex Sull.) Grout; on rock in vertical fissure, E face of Champlain Mtn.

B. graminicolor (Brid.) Grout; in mats over edge of ledge, NE of The Whitecap

Entodontaceae

Entodon brevisetus (Hook. & Wils. ex Wils.) Lindb.; on soil in cracks of rock ledges, E of Norway Dr., N of the Hemlock Trail, SE of Kebo summit

Sematophyllaceae

Sematophyllum marylandicum (C.M.) E.G. Britt.; in mats over rock in the middle of an itermittent stream, E of The Whitecap

Plagiotheciaceae

Plagiothecium cavifolium (Brid.) Iwats.; on rotted wood and tree bases Sieur du Monts Spring

P. laetum BSG base of living *Prunus*, Sieur du Monts Spring

Hypnaceae

Hypnum lindbergii Mitt.; on rotten stump behind Sand Beach

H. imponens Hedw.; in mats over rotten stumps and rocks, common

H. cupressiforme Hedw.; on humus of ledges and as epiphyte on bases of trees; Otter Point, Thompson's Island, Little Hunter's Brook

H. pallescens (Hedw. P.- Beauv.; on rocks under deciduous canopy, N of the Hemlock Trail, Seaside of Main Building COA campus

H. fertile Sendtn.; in mats over rock and at base of *Picea*, SE flank of Kebo Mtn., S of Hamilton Station Salisbury Cove

H. curvifolium Hedw.; on humus in conifer woods,Wonderland; base of *Thuja*, S flank of McFarland's Hill

Herzogiella striatella (Brid.) Iwats.; on roots of rotten stump and cracks of ledges, E flank of Dorr Mtn., SW of Hamilton Station Salisbury Cove

H. turfacea (Lindb.) Iwats.; on humus in coniferous woods, S of Jones Marsh Bog, SW of Hamilton Station Salisbury Cove, W of Hio Hill fire Rd.

Callicladium haldanianum (Grev.) Crum; on humus, mineral soil, stumps, and over rock, N of Sand Beach, seaside COA campus, Sunken Heath area, S of Rte 233 by the golf course Bar Harbor

Pylaissiella selwynii (Kindb.) of Crum, Steere & Anders.; on bark of dead apple tree by the Gatehouse, COA campus

Homomallium adnatum (Hedw.) Broth.; on bark of *Populus* W of Lurvey Spring Rd

Isopterygium tenerum (Sw.) Mitt. on humus in drainage, E of the Adams Bridge, Bass Harbor

Platydictya jungermannioides (Brid.) Crum; on mineral soil and over rock, NE of The Whitecap, N of the Hemlock trail

Ptilium crista- castrensis (Hedw.) De Not.; in mats over rock under deciduous canopies, SE of Kebo Mtn., NE of The Whitecap

Taxiphyllum deplanatum (Bruch + Schimp. ex Sull.) Fl.; on humus in small drainage, E of Adams Bridge Bass Harbor

Hylocomiaceae

Rhytidiadelphus triquetris (Hedw.) Warnst.; on humus in deep shade of conifer forests;common

R. squarrosus (Hedw.) Warnst.; in lawns and other open,mesic sites;common

Pleurozium schreberi (Brid.) Mitt.; in dense mats over humus in

mesic, fairly shaded (usually coniferous) woods, common

Hylocomium splendens (Hedw.) BSG; in dense mats over humus in mesic, fairly shaded (usually coniferous) woods, common

Climaciaceae

Climacium americanum Brid.; on soil of lawns and shaded ledges and over fallen branches in wet places. Also found growing as a facultive epiphyte on the bases of trees in *Thuja* swamps

C. dendroides (Hedw.) Web.+ Mohr; on soil of lawns and rock ledges also present in *Thuja* swamps

Diphysciaceae

Diphysium foliosum (Hedw.) Mohr; on disturbed soils at the edges of trails under canopy and exposed. also in cracks of exposed ledges and over rock in intermitent streambeds

Tetraphidaceae

Tetraphis pellucida Hedw.; on rotten wood and fallen logs, in conifer and hardwood stands usually absent from the more xeric ridgetops

Polytrichaceae

Pogonatum alpinum (Hedw.) Rohl.; in cracks and on the edges of rock ledges from mesic to more exposed sites

P. urnigerum (Hedw.) P.- Beauv.; on soil of rock ledges apparently restricted to mesic sites

P. pensilvanicum (Hedw.) P.- Beauv.; on mineral soil of wet disturbed sites hillside slump areas and under the eaves of buildings

Atrichum crispum (James) Sull.; on humus and mineral soil in the open, common

A.undulatum (Hedw.) P.- Beauv.; on soil often mineral, in lawns and disturbed soils of blowdowns

Polytrichum commune Hedw.; on soil in *Thuja* swamps and on ledges, in coniferous woods and in exposed site widespread

P. piliferum Hedw.; on exposed rock ledges in mats on shallow mineral soil and on bare rock widespread from sealevel to summits

P. pallidisetum Funck; on disturbed soils of roadsides, blowdown

areas and talus slopes

P. formosum Hedw.; on soil of roadside, West St. Extension, Bar Harbor

P juniperinum typical

P. juniperinum var.*affine* (Funck) Brid.; in mounds on humus in wet places, common

P. ohioense Ren.+ Card.on soil of coniferous woods

ADDITIONS TO THE FLORA

A number of species new to Mt. Desert Island were collected in the period 1982-1985. The calcium-loving members of the Orthotrichaceae, Bryaceae, Pottiaceae, and Grimmiaceae are the most significant of the additions. They are found growing on manmade substrates of concrete scattered over the island. People started using concrete as a building material around 1915 (Joanne Carpenter, pers. com.), so it's not surprising that these mosses did not show up in earlier collections. The burning of the buildings in the 1947 fire opened up these substrates to colonization by these mosses, and their subsequent colonization involves some interesting biogeographical questions. Where was the "seed source" for these plants? (The nearest outcrop of natural limestone exists outside of Rockland. These species have not been recorded from that area.) Were the plants dispersed onto Mt. Desert Island as spores or asexual propagules? This element of the flora deserves more attention.

Other additions such as Aulacomnium androgynum were probably overlooked by collectors due to their small size.

THE REPRODUCTIVE BIOLOGY And ECOLOGY Of BRYOPHYTES

The division Bryophyta of the plant kingdom is a very diverse group. It is composed of the plants commonly referred to as mosses, liverworts and hornworts. They are also known by the old name "cryptogam" which means "hidden flower". Although bryophytes don't have flowers in the literal sense, the name is appropriate. Because of their small size and assumed unimportance, the bryophytes are a little studied group; even now, they are incompletely understood. What we do know of these diminutive plants shows that they are as diverse in their forms and as complex in their ecological and genetic relationships as the "higher plants".

The Reproductive Cycle of Bryophytes

The bryophytes have, as a common character, a reproductive cycle in which the haploid (gametophyte) phase is the dominant one. Unlike flowering plants, the free-living, persistent part of the bryophyte has a single set of chromosomes. This gametophyte is seen as a leafy or thalloid photosynthetic body. The gamete- producing organs are borne among the leaves or on the surface of the thallus (hence the name gametophyte). Flagellated sperm cells are produced through mitosis in club-shaped antheridia and swim through a surface film of water -- or are carried by rain splash-- to the archegonia where fertilization takes place. The diploid zygote then grows into a stalked sporophyte, with the foot of the stalk embedded in, and deriving nutrients from, gametophyte tissue. Cells within the capsule of the sporophyte undergo meiosis and spores are produced which, after dispersal and germination, produce a filamentous protonema. After continued growth, and in response to unknown hormonal and environmental signals, buds develop from the protonema which expand into another gametophyte and the cycle is repeated.

Two aspects of this reproductive cycle deserve further comment. With the haploid phase of the life cycle dominant, it is commonly thought that the genetic structure of the plants represents a built-in conservatism. Without the diploid constitution, without the mechanism of dominant and recessive alleles to mask the effects of deliterious mutations, natural selection acts swiftly to remove such genetic variation from populations. With little genetic resources to call on, the plants are unable to cope with a widely fluctuating environemnt. This genetic dterminism is used to support the view that the bryophytes are a slowly changing, evolutionarily unsuccessful group.

The fact that in the bryophytes, the haploid genome through mediating metabolic processes, is in direct contact with the external environemnt has influenced the patterns of diversification of the group. The reliance of bryophytes on physiological flexibility instead of morphological changes to

deal with changing conditions may have its roots in this aspect of the reproductive cycle. But it is also true that the Musci have been able to escape the restrictions of the haploid genome through polyploidy. Stebbin's statement that the bryophytes are evolutionarily unsuccessful group of plants is a generalization not supported by facts as was pointed out by Khanna (1964).

Interpretation of patterns of evolutionary change is further complicated by the composite nature of the bryophytes. The sporophytes of most bryophytes are photosynthetic during at least part of the life cycle, and are partially independent of the gametophytes for their nutrition. The functions those organs fulfill are radically different. The sporophyte is an organ for the production and dispersal of spores. On the other hand, the major function of the gametophyte is to maintain photosynthetic efficiency in direct contact with a fluctuating environment. Because of these differences, natural selection can operate in different directions and at different rates on the different organs of the same plant.

The arrangement of archegonia and antheridia on the gametophyte varies. Some bryophytes are monoicous, that is, they have both types of "sex organs" on the same gametophyte. Others are dioicous; they bear the antheridia and archegonia on separate plants. The possibility that monoicous bryophytes are self-incompatible in some way, or that the archegonia and antheridia mature at different times and so reduce the chances of self-fertilization, has not been investigated to date. The importance of such information to an understanding of the reproductive biology and population dynamics of the plants is immense and hopefully, in the future, such investigations will be conducted.

As well as reproducing sexually, most bryophytes readily propagate themselves by asexual means. Any part of the plant can grow into another genetically identical individual. Fragments of gametophytic tissue are usually more successful at regeneration than a sporophyte-derived fragment. Species vary in their propensity toward reproduction by fragmentation, and the conditions under which fragments are more likely to survive varies as well. Also, mosses such as Leucobryum have deciduous stem apices, which fall off at the slightest provocation and grow into other gametophytes. Other specialized structures for assexual reproduction include the multicellular propagules in the leave axils of members of the genus Hypnum, and gemmae cups, which are common in the moss Tetraphis and the liverwort Marchantia. The multicellular propagules are long, thin strands much like rhizoids that are prone to breaking off. Gemmae cups are cups of tissue in which lens-shaped masses of cells called gemmae are produced. The cups serve to focus the effect of rain splash, much like the birds nest fungi. and the gemmae are knocked out of the cup by the falling water and carried away by wind or water.

Gene Flow Distances and the Size of Neighborhoods

The distance over which gametes are exchanged in bryophyte mats has only been investigated in two dioicous taxa, the moss genera Atrichum (Wyatt, 1977) and Weissia (Anderson and Lemmon,1974). In these studies, isolated clumps of sporophyte bearing mosses were examined and the distance between the sporophyte bearing plants and the nearest antheridial plants were measured. In this way, the distance sperm cells traveled was estimated to be between 2 and 11 cm. This method probably underestimates the distance over which sperm cells are dispersed, because fertilization doesn't necessarily occur between nearest neighbors.

These estimates fit in nicely with the traditionally held view that bryophytes are inbred, evolutionary dead-ends. Without sufficient gene/gamete exchange between a widely dispersed and widely varied populations, it is felt by many that the bryophytes are unable to maintain the genetic diversity that would enable them to adapt to changing circumstances. This inference about evolutionary processes seems at first glance to be accurate. For the most part, bryophytes seem to inhabit stable niches- the forest floor and the trunks of trees, for example. Fossil bryophytes 100 million years old can sometimes be attributed to families or genera still in existence. The morphology of the plants has changed little in that vast amount of time. This interpretation must be taken with a critical eye, though. Without understanding the extent and genetic composition of clones in bryophyte mats, meaningful interpretation of Wyatt's and Andersen and Lemmon's work is impossible to make.

This focus on the exchange of gametes as a definition of gene flow between populations seems to be misplaced. In the bryophytes, the movement of gametes represents only half of the dispersion that occurs each generation. The small spores of the bryophytes can be carried by wind over very large distances, and with the successful establishment of the protonema, can facilitate the exchange of gametes between genotypes that are widely separated in space. The parallel between the bryophytes and the pteridophytes (the ferns) is instructive. Both pteridophytes and bryophytes produce large numbers of small spores that are dispersed by the wind. Tryon (1970,1972), investigating the frequency of endemism and cosmopolitanism in the fern floras of oceanic islands, found evidence that fern spores are frequently dispersed over 500 miles. In comparing the frequency of occurrence of different fern taxa on neighboring islands between 100 and 500 miles of each other, Tryon found that a large portion of the fern floras of the islands were the same, whereas the vascular flora had many species of restricted range. Although his interpretation of the distributional data is based on the questionable assumption that evolutionary rates of ferns and flowering plants are similar -- hence the difference in the amounts of divergence in the fern and vascular plant floras of island and mainland areas are due to differences in amounts of

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gene flow between populations -- Tryon's work points out a series of factors which need to be considered in developing theories about the evolution of the bryophytes.

The importance of spore dispersal to the maintenence of breeding populations in bryophytes is overlooked because of a number of uncertainties. For the majority of taxa, we do not know how long moss spores maintain their viability in the atmosphere. The ferns which have been investigated show a good deal of variation in this respect (Lloyd and Klekowski,1970). "...certain generalizations can be made. Green spores germinate in two days or less after sowing. This period is followed by early growth of the gametophyte. These spores have short periods of viability, averaging about 48 days. Non-green spores, on the other hand, have slower germination rates (4-210 days) followed by a somewhat delayed gametophyte proliferation. Such spores also have much longer periods of viability, averaging about 2.8 years." The frequency of chlorophyllous and non-chlorophyllous spores in bryophytes has not been tabulated, but it seems reasonable to assume that the advantages of reduced metabolic activity and increased spore viability under adverse conditions would hold true for them as well. As an interesting parallel to these findings, Morgensen (1983) describes two main lines of specialization in the spores' of bryophytes: 1) the reduction of chloroplast size and levels of physiologic activity, and 2) the increase of spore wall thickness. Both of these trends would increase the spores tolerance of adverse conditions.

Van Zanten (1976, 1978) conducted experiments designed to estimate the ability of moss spores to survive the conditions encountered during long-distance dispersal in the upper atmosphere. Species endemic to New Zealand were compared with those that inhabit New Zealand and Australia, as well as those that occur on the major land masses of the southern hemisphere, and those that are disjunct between New Zealand and the northern hemisphere. It was found that the species with the largest distributions had higher germination percentages than those with more restricted ranges after the treatments. This was taken as circumstantial evidence in support of the hypothesis that long-distance dispersal is important in the generation and maintainence of the present patterns of distribution.

Schuster (1979), in his discussion of the distribution and dispersal of the Hepaticae, criticizes this interpretation. He raises the question: "If dispersal of spores and exchange of gametes occur between widely separated populations, why are large numbers of species restricted to the islands of New Zealand?" One obvious objection to this criticism is that the Musci and the Hepaticae may differ significantly in the ability of their spores to survive long-distance dispersal. Another objection is that the processes of speciation in the Bryophyta is more complicated than this discussion of spore viability and dispersability implies.

Another uncertainty about gene flow in bryophyte populations is the frequency with which new individuals are established through the germination of spores. We have never observed the germination of spores and the establishment of a protonema in the wild. With this lack of concrete observation, many assume such things happen infrequently. It seems more reasonable that the lack of direct observation is the result of the small size of the spores and the delicacy of the protonema involved.

The Genetic Basis and Ecological Consequences of Breeding Systems

The genetic basis of the dioicous condition exhibited by many bryophytes has been defined for some time (Vitt 1968). A homologous pair of chromosomes (called H and h by Tatuno [1948]) determines whether or not individuals are antheridial or archegonial. During meiosis in the sporophyte, these sex chromosomes are segregated into different spores, and the haploid gametophytes that arises from those spores bear either antheridia or archegonia. When fertilization of the egg takes place, the two chromosomes are brought together in the diploid, non-sexual sporophyte.

It has been proposed by many (Lowry,1948; Yano,1947; Anderson,1964) that monoicous taxa arose from dioicous ones through aneuploidy, polyploidy, or autopolyploidy. The findings of Heitz (quoted in Schuster,1966) illustrate a suggestive correlation:

chromosome number	species studied	percent	
		monoicous	dioicous
n= 9	33	27	73
n= 18	14	100 (93?)	0 (7?)

In recent years, this suggestion has been followed by comparative cytological and biosystematic studies of many bryophyte groups (see references in Ramsay,1983). What has been found is that aneuploid and polyploid chromosome numbers are correlated, in many instances, with derived character states such as immersed capsules, reduced peristomes, as well as the monoicous sexual condition.

There are significant ecological consequences of the dioicous condition, which are similar to the consequences of dioecy for vascular plants. The consequences arise out of the need to have two individuals of different genetic makeup in order to reproduce sexually. If an antheridial _Polytrichum_ plant is dispersed as a spore into an area without an archegonial plant in close proximity, then that plant is going to be limited to asexual reproduction. No further chromosomal recombination will occur and the plant will become an evolutionary dead-end. Also if one sex is eliminated from a population by environmental

fluctuations, a similar " regression of sexuality" will occur. Schuster (1983) , in a massive review of information about the biogeography of liverworts, has shown that such regressions have occurred on a massive scale and in a geographically specific manner.

For instance, the genus Plagiochila (Hepaticae) has roughly the same number of species in N. America and New Zealand (24, 26). In New Zealand, all but two of them are known from bisexual populations and produce gametangia and sporophytes. In contrast, the only N. American species that produces sporangia is P. asplenioides. The other species of this continent are known only from archegonial specimens. Genera of six other families show simalar distribution patterns. A slightly different pattern is demonstrated by the hepatic Anastrophyllum. Anastrophyllum saxicola is represented in N. America by a single stand of archegonial plants in Illinois, although it is common in the neotropics. No antheridial plants have been seen on this continent and no sporophytes have been produced. Schuster contends that climatic fluctuations, concentrating their effect in cold or arid areas, have reduced these, and other taxa, to populations of a single sex. The differential affect of climate in the two hemispheres is explained by geographical factors. The larger land masses in the northern hemisphere, leading to more continental type climates, intensified the effects of glacial freeze/drought cycles. Because of this, populations in the north were more severely decimated than those of the more oceanic southern hemisphere. It is interesting that most of the single-sex populations cited by Schuster are archegonial. No explanation for this observation has been put forward.

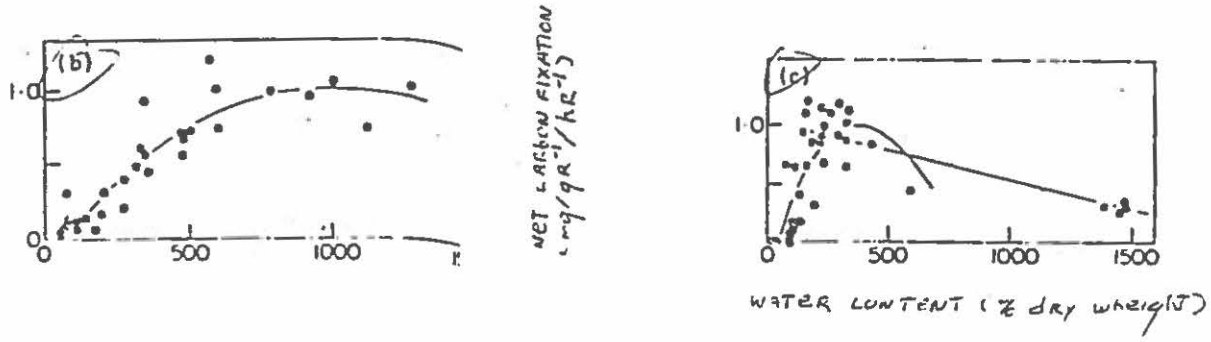
Such regressions of sexuality in bryophytes have interesting biogeographical consequeces. Given their propensity for asexual reproduction, unisexual stands of dioicous bryophytes can persist for a long time after the events which led to their depauperization. For instance, the Anastrophyllum stand mentioned in the preceeding paragraph is considered by Schuster to be a single genetic individual which was dispersed onto that cliffside by a spore. By making estimates of annual growth rates, the age of that stand was determined to be between 2 and 4 thousand years. To date, it is a healthy growth that is maintaining itself by cloning. The ability of such a clone to propagate itself through long-distance dispersal of specialized and unspecialized assexual propagules is a matter of conjecture, although Schuster believes this to be a natural assumption to make. Such populations are like living time capsules, preserving the affects of events long past. This, plus the slow rates of morphological change exhibited in many bryophytes, make this group important to the understanding of phytogeography in general, as Fulford (1951) recognized nearly thiry-five years ago.

The Physiological Ecology of Bryophytes

The persistence of bryophytes under less than ideal conditions is made possible by what Tryon (1972) calls "the general purpose genotype". By this he means a genome that enables a plant to respond productively to a wide range of environmental conditions. Bryophytes as well as pteridophytes have general purpose genotypes. Casual observation of such taxa as Eurhynchium which lives in a riparian habitat, or the granite mosses Grimmia and Andreaea show that these mosses , and many others, thrive in areas that vary widely in temperature and water availability. Eurhynchium grows on rocks that are submerged during spring runoff,and baked in the sun with occassional misting during the summer. Grimmia and Andreaea, as the common name implies, grow on exposed rock surfaces where the moisture content of the plants can go from non-existent to full saturation and then back to a totally air dry condition in a matter of days.

When rates of CO_2 uptake (analogous to photosynthetic rates) and CO_2 release (analogous to rates of respiration) are measured, interesting results are obtained. Dilks and Proctor (1979), in a review of their own and others work, found a generalized pattern of photosynthetic and respiratory response to changes in water potential in bryophytes that parallels the response found in lichens (Larsen 1979). At low water contents, photsynthesis is retarded due to the inhibition of photolysis and respiration rates are elevated (photolosis being the initial step in the light reaction of photosynthesis involving the breakdown of water into hydrogen and oxygen and the incorporation of the hydrogen in molecules of complex hydrocarbons). In this state, a plant is living off stored food. The net carbon fixation rate (photosynthesis minus respiration) is negative. As water content increases, photosynthesis rates increase and respiration rates decrease. At this point, net carbon fixation is positive and the plant is storing food. As the water content is increased further, photosynthesis rates go down again, due to the slowing of CO absorption through water.

The optimum water level for net carbon fixation varies among genera, species, and populations and is closely correlated with the ecology of the groups involved. The response of Hookeria lucens and Tortula intermedia are given below.



Hookeria lucens
shaded stream gully

Tortula intermedia
exposed limestone rock

from Dilks and Proctor, 1979

As can be seen from the graphs, the mesophyte Hookeria has a much less sudden photsynthetic response to increases in water content than the more xerophytic Tortula; and that Hookeria continues fixing carbon at high rates at water contents under which Tortula has shown a dramatic decrease in rates of photosynthesis and net carbon fixation. Hookeria's ability to fix carbon at high water contents is advantageous in the riparian habitat which it occuppies. On the other hand, Tortula's quick rise in photosynthesis rates and almost as quick decline in

respiration rates is advantageous for a xerophyte which must take advantage of what water there is when it is available.

There is some question as to whether or not percent water content is a biologically significant measure. Slavik (1965) argued that osmotic pressure is physiologically more significant than the amount of water held in a mat by capillary action. Studies using both methods have been done (Peterson and Mayo,1979) with comparable results. Despite the logic of Slavik's arguments, most studies that have been done use percent water content as a measure of water availability within the cell due to the difficulties involved in measuring osmotic pressure.

The importance of metabolic processes to the adaptation of bryophytes to specific habitats indicates that those processes have been important in the evolution of the group. In analyzing the fossil record of bryophytes, physiological data is unavailable. Consequently, the idea that bryophytes are a group of living fossils that have remained unchanged over hundreds of millions of years may be ill-advised. Although there are many morphological characters invovled with the utilization of xerophytic habitats by bryophytes, such as papillose cell walls which encourage the cappillary transport of water,and reduced length of seta, the major adaptation is the ability to survive extended periods of anabiosis. Being based on biochemical processes, the development of the anabiotic state is difficult to trace.

Another example of a living fossil which surprised people is Limulus, the horseshoe crab. Morphologically identical to animals living 250 million years ago,extant horseshoe crabs were thought to be a genetically homozygous species. When the enzyme systems of Limulus were analysed by electrophoresis, an amazing amount of genetic polymorphism was found (Selander, Yang, Lewontin, and Johnson, 1969). A similar study was made of the dioicous moss Atrichum angustatum (Cummins and Wyatt,1981) which, in the words of the authors "... indicated significant levels of genetic variability both within and among populations."

In an ecophysiological investigation of populations of Polytrichum commune from the North Slope of Alaska, northern Ontario, the Montreal area, and Gainesville, Florida, Sveinbjornsson and Oechel (1983) found evidence for metabolic differentiation of ecotypes. Photosynthesis and respiration rates were measured at constant water content over a wide range of temperatures. The Alaskan and Canadian populations were found to photosynthesize most efficiently at lower temperatures than the Florida samples. Since the pattern was consistent in 100 replications and over a wide range of water contents, it is believed by the authors to represent genetically based differences, not just environmentally defined phenotypic variation. Further investigation of metabolic differentiation of ecotypes in bryophytes is warranted.

As can be seen from the preceeding discussion, much is left to discover about the relationship between breeding systems and the ecology of the plants. Overgeneralization from an insufficient data-base is the rule at this point. The field is wide open.

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The keys in this book present two identically numbered statements. The statement that most accurately fits the moss being identified should always be selected. The leaders to the right of each statement indicate either a name, which is that of the moss, or another number. If it is a number, proceed to that number and again make a choice, always selecting the statement that better describes the specimen being identified. When a name is reached, indicating the identity of the moss, the illustrations, description, and other information regarding that particular moss should be carefully checked to make certain everything matches the specimen. If the identification seems incorrect, return to the point in the key where the name occurs in order to find the error. By proceeding in the key or retracing each step backward the correct name of the moss should be found. When there is indecision as to which statement best fits the specimen, both leads probably should be followed in order to find the one that provides the correct name of the moss. When it is not clearly understood what is meant by a statement in the key, time may be saved by simply finding an illustration showing the character in the glossary or by comparing the unknown moss with the species illustrations in question. For example, after reading the first pair of statements in the Key to Genera, it may save time to turn to the illustrations of *Sphagnum* to get a quick idea of the general appearance of members of that genus.

Since it is easy for the beginner to confuse the Hepaticae (commonly called liverworts) with their close allies, the mosses, the major differences follow:

Subdivision Hepaticae (Liverworts)
[Not Treated Here]

Plant thalloid or leafy, with 2–3 ranks of leaves (one row on each side of the stem and the third, if present, on the underside of the stem, midway between the lateral leaves); leaves usually round, lobed or deeply incised; costa lacking.

Subdivision Musci (Mosses)

Plant leafy (leaves not evident in *Buxbaumia*) but leaves usually in more than 2 ranks (two-ranked in *Fissidens, Distichium*, and pinnate plants of *Schistostega*); leaves rarely round, or, if so, never lobed or dissected; costa often present, single or double.

Key to Genera

1. Plants usually with 2 to several branches in fascicles, branches crowded at the stem apex forming a head-like tuft, sometimes tinged with brilliant reddish pigments; leaf cells a network of chlorophyllose cells and large hyaline cells with microscopic pores and spiral bands; plants in bogs, fens, swamps, wet depressions in woods, at pond and lake margins, or other hydric habitats ..... *Sphagnum* (p. 41)
1. Plants without branches in fascicles and leaf cells not a network of chlorophyllose and hyaline cells 2
   2. Leaves distichous, appearing to be inserted edgewise giving the plants a flattened appearance, split in the lower half with the two halves clasping the stem . *Fissidens* (p. 100)
   2. Leaves not distichous or if so, not split in the lower half 3
3. Plants apparently lacking leaves, consisting mostly of a large, conspicuous capsule, 5–7 mm long, elevated on a long, warty seta ..... *Buxbaumia* (p. 655)
3. Plants usually with conspicuous leaves 4
   4. Plants with a large, ovoid capsule and lacking a seta; capsule surrounded by bristle-tipped leaves ..... *Diphyscium* (p. 657)
   4. Plants usually with a small capsule and with a conspicuous seta or if lacking seta, capsule not ovoid nor surrounded by bristle-tipped leaves 5

5. Plants erect, small, stems less than 2 cm high, brown, reddish brown to black, rupestral; capsule eperistomate, opening most of its length by 4 longitudinal slits ..... *Andreaea* (p. 9
5. Plants otherwise; capsule peristomate or eperistomate, usually opening at the tip by an operculum, rarely by rupture of capsule wall .....
    6. Plants whitish green, usually 3–6 cm high, in large, rounded cushions on the ground; leaves dense, imbricate, mostly tubulose, multistratose, many cells, especially near apex, with a large central pore (seen in cross-section) ..... *Leucobryum* (p. 19(
    6. Plants otherwise; leaf cells always lacking central pore .....
7. Plants with sterile, frondiform shoots, the leaves distichous, with confluent leaf bases, ecostate ..... *Schistostega* (p. 112
7. Plants lacking sterile, frondiform shoots with confluent leaf bases .....
    8. Main stem of plant erect or nearly so, simple or with only a few branches; costa usually prominent, single; sporophyte arising from stem apex or a branch below 9
    8. Main stem prostrate, sometimes with erect tips, usually much branched, often pinnate, rarely simple or if so, the stems long and intertwined; costa often indistinct, single, double, or frequently lacking; sporophyte arising from main stem somewhere below tip 109

ACROCARPOUS MOSSES

9. Gemmae cups (formed by apical leaves) present at tips of sterile shoots; peristome teeth 4; plants mainly on rotten wood; common ..... *Tetraphis* (p. 659)
9. Gemmae cups lacking; peristome teeth 4, or multiples of 4, sometimes lacking; plants on various substrates 10
    10. Peristome teeth 4; clusters of ecostate, linear-clavate vegetative leaves arising around fertile plants; plants on rock; rare ..... *Tetradontium* (p. 663)
    10. Peristome teeth 8 or more, sometimes lacking; plants on various substrates 11
11. Leaves with lamellae or branched filaments on upper surface 12
11. Leaves lacking lamellae or branched filaments 15

Leaves with Lamellae or Filaments on Upper Surface

12. Leaves entire at apex, upper surface with branched filaments ..... *Aloina* (p. 229)
12. Leaves toothed at apex, upper surface with lamellae 13
13. Lamellae few, less than 10; leaves undulate, crisped or contorted when dry, costa narrow; calyptrae hispid at the apex ..... *Atrichum* (p. 665)
13. Lamellae numerous, more than 10; leaves rigid, not undulate, scarcely contorted when dry, costa broad; calyptrae densely hairy 14
    14. Lamellae with marginal cells smooth or minutely papillose (best seen in cross-section); capsules angled ..... *Polytrichum* (p. 682)
    14. Lamellae with marginal cells papillose; capsules terete ..... *Pogonatum* (p. 675)

Leaves Lacking Lamellae and Filaments on Upper Surface

15. Leaves narrow, often subulate, 15–30 or more times as long as leaf width near middle; costa covering most of leaf near middle 16
15. Leaves broad, lanceolate, ovate, obovate or oblong, mostly less than 15 times as long as broad; costa covering only a small portion of leaf near middle 35

16. Leaves distichous, thereby giving gametophyte a noticebly flattened appearance ..... *Distichium* (p. 131)
16. Leaves in more than 2 rows, gametophyte not noticeably flattened 17
17. Capsules immersed, leaves extending far above its mouth ..... *Pleuridium* (p. 114)
17. Capsules exserted, extending above the leaves 18
18. Plants very small, gametophyte seldom reaching 4 mm high 19
18. Plants larger, gametophyte mostly 4 mm high or more 21
19. Leaves squarrose from an enlarged base; plants on soil ..... *Trichodon* (p. 125)
19. Leaves not squarrose, without enlarged base; plants on sandstone or limestone 20
20. Leaves strongly curled when dry, margins often bistratose above leaf middle; peristome teeth bifid, papillose ..... *Campylostelium* (p. 383)
20. Leaves straight or nearly so, margins unistratose; peristome teeth entire, smooth ..... *Seligeria* (p. 135)
21. Leaf cells papillose 22
21. Leaf cells smooth 27
22. Leaf cells with several papillae per cell 23
22. Leaf cells with 1 papilla per cell, sometimes present at the end of the cell 24
23. Leaves with plane, entire margins and a V-shaped region of hyaline, elongate, mostly smooth cells at base; leaf cells with nearly round, irregularly arranged papillae ..... *Tortella* (p. 213)
23. Leaves with recurved, serrate margins and lacking V-shaped region of differentiated basal cells; leaf cells with elongate papillae in rows often appearing as striations ... *Plagiopus* (p. 370)
24. Alar cells noticeably differentiated, often inflated and coloured ..... *Dicranum* (p. 171)
24. Alar cells not noticeably differentiated 25
25. Leaf margin plane ..... *Kiaeria* (p. 167)
25. Leaf margins recurved 26
26. Leaves long, often 4–5 mm, strongly serrate, often doubly serrate on margins; capsules globose when wet ..... *Bartramia* (p. 372)
26. Leaves short, seldom reaching 4 mm, weakly serrate to serrulate with single teeth; capsules cylindric when wet ..... *Cynodontium* (p. 158)
27. Alar cells noticeably differentiated, often inflated and coloured 28
27. Alar cells not noticeably differentiated 30
28. Leaves entire to minutely denticulate; capsules short, nearly as broad as long ..... *Blindia* (p. 139)
28. Leaves serrate to serrulate; capsules long, much longer than broad 29
29. Costae broad, occupying about $^2/_3$ of leaf at the base and nearly all of the leaf near the middle, striate on dorsal surface ..... *Paraleucobryum* (p. 194)
29. Costae narrow, occupying about $^1/_3$ of leaf at the base and usually less above, smooth or with 2–4 ridges on dorsal surface ..... *Dicranum* (p. 171)
30. Capsules distinctly narrowed at the neck, the neck nearly as long as the remainder of the urn (especially noticeable when dry) 31
30. Capsules not narrowed at neck 32
31. Capsules cylindric, erect to somewhat inclined ..... *Trematodon* (p. 142)
31. Capsules pyriform, horizontal to pendulous ..... *Leptobryum* (p. 306)
32. Leaves squarrose, with an enlarged base clasping the stem; capsules strumose; plants usually on wood ..... *Oncophorus* (p. 165)
32. Leaves not squarrose or if squarrose, without enlarged clasping base; capsules with or without struma; plants usually on soil or rock 33

33. Leaf margins strongly and broadly recurved, bistratose; apical leaf cells as long or nearly as long as broad; capsules erect, deeply furrowed when dry ..... *Cynodontium* (p. 158)
33. Leaf margins plane, incurved, sometimes narrowly and indistinctly recurved, unistratose or bistratose; apical leaf cells longer than broad; capsules erect to inclined, smooth or with shallow furrows 34
    34. Peristome teeth filiform, the teeth divided to the base and about the same size throughout, papillose ..... *Ditrichum* (p. 117)
    34. Peristome teeth lanceolate, the teeth divided only halfway to base which is broader, vertically pitted-striolate below ..... *Dicranella* (p. 144)

Leaves Broad (Less than 15:1)

35. Leaf cells papillose, mammillose or with cuticular ridges 36
35. Leaf cells smooth 66

Leaf Cells Papillose, Mammillose or with Cuticular Ridges

    36. Leaf cells with cuticular ridges or 1 papilla or mammilla per cell 37
    36. Leaf cells with several papillae per cell 47
37. Alar cells strongly differentiated, inflated and often coloured 38
37. Alar cells not noticeably differentiated 39
    38. Leaf cells papillose or mammillose; plants dioicous ..... *Dicranum* (p. 171)
    38. Leaf cells with cuticular ridges; plants autoicous ..... *Dicranoweisia* (p. 163)
39. Leaf margins entire 40
39. Leaf margins serrate 43
    40. Leaves with plane margins, apex broad and obtuse ... *Orthotrichum obtusifolium* (p. 392)
    40. Leaves with recurved margins, apex narrow and acute 41
41. Basal leaf cells thick-walled, strongly pitted; leaf margins unistratose; gemmae, when present, cylindric, in conspicuous rounded masses at leaf tips ..... *Ulota* (p. 401)
41. Basal leaf cells thin-walled, lacking pits or pits indistinct; leaf margins sometimes bistratose; gemmae, when present, globose, often concealed on stems and leaves 42
    42. Costae covered by short cells on upper surface; axillary gemmae often present, globose, multicellular bodies ..... *Didymodon* (p. 220)
    42. Costae covered by elongate cells on upper surface; gemmae lacking ..... *Barbula fallax* (p. 223)
43. Apical leaf cells elongate, papillae small and near the end of the cells; capsules nearly as broad as long, narrowed at mouth ..... *Philonotis* (p. 374)
43. Apical leaf cells short, about as broad as long, papillae large and approximately in the center of the cells; capsules longer than broad, scarcely, if at all, narrowed at mouth 44
    44. Leaf margins bistratose 45
    44. Leaf margins unistratose 46
45. Leaves often hyaline-tipped near stem and branch apices; gemmae rarely present in globose clusters at tips of deformed leaves; capsules immersed ..... *Grimmia* (p. 244)
45. Leaves lacking hyaline tips; gemmae lacking; capsules exserted ..... *Cynodontium* (p. 158)
    46. Sterile stems often present bearing clusters of gemmae or brood bodies at the tip of a naked or nearly naked pseudopodium; capsules ribbed when dry; peristome double ..... *Aulacomnium* (p. 358)
    46. Sterile stems without pseudopodia bearing gemmae; capsules smooth when dry; peristome single ..... *Dichodontium* (p. 161)
47. Leaf margins involute almost to apex 48
47. Leaf margins plane or recurved 50

48. Leaves ending in a long, hyaline hair-point; globose gemmae on the upper leaf surface; lacking sporophytes; plants on tree trunks ..... *Tortula* (p. 239)
48. Leaves lacking long hair-point and gemmae; sporophytes often present; plants on soil or soil over rock 49
49. Capsules immersed ..... *Astomum* (p. 206)
49. Capsules exserted on a long seta ..... *Weissia* (p. 208)
50. Leaf cells with thick, strongly sinuose walls ..... *Rhacomitrium* (p. 257)
50. Leaf cells sometimes thick-walled but the walls not sinuose 51
51. Apical leaf cells elongate; capsules nearly as broad as long ..... *Philonotis* (p. 374)
51. Apical leaf cells short, about as broad as long; capsules longer than broad 52
52. Plants on trees, often several feet above ground, sometimes on rock, but not on soil; plants in small cushions or tufts, often rounded in outline 53
52. Plants on soil or rock, sometimes in rock crevices, occasionally on bases of trees; plants often in extensive tufts 55
53. Leaves with plane margins, basal cells nearly as long as broad; 3–7 celled clavate gemmae common in leaf axils; sporophytes rarely produced and neither sex organs nor sporophytes known from the Maritimes; plants on trees ..... *Zygodon* (p. 385)
53. Leaves with recurved margins, basal cells much longer than broad; gemmae usually lacking; sporophytes frequently produced; plants on trees or rocks 54
54. Leaves with two types of cells at base, thick-walled, linear cells near costa and short cells with thick cross-walls along the margins; capsules with superficial stomata ..... *Ulota* (p. 401)
54. Leaves with only one type of cell at base and lacking differentiated cells along margins; capsules with superficial or immersed stomata ..... *Orthotrichum* (p. 392)
55. Leaves with a V-shaped region of hyaline, elongate, mostly smooth cells at base ..... *Tortella* (p. 213)
55. Leaves lacking V-shaped region of differentiated cells 56
56. Stems frequently with 1–several long branches; plants often in tight, compact tufts 57
56. Stems simple or sometimes with 1, rarely 2, short or long branches; plants scattered or in loose tufts 59
57. Leaves with a few distinct teeth near apex, margins strongly recurved; plants noticeably reddish below; peristome present, teeth very short ..... *Bryoerythrophyllum* (p. 218)
57. Leaves entire or minutely serrulate at apex, margins plane or weakly recurved; plants not reddish below; peristome lacking 58
58. Papillae elliptic or oval on basal leaf cells, numerous, usually 4–8 per cell; capsules immersed to somewhat exserted ..... *Amphidium* (p. 389)
58. Papillae round on basal leaf cells, few, 2–4 per cell, sometimes lacking; capsules exserted on a long seta ..... *Gymnostomum* (p. 202)
59. Plants with filiform gemmae on stems ..... *Encalypta procera* (p. 199)
59. Plants lacking gemmae 60
60. Plants small, stems 2–4 mm high; capsules immersed ..... *Phascum* (p. 227)
60. Plants with stems usually larger than 4 mm; capsules exserted 61
61. Leaves narrow, often over 5 times as long as wide, gradually narrowed to an acute apex, margins plane; plants not known to produce sporophytes in the Maritimes ... *Oxystegus* (p. 211)
61. Leaves broad, seldom 5 times as long as wide, often abruptly narrowed to a mucro or hair-point, margins recurved; sporophytes frequently present 62
62. Leaves with a toothed hair-point or a very long mucro; peristome teeth long and twisted ..... *Tortula* (p. 239)
62. Leaves with a short mucro or a blunt apex; peristome lacking or present, teeth short or long and twisted 63
63. Capsules lacking peristome ..... *Pottia* (p. 231)
63. Capsules with peristome 64

Calyptrae infrate, covering all or most of capsule, fringed at base; capsules erect, up to 3 mm long ..... *Encalypta* (p.

64. Calyptrae cucullate, covering only a portion of capsule, without fringed base; capsules erect to inclined, up to 2 mm long .....

65. Leaves with recurved margins nearly to apex, sometimes margins bordered with elongate, thick-walled cells, basal cells elongate and thin-walled; capsules erect or inclined, with short peristome teeth, rarely lacking teeth ..... *Desmatodon* (p.

65. Leaves with plane margins in upper half, margins not bordered, basal cells short and thick-walled; capsules erect, with long, twisted teeth ..... *Barbula* (p.

Leaf Cells Smooth

66. Leaves strongly squarrose-recurved, nearly as broad as long ..... *Paludella* (p. 3

66. Leaves not squarrose-recurved or, if so, much longer than broad .....

67. Plants minute, scarcely reaching 2 mm high; capsules immersed; plants on bare soil ..... *Ephemerum* (p. 2

67. Plants larger, usually over 2 mm high; capsules exserted or sometimes immersed; plants on various substrates .....

68. Leaf cells thick-walled and strongly sinuose-nodulose ..... *Rhacomitrium* (p. 2

68. Leaf cells thin-walled or sometimes thick-walled but not sinuose .....

69. Leaves entire to minutely denticulate .....

69. Leaves serrulate to strongly toothed .....

Leaves Entire To Minutely Denticulate

70. Alar cells differentiated, often inflated and coloured ..... *Blindia* (p. 13

70. Alar cells not differentiated .....

71. Leaves with a distinct border of linear cells, often in several rows and layers, the walls usually thicker than the inner cells .....

71. Leaves not bordered or border indistinct .....

72. Leaves ovate, oblong, lingulate or spatulate, narrow, mostly less than 1 mm wide .....

72. Leaves obovate to rounded-ovate, broad, usually more than 1 mm wide .....

73. Leaves ovate to oblong-ovate or lanceolate, costa often long-excurrent; peristome double ..... *Bryum* (p. 308

73. Leaves oblong to lingulate or spatulate, costa subpercurrent to short-excurrent; peristome single or lacking ..... *Desmatodon* (p. 233

74. Leaves rounded or ending in a short, blunt mucro ..... *Rhizomnium* (p. 353

74. Leaves acute, with a short mucro or apiculus ..... *Cyrtomnium* (p. 351

75. Plants julaceous, leaves shiny, concave, nearly as broad as long .....

75. Plants not julaceous and leaves not shiny or, if so, leaves longer than broad .....

76. Plants yellowish green, leaves obtuse to broadly acute, apex plane, costa ending below apex to percurrent ..... *Pohlia filiformis* (p. 288)

76. Plants whitish green above, pink or red below, leaves acuminate, apex reflexed, costa excurrent ..... *Plagiobryum* (p. 304)

77. Leaves with apical cells about as broad as long, thick-walled .....

77. Leaves with apical cells mostly longer than broad, thin-walled or rarely thick-walled .....

78. Main stem prostrate, with numerous erect branches; plants on tree trunks ..... *Drummondia* (p. 407)

78. Main stem erect, branches few and also erect; plants on soil or rock .....

79. Capsules exserted on a long, straight seta; gemmae often present, globose, multicellular ..... *Didymodon* (p. 220)

79. Capsules immersed or exserted on a short, curved seta; gemmae lacking ..... *Grimmia* (p. 244)

80. Leaf apices obtuse, sometimes a few somewhat acute .....

80. Leaf apices acute .....

81. Leaves linear-lanceolate, narrowed at apex, costa percurrent to excurrent; capsules erect, without a distinct neck ..... *Ditrichum lineare* (p. 118)
81. Leaves lingulate, scarcely narrowed at apex, costa ending below apex; capsules inclined above an erect neck ..... *Meesia uliginosa* (p. 365)
82. Plants bulbiform; capsules on a flexuose seta, urn sulcate when dry ..... *Funaria* (p. 274)
82. Plants not bulbiform; capsules on a straight seta, urn smooth when dry 83
83. Leaves concave, with a long, flexuose point; capsules cylindric, erect ..... *Tetraplodon mnioides* (p. 280)
83. Leaves keeled, without flexuose point; capsules round to ovoid, pendulous ..... *Catoscopium* (p. 368)

Leaves Serrulate To Strongly Toothed

84. Leaves with a border of linear cells whose walls are usually thicker than the inner cells .. 85
84. Leaves lacking border 88
85. Leaf margins with teeth in pairs ..... *Mnium* (p. 334)
85. Leaf margins with single teeth, or margins serrate to serrulate 86
86. Median leaf cells mostly rounded or hexagonal, about as broad as long; leaf margins toothed, the teeth sometimes composed of several cells ..... *Plagiomnium* (p. 342)
86. Median leaf cells rhomboidal, much longer than broad; leaf margins serrate to serrulate, sometimes nearly entire, rarely toothed 87
87. Plants large, leaves arranged in a terminal rosette, leaves up to 1 cm long; 1–5 sporophytes per plant ..... *Rhodobryum* (p. 332)
87. Plants comparatively small, leaves seldom arranged in a terminal rosette, leaves up to 5 mm long; sporophytes solitary ..... *Bryum* (p. 308)
88. Apical leaf cells isodiametric 89
88. Apical leaf cells elongate 101

Apical Leaf Cells Isodiametric

89. Alar cells strongly differentiated, inflated and often coloured ..... *Dicranum* (p. 171)
89. Alar cells not noticeably differentiated 90
90. Leaves with an enlarged, sometimes orange, sheath that clasps stem, margins strongly incurved when dry; calyptrae attached to seta just below capsule ..... *Timmia* (p. 380)
90. Leaves lacking sheath, margins not incurved; calyptrae not attached to seta 91
91. Plants bluish green and glaucous due to a whitish granular or cottony substance on the leaves and stems ..... *Saelania* (p. 127)
91. Plants not glaucous 92
92. Leaves with large marginal teeth sometimes composed of several cells, most cells with a single, large indistinct papilla in the centre ... *Aulacomnium heterostichum* (p. 358)
92. Leaves with small marginal teeth composed of a single cell 93
93. Leaves, especially the upper, with long, hyaline tips ..... *Grimmia* (p. 244)
93. Leaves lacking hyaline tips 94
94. Leaves in three distinct ranks, widely spreading to squarrose; setae long, often over 7 cm ..... *Meesia triquetra* (p. 365)
94. Leaves not three-ranked or squarrose; setae short, seldom up to 3 cm 95
95. Leaf margins plane 96
95. Leaf margins recurved 99
96. Leaves narrow, about 0.5 mm wide 97
96. Leaves broad, mostly 1 mm wide 98
97. Leaves with a distinct region of hyaline cells at base that are much broader and longer than the cells above ..... *Rhabdoweisia* (p. 156)
97. Leaves lacking region of hyaline cells at base ..... *Kiaeria* (p. 167)

98. Costae red, leaves long-decurrent ..... *Mnium stellare* (
98. Costae green or yellow, leaves short-decurrent or nondecurrent ..... *Tayloria* (
99. Costae percurrent to excurrent, often reddish, especially near the stem; leaf margins unistratose; setae purplish to red ..... *Ceratodon* (
99. Costae ending below apex and lacking reddish colour; leaf margins bistratose or unistratose; setae yellow to brown 100
100. Leaf margins unistratose ..... *Rhabdoweisia* (
100. Leaf margins bistratose ..... *Cynodontium* (

Apical Leaf Cells Elongate

101. Alar cells strongly differentiated, inflated and often coloured ..... *Dicranum* (p
101. Alar cells not strongly differentiated 102
102. Leaves widely spreading to squarrose ..... *Dicranella* (p
102. Leaves erect to somewhat spreading but not squarrose 103
103. Plants with 1–several, bulbiform or elongate gemmae in the leaf axils ..... *Pohlia* (p.
103. Plants lacking gemmae 104
104. Leaves broadly elliptic with a broad apex ending in a short apiculus ..... *Pseudobryum* (p.
104. Leaves lanceolate to ovate or oblong and narrowed to an acute to acuminate apex ...
105. Leaves narrowed to a long, flexuose point, the margins with teeth sometimes composed of 2 cells; setae short, the leaves extending above the mouth of the capsule ..... *Tetraplodon angustatus* (p.
105. Leaves acute, the margins with teeth usually composed of 1 cell or occasionally of 2 cells; setae long, elevating capsule above upper leaves .....
106. Leaf cells narrow and mostly thick-walled, often 5–12 times as long as broad ..... *Pohlia* (p.
106. Leaf cells broad and thin-walled, usually less than 5 times as long as broad .....
107. Leaves with costa extending to apex or nearly so, margins sometimes with multicellular teeth; neck of capsules often enlarged and brilliantly coloured purple, red, or yellow ..... *Splachnum* (p.
107. Leaves with costa ending several cells below apex, margins with single-celled teeth; neck of capsules not greatly expanded nor brilliantly coloured .....
108. Capsules globose or pyriform, often urceolate when dry, lacking peristome; plants on soil ..... *Physcomitrium* (p. 2
108. Capsules cylindric, peristome present; plants on dung ..... *Tayloria* (p. 2

PLEUROCARPOUS MOSSES

109. Costae single .....
109. Costae double or lacking .....

Costae Single

110. Leaf cells thick-walled and strongly sinuose-nodulose ..... *Rhacomitrium* (p. 25
110. Leaf cells thin to thick-walled but not strongly sinuose .....
111. Leaf cells papillose .....
111. Leaf cells smooth .....

Leaf Cells Papillose

112. Papillae formed by projecting cell ends (prorate) on dorsal leaf surface .....
112. Papillae over cell lumen .....

113. Alar cells abruptly inflated and enlarged ..... *Cratoneuron* (p. 504)
113. Alar cells not abruptly inflated or enlarged 114
114. Plants regularly pinnate to tripinnately branched, often frondose; stems and branches covered with numerous paraphyllia 115
114. Plants irregularly branched and never frondose; stems and branches lacking paraphyllia but pseudoparaphyllia sometimes present 116
115. Leaf margins strongly serrate to toothed ..... *Hylocomium pyrenaicum* (p. 645)
115. Leaf margins entire to serrulate ..... *Helodium* (p. 474)
116. Leaves strongly rugose and plicate ..... *Rhytidium* (p. 638)
116. Leaves not rugose 117
117. Stems and branches julaceous, red; costae rarely extending to leaf middle; gemmae present, 2–4 celled ovoid or cylindric bodies ..... *Pterigynandrum* (p. 445)
117. Stems and branches not julaceous, green or yellow; costae extending to leaf middle and above; gemmae lacking ..... *Bryhnia* (p. 562)
118. Leaf cells with 1 papilla 119
118. Leaf cells with 2 or more papillae 124
119. Leaf margins ciliate ..... *Thelia* (p. 447)
119. Leaf margins not ciliate (perichaetial leaves sometimes ciliate) 120
120. Paraphyllia filamentous, long and matted on stems, the cells elongate .. *Helodium* (p. 474)
120. Parphyllia filamentous or foliose, short and not matted, the cells nearly isodiametric .. 121
121. Stems irregularly branched; paraphyllia few, not branched 122
121. Stems pinnately to tripinnately branched; paraphyllia numerous, often branched; capsules inclined to horizontal 123
122. Leaves acute, margins plane or narrowly recurved, median cells isodiametric; plants on trees and rotten logs ..... *Leskea* (p. 438)
122. Leaves acuminate, margins strongly recurved, median cells sometimes longer than wide; plants on rock ..... *Lescuraea* (p. 443)
123. Plants small, stems seldom reaching 5 cm in length ..... *Haplocladium* (p. 463)
123. Plants large, stems often over 5 cm long ..... *Thuidium* (p. 466)
124. Plants with paraphyllia ..... *Thuidium* (p. 466)
124. Plants lacking paraphyllia 125
125. Plants with lingulate leaf apices that are usually broken off ..... *Haplohymenium* (p. 449)
125. Plants with leaf apices not broken off ..... *Anomodon* (p. 451)

Leaf Cells Smooth

126. Leaves with a border of 3–5 rows of linear cells in 1–2 layers; plants on rocks in streams ..... *Sciaromium* (p. 476)
126. Leaves lacking border of differentiated cells 127
127. Plants dendroid, connected by a subterranean, rhizome-like stem; filamentous paraphyllia present ..... *Climacium* (p. 651)
127. Plants not dendroid; paraphyllia lacking or sometimes present but foliose 128
128. Plants complanate, leaves oblong-lingulate with a broadly rounded to abruptly acute apex ..... *Homalia* (p. 432)
128. Plants not complanate or, if so, with lanceolate to ovate-lanceolate leaves narrowed to an acute to acuminate apex 129
129. Costae extending to apex or nearly so 130
129. Costae rarely extending 3/4 length of leaf 139
130. Stems bearing axillary clusters of brood branchlets at or near the apices; leaves smooth, costa excurrent as a slender acumen ..... *Leskeella* (p. 441)
130. Stems lacking clusters of brood branchlets; leaves smooth or plicate, costa usually ending at or near apex, rarely excurrent 131
131. Alar cells abruptly inflated or enlarged 132
131. Alar cells quadrate to rectangular and not abruptly inflated or enlarged 134

Leaf apices broadly obtuse, nearly as broad as leaf near middle; plants in bogs, fens, swamps, wet depressions in woods and other wet habitats ..... *Calliergon* (
132. Leaf apices acute or narrowly obtuse; plants of wet or dry habitats .....
133. Stems with foliose paraphyllia, sometimes few and difficult to see; median leaf cells short, seldom up to 6 times as long as broad ..... *Cratoneuron* (
133. Stems lacking paraphyllia; median leaf cells long, often over 6 times as long as broad ..... *Drepanocladus* (p
134. Leaf margins serrulate to serrate from apex to middle or sometimes to base .....
134. Leaf margins entire to serrulate near apex, entire below .....
135. Leaves small, mostly 1 mm or less long; small, foliose to filamentous pseudoparaphyllia present; gemmae borne on leaves, filamentous ..... *Conardia* (p.
135. Leaves large, usually 1 mm or more long; pseudoparaphyllia lacking or large and foliose; gemmae lacking ..... *Brachythecium* (p.
136. Leaves in 3 rows, narrow, often subulate, 6 or more times as long as broad; capsules immersed ..... *Dichelyma* (p.
136. Leaves in more than 3 rows, broad, less than 6 times as long as broad; capsules exserted ..... 13.
137. Leaves entire, apical cells thick-walled and isodiametric; plants on tree trunks ..... *Drummondia* (p.
137. Leaves serrulate or sometimes entire, apical cells thin to thick-walled and elongate; plants on soil, rock, wood or bases of trees .....
138. Leaves with costa broad, scarcely narrowed near apex, basal cells mostly rectangular, rarely quadrate; plants usually occurring on rocks in or near water ..... *Hygroamblystegium* (p. 4
138. Leaves with costa narrow, becoming narrower and indistinct near apex, basal cells mainly quadrate or shortly rectangular; plants on soil, wood, bases of trees but usually not on rocks in water ..... *Amblystegium varium* (p. 4
139. Plants very small, leaves seldom reaching 0.5 mm long, costa often short and indistinct; plants on wood ..... *Platydictya* (p. 4
139. Plants small to large, leaves mostly 1 mm or more in length, costa long, often reaching 1/2 to 2/3 length of leaf, distinct; plants on various substrates .....
140. Median leaf cells short, mostly less than 6 times as long as wide .....
140. Median leaf cells long, usually 6–15 times as long as wide .....
141. Plants subdendroid to dendroid, leaves with margins coarsely and irregularly serrate, costa often with teeth on dorsal surface ..... *Thamnobryum* (p. 43
141. Plants not dendroid, leaves with margins entire to regularly serrate, costa without teeth on dorsal surface .....
142. Plants usually high up on trees in seepy knotholes or cracks; capsules erect and straight, strongly contracted below mouth when dry, peristome teeth reflexed when dry ..... *Anacamptodon* (p. 436
142. Plants not on trees in seepy knotholes or cracks but sometimes on bases of trees; capsules inclined and arcuate, peristome teeth not reflexed when dry .....
143. Leaves with a somewhat channelled acumination, alar cells often inflated or enlarged, sometimes coloured ..... *Campylium* (p. 495
143. Leaves with a flat apex, alar cells not inflated and seldom enlarged .....
144. Leaves with margins entire to serrate in upper half, rarely serrate to base, alar regions often with quadrate to transversely rectangular cells ..... *Amblystegium* (p. 483)
144. Leaves with margins serrulate to serrate nearly to base, alar regions with rectangular or sometimes quadrate cells ..... *Leptodictyum trichopodium* (p. 487)
145. Plants somewhat julaceous, with concave leaves abruptly contracted to a long-filiform apex ..... *Cirriphyllum* (p. 566)
145. Plants not with concave leaves that are abruptly contracted to a long-filiform apex .....

146. Leaves acute, sometimes nearly obtuse, strongly serrate to serrulate nearly to base, costa often ending in a tooth on the dorsal surface; opercula long-rostrate, arcuate 147
146. Leaves acuminate, rarely nearly acute, entire to serrate, costa usually smooth; opercula conic to short-rostrate, straight 148
147. Stems much branched, nearly pinnate; leaves long-decurrent .... *Stokesiella* (p. 575)
147. Stems with few branches; leaves nondecurrent or short-decurrent .... *Eurhynchium* (p. 570)
148. Plants regularly branched, large, up to 10 cm high, stems densely tomentose with brown rhizoids almost to apex, leaves strongly plicate, nearly straight; plants in bogs or fens .... *Tomenthypnum* (p. 535)
148. Plants mostly irregularly branched, lacking dense tomentum, leaves smooth or plicate, sometimes falcate; plants in various habitats 149
149. Leaves acute to acuminate, falcate-secund, especially near stem and branch tips; alar cells often inflated; plants in extremely wet habitats, mainly bogs, fens, swamps, and lakes .... *Drepanocladus* (p. 508)
149. Leaves acute to narrowly obtuse, straight or sometimes falcate, but not secund; alar cells gradually enlarged, rarely somewhat inflated 150
150. Leaves narrowly obtuse, margins usually with a few serrulations at the apex; plants on rocks in or near streams and creeks .... *Hygrohypnum* (p. 517)
150. Leaves acute, margins entire or serrulate to serrate nearly to base 151
151. Leaves entire 152
151. Leaves serrulate to serrate 153
152. Leaves smooth, margins plane, alar cells elongate; plants in wet habitats .... *Leptodictyum* (p. 487)
152. Leaves plicate, margins often recurved at base, alar cells quadrate; plants in dry habitats .... *Brachythecium albicans* (p. 543)
153. Plants with numerous attenuate branches, leaves smooth, with irregularly serrate margins and numerous round, thick-walled alar cells .... *Isothecium* (p. 538)
153. Plants rarely with attenuate branches, leaves often plicate, with regularly serrate margins and quadrate to rectangular, thin-walled alar cells .... *Brachythecium* (p. 540)

Costae Double or Lacking

154. Stems and branches covered with numerous paraphyllia; plants often bi- or tri-pinnately branched, frequently frondose .... *Hylocomium* (p. 645)
154. Stems and branches lacking paraphyllia but pseudoparaphyllia sometimes present 155
155. Leaf cells papillose 156
155. Leaf cells smooth 162

Leaf Cells Papillose

156. Leaf cells with 1–2 papillae over the lumen 157
156. Leaf cells prorate on dorsal surface 158
157. Leaf cells with 1–2 papillae per cell; plants large, leaves with a hyaline apex, 1–2 mm long, perichaetial leaves ciliate; plants on noncalcareous rock .... *Hedwigia* (p. 409)
157. Leaf cells with 1 papilla per cell; plants small, leaves without a hyaline apex, up to 0.5 mm long, perichaetial leaves lacking cilia; plants on calcareous rock .... *Myurella sibirica* (p. 458)
158. Plants irregularly branched, stems and branches julaceous, slender, seldom up to 0.5 mm wide 159
158. Plants mostly regularly branched, stems not julaceous, branches sometimes julaceous, mostly over 0.5 mm wide 160

longer than broad, costa distinct, sometimes reaching 1/4 length of leaf; gemmae present, 2–4 celled ovoid or cylindric bodies ..... *Pterigynandrum* (p.

159. Leaves tightly imbricate, apices erect when dry, rounded to rounded ovate, often as long as broad, costa faint, seldom reaching but a few cells up leaf; gemmae lacking .... *Myurella julacea* (p.

160. Stem and branch leaves different, stem leaves acuminate, spreading to squarrose, branch leaves acute to rounded, imbricate and julaceous ..... *Heterocladium* (p.

160. Stem and branch leaves similar except in size .....

161. Plants large, stems up to 15 cm long, leaves often 5 mm long or longer .... *Rhytidiadelphus triquetrus* (p.

161. Plants small, stems up to 6 cm long, leaves mostly 2 mm long, rarely longer .... *Ctenidium* (p.

Leaf Cells Smooth

162. Plants on rocks submerged in flowing water or on rocks protruding from water or beside water .....

162. Plants not usually aquatic or semi-aquatic, occurring on rock, wood, humus or rarely soil .....

163. Plants small, stems up to 5 cm long, leaves in more than 3 rows, often as wide as long, costa usually distinct ..... *Hygrohypnum* (p. 5

163. Plants large, stems usually more than 5 cm long, sometimes up to 20 cm, leaves in 3 rows, usually longer than wide, costa lacking ..... *Fontinalis* (p. 4

164. Median leaf cells short, mostly less than 6 times as long as wide .....

164. Median leaf cells long, usually 6 or more times as long as wide .....

165. Plants large, leaves usually 1–2 mm long ..... *Leucodon* (p. 4

165. Plants small, leaves usually less than 1 mm long .....

166. Plants julaceous ..... *Myurella julacea* (p. 45

166. Plants not julaceous .....

167. Leaves squarrose ..... *Campylium hispidulum* (p. 49

167. Leaves not squarrose .....

168. Leaves falcate-secund, stems often subpinnately to pinnately branched .. *Hypnum* (p. 60

168. Leaves straight or somewhat curved but not falcate-secund, stems simple or with a few branches ..... *Platydictya* (p. 49

169. Alar cells enlarged and inflated, often orange .....

169. Alar cells not enlarged or inflated .....

Alar Cells Enlarged and Inflated

170. Leaves serrate to serrulate throughout ..... *Herzogiella striatella* (p. 631

170. Leaves entire or sometimes serrate only at apex .....

171. Plants pinnately to subpinnately branched, leaves close, imbricate, stem leaves apiculate ....

171. Plants irregularly branched, stem leaves not apiculate .....

172. Stems red, epidermal cells small and thick-walled in cross-section; alar cells orange ..... *Pleurozium* (p. 579

172. Stems green to yellowish green, epidermal cells large and thin-walled in cross-section; alar cells hyaline or yellow ..... *Calliergonella* (p. 533)

173. Plants large, stems often 10 cm long, leaves strongly concave, falcate, irregularly wrinkled ..... *Scorpidium* (p. 526)

173. Plants small, stems seldom up to 8 cm long, leaves flat or slightly concave, straight or falcate, smooth .....

174. Leaves cordate-ovate, spreading to squarrose ..... *Campylium stellatum* (p. 496)

174. Leaves not cordate-ovate, usually oblong-ovate or ovate-lanceolate .....

175. Leaves falcate-secund, the tips turned toward the substrate 176
175. Leaves not or rarely falcate-secund (sometimes only at tips of stems and branches) 177
176. Stems with short, filamentous pseudoparaphyllia ..... *Brotherella* (p. 588)
176. Stems with foliose pseudoparaphyllia or lacking pseudoparaphyllia ..... *Hypnum* (p. 605)
177. Alar cells usually coloured yellow, orange or reddish 178
177. Alar cells hyaline and not coloured 180
178. Stem and branch tips with clusters of axillary brood branches ..... *Platygyrium* (p. 593)
178. Stems and branches lacking brood branches 179
179. Stems with narrowly lanceolate, foliose pseudoparaphyllia; capsules long, usually 2 mm or more in length, exothecial cells noncollenchymatous; common ..... *Callicladium* (p. 603)
179. Stems lacking pseudoparaphyllia; capsules short, seldom reaching 2 mm long, exothecial cells collenchymatous; rare ..... *Sematophyllum* (p. 590)
180. Leaves long-decurrent, margins recurved ..... *Plagiothecium denticulatum* (p. 583)
180. Leaves not or shortly decurrent, margins plane or incurved 181
181. Leaves falcate-secund; stems irregularly branched, branches few, seldom complanate ..... *Hypnum* (p. 605)
181. Leaves not falcate-secund or only at tips of stems and branches; stems pinnately branched or with many branches, somewhat complanate ..... *Callicladium* (p. 603)

Alar Cells Not Enlarged and Inflated

182. Plants large, stems often red, 10 cm long or more, pinnately or subpinnately branched 183
182. Plants small to medium-sized, stems green or sometimes red, usually less than 7 cm long, irregularly branched or sometimes pinnately branched 184
183. Plants pinnately branched with numerous, close branches, stems yellow, green or brown, leaves strongly falcate-secund, plicate ..... *Ptilium* (p. 636)
183. Plants pinnately to subpinnately branched with distant branches, stems red, leaves falcate secund or squarrose, smooth or plicate ..... *Rhytidiadelphus* (p. 640)
184. Plants complanate, leaves strongly undulate; capsules immersed; plants on tree trunks ..... *Neckera pennata* (p. 428)
184. Plants not complanate or if so, leaves not strongly undulate; capsules exserted 185
185. Leaves falcate-secund; stems often pinnately branched; capsules arcuate, sometimes straight, contracted under mouth when dry ..... *Hypnum* (p. 605)
185. Leaves straight or falcate but rarely falcate-secund; stems irregularly branched; capsules straight or rarely arcuate, sometimes contracted under mouth when dry 186
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187. Outer layers of stem cells small and thick-walled 189
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189. Stem and branch tips with clusters of brood bodies (branchlets) in leaf axils 190
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190. Leaf margins serrate near apex; plants on soil ..... *Isopterygium* (p. 620)
190. Leaf margins entire or minutely serrulate; plants usually on wood 191
191. Median cells thick-walled, pitted, several rows of rounded, quadrate, or rectangular cells at base ..... *Leucodon* (p. 411)
191. Median cells thin-walled, not pitted, few quadrate to rectangular cells at base ..... *Platygyrium* (p. 593)

192. Alar cells quadrate, 3 or more on margins of some leaves, often numerous and in several rows .....
192. Alar cells mostly elongate, sometimes 2–3 quadrate cells in marginal row .....
193. Stems with numerous, short, crowded branches that are usually curved when dry; plants on tree trunks ..... *Pylaisiella* (p. 5
193. Stems lacking numerous short branches; plants on bases of trees or soil over rock .....
194. Leaf margins serrate to serrulate throughout; foliose pseudoparaphyllia present ..... *Taxiphyllum* (p. 6
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195. Plants complanate, many leaves rounded and apiculate; conspicuous foliose pseudoparaphyllia present ..... *Neckera complanata* (p. 4
195. Plants terete, leaves long-acuminate; pseudoparaphyllia lacking or inconspicuous ..... *Entodon* (p. 5
196. Plants complanate .....
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197. Leaves decurrent, narrowed to an acute to acuminate apex; pseudoparaphyllia lacking; common ..... *Plagiothecium* (p. 5
197. Leaves nondecurrent, many leaves rounded and apiculate at apex; foliose pseudoparaphyllia present; rare ..... *Neckera complanata* (p. 42
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198. Stems lacking numerous short branches; plants on soil or soil over rock ..... *Isopterygium* (p. 62

Glossary

Most of the definitions have been taken from Crum (1976). The figure numbers refer to the illustrations at the end of the glossary.

A- – a prefix, meaning not, without.
Abaxial – away from the stem or axis, opposed to *adaxial*; (see also *dorsal*). (Fig. 40)
Acaulescent – stemless or apparently so, e.g., *Ephemerum*.
Acicular – needle-like. (Fig. 63)
Acidophile – a plant of acid habitats, an *oxylophile*.
Acrocarpous – producing the sporophyte at the end of a stem or main branch (opposed to *pleurocarpous*). Acrocarpous mosses generally grow erect in tufts (rather than mats) and are sparsely branched. (Fig. 1)
Acumen (pl. Acumens or Acumina) – a slender tapering point.
Acuminate – slenderly tapered. (Fig. 74)
Acute – sharply pointed (less than 90°). (Fig. 75)
Adaxial – toward the stem or axis, opposed to *abaxial*; (see also *ventral*). (Fig. 40)
Adherent – sticking to another organ, as opposed to *coherent*, or sticking to an organ of the same kind.
Adnate – fused with or attached to another organ.
Adventive – a plant that is introduced often accidentally and imperfectly naturalized; not native.
Aeruginose – bluish-green, the colour of copper rust (verdigris).
Aggregate – clustered; often applied to sporophytes, e.g., AGGREGATE SPOROPHYTES – several sporophytes per perichaetium. (Fig. 185)
Alar cells – cells at the basal angles of a leaf, often differentiated in shape, size or colour. (Fig. 43)
Alveolate – with depressions on the surface, sometimes applied to spores. (Fig. 165)
Amorphous – without definite shape.
Amphithecium – an embryonic tissue of a developing capsule, surrounding the central *endothecium*.
Amplexicaul – clasping the stem. (Fig. 21)
Androecium – the male inflorescence. (Fig. 178)
Androgynous – male and female sex organs in the same inflorescence.
Anisophyllous – in *Sphagnum*, stem and branch leaves morphologically different.
Anisosporous – producing spores of two overlapping size classes in the same capsule (sometimes associated with asexual dimorphism); differentiated from the heterosporous condition of higher plants in which the microspores and megaspores are of two distinct sizes and are produced in different structures.
Annotinous – in yearly growths (the junction with the previous year's growth evident because of crowded leaves or other signs of interrupted growth). (Fig. 16)
Annular – ring-like.
Annulus (pl. Annuli) – a ring of differentiated cells between the mouth of the capsule and the operculum, aiding in dehiscence. (Fig. 221)
Antheridium (pl. Antheridia) – the male reproductive organ, a globose to cylindric, stalked structure producing sperms (*antherozoids*). (Fig. 179)
Antrorse – directed forward or (in reference to papillae) toward the leaf tip.
Apiculate – abruptly short-pointed (*mucronate* is even shorter; *cuspidate* is longer and stouter). (Fig. 81)
Apiculus – a short, abrupt point. (Fig. 81)
Apophysis – a swelling or expansion at the base of the capsule (also called *hypophysis*). (Fig. 207, 208)
Appendiculate – with short, transverse projections, usually referring to cilia of endostome. (Fig. 229)
Appressed – lying close together; closely applied to the stem. (Fig. 18)
Approximate – close together.
Arboreal – growing on trees.
Archegonium (pl. Archegonia) – the female reproductive organ, a flask-shaped structure producing an egg. (Fig. 182)
Arcuate – curved like a bow. (Fig. 199)
Arenicolous – growing on sand.
Areolae – small, angular areas forming a network.
Areolation – the cellular network of a leaf.
Aristate – bristle-pointed, ending in an awn (*arista*). (Fig. 72)
Articulate – with thickened joints, jointed, usually referring to exostome. (Fig. 228).
Ascending – directed upward.
Asexual – involving no sexual action; also possessing neither male nor female organs.
Astomous – without an operculum, hence indehiscent; also called *cleistocarpous*. (Fig. 213)
Attenuate – narrowly tapered. (Fig. 6)
Auricle – a small, ear-like bulge or lobe at the basal margins of a leaf. (Fig. 107)
Auriculate – with basal auricles. (Fig. 107)
Autoicous (or Autoecious) – with archegonia and antheridia in separate inflorescences on the same plant (see *cladautoicous, gonioautoicous, pseudautoicous* and *rhizautoicous*). (Fig. 170, 171)
Awn – a bristle- or hair-point, usually formed by an excurrent costa. (Fig. 72)
Axil – the upper angle between leaf and stem. (Fig. 40)
Axillary – in the leaf axils.

Basal Membrane – a delicate but often well-developed membrane at the base of the inner peristome of many mosses, commonly terminating in segments and cilia. (Fig. 223)
Beak – the prolonged apex of an operculum; also called a *rostrum*. (Fig. 205)
Bi- – a prefix meaning two.
Bicostate – with two nerves or costae. (Fig. 47)
Bicrurous – with two divisions (or "legs").
Bifarious – in two rows.
Bifid (or Bifurcate) – forked, divided into two parts. (Fig. 230)
Bigeminate – doubly paired in 4's. (Fig. 220)
Bilobed – with two lobes. (Fig. 65)
Binate – in pairs.
Bipartite – in two parts.
Bipinnate – twice-pinnately branched. (Fig. 5)
Biseriate – in two layers.
Bloom – a covering or waxy material causing a whitish or bluish overcast; see also *glaucous*.
Bog – a waterlogged open type of vegetation poor in mineral nutrition because all water is derived from precipitation, rather than from the soil; often used in this work and elsewhere for *poor fens* (which see). A bog is usually dominated by *Sphagnum*.
Bordered – having margins differentiated from the rest of the leaf in shape, size, colour, or thickness of cells (Fig. 42)
Boreal – northern, especially referring to the boreal coniferous forest which extends around the Northern Hemisphere, from the treeless tundra to temperate latitudes (and deciduous forests).
Bracts – specialized leaves surrounding reproductive organs. (Fig. 178, 181)
Brood Bodies – reduced buds, leaves (*propagula*) or branches (*brood branchlets*) (Fig. 168) or small, globose, ellipsoidal, or cylindric to filamentous, septate bodies (*gemmae*) serving in vegetative reproduction. (Fig. 169)

Bryaceous (or Bryoid) Peristome – like a *Bryum*, i.e., a "perfect" double peristome, with 16 lanceolate teeth, papillose throughout, trabeculate at back, and a well-developed endostome consisting of a high basal membrane and 16 lanceolate, keeled segments alternating with one or more cilia. (Fig. 223, 226)

Bulbiform – bulb-shaped. (Fig. 33)

Bulbil – a small, reduced bulb-shaped bud, usually axillary, serving in vegetative reproduction, e.g. *Pohlia andalusica*.

Caducous – deciduous, regularly falling off.

Caesious – bluish or bluish-glaucous.

Caespitose – tufted, growing in cushions or sods.

Calcareous – containing calcium carbonate; limestone or dolomite rocks.

Calcicolous – living in calcareous habitats.

Calciphile – a plant of calcareous habitats; opposed to *calciphobe* (*calcifuge*), a plant not occupying calcareous habitats.

Callose – hard and thick.

Calyptra (pl. Calyptrae) – a membranous hood over the developing sporophyte, developed from the archegonium, in true mosses ruptured near the base, carried upward on the elongation of the seta, and continuing growth to form a cap over the capsule. (Fig. 191–194)

Campanulate – bell-shaped. (Fig. 214)

Canaliculate – channelled. (Fig. 106)

Canescent – hoary because of hyaline hair-points on the leaves.

Capillary – hair-like.

Capitate (or Capitulate) – rounded and compact forming a head-like *capitulum* (e.g., *Sphagnum*).

Capsule – the spore case, often differentiated into an upper spore-bearing *urn* or *theca* and a sterile basal portion called the *neck* (which may be considerably differentiated as a broad *apophysis* or *hypophysis*). (Fig. 195)

Carinate – keeled like the bottom of a boat. (Fig. 104)

Cartilaginous – firm and tough.

Castaneous – chestnut-brown.

Catenulate – chain-like. (Fig. 20)

Caulescent – having a stem.

Caulid – haploid stem of bryophyte.

Cauline – referring to the stem.

Central strand – a small group of elongate cells forming a central axis of some stems. (Fig. 150)

Cernuous – nodding or drooping. (Fig. 219)

Chartaceous – papery.

Chlorocysts – small, elongate, green cells forming a network enclosing the large, hyaline cells (*leucocysts*) of a *Sphagnum* leaf, also called *green cells* or *chlorophyll cells*; also applied to small, green cells enclosed by layers of hyaline cells in the leaves of Leucobryaceae or mingled with them in *Paraleucobryum*. (Fig. 151, 152)

Chlorophyllose – green, containing chlorophyll.

Cilia (sing. Cilium) – delicate, thread-like structures alternating with the segments of the inner peristome of many mosses; also applied to hair-like appendages fringing leaves or calyptrae. (Fig. 223)

Ciliate – fringed with hairy appendages. (Fig. 100)

Cinereous – ashy-gray.

Circinate – curved in a circle. (Fig. 70)

Circumboreal – widespread in the Northern Hemisphere, circumpolar.

Cirrate (or Cirrose) – curled. (Fig. 112)

Cladautoicous – with the male inflorescence on a separate branch. (Fig. 171)

Cladocarpous – producing the sporophyte at the end of a special, short branch. (Fig. 3)

Clavate (or Claviform) – slender, elongate, and thickened upward, club-like. (Fig. 62)

Cleistocarpous – lacking an operculum and hence irregularly dehiscent (opposed to *stegocarpous*). (Fig. 213)

Coalesced – fused together.

Coarctate – pressed together, squeezed in, constricted, sometimes applied to strangulate capsules (e.g., *Orthotrichum*). (Fig. 209)

Cochleariform – round and deeply concave, shaped like the bowl of a spoon (not snail-like or spiraled as the derivation would suggest). (Fig. 54)

Coherent (or Cohering) – sticking together, sticking to another organ of the same kind.

Collenchymatous – with cell walls thickened at the corners; in liverworts such thickenings are called *trigones*. (Fig. 140)

Collum – the tapered base or *neck* of a capsule. (Fig. 195)

Columella – the central axis of a capsule around which the spores develop. (Fig. 198, 212)

Comb-fibril – a ridge-like growth on the branch leaf hyaline cell walls adjacent to the chlorophyllose cells. (Fig. 156, 157)

Commissure – margin; in branch leaves of *Sphagnum*, the "seam" formed by the adjacent walls of hyaline and green cells; hence, pores along the commissures are arranged along the lateral margins of hyaline cells.

Comose – hairy, but used by bryologists to refer to leaves larger and more crowded, forming a tuft or *coma* at the stem tip; extremely comose stems may be *rosulate* in appearance.

Complanate – flattened together or compressed in one plane. (Fig. 24)

Complicate – folded lengthwise. (Fig. 102)

Complicate-Carinate – sharply folded along a keel. (Fig. 103)

Compressed – flattened.

Concolorous – of the same colour.

Conduplicate – strongly folded along the middle. (Fig. 101)

Confluent – merging. (Fig. 23)

Connate – fused, joined together.

Connivent – approaching or meeting at the tips, directed to a single point, converging.

Constricted – abruptly narrowed. (Fig. 209)

Contorted – bent into irregular curves, irregularly twisted. (Fig. 112)

Cordate – heart-shaped. (Fig. 47)

Coriaceous – tough, leathery.

Cortex – differentiated outer layers of a stem or branch, surrounding a central cylinder. (Fig. 150)

Cortical – referring to the outer cells of stems or branches.

Corticolous – growing on bark.

Cosmopolitan – occurring in all major floristic zones of the world.

Costa (pl. Costae) – nerve of a leaf, sometimes double, sometimes single forming a midrib. (Fig. 42)

Costate – with a costa.

Crenate – with rounded teeth. (Fig. 122)

Crenulate – with minute, rounded teeth.

Cribrose – finely perforated, sieve-like. (Fig. 232)

Crisped (or Crispate) – wavy (like crisp bacon); often used more loosely to mean variously curled, twisted and contorted. (Fig. 112)

Cryptopore – having *immersed* stomata, with the guard cells sunken below the level of the exothecial cells and often ± covered by them (opposed to *phaneropore*). (Fig. 126)

Cucullate – hooded or hood-shaped; a *cucullate* calyptra is conic and split up one side, resembling a monk's hood (Fig. 192); also used to describe leaves concave at the tips (Fig. 109). A *mitrate* calyptra may be entire at base or several-lobed.

Cultriform – shaped like a knife, in bryology meaning curved and asymmetric, like a short, broad scimitar (apparently an incorrect form resulting from a confusion with *cultiform*, or shaped like a ploughshare). (Fig. 61)

Cuneate – wedge-shaped, cuneiform.

Cupulate – cup-shaped, rounded and swollen. (Fig. 215)

Cushion – with stems ± erect but somewhat radiating to form small hemispherical tufts (as in *Orthotrichum*).

Cuspidate – ending abruptly in a stout, rigid point. (Fig. 82)

Cuticle – the non-cellular covering of such organs as leaves or capsules, often variously roughened; epidermal cells of stems are sometimes referred to as *cuticular* or *cortical* cells.

Cyathiform – cup-shaped. (Fig. 215)
Cygneous – curved downward like a swan's neck. (Fig. 184)
Cymbiform – concave and broadly boat-shaped. (Fig. 44)

Deciduous – falling off.
Decumbent – ascending from a prostrate base, lying prostrate but with ascending tips.
Decurrent – with the margins extending down the stem below the leaf insertion as ridges or narrow wings. (Fig. 108)
Decurved – curved downward. (Fig. 11)
Deflexed – bent or curved downward. (Fig. 90)
Defoliate – denunded of leaves.
Dehiscent – splitting open, referring to capsules opening by valves or by an operculum, or irregularly.
Deltoid – equilaterally triangular. (Fig. 45, 155)
Dendroid – branched above a trunk-like base and resembling a tree (e.g., *Climacium*). (Fig. 28)
Dentate – with sharp teeth directed outward. (Fig. 116)
Denticulate – finely dentate. (Fig. 115)
Denuded (or Denudate) – with leaves worn off.
Depauperate – poorly developed.
Depressed – flattened, low.
Descending – directed downward.
Dextrorse – twisted to the right (opposed to *sinistrorse*).
Diaphanous – transparent.
Diaspore – any agent which moves reproductive germ plasm from one place to another.
Dichotomous – equally forked, with paired branches. (Fig. 14)
Dimidiate – split on one side (cucullate calyptrae are dimidiate and hooded). (Fig. 191)
Dimorphous – of two forms.
Dioicous (or Dioecious) – with archegonia and antheridia on separate plants. (Fig. 176, 177)
Discoid (or Disciform) – flattened and disc-like or plate-like (Fig. 183); male inflorescence may be *discoid* (resembling small flowers), *cupulate* (rounded and swollen), or *gemmiform* (small and bud-like).
Disjunct – a discontinuous distribution of an organism.
Distal – away from the base or point of attachment (opposed to *proximal*).
Distichous – in two opposite rows (e.g., *Fissidens*). (Fig. 39)
Divaricate – widely spreading from each other.
Divergent – spreading from each other.
Divisural Line – the median line of a peristome tooth, usually zig-zag, sometimes furrowed. (Fig. 223)
Dorsal – the *back*, *lower* or *abaxial* surface of a leaf, the *outer* surface of a peristome tooth, or the *upper* surface of a flattened plant body. (Fig. 40)
Dorsal Lamina – in *Fissidens* the portion of the leaf blade at the back of the costa, opposite the sheathing base. (Fig. 105)
Dorsal Plates – the outer surface of exostome teeth.
Dorsiventral – flattened, with distinct upper and lower surfaces.
Doubly Serrate – with teeth overlapping and joined in pairs. (Fig. 121)

E- – a prefix, meaning not, without.
Echinate – roughened by blunt, spiny projections. (Fig. 162)
Echinulate – minutely spiny.
Echlorophyllose – without chlorophyll.
Ecostate – without a costa. (Fig. 73)
Edentate – without teeth (see also *entire*). (Fig. 114)
Elliptic – essentially oblong but convex at sides and ends. (Fig. 48)
Ellipsoidal – a solid having an elliptic outline. (Fig. 164)
Emarginate – broad at the apex and shallowly notched (deeper than *retuse*).
Emergent – partially exposed, referring to capsules only partly exceeding the tips of the perichaetial leaves. (Fig. 187)
Endemic – limited to a single country or floristic area.
Endostome – the inner peristome (usually consisting of segments, often from a basal membrane, frequently alternating with cilia). (Fig. 224)
Endothecium – the inner cell layer of lining of a capsule, forming a spore-sac; usually applied to the inner embryonic tissue of a young capsule (surrounded by the *amphithecium*).
Enervate – lacking a costa (see also *ecostate*). (Fig. 73)
Ensiform – sword-shaped. (Fig. 60)
Entire – not at all toothed when referring to leaves (Fig. 114); not lobed or divided when referring to peristome teeth.
Eperistomate – without a peristome.
Ephemeral – lasting a few days; short-lived.
Epidermis – a single layer of cells at the surface (particularly applied to stem cross-sections). (Fig. 150)
Epiphragm – in Polytrichaceae, a circular membrane formed by the expanded tip of the columella, partially closing the mouth of the capsule after dehiscence. (Fig. 204)
Equitant – straddling like a rider on horseback, referring to the conduplicate and strongly sheathing leaf bases of *Fissidens*. (Fig. 105)
Erect-Spreading – spreading at an angle of about 45° or less, erecto-patent. (Fig. 26)
Erose – irregularly notched or ragged, as though gnawed. (Fig. 98)
Eutrophic – rich in minerals, hence ± basic or alkaline.
Exannulate – lacking an annulus.
Exasperate – roughened.
Excavate – abruptly hollowed out.
Excurrent – extending beyond the apex or end of lamina. (Fig. 87, 88)
Exospore – the outer wall or surface of a spore.
Exostome – the outer peristome, consisting of *teeth* (only rarely undivided). (Fig. 224)
Exothecium – the outermost layer of the capsule wall, made up of *exothecial* cells. (Fig. 198)
Exserted – projecting and exposed, applied to capsules which project beyond the tips of the perichaetial leaves. (Fig. 188)
Exsiccati – dried specimens; usually referring more specifically to widely distributed, published sets of specimens, with printed labels, used as standards for comparison and often cited in monographic works.

Falcate – curved like the blade of a sickle. (Fig. 71)
Falcate-Secund – strongly curved and turned to one side. (Fig. 25)
Fascicle – a small bundle or cluster. (Fig. 9)
Fasciculate – bunched together, in bundles or *fascicles*.
Fastigiate – with branches nearly parallel and of ± equal length; also erect and columnar, because of the type of branching. (Fig. 13)
Fen – an open boggy habitat receiving nutrients from groundwater (*soligenous*), hence more mineral-rich than a bog (*ombrotrophic* in nutrition, receiving water and nutrients only by precipitation). BOGS are acid; FENS may be acid to neutral or alkaline. RICH FENS are dominated by sedges, with *Sphagnum* a minor element. POOR FENS (often called bogs) are *Sphagnum* dominated and are floristically similar to true bogs but richer in species.
Fenestrate – with broad, window-like openings (a more extreme condition than *perforate*).
Ferruginous – rusty.
Fibril – fine, fiber-like thickening of walls of hyaline cells of *Sphagnum*. (Fig. 151)
Fibrillose – with fine, fiber-like wall thickenings (*fibrils*); applied to hyaline cells of *Sphagnum* in which the fibrils may be spiral or annular. (Fig. 151)
Filiform – slender and elongate, filamentous, thread-like.
Fimbriate – fringed. (Fig. 96)
Flaccid – soft, limp, flabby.
Flagelliform (or Flagellate) – like the lash of a whip. (Fig. 12)
Flagellum (pl. Flagella) – a slender branch; referring to minute, axillary brood-branches and sometimes to long, slender, tapering stems or branches; a long, whip-like structure controlling the movement of the sperm cell. (Fig. 10)
Flexuose – slightly and irregularly bent, twisted, or wavy. (Fig. 113)

Foliose – leafy.
Foot – the basal absorbing organ of the sporophyte. (Fig. 196, 197)
Fovea – a depression or pit. (Fig. 167)
Foveolate – pitted. (Fig. 167)
Frondiferous – producing fronds.
Frondiform – like the fronds of ferns. (Fig. 23, 35)
Frondose – closely and regularly branched in one plane and resembling a fern frond.
Fruit – the capsule (or more loosely the sporophyte).
Fugacious – vanishing or readily falling away.
Fulvous – tawny, dull yellow-brown.
Fundus – the base of a peristome tooth. (Fig. 223)
Furcate – forked. (Fig. 143)
Furfuraceous – scaly.
Fuscous – dull, dark-brown, often tinged with black.
Fusiform – narrow and tapered at both ends, spindle-shaped. (Fig. 138)

Gametangia (sing. Gametangium) – antheridia and archegonia.
Gametophyte – the dominant, sexual generation; in mosses, the green, leafy plant (Fig. 1, 2); in liverworts, the gametophyte may be leafy or thallose.
Gasteropodous – bulging on one side (like a stomach); see also *gibbous* and *ventricose*. (Fig. 217)
Geminate – in pairs.
Gemma (pl. Gemmae) – a small, globose, elliptic, or cylindric body of a few cells serving in vegetative reproduction (see also *brood-body* and *propagulum*). (Fig. 169)
Gemmiferous (or Gemmiparous) – bearing gemmae.
Gemmiform (or Gemmaceous) – bud-like.
Geniculate – abruptly bent, like a knee. (Fig. 190)
Gibbous – swollen on one side above, resembling a hunched back. (Fig. 217)
Glabrous – smooth.
Glaucous – with a whitish, grayish, or bluish overcast (resembling the waxy bloom on a plum).
Globose – spherical. (Fig. 216)
Gonioautoicous (or Gonioautoecious) – monoicous, with the male inflorescence small, gemmiform, and axillary. (Fig. 170)
Gonidia – rarely used to refer to gemmae.
Granulose – roughened with minute, blunt projections (i.e., minutely grainy). (Fig. 163)
Gregarious – growing close together but not in tufts or mats.
Guard Cells – the cells surrounding a stoma, usually paired and kidney-shaped, occasionally a single cell with a central slit. (Fig. 126, 127)
Guide Cells – large, empty, rather thin-walled cells in a median row (as viewed in cross-section) in the costa of many mosses. (Fig. 130)
Gymnostomous – lacking a peristome.
Gynoecium – the female inflorescence (more often applied to hepatics). (Fig. 181)
Gyrate – circinate, coiled. (Fig. 70)

Habit – the aspect or general appearance of a plant.
Habitat – environment.
Hamate – hooked.
Hastate – abruptly broadened and auriculate at base, shaped like an arrow. (Fig. 66)
Helicoid – spirally twisted. (Fig. 111)
Heliophilous – preferring sunny places, photophilous.
Hemi-Isophyllous – in *Sphagnum*, stem leaves morphologically somewhat similar to branch leaves.
Heterogeneous – dissimilar.
Heteroicous (or Heteroecious) – with several forms of inflorescence on the same plant (or various plants of the same species); also called *polyoicous* and *polygamous*. (Fig. 174)
Heteromallous – pointing in all directions (opposed to *homomallous*, all pointing the same way).
Hispid – with short, stiff hairs, bristly. (Fig. 194)
Hoary – whitish or grayish.
Homogeneous – uniform.
Homomallous – pointing the same way.
Humicolous – growing on the ground.
Hyaline – colourless and transparent.
Hyalocyst – in *Sphagnum* leaves, a large, empty, colourless water-storage cell enclosed in a network of green chlorocysts; also called *hyaline cells*. (Fig. 151, 152)
Hyaloderm – in *Sphagnum*, a cortex of large, empty, colourless cells.
Hydric – very wet or aquatic.
Hydrophyte – an aquatic plant, growing submerged or floating.
Hydrophilous – in water, submerged or floating.
Hydroids – tracheid-like conductive cells in the axial strand of many mosses, sometimes also in the costa but not usually in contact with the central strand. (Fig. 150)
Hygrophyte – a plant of wet habitats but not in water.
Hygrophilous – adapted to wet (but not aquatic) habitats.
Hygroscopic (or Hygrometric) – changing position with a change in humidity, readily absorbing moisture (e.g., peristome teeth).
Hypnaceous (or Hypnoid) Peristome – like a *Hypnum*, i.e., a "perfect" double peristome, with 16 lanceolate teeth, cross-striolate at base, papillose above and trabeculate at back and a well-developed endostome consisting of a high basal membrane and 16 lanceolate, keeled segments alternating with one or more cilia. (Fig. 223, 225)
Hypophysis – a conspicuous swelling or expansion of the neck of the capsule (also called an *apophysis*). (Fig. 207, 208)

Imbricate – closely appressed and overlapping. (Fig. 17)
Immarginate – without a border.
Immersed – completely covered; immersed capsules are exceeded by the tips of the perichaetial leaves (Fig. 186); immersed stomata have guard cells ± sunken below the level of the exothecial cells (Fig. 126).
Inaperturate Spores – lacking "apertures" or thin spots in the exine (the most common type of moss spore).
Incised – cut into sharp divisions separated by narrow sinuses. (Fig. 97)
Inclined Capsules – less than vertical, between erect and horizontal. (Fig. 200)
Included – enclosed, not reaching the surface or extending beyond the surrounding organs.
Incrassate – thickened.
Incurved – curved upward and inward, applied to leaf tips and margins. (Fig. 92)
Indehiscent – without an operculum.
Inflated – swollen.
Inflexed (or Infolded) – bent upward and inward, applied to leaf margins (opposed to *reflexed*, bent under and inward). (Fig. 92)
Inflorescence – a cluster of sex organs and the leaves or bracts surrounding them.
Innovation – a new shoot, a branch formed after the maturity of sex organs, usually at the base of an inflorescence. (Fig. 8)
Inoperculate (or Deoperculate) – without the operculum, referring to a capsule after the operculum has fallen. (Fig. 224)
Insertion – the place of attachment of a leaf, branch, or peristome.
Intricate – interwoven, tangled.
Involute – inrolled, applied to leaf margins (opposed to *revolute*). (Fig. 93)
Isodiametric – about as broad as long (including square, rounded, or hexagonal). (Fig. 135)
Isophyllous – in *Sphagnum*, stem and branch leaves morphologically similar.

Jugum (pl. Juga) – a pair of leaves, rarely applied to leaves of *Fissidens*.
Julaceous – smoothly cylindric, like a worm or a catkin, referring to stems or branches with crowded and imbricate leaves. (Fig. 19)

Keeled - sharply folded along the middle, like the keel of a boat, *carinate*. (Fig. 104)

Lacerate - deeply and irregularly slashed or torn. (Fig. 99)
Laciniate - dissected into fine, deep, irregular divisions (*laciniae*), ciliate-fringed.
Lacunose - with irregular lumina because of deeply porose cell walls, or perforated, sometimes referring to cells with very thick walls (the lumina resembling a blank space or cavity).
Lamellae (sing. Lamella) - green ridges or plates on the costa or lamina of some moss leaves (Fig. 94, 95); thickened plates on peristome teeth, derived from cell walls.
Lamellose - composed of or furnished with lamellae.
Lamina (pl. Laminae) - the leaf blade (as distinguished from the *costa*). (Fig. 42)
Lanceolate - lance-shaped, narrow and tapered from the base (narrower than *ovate*). (Fig. 59)
Lanuginose - woolly, tomentose.
Lateral - at the side; opposed to *terminal*.
Lax - soft or loose, usually referring to large thin-walled cells.
Lenticular (or **Lentiform**) - doubly convex, lens-shaped. (Fig. 154)
Leptodermous - thin-walled, referring to leaf cells and also to capsules with soft or delicate walls (opposed to *pachydermous*).
Leucocyst - the large, empty, hyaline leaf cells of *Sphagnum*, Leucobryaceae, and *Paraleucobryum* (also called *hyalocysts*). (Fig. 151, 152)
Lid - operculum. (Fig. 200)
Ligulate - strap-shaped (longer and narrower than *lingulate*). (Fig. 55)
Limb - the upper part of a leaf, contrasted with the base. (Fig. 94)
Limbate - bordered. (Fig. 42)
Linear - very narrow and elongate, with nearly parallel sides (narrower than *ligulate*). (Fig. 56)
Lingulate - tongue-shaped, oblong with a broadened apex. (Fig. 58)
Lumen (pl. Lumens or Lumina) - the cell cavity. (Fig. 141)
Lunate (or **Lunulate**) - crescent-shaped. (Fig. 147)
Lurid - dingy brown or yellow, pale.

Macronemata (sing. Macronema) - large, freely branched rhizoids produced around branch primordia and in the leaf axils (Mniaceae). (Fig. 37)
Mammilla (pl. Mammillae) - a bulging protuberance with a blunt, nipple-like tip. (Fig. 148, 149)
Mammillose (or **Mammillate**) - convex with a blunt central projection. (Note: also correctly spelled mamilla, mamillose, etc.). (Fig. 148, 149)
Mat - a densely interwoven, horizontal form of growth (*cf. Hypnum*).
Median - middle.
Median Leaf Cells - cells in the upper middle of the leaf; in leaves with a well-developed costa, those between costa and margin about 2/3 up the leaf.
Membrane Gaps - irregular openings in the outer walls of hyaline cells of *Sphagnum* stem leaves. (Fig. 153)
Meristem - the growing point or a zone of continuing growth.
Mesic - moist, neither very wet nor very dry but intermediate.
Mesophytic - adapted to a temperate climate or a relatively moist habitat.
Mesotrophic - more or less neutral in reaction, neither acid nor basic (cf. *eutrophic* and *oligotrophic*).
Micrometer - one-thousandth of a millimeter (represented by μm); replaces *micron* (μ).
Micronemata (sing. Micronema) - small, sparsely branched rhizoids scattered along the stems without any definite location in relation to the leaves or branch primordia (Mniaceae). (Fig. 37)
Midrib - a mid-vein or single costa. (Fig. 42)
Mitrate (or **Mitriform**) - conic and undivided or equally lobed at base, similar to a bishop's miter, referring to calyptrae (opposed to *cucullate* or split on one side). (Fig. 193)
Moniliform - resembling a string of beads.
Monoicous (or **Monoecious**) - with antheridia and archegonia on the same plant, including autoicous, synoicous, paroicous, and polyoicous (opposed to *dioicous*). (Fig. 170-175)
Monolete Spores - having a single scar on the surface of the exine (as in *Funaria hygrometrica* and *Bryum caespiticium*).
Monopodial Branching - differentiation into primary and secondary shoots (or stems and branches).
Morphology - form, structure.
Mucro - a short, abrupt point. (Fig. 76)
Mucronate - ending abruptly in a short point usually caused by a shortly excurrent costa (Fig. 76); APICULATE indicates a somewhat longer tip (Fig. 81) and CUSPIDATE a longer, stouter, tooth-like tip (Fig. 82).
Multi- - prefix meaning many, as in *multicellular, multistratose*.
Muriculate - roughened with minute, sharp points (diminutive of *muricate*).
Muticous - without a point or awn.

n - number of chromosomes in the gametophyte or haploid generation; when a number like 19 + 2 is given, + 2 indicates the presence of m-chromosomes which are minute, accessory chromosomes.
2n - number of chromosomes in the sporophyte or diploid generation.
Naked - lacking various organs or appendages; a *naked calyptra* lacks hairs.
Nanandry - sexual dimorphism, with male plants dwarfed (see also *phyllodioicous* and *pseudomonoicous*).
Navicular - boat-shaped. (Fig. 44)
Neck - the sterile basal portion of a capsule, sometimes considerably differentiated. (Fig. 195)
Nerve - costa. (Fig. 42)
Nidulant - nesting, rarely used to refer to the bud-like plants of *Ephemerum* nested on an abundant protonematal mat.
Nitrophilous - preferring substrata rich in nitrogenous compounds.
Node - the joint, often swollen, where segments of the peristome are united. (Fig. 231)
Nodose - with knob-like thickenings. (Fig. 231)
Nodulose - minutely knobbed.
Nutant - nodding, drooping.

Ob- - a prefix indicating inversion, as in *obovate* (Fig. 52) (egg-shaped, with the broader portion at the apex rather than the base), *obconic, obclavate, obcordate*, etc.
Oblate - wider than long.
Oblong - much longer than broad, with nearly parallel sides. (Fig. 50)
Obscure - dark, indistinct.
Obsolete - scarcely evident, almost lacking (usually referring to the costa).
Obtuse - broadly pointed (more than 90°); used by some authors to mean blunt or rounded. (Fig. 77)
Ochraceous - brownish-yellow.
Oligo- - a prefix denoting few.
Oligoporous - with a few pores.
Oligotrophic - poor in minerals, hence acid in reaction (opposed to *eutrophic*).
Olivaceous - olive-green.
Opaque - dark, not transparent or translucent.
Operculate - capsule with an operculum.
Operculum (pl. Opercula) - the lid covering the mouth of a moss capsule, falling at maturity to release the spores. (Fig. 200)
Oral - referring to the mouth of a capsule.
Orbicular - nearly circular. (Fig. 53)
Orifice - mouth of a capsule.
Oval - broadly elliptic. (Fig. 49)

Ovate – egg-shaped (with the base broader than the apex). (Fig. 51)

Ovoid – an egg-shaped solid. (Fig. 159)

Oxylophile (or Oxylophyte) – a plant of acid habitats, an acidophile.

Pachydermous – thick-walled, referring to cell walls or to firm and tough or leathery capsules.

Palmate – with finger-like lobes radiating from the centre.

Panduriform – shaped like the body of a violin (obovate with a sinus on either side). (Fig. 46)

Papilla (pl. Papillae) – a minute protuberance of various forms. (Fig. 143, 144)

Papillose – roughened by one to many minute protuberances.

Paraphyllium (pl. Paraphyllia) – small, green, filiform, lanceolate, or leaf-like, sometimes branched structures often produced on stems or branches of pleurocarpous mosses. (Fig. 125)

Paraphyses (sing. Paraphysis) – hyaline or yellowish, uniseriate, multicellular hairs, sometimes club-shaped, mingled with the antheridia (and often with archegonia). (Fig. 178, 180, 181)

Parenchyma – a tissue of relatively undifferentiated cells, usually thin-walled and isodiametric (hence with broad ends). (Fig. 150)

Parenchymatous – composed of ± short cells joined end to end (opposed to *prosenchymatous*).

Paroicous (or Paroecious) – with antheridia and archegonia in the same inflorescence but not mixed, the antheridia in the axils of uppermost and perichaetial leaves. (Fig. 175)

Patent – spreading at 45° or more (used by some authors to mean spreading at 26–45°, *patulous* meaning 46–90°). (Fig. 27)

Pectinate – resembling a comb.

Pedicel – the stalk or seta on which the capsule is borne. (Fig. 196)

Pellucid – clear, translucent or transparent.

Peltate – shield-like, flat and attached by a stalk on the underside.

Pendent – hanging. (Fig. 219)

Pendulous – somewhat drooping, inclined more than horizontally; with stems and branches hanging, a growth form common in tropical cloud forests.

Penicillate – like an artist's brush, ending in a tuft. (Fig. 7)

Percurrent – extending to the apex. (Fig. 86)

Perfect Peristome – see *bryaceous* or *hypnaceous peristome*. (Fig. 223)

Perichaetium (pl. Perichaetia) – the leaves (*perichaetial leaves*) or bracts surrounding the archegonia, opposed to the *perigonium*.

Perigonium (pl. Perigonia) – the leaves (*perigonial leaves*) or bracts surrounding the antheridia, opposed to the *perichaetium*.

Perigonial Bud – the male inflorescence. (Fig. 178)

Perichaetial Bud – the female inflorescence. (Fig. 181)

Peristome – a single or double circle of teeth inside the mouth of the capsule; the outer peristome (or *exostome*) consisting of *teeth*, the inner peristome (or *endostome*) consisting of *segments*, sometimes alternating with *cilia*, often rising from a *basal membrane*. (Fig. 195, 224).

Phaneropore – with superficial stomata, that is, the guard cells at the same level as other exothecial cells and not sunken in chambers (opposed to *cryptopore*). (Fig. 127)

Photophilous – preferring well-lighted habitats, *heliophilous*; opposed to *sciaphilous*.

Phyllodioicous – nanandrous; with dwarf male plants which rest on leaves or tomentum of the larger female plants.

Phyllotaxy – the arrangement of leaves in regard to the axis.

Piliferous – hair-pointed. (Fig. 72)

Pilose – long-hairy.

Pinnate – with numerous, spreading branches on two sides of the axis and thus resembling a feather. (Fig. 4)

Pit – small opening or pore through the walls of adjoining cells, sometimes marked by a conspicuous depression in thick-walled cells. (Fig. 141)

Plane – flat. (Fig. 89)

Pleurocarpous – producing the sporophytes laterally (from a mere perichaetial bud or a short, specialized branch) rather than at the stem tip; PLEUROCARPOUS MOSSES are usually prostrate, freely branched and grow in mats rather than tufts. (Fig. 2)

Plicate – folded in longitudinal pleats (*plicae*). (Fig. 68)

Plumose – closely and regularly pinnate, feathery. (Fig. 32)

Pluri- – a prefix denoting many, as in *pluripapillose*, *pluriseriate*, or *pluristratose*.

Polyedaphic – occurring on many kinds of substrates.

Polygamous – with antheridia and archegonia in separate inflorescences and also mixed together on the same plants, or on different plants of the same species (also called *polyoicous* and *heteroicous*). (Fig. 174)

Polymorphous (or Polymorphic) – of many forms, variable.

Polyoicous (or Polyoecious) – see polygamous. (Fig. 174)

Pores – small openings or "pits" in the walls of some cells, sometimes conspicuous as depressions in thick walls between adjacent cells (Fig. 141); in *Sphagnum* the pores are particularly large and conspicuous in the exposed walls of the hyaline cells of branch leaves and also in outer stem cells (Fig. 151, 153); porose cell walls may be minutely or quite obviously perforated.

Porose – pierced with small holes; also called PITTED. (Fig. 141, 151)

Predominant – very conspicuous, prominent.

Primary Stem – the main stem, often creeping or rhizome-like with reduced or scale-like leaves.

Processes – segments of the endostome.

Procumbent – spreading, prostrate.

Proliferous – continuing growth by the production of a new stem (or *innovation*).

Propagulum (pl. Propagula) – reduced bud, branch, or leaf serving in vegetative reproduction (see also *brood body* and *gemma*). (Fig. 168)

Prorate – cells that appear papillose by protruding ends (i.e., "papillose by projecting cell ends" according to many bryologists). (Fig. 139)

Prorula – a protrusion of the distal or proximal ends of (superficial) cell walls.

Prosenchyma – a tissue made up of elongate cells with tapered ends. (Fig. 142)

Prosenchymatous – with narrow, elongate cells overlapping at the ends (opposed to *parenchymatous*).

Prostrate – creeping.

Protean – exceedingly variable.

Protonema (pl. Protonemata) – green, branched filaments produced on germination of spores and giving rise to a leafy or thallose gametophyte (Fig. 128); in *Sphagnum and Andreaea* the protonema is ± thallose rather than filamentous (Fig. 129); *secondary protonemata* are sometimes also produced on leaves or stems of mosses, sometimes at wounds (e.g., broken leaves).

Protonematous Rhizoids – macronemata capable of producing protonemata if detached from stems (Mniaceae).

Proximal – the part nearest the axis (opposed to DISTAL).

Pseudo- – a prefix denoting false.

Pseudannulus – an apparent annulus consisting of small, non-vesiculose cells.

Pseudautoicous or Pseudomonoicous – with dwarf males growing on female plants.

Pseudoparaphyllium (pl. Pseudoparaphyllia) – a small, unistratose, foliose (Fig. 124) or filamentous (Fig. 123) structure resembling paraphyllia but occurring only around the branch primordia or branch bases of pleurocarpous mosses.

Pseudopodium – an elongation of the gametophytic axis below the sporophyte in *Sphagnum* and *Andreaea*, serving the function of a seta (Fig. 197); also applied to a similar extension of a stem tip bearing clusters of gemmae (e.g., *Aulacomnium*). (Fig. 189)

Pseudopore - Pore-like features developed along the commissures in branch leaves of *Sphagnum*. Formed by extensions of the reinforcing fibrils that extend parallel to the commissures and perpendicularly between the fibril bands.
Pseudostomata - in *Sphagnum* capsules, vestigial stomata, consisting of two guard cells but no pore. (Fig. 160)
Pulvinate - cushion-like.
Punctate - dotted, usually referring to spore markings.
Punctulate - minutely dotted.
Pungent - ending in a stiff or hard point.
Pyriform - pear-shaped. (Fig. 218)

Quadrate - square.
Quinquefarious - in five rows.

Radicles - rhizoids, slender, non-chlorophyllose threads attaching the plants to the substrate, often covering stems, occasionally growing from leaf tips; the radicles of mosses usually have oblique cross-walls. (Fig. 1)
Radiculose - covered with rhizoids.
Ramentum - a woolly covering or tomentum, made up of radicles.
Ramuli (sing. Ramulus) - the smaller divisions of a much branched plant.
Ramulose - with small branches.
Rank - row.
Receptacle - an expanded and ± elevated structure bearing sex organs and eventually sporophytes, rarely used in the Musci to refer to the tissue on which the reproductive organs are borne.
Recurved - curved downward or backward, referring to leaf margins or tips, marginal teeth, or peristome teeth. (Fig. 90)
Reflexed - bent backward. (Fig. 90)
Regular - symmetric.
Reniform - kidney-shaped. (Fig. 64)
Repand - slightly sinuose.
Repent - creeping.
Resorption - disappearance or erosion of parts of cell walls in *Sphagnum* leaves. (Fig. 152, 153)
Resorption Furrow - a furrow produced by the disappearance of the outer cell walls at the leaf margins of some species of *Sphagnum*, best seen in cross-section. (Fig. 152, 153)
Reticulate - in a network.
Retort Cells - cells with a pore at the upper end, terminating a short, projecting neck, found in the cortex of branches in many species of *Sphagnum*. (Fig. 161)
Retuse - slightly indented at a broad apex. (Fig. 79)
Revoluble - rolling away, referring to an annulus which falls in a ring. (Fig. 221)
Revolute - rolled downward and backward, referring to leaf margins. (Fig. 91)
Rhizautoicous - monoicous, with the male inflorescence on a very short branch attached to the female stem by rhizoids and thus appearing to be a separate plant.
Rhizoidal Gemma (or Tuber) - asexual reproductive body borne on a rhizoid (normally subterranean). (Fig. 131)
Rhizoids - simple or branched, septate filaments, usually with oblique cross-walls, dead at maturity, anchoring the plant and sometimes covering the stem (see also *radicles*). (Fig. 1)
Rib - a longitudinal ridge on capsules or other organs. (Fig. 203)
Rhizome - a slender, horizontal, subterranean, root-like stem. (Fig. 28)
Rhombic - diamond-shaped. (Fig. 136)
Rhomboidal - longer than rhombic, oblong-hexagonal. (Fig. 137)
Ringed Pore - in *Sphagnum*, a pore with a fibril ring around it.
Rosette - circular (rose-like) arrangement of leaves. (Fig. 34)
Rostellate - shortly or minutely beaked.
Rostrate - beaked. (Fig. 202)
Rostrum - see *beak*. (Fig. 205)
Rosulate - in rosettes. (Fig. 34)
Rotund - round.
Rufous - reddish.
Rugose - with irregular transverse wrinkles or undulations. (Fig. 69)
Rugulose - slightly rugose.
Rupestral - growing on rocks (also called *saxicolous*).

Saccate - abruptly and deeply concave, forming a sack.
Saprophyte - living on dead organic matter, opposed to *parasite*.
Saxicolous - growing on rocks (*rupestral*).
Scabrous - rough.
Scalariform - ladder-like.
Scalpelliform - asymmetric and resembling the blade of a penknife. (Fig. 61)
Scarious - dry and thin, scale-like or membranous.
Sciaphilous - preferring shady habitats.
Scindula - a protrusion of the distal or proximal ends of (superficial) cell walls (see *prorula*).
Scleroderm - the thick-walled cells forming a woody cylinder in stems and branches of *Sphagnum*.
Secondary Stem - branches arising from the main or primary stem.
Secund - turned to one side.
Segments - the tooth-like divisions of the inner peristome, sometimes called *processes*. (Fig. 223)
Septate - divided by cell walls, having partitions.
Seriate - in rows.
Serrate - saw-toothed, with marginal teeth pointing forward (*doubly serrate* is when the teeth overlap and are joined in pairs). (Fig. 120, 121)
Serrulate - minutely serrate. (Fig. 119)
Sessile - without a stalk or seta, hence *immersed*.
Seta (pl. Setae) - the stalk supporting the capsule. (Fig. 196)
Setaceous - bristle-like. (Fig. 83)
Sheath - basal portion of leaf clasping stem, e.g., leaf of *Polytrichum*. (Fig. 94)
Sheathing - ± surrounding and clasping the stem or the base of the seta. (Fig. 36)
Shoulder - the area where a leaf base is abruptly narrowed to the limb. (Fig. 94)
Sigmoid - somewhat S-shaped. (Fig. 133)
Siliceous - having a high silicon content, sandy (usually poor in bases).
Silicicolous - growing on sandstone or other siliceous rock.
Simple - applied to structures, organs or plants that are unbranched.
Sinistrorse - twisted to the left.
Sinuose (or Sinuate) - wavy. (Fig. 134)
Sinuolate - minutely or slightly wavy.
Sinus - a depression between two lobes or prominences; the indentation between lobes of a leaf. (Fig. 65)
Sordid - of a dirty or muddy colour.
Spatulate - tapered from a broad, rounded apex (similar to lingulate but more abruptly narrowed from a broad apex). (Fig. 57)
Spiculose - sharply and minutely toothed or papillose. (Fig. 117)
Spindle-shaped - fusiform; narrow, elongate and tapered at both ends. (Fig. 138)
Spinose - spiny, with sharp, slender teeth or projections. (Fig. 41, 118)
Spinulose - minutely spiny.
Sporangium (pl. Sporangia) - the spore case or capsule of the sporophyte. (Fig. 196, 197)
Spore Sac - a cavity in the capsule or sporangium of a moss where the spores are produced.
Spores - minute, mostly spherical, nearly always unicellular bodies, produced in the capsule as a result of reduction division, giving rise on germination to protonemata.
Sporophyte - the spore-bearing generation; the spore-bearing plant, produced by the fertilization of an egg, remaining attached to the gametophyte and partially dependent on it, typically consisting of foot, seta and capsule. (Fig. 1, 2, 196, 197)

Spreading – at an angle of 45° or more; *wide-spreading* means nearly 90°, *squarrose* 90°, *squarrose-recurved* 90° with recurved tips. (Fig. 27)
Squalid – sordid or dirty.
Squamose – scaly or scale-like.
Squarrose – spreading at right angles. (Fig. 30)
Squarrose-recurved – spreading at right angles, with the tips curved downward. (Fig. 31)
Stegocarpous – with operculum differentiated (opposed to *cleistocarpous* or *astomous*).
Stellate – star-shaped.
Stereids – slender, elongate, thick-walled, fiber-like cells found in groups in the costa of some mosses; also applied to linear, thick-walled border cells. (Fig. 130)
Sterile – barren, not fertile, lacking sporophytes.
Stipe – the unbranched base of a dendroid or frondose plant.
Stipitate – with a trunk-like base.
Stoloniferous (or Stoloniform) – plants that bear slender, creeping, usually minutely leaved stems and branches (*stolons*), often radiculose near the tips (e.g., sterile shoots of *Plagiomnium*).
Stoma (pl. Stomata) – opening in the capsule wall, usually in the neck, surrounded by guard cells. (Fig. 126, 127)
Stramineous – straw-coloured.
Strangulate – deeply constricted below the mouth of a capsule. (Fig. 209)
Stratose – in distinct layers.
Stratum (pl. Strata) – a layer.
Striate – marked with fine, longitudinal ridges (*striae*). (Fig. 201)
Strict – straight and rigid.
Striolate – finely ridged.
Strumose – with a goiter-like swelling (or *struma*) at the base; applied to some capsules. (Fig. 205)
Strumulose – with a small or indistinct swelling at one side of the capsule base.
Sub- – a prefix meaning nearly, almost, somewhat, as in *subacute*, *subentire*, *subpercurrent*, *subdendroid*, or *subquadrate*; also used to mean under, as *submedian* or *subterranean*.
Subula – a long, slender point. (Fig. 85)
Subulate – slenderly long-acuminate, shaped like a needle or awl. (Fig. 84)
Sulcate – grooved or furrowed. (Fig. 202)
Surculus – a sucker-like outgrowth, rarely used to refer to upright secondary stems arising from a horizontal primary stem or "rhizome".
Suture – a line formed by the junction of two parts.
Synoicous (or Synoecious) – with antheridia and archegonia mingled in the same inflorescence. (Fig. 172, 173)
Systylius (or Systylous) – with the operculum remaining attached to the tip of the columella after dehiscence. (Fig. 212)

Taxon (pl. Taxa) – a taxonomic group or entity of any rank (e.g., species, variety, form, etc.).
Teeth – see *tooth*.
Terete – rounded in cross-section, cylindric. (Fig. 19)
Terrestrial – growing on the ground, *terricolous*.
Tessellated – checkered, in a pattern of squares; applied to the basal membrane of *Tortula*. (Fig. 222)
Tetrad – a group of four developing or rarely mature spores; because of development in tetrads some mature spores are ellipsoidal, angular, or ± kidney-shaped, sometimes *tetrahedral*.
Tetrahedral – having or made up of four sides; e.g., *Sphagnum* spores.
Thallose – flat, not much differentiated, and cordate or ribbon-like in body form. (Fig. 129)
Tomentose – woolly, densely radiculose, covered by a *tomentum* of rhizoids. (Fig. 38)
Tomentum – a covering of hair; the dense felt of rhizoids covering the lower parts of the stems in many mosses.
Tooth – a division of the outer peristome (divisions of the endostome are called *segments* or *processes* (Fig. 223); also applied to an irregularity or projection on leaves (*toothed*). (Fig. 118)
Tortuose – irregularly bent or twisted. (Fig. 110)
Trabeculate – with projecting cross-bars (*Trabeculae*) on the peristome teeth. (Fig. 227)
Tri- – a prefix meaning thrice.
Trifarious (or Tristichous) – in three rows. (Fig. 22)
Trigonous (or triquetrous) – three-cornered.
Trilete Spores – having a three-pronged scar on the wall (as in *Sphagnum*). (Fig. 158)
Triradiate – three-pronged; often used to refer to the scar of a trilete spore.
Truncate – abruptly cut off or squared off at the apex.
Tuber – see rhizoidal gemma. (Fig. 131)
Tuberculate – beset with knobby projections. (Fig. 166)
Tubulose – tube-like, usually referring to leaves with strongly incurved margins. (Fig. 106)
Tufa – a porose limestone formed by deposition from calcareous waters (often formed because of the CO_2 relationships – in photosynthesis and respiration – of mosses).
Tuft – clump or cluster of ± erect shoots.
Tumid – swollen, inflated.
Turbinate – top-shaped. (Fig. 211)
Turgid – plump or swollen.

Umbonate – convex with an abrupt, rounded, central point. (Fig. 80)
Uncinate – hooked. (Fig. 70)
Undulate – wavy. (Fig. 67)
Unequal – asymmetric.
Unguiculate – ending in a point similar to an animal's claw. (Fig. 85)
Uni- – a prefix meaning one, as in *unilateral*, *unipapillose*, *unistratose*, or *uniseriate*.
Urceolate – urn-shaped, applied to capsules constricted below a wide mouth and abruptly narrowed at the base. (Fig. 210)
Urn (or Theca) – the spore-bearing portion of a capsule, as opposed to the sterile neck. (Fig. 195)
Utricle – a vesicle, rarely used to refer to the enlarged cortical cells of *Sphagnum*.

Vaginate – sheathing.
Vaginant Lamina – in *Fissidens*, the expanded lamina at base of the leaf which clasps the stem and the base of the leaf above it. (Fig. 105)
Vaginula – the ring or sheath enveloping the base of the seta, derived from the base of the archegonium and remaining after the separation of the calyptra.
Valve – one of the segments into which a capsule separates on dehiscence; among Bryophyta, applied only to some liverworts and the Andreaeopsida. (Fig. 206)
Vegetative Leaves – all the leaves on the plant except the perigonial and perichaetial leaves.
Venter – the swollen basal portion of an archegonium, containing the egg. (Fig. 182)
Ventral – the inner surface of a peristome tooth, the upper (*adaxial*) surface of a moss leaf, or the lower surface of a prostrate stem or thallus. (Fig. 40)
Ventral Lamina – in *Fissidens*, the portion of the leaf blade above the vaginant lamina. (Fig. 105)
Ventricose – bulging on one side below (like a stomach). (Fig. 217)
Vermicular – narrowly cylindric and curved, like a worm. (Fig. 132)
Verrucose (or Verruculose) – very warty, much covered with warts. (Fig. 145, 146)
Vesiculose – inflated, bladder-like.
Villi (sing. Villus) – paraphyllia. (Fig. 125)
Vittate – striped.

Wefts - a loosely interwoven, often ascending growth form (as in *Thuidium*).
Whorled - arranged in a ring or circle. (Fig. 15)
Wide-Spreading - spreading at a wide angle but less than 90° (which is squarrose). (Fig. 29)

Xeric - very dry.
Xeromorphic - structurally adapted for dryness.
Xerophilous - preferring dry places.
Xerophyte - a plant of dry, often hot places.

Zygomorphic - bilaterally symmetric. (Fig. 210, 215, 216)

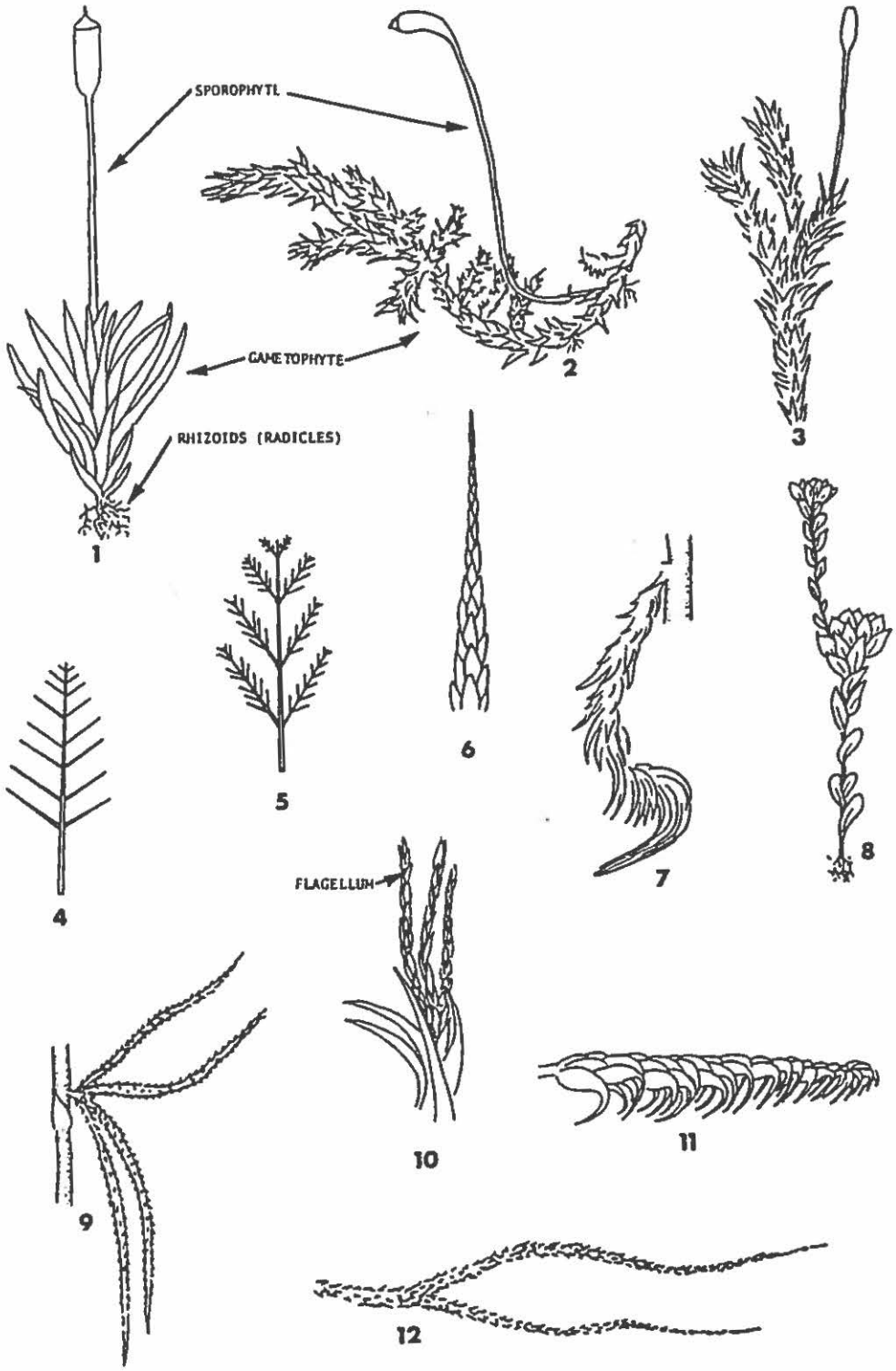


Plate 399. 1. Acrocarpous. 2. Pleurocarpous. 3. Cladocarpous. 4. Pinnate. 5. Bipinnate. 6. Attenuate. 7. Penicillate. 8. Innovation. 9. Fascicle. 10. Flagella. 11. Decurved. 12. Flagelliform.

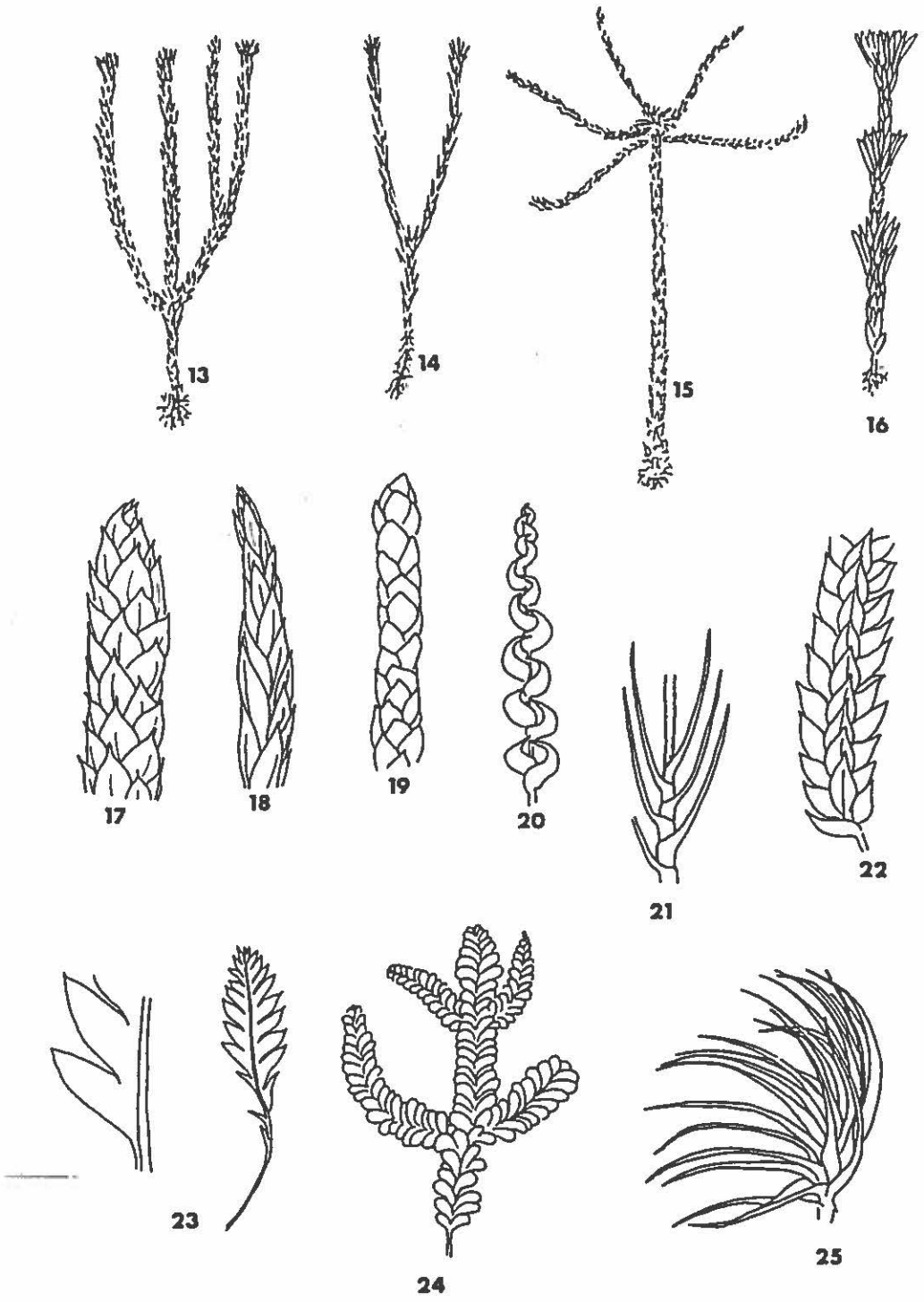


Plate 400. 13. Fastigiate. 14. Dichotomous. 15. Whorled. 16. Annotinous. 17. Imbricate. 18. Appressed. 19. Julaceous, terete. 20. Catenulate. 21. Amplexicaul. 22. Trifarious. 23. Confluent, frondiform. 24. Complanate. 25. Falcate-secund.

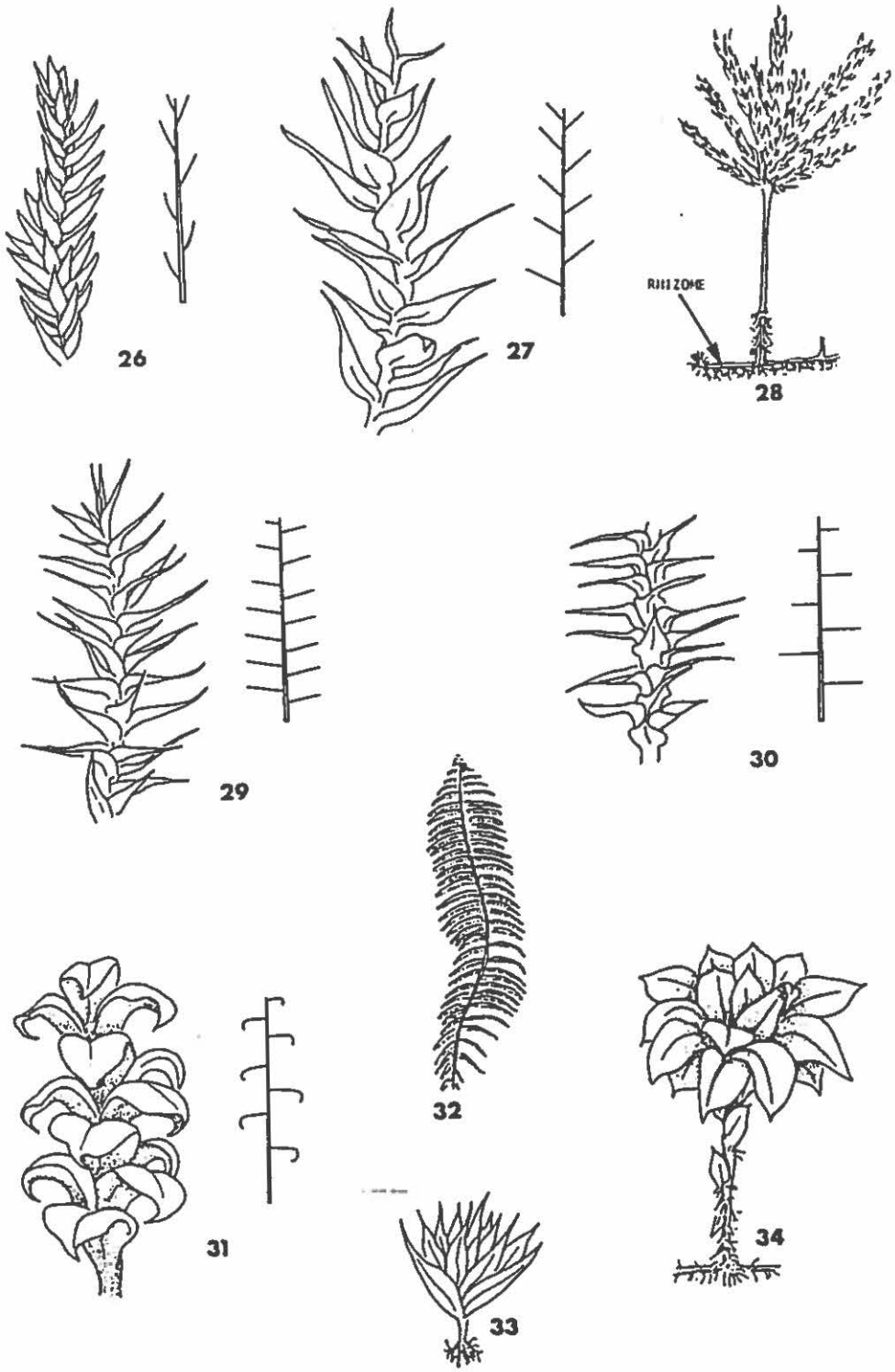


Plate 401. 26. Erect-spreading. 27. Spreading, patent. 28. Dendroid. 29. Wide-spreading, patulous. 30. Squarrose. 31. Squarrose-recurved. 32. Plumose. 33. Bulbiform. 34. Rosette, rosulate.

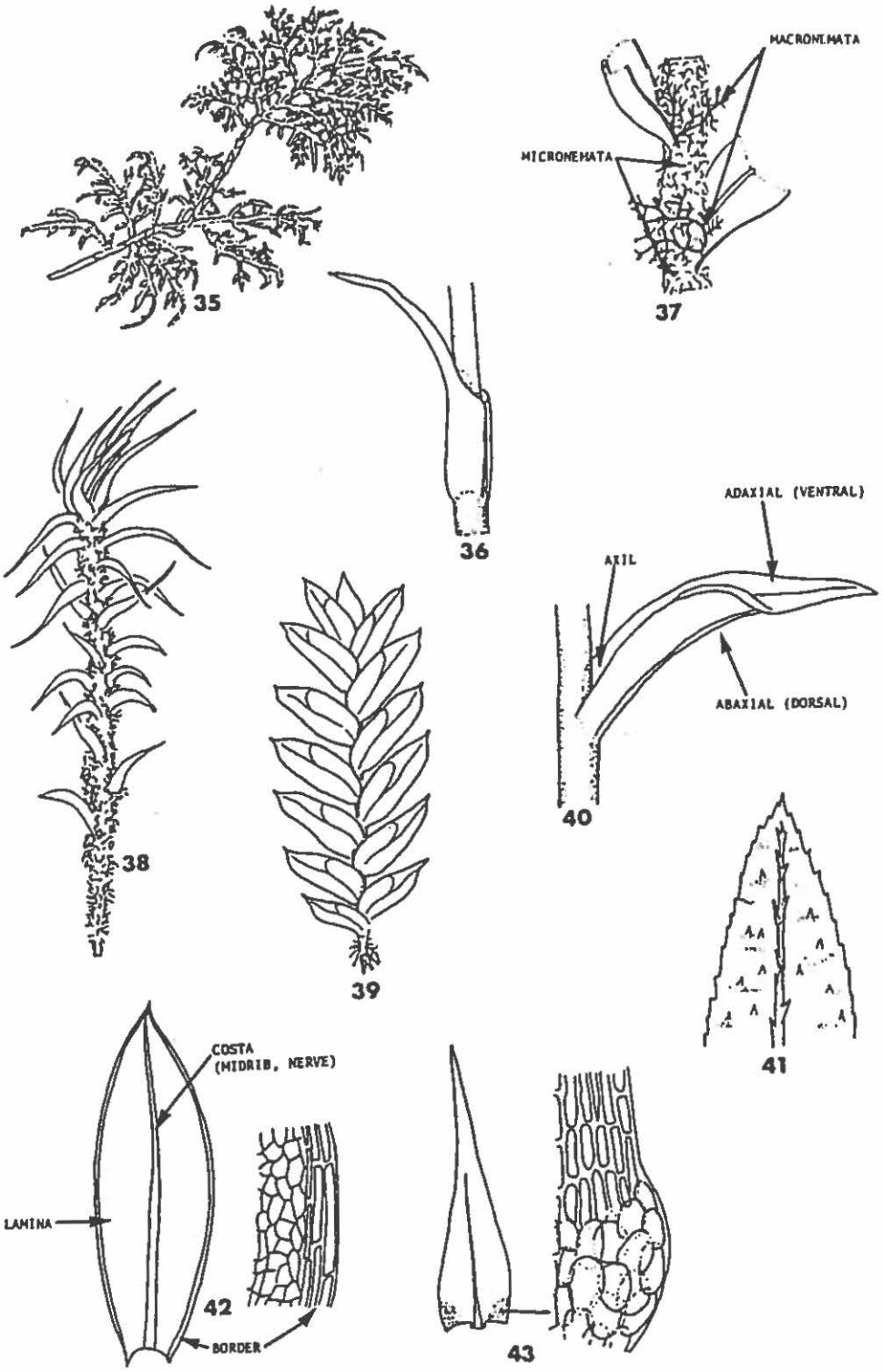


Plate 402. 35. Frondiform. 36. Sheathing. 37. Macronemata and micronemata. 38. Tomentose. 39. Distichous. 40. Leaf axil, adaxial (ventral) and abaxial (dorsal) surfaces. 41. Spinose. 42. Limbate, bordered. 43. Alar cells.

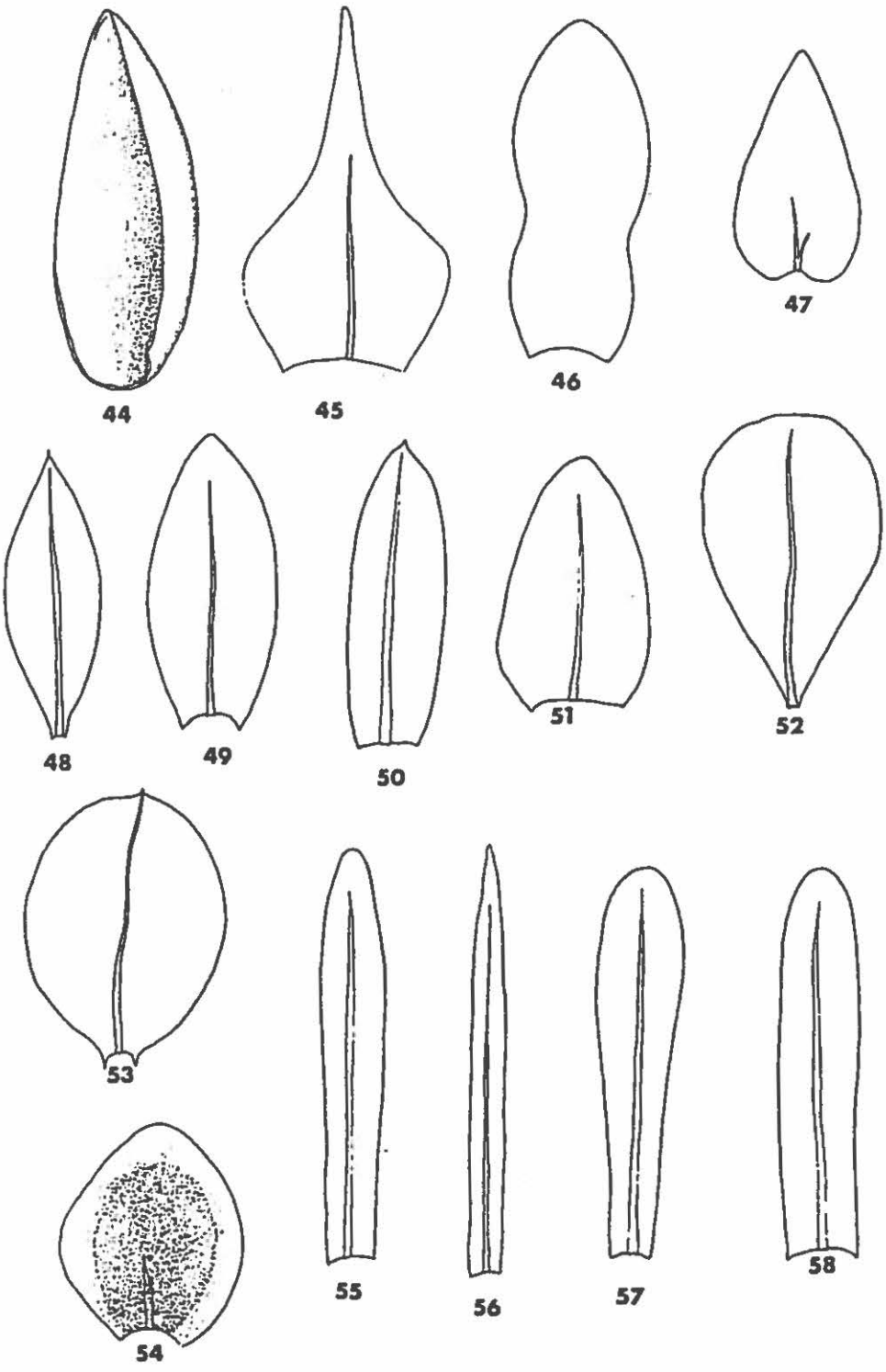


Plate 403. 44. Cymbiform, navicular. 45. Deltoid. 46. Panduriform. 47. Cordate. 48. Elliptic. 49. Oval. 50. Oblong. 51. Ovate. 52. Obovate. 53. Orbicular. 54. Cochleariform. 55. Ligulate. 56. Linear. 57. Spatulate. 58. Lingulate.

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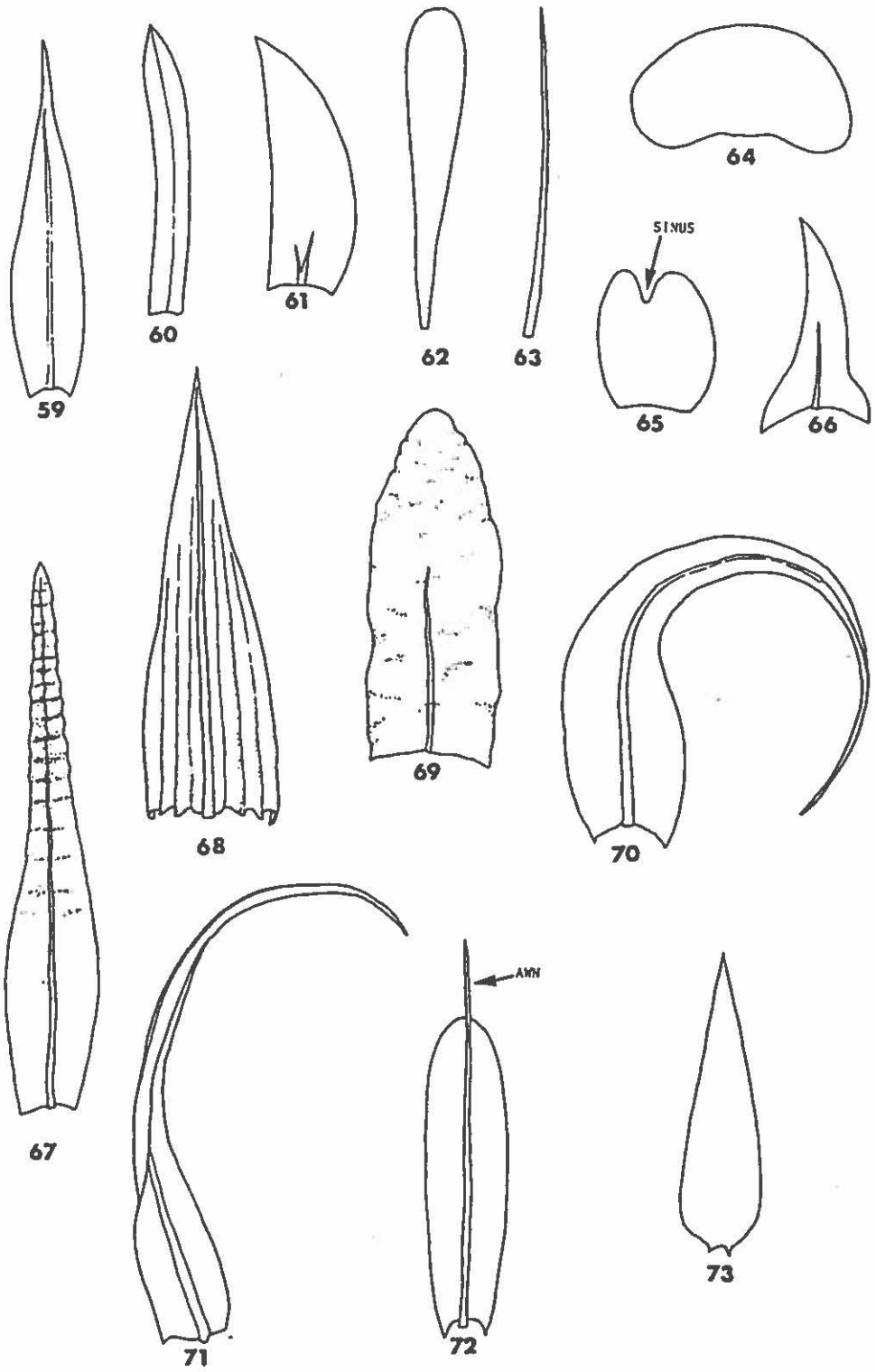


Plate 404. 59. Lanceolate. 60. Ensiform. 61. Cultriform, scalpelliform. 62. Clavate. 63. Acicular. 64. Reniform. 65. Bilobed. 66. Hastate. 67. Undulate. 68. Plicate. 69. Rugose. 70. Circinate, gyrate, uncinate. 71. Falcate. 72. Aristate, piliferous. 73. Ecostate, enervate.

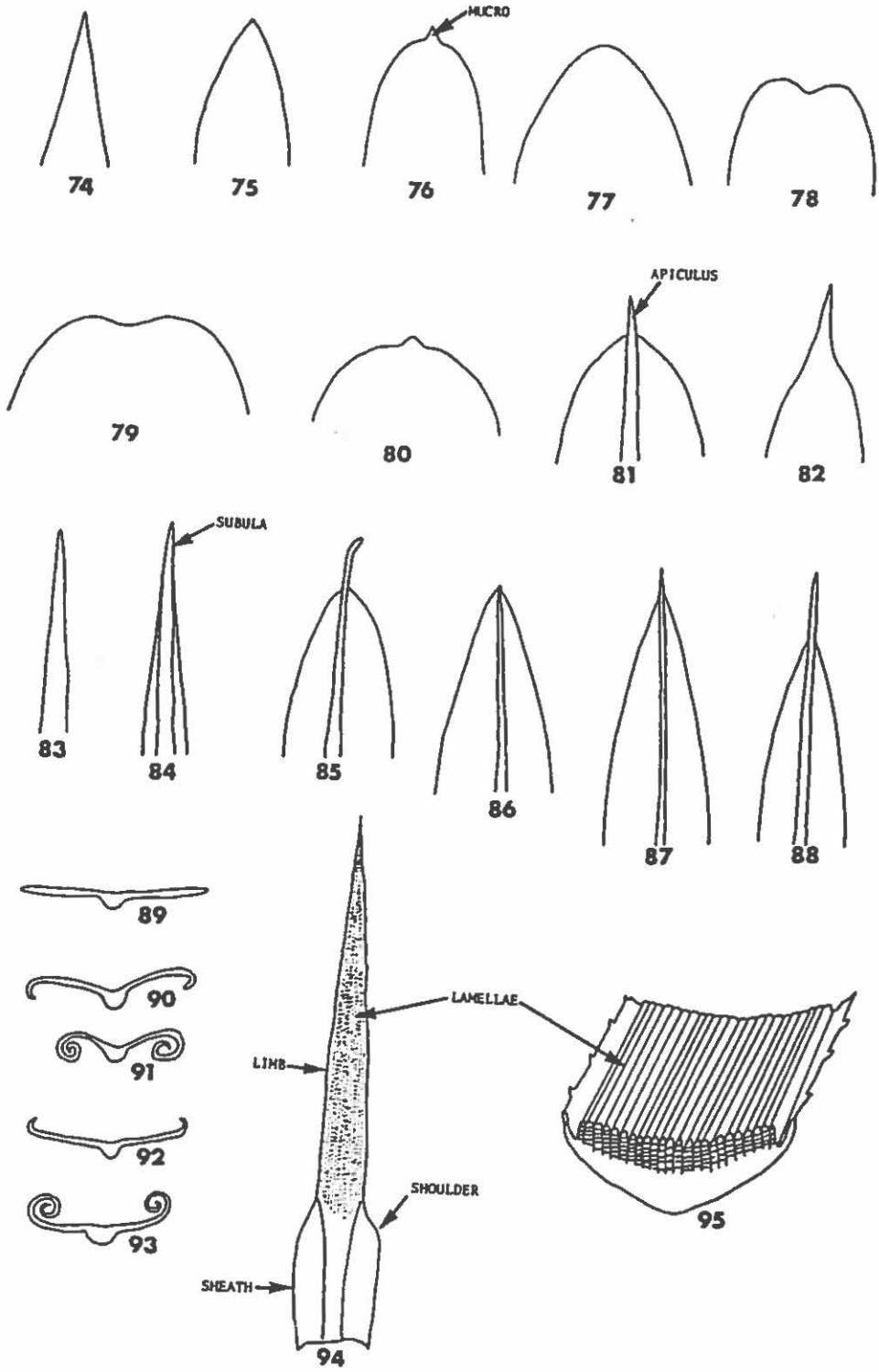


Plate 405. 74. Acuminate. 75. Acute. 76. Mucronate. 77. Obtuse. 78. Emarginate. 79. Retuse. 80. Umbonate. 81. Apiculate. 82. Cuspidate. 83. Setaceous. 84. Subulate. 85. Unguiculate. 86. Percurrent. 87–88. Excurrent. 89–93. Cross-sections of leaves. 89. Plane. 90. Deflexed, recurved, reflexed. 91. Revolute. 92. Incurved, inflexed. 93. Involute. 94. Lamellae on *Polytrichum* leaf. 95. Section of lamellae on *Polytrichum* leaf.

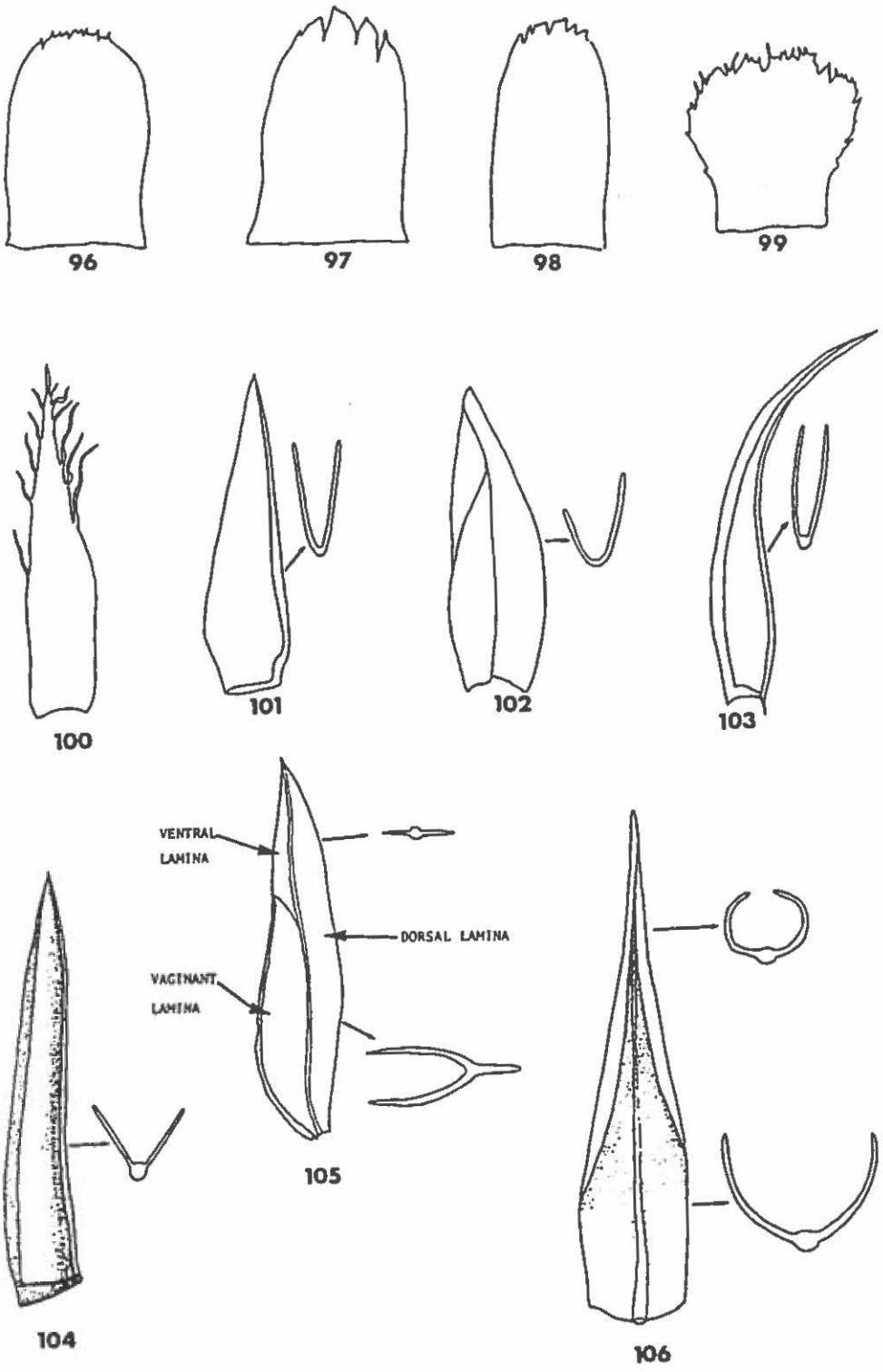


Plate 406. 96. Fimbriate. 97. Incised. 98. Erose. 99. Lacerate. 100. Ciliate. 101. Conduplicate. 102. Complicate. 103. Complicate-carinate. 104. Carinate, keeled. 105. Equitant. 106. Canaliculate, tubulose.

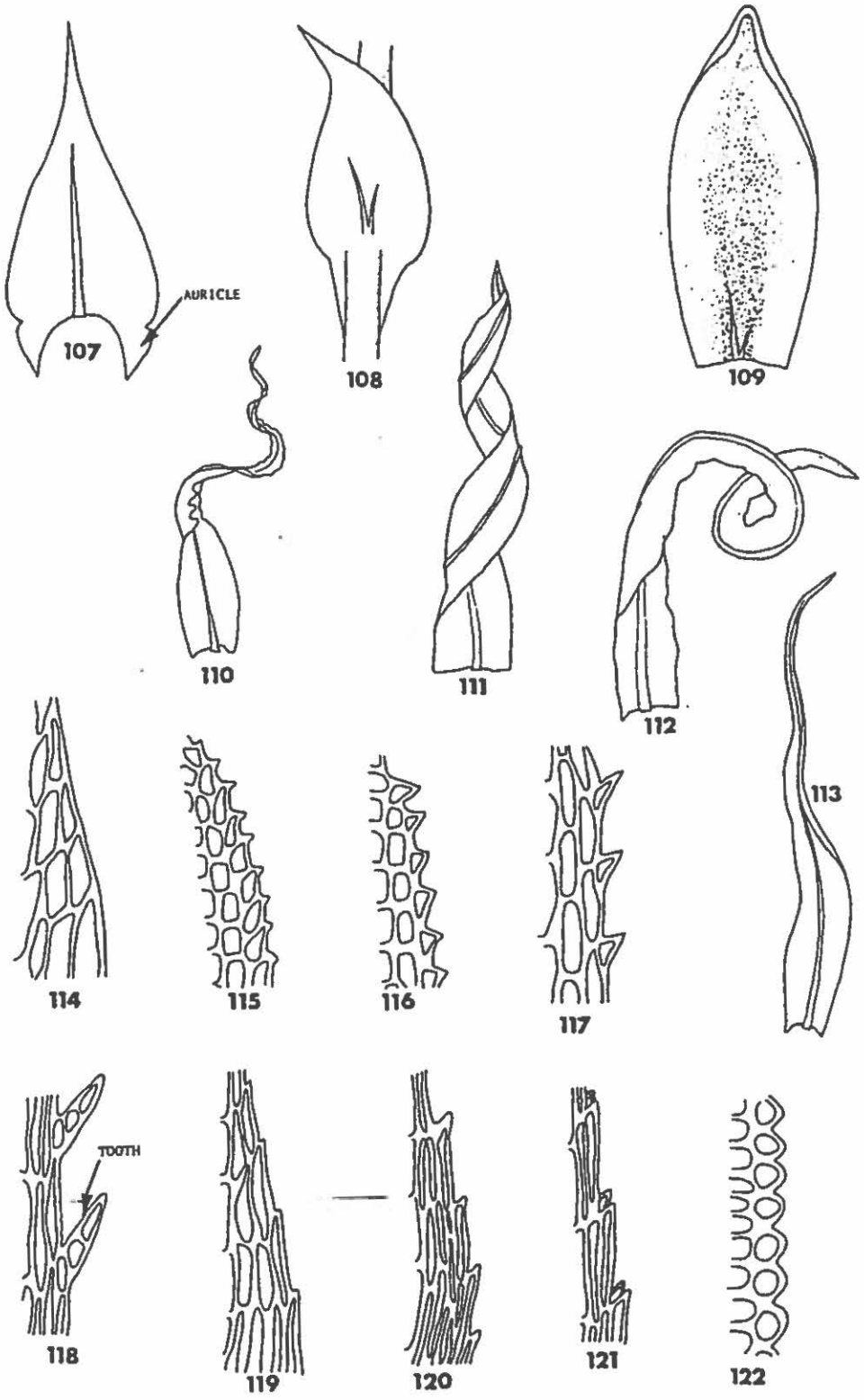
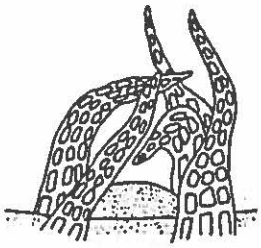


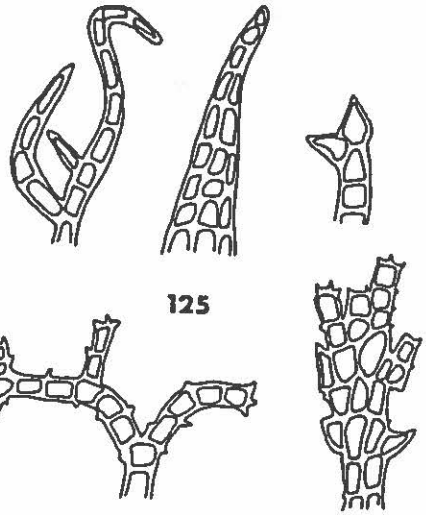
Plate 407. 107. Auriculate. 108. Decurrent. 109. Cucullate. 110. Tortuose. 111. Helicoid. 112. Cirrate, contorted, crisped. 113. Flexuose. 114–122. Leaf margins. 114. Entire, edentate. 115. Denticulate. 116. Dentate. 117. Spiculose. 118. Spinose, toothed. 119. Serrulate. 120. Serrate. 121. Doubly serrate. 122. Crenate.



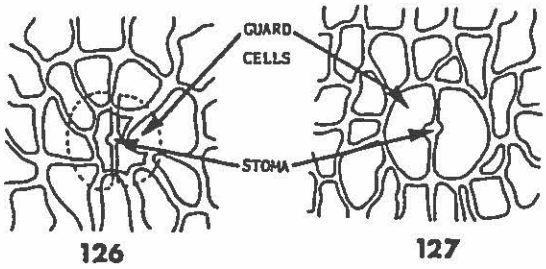
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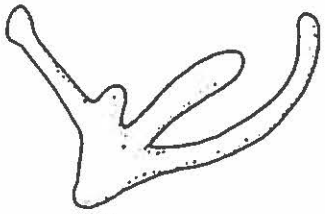
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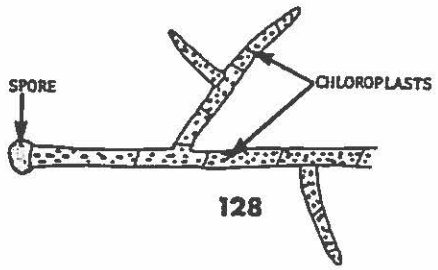
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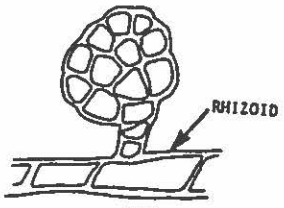
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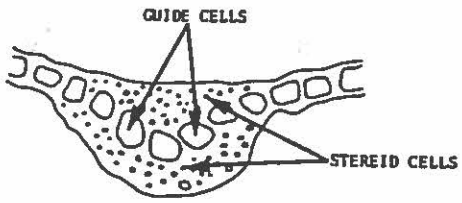
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131



130

Plate 408. 123–124. Pseudoparaphyllia. 123. Filamentose. 124. Foliose. 125. Paraphyllia, villi. 126–127. Stomata. 126. Cryptopore, immersed stoma. 127. Phaneropore, superficial stoma. 128. Filamentous protonema. 129. Thallose. 130. Cross-section of costa. 131. Rhizoidal gemma, tuber.

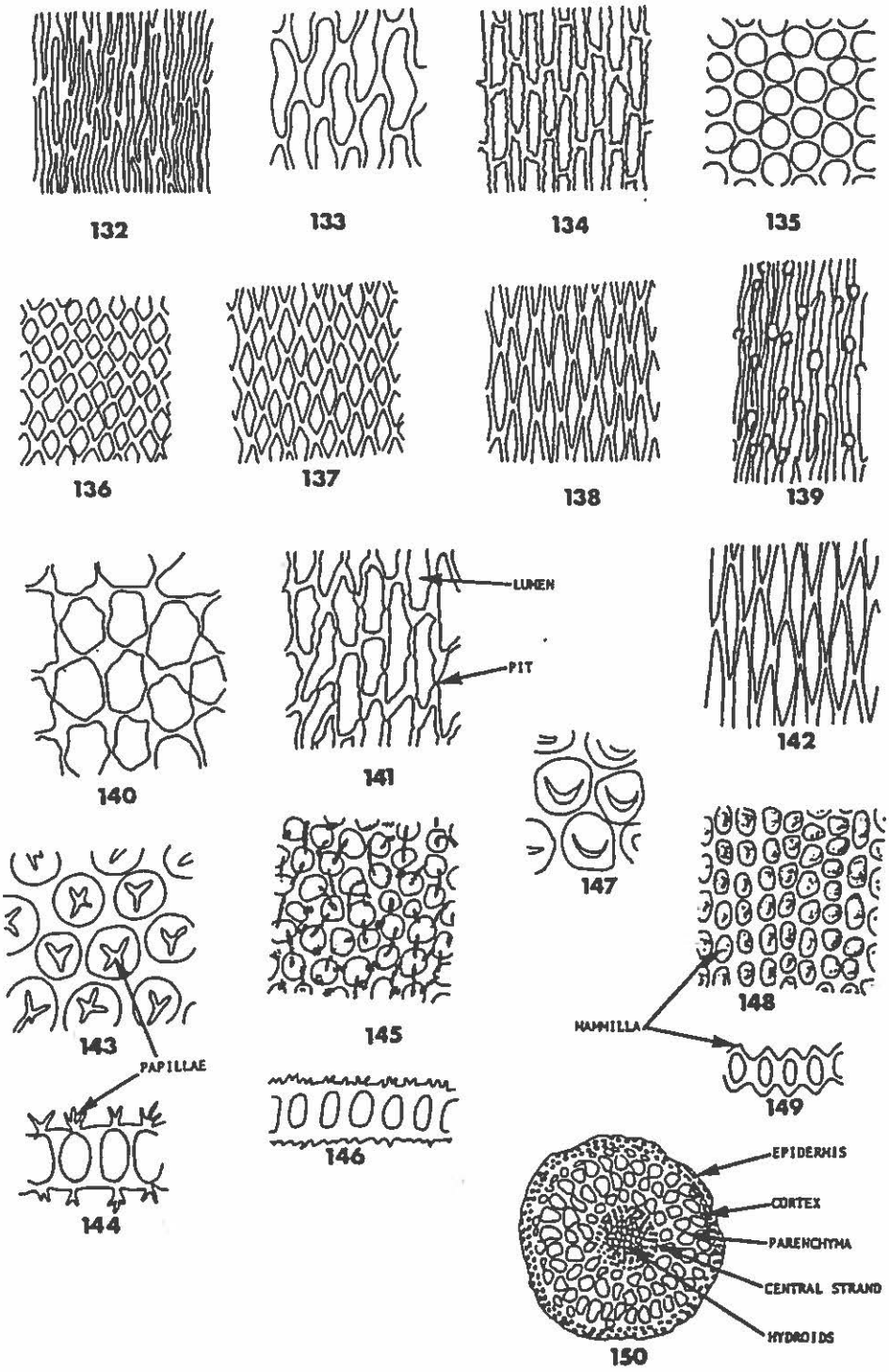


Plate 409. 132. Vermicular. 133. Sigmoid. 134. Sinuose. 135. Isodiametric. 136. Rhombic. 137. Rhomboidal. 138. Fusiform, spindle shaped. 139. Prorate. 140. Collenchymatous. 141. Porose, pitted. 142. Prosenchyma. 143. Furcate papillae. 144. Cross-section of cells with furcate papillae. 145. Verrucose. 146. Cross-section of verrucose leaf cells. 147. Lunate papillae. 148. Mammillose. 149. Cross-section of mammillose cells. 150. Cross-section of stem.

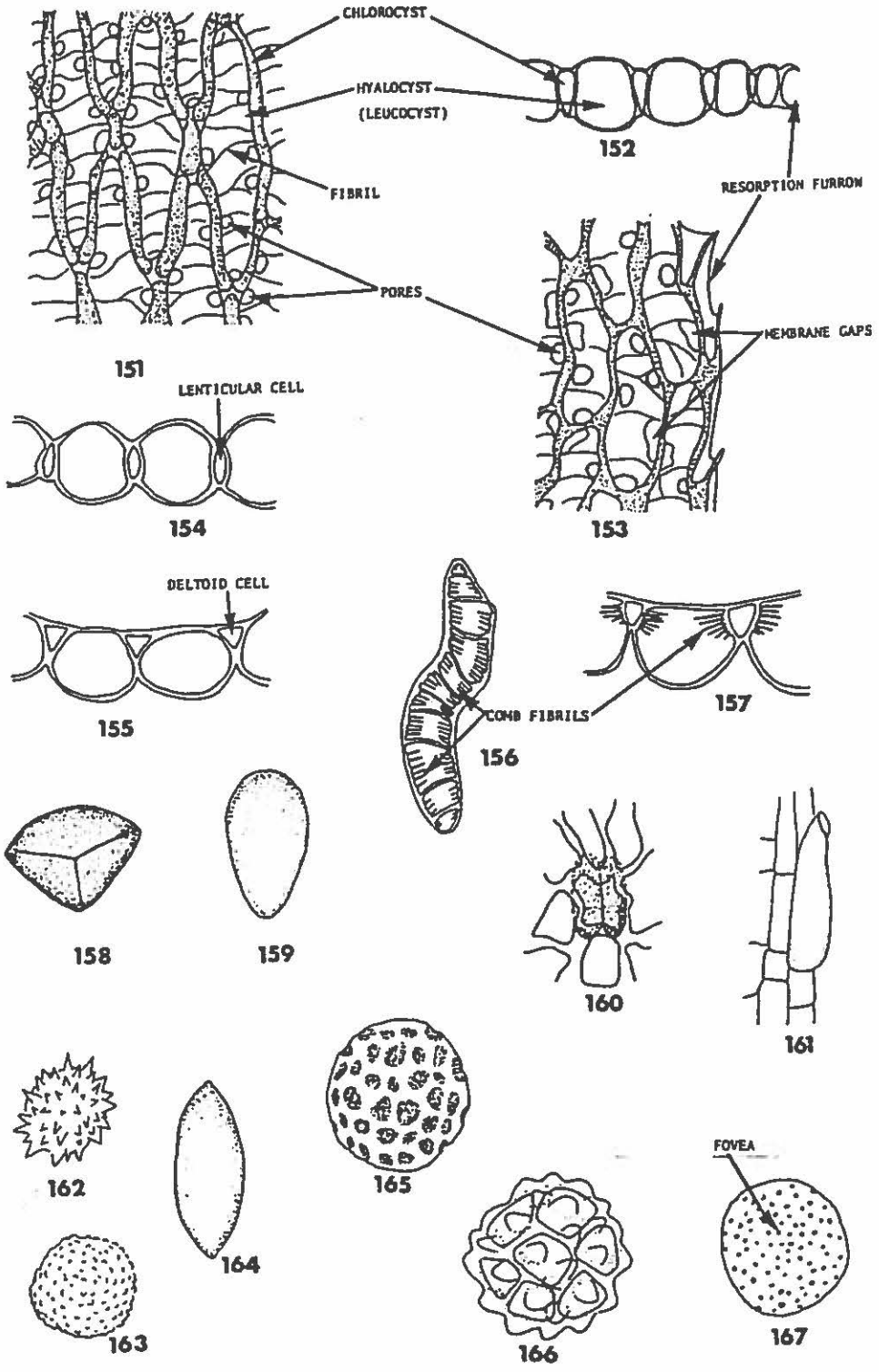


Plate 410. 151. *Sphagnum* leaf cells. 152. Cross-section of leaf margin of *Sphagnum*. 153. Marginal leaf cells of *Sphagnum*. 154–155. Cross-section of median leaf cells of *Sphagnum*. 156. Comb fibrils of *Sphagnum* cell. 157. Comb fibrils in cross-section of cell. 158. Trilete spore. 159. Ovoid. 160. Pseudostoma. 161. Retort cell. 162. Echinate. 163. Granulose. 164. Ellipsoidal. 165. Alveolate. 166. Tuberculate. 167. Foveolate.

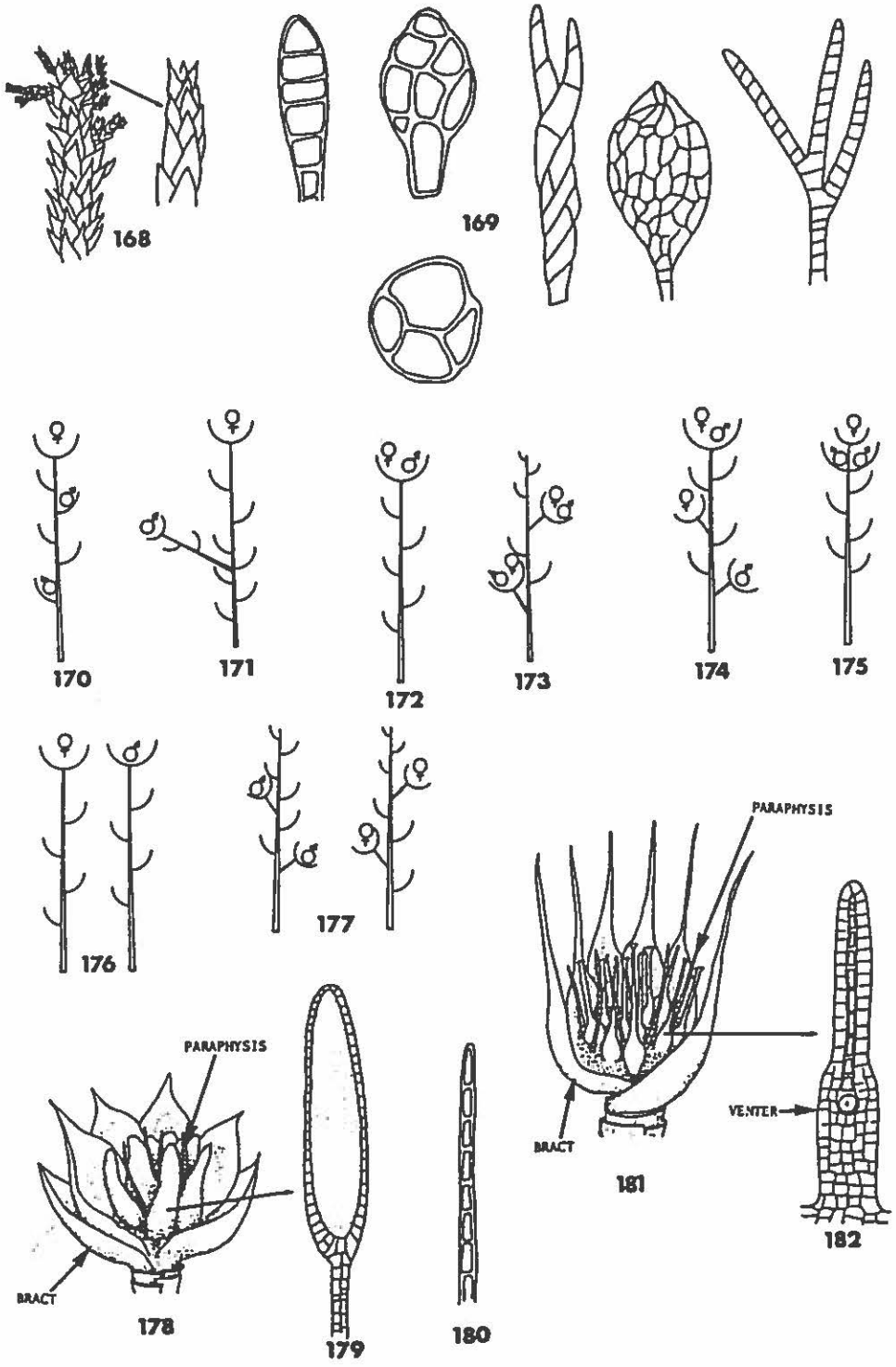


Plate 411. 168–169. Brood bodies. 168. Brood branchlets. 169. Gemmae. 170–175. Monoicous. 170. Autoicous: gonioautoicous. 171. Autoicous: cladautoicous. 172–173. Synoicous. 174. Polygamous, polyoicous, heteroicous. 175. Paroicous. 176–177. Dioicous. 178. Androecium, perigonial bud. 179. Antheridium. 180. Paraphysis. 181. Gynoecium, perichaetial bud. 182. Archegonium.

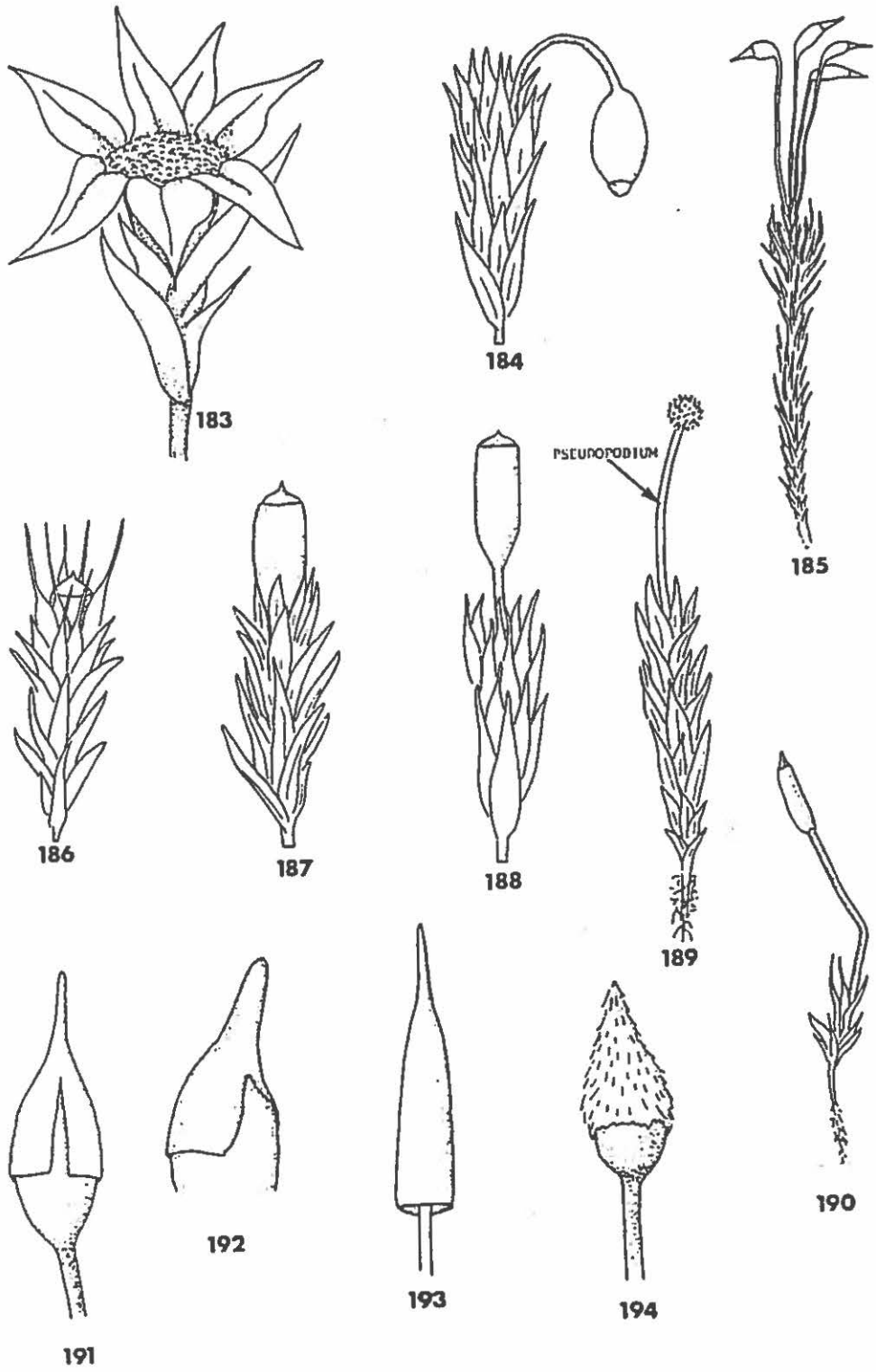


Plate 412. **183.** Discoid male inflorescence. **184.** Cygneous seta. **185.** Aggregate sporophytes. **186.** Immersed capsule. **187.** Emergent capsule. **188.** Exserted capsule. **189.** Pseudopodium. **190.** Geniculate seta. **191–194.** Calyptrae. **191.** Dimidiate. **192.** Cucullate. **193.** Mitrate. **194.** Hispid.

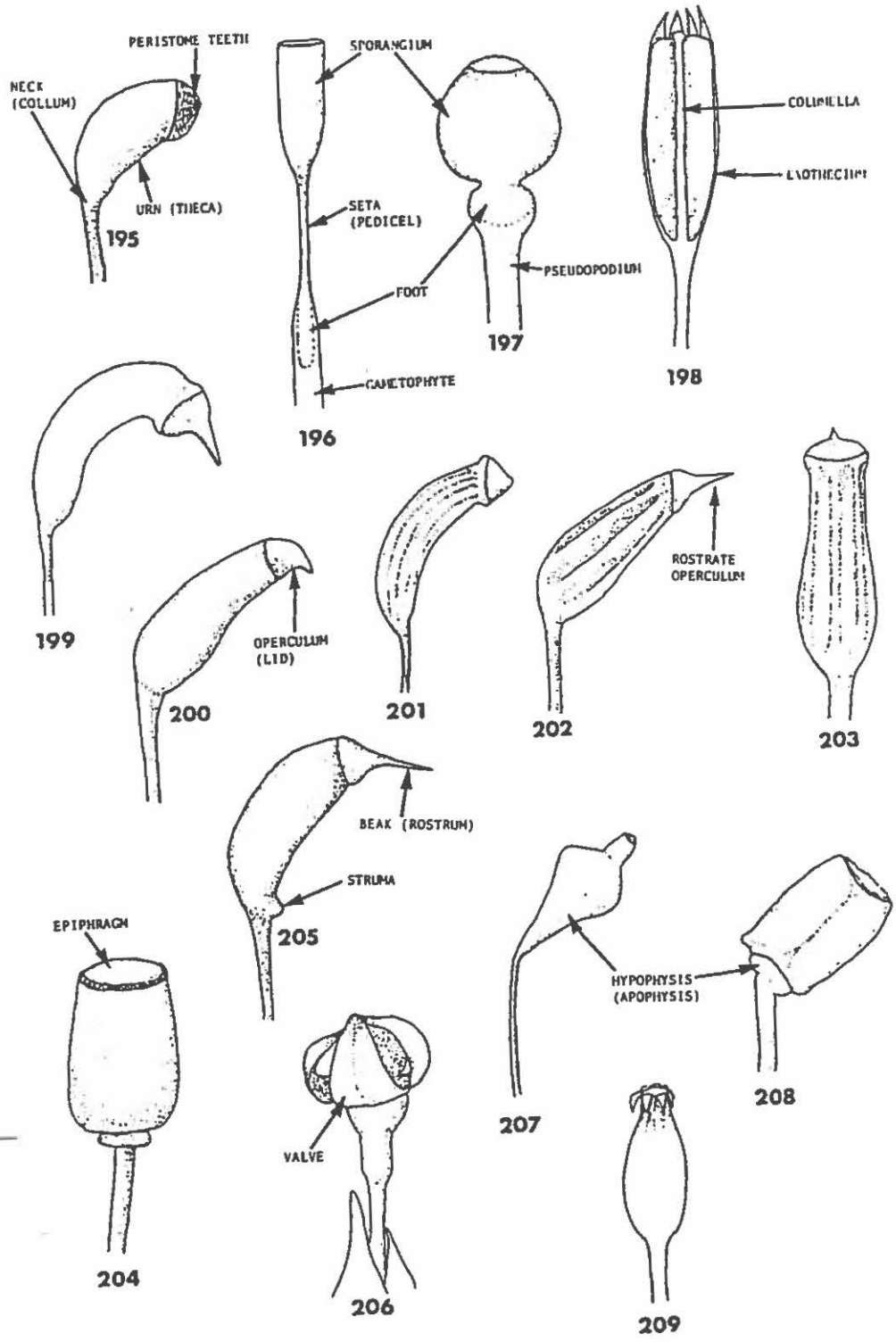


Plate 413. 195. Capsule. 196–197. Sporophyte. 198. Columella (seen in longitudinal section of capsule). 199–209. Capsules. 199. Arcuate. 200. Inclined. 201. Striate. 202. Sulcate. 203. Ribbed. 204. Epiphragm of Polytrichaceae capsule. 205. Strumose. 206. Valves of *Andreaea* capsule. 207. Hypophysis of *Splachnum* capsule. 208. Hypophysis of *Polytrichum* capsule. 209. Coarctate, constricted, strangulate.

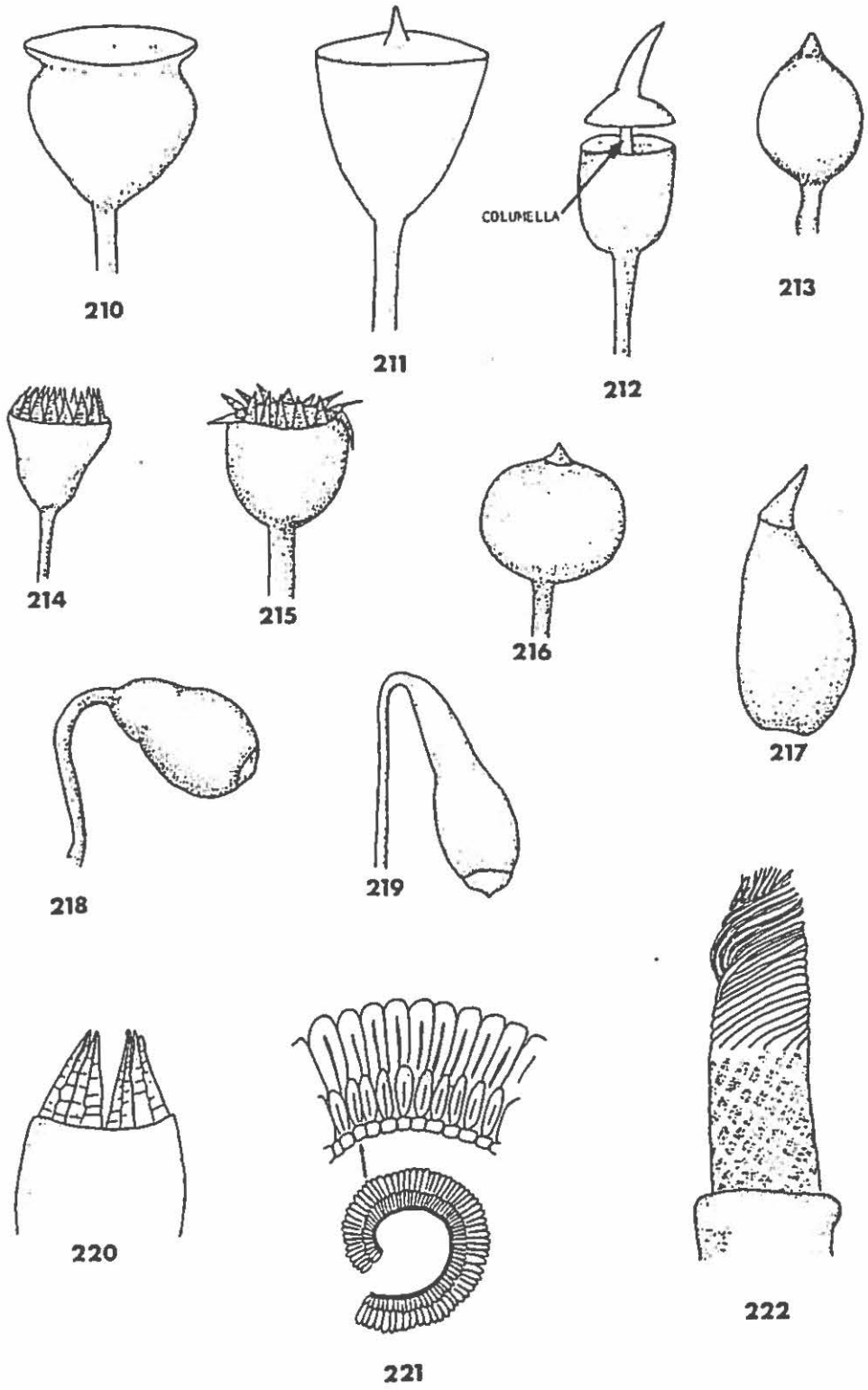


Plate 414. 210–219. Capsules. 210. Urceolate. 211. Turbinate. 212. Systylius. 213. Astomous, cleistocarpous. 214. Campanulate. 215. Cupulate, cyathiform. 216. Globose. 217. Gasteropodous, gibbous, ventricose. 218. Pyriform. 219. Cernuous, pendent. 220. Bigeminate teeth. 221. Annulus (revoluble). 222. Tessellated basal membrane.

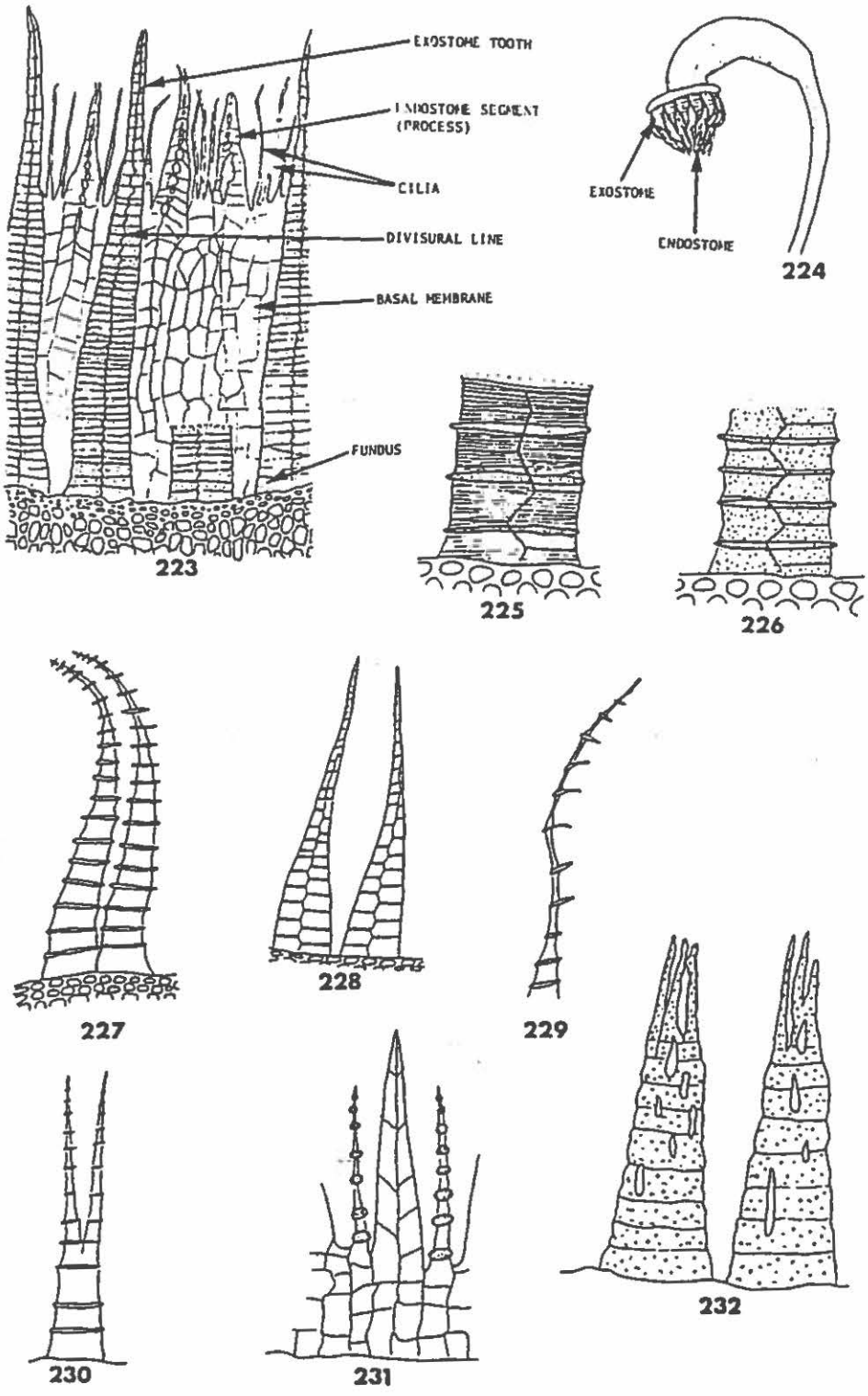


Plate 415. 223. Portion of peristome. 224. Inoperculate capsule with exostome and endostome. 225. Basal portion of hypnaceous exostome tooth. 226. Basal portion of bryaceous exostome tooth. 227. Trabeculate teeth. 228. Articulate teeth. 229. Appendiculate cilium. 230. Bifid tooth. 231. Portion of endostome with nodose cilia. 232. Cribrose teeth.

Class II. BRYOPHYTA.

Division I. MUSCI; MOSSES.

Order I. SPHAGNACEÆ. Peat Mosses.

List prepared by Edward L. Rand, assisted greatly by Edwin Faxon and Prof. Daniel C. Eaton, and arranged mainly in accordance with the writings of Dr. Carl Warnstorf, of Neuruppin, Germany.

The plants catalogued in the following list have been collected mostly by Edwin Faxon and Edward L. Rand; the determinations are by Dr. Carl Warnstorf. In view of the great difficulty of finding descriptions of the various species and varieties, it has been thought wise to give freely references to Lesquereux and James's "Mosses of North America," and to Dr. Warnstorf's articles on North American Sphagna, to be found in Coulter's Botanical Gazette, Vol. XV., in the numbers for the months of June, August, September, and October, 1890,— both of which works can be consulted with little trouble. In cases, furthermore, where descriptions are not there given, they have been either translated or specially prepared for this list by Prof. Eaton and Mr. Faxon. It has not seemed best to include *forms* and *sub-forms* herein, since most of them have little value except for the critical student. Very many of them are, however, represented in the Mt. Desert Herbarium. On the other hand, all varieties are given, without regard to the distinctions on which they are founded. The value, however, of most of the so-called color varieties is very doubtful, since careful observations seem to prove beyond question that the color of Sphagnum varies greatly with the season. It is even a matter of doubt whether a given plant of any species may not quickly vary through the influence of temporary external conditions, assuming at one time the form of one variety, at another time the form of another. This doubtful value of varieties of Sphagnum furnishes an additional reason for the exclusion of mere *forms* and *sub-forms* from a local catalogue of plants.

SPHAGNUM, L. Peat Moss.

§ 1. Acutifolia.

S. fimbriatum, Wils. L. & J., Mosses N. A., 14. Var. tenue. Gravet. Bot. Gaz., xv. 128.

Swamp west of Sea Wall; Red Rocks, Great Cranberry Isle; Bass Harbor (Rand); — Little Cranberry Isle (Redfield); — Sargent Mt. (E. Faxon).

S. Girgensohnii, Russ. *S. strictum*, Lindb. L. & J., Mosses N. A., 13.

Common.

Var. **stachyodes**, Russ. Bot. Gaz., xv. 129.

Southwest Harbor; western side of Browns Mt.; Seal Harbor; Long Pond meadows (Rand).

Var. **hydrophilum**, Russ.

Plant 5–8 cm. high, pale green, mostly drepanocladous, growing in wet places, the coma indistinct; stem leaves narrow, nearly twice longer than broad, very narrowly margined except at the very base, hyaline cells often partitioned, pores and fibrils none; branch leaves loosely imbricate with spreading tips. High Head (Rand).

Var. **teretiusculum**, Warnst.

In extremely compact tufts, 5–7 cm. high; plants very slender; stem leaves very small, lingulate, about one and one half times as long as wide; branch leaves also small, closely imbricated, so that the short branches are perfectly terete. Warnst., Hedwigia, xxxii. (1893) 15. Summit of Sargent Mt. (Rand).

Var. **sphærocephalum**, Warnst.

In compact tufts about 10 cm. high; stem leaves small, lingulate, little longer than broad; branches of the coma united into a large, thick, almost spherical head, with leaves remarkably large and in part squarrosely spreading. Warnst., Hedwigia, xxxii. (1893) 15. Reservoir, Jordan Pond road (Rand).

S. Russowii, Warnst. Bot. Gaz., xv. 130.

Pemetic Mt. (Rand).

Var. pœcilum, Russ. Bot. Gaz., xv. 132.

Beech Mt. (Rand).

Var. rhodochroum, Russ. Bot. Gaz., xv. 132.

Breakneck Ponds (E. Faxon).

Var. carneum, Russ.

Upper part of plant pale flesh-color, passing below into pale gray or grayish green. Woods, Norwood Cove; woods, southern foot of Dog Mt. (Rand).

S. fuscum (Schimp.), von Klinggraef. Bot. Gaz., xv. 133. *S. acutifolium*, var. *fuscum*, Schimp. L. & J., Mosses N. A., 13. Var. fuscescens, Warnst. Bot. Gaz., xv. 135.

Common in dry bogs. Freeman Heath; Sunken Heath; Aunt Bettys Pond (Faxon & Rand); — The Heath, Great Cranberry Isle; Sea Wall, etc. (Rand).

S. tenellum (Schimp.), von Klinggraef. Bot. Gaz., xv. 135.

Browns Mt.; woods, Sea Wall Swamp (E. Faxon).

Var. rubellum (Wils.), von Klinggraef. Bot. Gaz., xv. 137. *S. rubellum*, Wils. L. & J., Mosses N. A., 13.

Common in various forms.

Var. versicolor, Warnst. Bot. Gaz., xv. 137.

Pond Heath; Sunken Heath (E. Faxon).

Var. violascens, Warnst.

Color above, a livid mixture of violet, red, and green; below, pale reddish. Lower Breakneck Pond (E. Faxon).

S. Warnstorfii, Russ. Bot. Gaz., xv. 138. Var. violascens, Warnst.

Plants pale yellowish green mixed with pale violet or violet-red. High Head meadow (E. Faxon).

Var. purpurascens, Russ. Bot. Gaz., xv. 140.

High Head meadow (Rand).

S. acutifolium (Ehrh. in part), Russ. & Warnst. Bot. Gaz., xv. 191.

Common.

Var. rubrum (Brid.), Warnst.

Plants rosy-red above, gradually becoming paler below. Common.

Var. versicolor, Warnst. Bot. Gaz., xv. 193.

Frequent. Freeman Heath; Beech Hill (E. Faxon); — Breakneck Ponds; Sargent Mt.; Beech Mt. Notch (Rand).

Var. viride, Warnst. Bot. Gaz., xv. 193.

Beech Mt.; Cold Brook; Southwest Harbor (Rand).

Var. pallescens, Warnst. Bot. Gaz., xv. 193.

Sargent Mt.; Beech Mt. Notch (Rand).

S. subnitens, Russ. & Warnst., var. flavicomans, Card. Bot. Gaz., xv. 194–196.

Frequent. Swamp, Meadow Brook, Somesville; Breakneck Ponds; Freeman Heath; Sea Wall Swamp (E. Faxon); — bog west of Hio; Great Cranberry Isle; Somes Pond, etc. (Rand).

Var. obscurum, Warnst. Bot. Gaz., xv. 196.

Little Cranberry Isle (Redfield).

Var. violascens, Warnst.

Whole plant very pale, soft; white with faint tinge of violet; coma faint pink. Breakneck Ponds (Rand).

Var. pallescens, Warnst.

Plant soft, whitish, becoming pale green toward the coma, but without any tinge of brownish yellow. Breakneck Ponds (Faxon & Rand); — bog west of Hio (Rand).

§ 2. Cuspidata.

S. recurvum (Beauv.), Russ. & Warnst. *S. intermedium*, Hoffm. L. & J., Mosses N. A., 15.

Sea Wall Swamp; Sargent Mt. (E. Faxon); — Breakneck Ponds (Rand).

Var. pulchrum, Lindb. Bot. Gaz., xv. 218.

Frequent; found in many forms, of which *forma fuscescens*, with the whole plant rich golden brown in color, is the most beautiful. Abundant at Sunken Heath; Breakneck Ponds (Faxon & Rand); — Sea Wall; Great Cranberry Isle (Rand).

Var. mucronatum, Russ. Bot. Gaz., xv. 218.

Breakneck Ponds; Otter Cliffs (Rand).

Var. amblyphyllum, Russ. Bot. Gaz., xv. 219.

Northwest Arm woods (Rand); — near Northwest Cove; Sea Wall Swamp (E. Faxon).

Var. parvifolium (Sendt.), Warnst. Bot. Gaz., xv. 219.

Pond Heath (E. Faxon); — bog near Sea Wall (Rand).

S. cuspidatum (Ehrh.). Russ. & Warnst., var. Miquelonense, Ren. & Card. Bot. Gaz., xv. 230.

Frequent. Round Pond; near Northwest Cove (E. Faxon); — Aunt Bettys Pond; Northwest Arm woods, etc. (Faxon & Rand); — Great Cranberry Isle (Rand).

Var. falcatum, Russ. L. & J., Mosses N. A., 15.

Branches distinctly falcate at the apex. Pools, Great Heath; The Heath, Great Cranberry Isle (Rand).

Var. submersum, Schimp.

Tufts loose, very soft, deep green, nearly or quite submersed or floating; stem very long and slender, green; branches rather long, decurved; stem leaves broadly ovate-oblong, pointed, fibrillose near the apex; branch leaves rather long and narrow, green, flexuous when dry; fruit scattered along the stem below the coma, pseudopodia often very long, perichætial leaves scattered, fibrillose. Plant softer than var. *Miquelonense*, and much smaller than var. *Torreyanum*. Frequent. In pools, Freeman Heath; Dog Mt. (Faxon); — Beech Mt. (Faxon & Rand); — Sea Wall; Sunken Heath (Rand); — Great Cranberry Isle (Redfield).

Var. plumulosum, Schimp. L. & J., Mosses N. A., 15.

Tufts soft, compact; stems short and branches erect; leaves short, lanceolate-subulate, very narrow. Pools, Sunken Heath

(Faxon & Rand); — The Heath, Great Cranberry Isle; Great Heath (Rand).

S. Dusenii (Jens.), Russ. & Warnst. *S. Mendocinum*, Warnst. in Bot. Gaz., xv. 221, not of S. & L. Var. parvifolium, Warnst.

Plants soft and slender, in dense tufts, partly immersed; stem leaves small, about 0.54–0.60 mm. long and as broad at base, triangular-lingulate, without fibrils or somewhat fibrillose toward the usually rounded and slightly fimbriate apex; branch leaves also small, about 1.14–1.37 mm. long and 0.54 mm. broad, almost always falcate-secund, narrowly bordered; outer pores numerous, often passing into large membrane-gaps toward the apex. Warnst., Hedwigia, xxxii. (1893) 14. In pool, Dog Mt. (E. Faxon).

S. molluscum, Bruch. *S. tenellum*, Ehrh. L. & J., Mosses N. A., 20.

Abundant, Sunken Heath (Faxon & Rand); — Great Heath (E. Faxon); — The Heath, Great Cranberry Isle (Rand). The more robust forms are var. *robustum*, Warnst.

§ 3. Squarrosa.

S. squarrosum, Pers. L. & J., Mosses N. A., 16.

Frequent. Near Northwest Cove (Faxon); — Seal Harbor; woods, Somes Pond (Rand).

Var. spectabile, Russ. Bot. Gaz., xv. 224.

Not uncommon.

Var. semisquarrosum, Russ. Bot. Gaz., xv. 224.

Southwest Valley road (Rand).

S. teres, Angstr. L. & J., Mosses N. A., 16.

Rare. The Barcelona meadow (E. Faxon).

Var. imbricatum, Warnst. Bot. Gaz., xv. 224.

Bog, north of Beech Hill (Rand).

§ 4. Polyclada.

S. Wulfianum, Girgens. L. & J., Mosses N. A., 16. Var. viride, Warnst. Bot. Gaz., xv. 225.

Rare. Cold Brook; Beech Mt. (Rand).

§ 5. Rigida.

S. compactum, DC. *S. rigidum*, Schimp. L. & J., Mosses N. A., 17.

Frequent in its three varieties.

Var. squarrosum, Russ. Bot. Gaz., xv. 226.

Woods, Lower Breakneck Pond (Faxon & Rand); — Southwest Harbor; Seal Harbor; Sargent Mt. (Rand); — Robinson Mt. (Faxon).

Var. subsquarrosum, Warnst. Bot. Gaz., xv. 226.

Sargent Mt. (Faxon); — Lower Breakneck Pond; Browns Mt.; Dog Mt.; Southwest Harbor; Great Cranberry Isle (Rand).

Var. imbricatum, Warnst. Bot. Gaz., xv. 226.

Sargent Mt. (Faxon & Rand); — Dog Mt. (Rand).

S. Garberi, L. & J. Mosses N. A., 18. Var. squarrosulum, Warnst.

Tufts pale or bluish-green, low or even 20 cm. high, and then quite similar in habit to *S. compactum*, var. *squarrosulum*; branch leaves all with the apical half squarrose-recurved. Warnst., Hedwigia, xxxii. (1893) 15. Very rare. Sargent Mt. (Rand). The specimens are *forma sphærocephalum*, Warnst., which is extremely robust, with the comal branches gathered into a large globular head. This form is exceedingly rare, there being only one other known station.

Var. subsquarrosum, Warnst.

Branch leaves generally merely curved outward, only here and there squarrose. Warnst., Hedwigia, xxxii. (1893) 15. Rare. Beech Mt. (Rand & Faxon); — Sargent Mt. (Rand).

§ 6. Subsecunda.

S. Pylæsii, Brid. L. & J., Mosses N. A., 23. Var. ramosum, Warnst. Bot. Gaz., xv. 243.

Frequent in very wet places, from the sea level to mountain summits. Appearing in a number of forms distinguished merely by color, black (*f. nigricans*, Brid.), green (*f. virescens*, Warnst.), yellow (*f. flava*, Warnst.), and red-brown (*f. rufescens*, Warnst.). Green Mt.; Browns Mt. (E. Faxon); — Sea Wall; Sunken Heath; Aunt Bettys Pond (Faxon & Rand); — Breakneck Ponds; Pemetic Mt. (Rand).

S. subsecundum, Nees. L. & J., Mosses N. A., 19.

Meadow on Denning Brook; Town Hill; Sea Wall Swamp; Southwest Valley road (E. Faxon); — Bass Harbor Marsh (Rand).

Var. macrophyllum, Roell.

Stem leaves lingulate, evenly bordered, 1.14–1.45 mm. long, nearly two thirds as broad, the upper part porose and fibrillose; hyaline cells often partitioned; branch leaves ovate, 1.71–1.90 mm. long, little more than half as broad, inner pores in the cell angles, mostly near the margins. Southwest Harbor; Upper Breakneck Pond (Rand); — Little Cranberry Isle (Redfield).

Var. mesophyllum, Warnst.

Stem leaves lingulate, evenly bordered, 1–1.40 mm. long, two thirds to four fifths as broad, the upper part porose and fibrillose; hyaline cells much partitioned; branch leaves ovate, about as long and broad as the stem leaves, inner surface with feebly ringed pores towards the apex. Breakneck Ponds; Beech Mt. Notch; woods, Norwood Cove; Deer Brook (Rand).

Var. microphyllum, Roell.

Stem leaves small, somewhat triangular, border widened to the base, about 0.57 mm. long, and the same in greatest breadth, usually without pores or fibrils; hyaline cells not partitioned; branch leaves lance-ovate, about 0.80 mm. long, and little more

than half as broad, loosely somewhat secund, inner surface without pores. Southwest Harbor (Rand).

S. rufescens, Bryol. Germ. Bot. Gaz., xv. 246. *S. subsecundum*, Nees, var. *contortum*, Schimp. L. &. J., Mosses N. A., 19.

In water. Upper Breakneck Pond (Faxon & Rand); — border of Somes Pond (E. Faxon).

§ 7. Cymbifolia.

S. imbricatum (Hornsch.), Russ. Bot. Gaz., xv. 249. *S. Austini*, Sulliv. L. & J., Mosses N. A., 21. Var. **sublæve**, Warnst. Bot. Gaz., xv. 250.

Woods, The Barcelona meadow (Rand); — Gilmore Meadow; Little Harbor Brook (Redfield).

Var. **cristatum**, Warnst. Bot. Gaz., xv. 250.

Sea Wall Swamp (E. Faxon); — Breakneck Ponds; bogs, southwest of Sea Wall, and north of Beech Hill (Rand).

Var. **affine** (Ren. & Card.), Warnst. Bot. Gaz., xv. 250.

Swamp on Meadow Brook, Somesville; Clark Cove; The Barcelona meadow (E. Faxon); — bog north of Beech Hill; Sutton Island; Beech Mt. Notch; Deer Brook (Rand).

S. cymbifolium, Ehrh. L. & J., Mosses N. A., 21.

Canada Valley; bogs, southwest of Sea Wall; Southwest Harbor; Sutton Island, and elsewhere (Rand).

Var. **glaucescens**, Warnst. Bot. Gaz., xv. 251.

Cold Brook (Rand).

S. papillosum, Lindb. L. & J., Mosses N. A., 21. *S. cymbifolium*, Ehrh., var. *papillosum* (Lindb.), Schimp. Bot. Gaz., xv. 251. Var. **normale**, Warnst.

Hadlock Upper Pond; Great Cranberry Isle (Rand); — Sunken Heath (E. Faxon).

S. medium, Limpr. Bot. Gaz., xv. 252.

Common. Beech Hill road (Faxon & Rand); — bogs southwest of Sea Wall, and north of Beech Hill (Rand).

Var. **purpurascens**, Russ. *S. medium*, var. *lævo*, *f. purpurascens* (Russ.), Warnst. Bot. Gaz., xv. 253.

Somes Pond (E. Faxon); — Aunt Bettys Pond; bogs southwest of Sea Wall; Red Rocks, Great Cranberry Isle (Rand); — Little Cranberry Isle (Redfield).

Var. **pallescens**, Warnst.

Color very pale yellowish-green. Bog on Prettymarsh road, west of Somesville (Rand).

Order II. ANDREÆACEÆ. Schizocarpous Mosses.

ANDREÆA, Ehrh.

A. petrophila, Ehrh. A. rupestris Hedw.

Frequent on wet rocks on the mountains. Sargent Mt. (Faxon & Rand); — Green Mt. (D. C. Eaton); — Beech Mt. (Rand); — Robinson Mt. (E. Faxon).

A. crassinervis, Bruch. A. Rothii Web. + Mohr

On wet rocks, summit of Sargent Mt. (E. Faxon); — Beech Mt.; Beech Cliff (Faxon & Rand).

much more widespread than these collections indicate

Order III. BRYACEÆ. True Mosses.

List prepared by Edward L. Rand, under the supervision of Elizabeth G. Britton. Plants collected mainly by Walter L. Burrage, John H. Redfield, Edward L. Rand, Edwin Faxon, and Theodore G. White, determinations by Elizabeth G. Britton and Dr. Charles R. Barnes.

In view of the great importance of following the arrangement and nomenclature adopted in some standard work of ready reference, and in view also of the great disagreement on these very matters of arrangement and nomenclature among the authorities, it has seemed wise to follow Lesquereux and James's "Mosses of North America" in the preparation of this list. Synonyms, however, have been given where they seemed of real value; some necessary descriptions have been added; and a few corrections made where they were of real, not merely of verbal importance.

SECTION I. ACROCARPI.

Tribe WEISIEÆ.

CYNODONTIUM, Schimp.

C. polycarpum (Ehrh.), Schimp. *Oncophorus polycarpus* (Ehrh.), Brid.

On decayed wood. Wood road to Great Pond, Southwest Harbor (Rand).

C. virens (Swz.), Schimp., var. Wahlenbergii (Brid.), Schimp. *Oncophorus Wahlenbergii*, Brid.

On decayed wood. Upper Breakneck Pond (Rand).

TREMATODON, Mr.

T. ambiguum (Hedw.), Hornsch.

On the ground. Green Mt. (D. C. Eaton); — moist woods, north of Long Pond (Theodore G. White).

DICRANELLA, Schimp.

D. squarrosa (Starke), Schimp.

In dense mats on sandy shore, Jordan Pond; submersed (Rand). As the specimens found are all sterile, some doubt has arisen as to their identity. They are almost identical with specimens collected by E. Faxon at Ammonoosuc Lake, Crawfords, N. H., June 14, 1883, and very similar to specimens collected by Oakes at the White Mts., N. H. (Sulliv. & Lesq., Musci Bor. Am., No. 245). The latter specimens were distributed as "*Meesia longiseta*, Hedw. var.?" Faxon's specimens, however, are *Dicranella squarrosa*, and so with very little doubt are the Mt. Desert specimens. The true identity of Oakes's specimens is still in doubt. Especial thanks are due Dr. C. R. Barnes and Mrs. E. G. Britton for the solution of these puzzling questions of identification.

D. heteromalla (L.), Schimp.

On the ground; common (Rand). Also Great Cranberry Isle (Theodore G. White).

DICRANUM, Hedw.

D. Blyttii, Bruch & Schimp. *D. Schisti* (Gunn.), Lindb.

Falls, Sargent Mt. Gorge (Theodore G. White).

D. montanum, Hedw.

On decaying trees. Woods, Hadlock Upper Pond (Walter L. Burrage); — near Ripples Pond; Beech Mt.; Oak Hill (Rand).

D. viride (Sull. & Lesq.), Lindb.

On decaying trees; sterile. Near Aunt Bettys Pond; Cold Brook; Seal Harbor (Rand); — on ledges, Seal Harbor (Theodore G. White).

D. flagellare, Hedw.

On decaying tree trunks; common (W. L. Burrage, Rand, E. Faxon, T. G. White).

D. fulvum, Hook.

On granitic rocks, West Branch of Hadlock Brook; Southwest Valley road (Rand). On ground, woods, head of The Barcelona meadow (Rand); — also Seal Harbor (Theodore G. White).

D. longifolium, Ehrh.

Dry woods, behind schoolhouse, Seal Harbor (Theodore G. White).

D. fuscescens, Turn.

On decaying tree trunks; common (Rand, Theodore G. White).

Var. longirostre, Schimp.

Woods on Sargent Mt. (Walter L. Burrage).

D. congestum, Brid. *D. fuscescens*, Lesq. & J., in part.

On decayed wood. Northern foot of Beech Mt.; Upper Breakneck Pond; Jordan Pond trail, Northeast Harbor (Rand).

D. scoparium (L.), Hedw.

On ground, rocks, etc.; common (Walter L. Burrage, Rand, Theodore G. White); — also Great Cranberry Isle (Theodore G. White).

Var. squarrosum, Lesq. & J.

Seal Harbor (Theodore G. White).

Var. paludosum, Bruch & Schimp.

Seal Harbor (Theodore G. White).

Var. pallidum, C. Mueller.

Jordan Pond trail, Seal Harbor (Theodore G. White).

Var. rupestre, Austin.

Leaves short, curled and twisted when dry; plants small and usually sterile. Musci App., No. 90 (1870). S. & L., Musci Bor. Am., ed. 2, No. 76 (1865). On rocks in woods. Breakneck Ponds (Annie S. Downs); — Seal Harbor (Theodore G. White).

Var. recurvatum (Schultz), Brid.

Plants tall and slender, usually sterile, bright yellow; leaves uncinate, recurved, narrow and plumose at tip; distant, not crowded on the stems. Prettymarsh Harbor (Theodore G. White).

D. majus, Smith.

Damp ground. Cold Brook; Great Cranberry Isle (Rand); — Sutton Island (Theodore G. White).

D. palustre, Bruch & Schimp. *D. Bonjeani*, DeNot. D. scoparium

Moist ground. Sargent Mt. (Faxon & Rand); — Western Mt.; Beech Mt. Notch; woods, Norwood Cove; wood road to Great Pond, Southwest Harbor; Seal Harbor (Rand); — Prettymarsh; The Cleft; Seal Harbor (Theodore G. White).

D. Schraderi, Web. & Mohr. *D. Bergeri*, Bland. D. undulatum

Moist ground in woods and on the mountains. Browns Mt. (Faxon & Rand); — Dog Mt. (E. Faxon); — Norwood Cove; Intervale Brook; Beech Cliff; near Aunt Bettys Pond (Rand).

D. spurium, Hedw.

Dry ground. Browns Mt. (Redfield, Faxon & Rand); — Browns Mt. Notch; Seal Harbor; West Branch of Hadlock Brook (Rand); — Barr Hill (Theodore G. White).

D. brachycaulon, Kindb. D. spurium Hedw

Allied to *D. spurium*, but differing in the short stem only 1 cm. high, the leaves smaller and shorter, oblong-ovate, acute, not acuminate, entire, not papillose at back, costa elevate, percurrent and smooth, alar cells brown, capsule small, pedicel 1 cm. long. Peculiar in its short leaves and its elevate costa. Kindberg in Macoun, Cat. Canadian Plants, part vi. 34. Not uncommon in dry places on the hills and mountains. High Head (Faxon & Rand); — Dog Mt.; Robinson Mt. (E. Faxon); — Sargent Mt.; Jordan Mt. (Rand).

D. Drummondi, C. Mueller. D. ontariense Peters.

On ground, mostly in woods; frequent. Browns Mt. (E. Faxon); — Western Mt.; Norwood Cove; Upper Breakneck Pond (Rand); — between Hadlock farm and Frenchman Camp (Redfield); — Seal Harbor; High Head (Theodore G. White).

D. undulatum, Ehrh.

On ground in woods; very common (A. B. Eaton, Burrage, Rand, Faxon, Redfield, White). An unusual form, with five pedicels in a cluster, Beech Cliff (Theodore G. White).

FISSIDENS, Hedw.

F. adiantoides (L.), Hedw.

On wet rocks. Western Mt.; Southwest Valley road (Rand).

LEUCOBRYUM, Hampe.

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

On ground, woods and hills; common (Rand, Redfield, White).

L. minus, Sulliv. *L. albidum* (Brid.), Lindb.

On ground. Great Cranberry Isle; Seal Harbor (Theodore G. White).

CERATODON, Brid.

C. purpureus (L.), Brid.

On rocks and ground; common (Burrage, Faxon, Rand, White). Also Great Cranberry Isle (Theodore G. White).

"Ceratodon is able to survive fire and thrive on recently burned areas." Crum + Anderson p139.

C. conicus (Hampe), Lindb. ?

"Differs from *C. purpureus* in the long excurrent costa, the capsule erect and symmetric, faintly sulcate, the lid shorter, the teeth pale, red at base, with fewer articulations." Kindberg in Macoun, Cat. Canadian Plants, part vi. 39.* On rocks. Browns Mt. (Walter L. Burrage, Faxon & Rand).

Tribe POTTIEÆ.

LEPTOTRICHUM, Hampe. (*Ditrichum*, Timm.)

L. pallidum (Schreb.), Hampe. *D. pallidum* (Schreb.), Hampe.

A depauperate form on ground, Long Pond, Eden (Rand).

D. pallidum (Hedw.) Hampe

BARBULA, Hedw.

TORTELLA TORTUOSA (Hedw.) Limpr.

B. tortuosa (L.), Web. & Mohr.

On ground. West Branch of Hadlock Brook (Rand).

Tribe GRIMMIEÆ.

GRIMMIA, Ehrh.

G. conferta, Funck. G. alpicola Hedw.

On rocks. Seal Harbor (Theodore G. White).

G. apocarpa (L.), Hedw., var. gracilis (Schleich.), Web. & Mohr.

On rocks. East Point, Seal Harbor (Theodore G. White).

G. maritima ? MDI ?

RACOMITRIUM, Brid.

R. aciculare (L.), Brid.

Wet rocks, in brooks, etc. Little Harbor Brook (Redfield, Rand); — Intervale Brook (Rand).

R. heterostichum (Hedw.), Brid.

On rocks. Beech Cliff (Rand); — Dog Mt. (E. Faxon).

* See also Braithw., British Moss Flora, 175.

R. fasciculare (Schrad.), Brid.

On rocks. Browns Mt.; Sargent Mt. (Faxon & Rand); — The Cleft (Theodore G. White).

R. microcarpum, Brid. R. fasciculare var. microcarpon

On rocks. Browns Mt.; Beech Mt.; north of Beech Hill (Rand); — Robinson Mt. (E. Faxon).

R. lanuginosum, Brid. *R. hypnoides* (L.), Lindb.

On rocks, mountain summits. Sargent Mt. (E. Faxon); — Green Mt. (D. C. Eaton); — Pemetic Mt. (Rand).

HEDWIGIA, Ehrb.

H. ciliata, Ehrh.

On rocks; common. Sargent Mt., and elsewhere (Faxon & Rand); — Beech Hill; Somesville, and elsewhere (Rand); — Seal Harbor (Theodore G. White).

Var. viridis, Schimp.

Browns Mt. (Redfield); — Seal Harbor (Theodore G. White).

Tribe ORTHOTRICHEÆ.

AMPHORIDIUM, Schimp.

A. Lapponicum (Hedw.), Schimp.

On wet rocks. Canada Cliff (E. Faxon).

A. Mougeotii (Benth.), Schimp.

On rocks. Green Mt. Gorge (D. C. Eaton).

ULOTA, Mohr. (*Weissia*, Ehrh.*)

U. Ludwigii, Brid. *Weissia coarctata* (Beauv.), Lindb.

On trees; common (Burrage, Faxon, Rand, Redfield, White).

U. crispa, Brid. *Weissia ulophylla*, Ehrh.

On trees; common (Burrage, Rand, Redfield). On rocks. Balance Rock, Seal Harbor; north of Beech Hill (Rand).

* See Elizabeth G. Britton, N. A. Species of Weissia, Bull. Torr. Bot Club, xxi. 65.

U. crispula, Brid. *Weissia crispula*, Lindb.

On trees. Sargent Mt. (Faxon & Rand).

U. phyllantha, Brid. *Weissia phyllantha* (Brid.), Lindb.

On trees. Seal Harbor (Theodore G. White).

U. Hutchinsiæ (Smith), Hammar. *Weissia Americana* (Beauv.), Lindb.

On rocks; common (Redfield, Rand, White).

ORTHOTRICHUM, Hedw.

O. fallax, Schimp. *O. Schimperi*, Hammar.

On willow trees. Somesville (Rand).

Tribe TETRAPHIDEÆ.

TETRAPHIS, Hedw. (*Georgia*, Ehrh.)

T. pellucida (L.), Hedw. *Georgia pellucida* (L.), Ehrh.

On decaying wood; common (Burrage, Rand, White).

Tribe SPLACHNEÆ.

SPLACHNUM, L.

S. ampullaceum, ~~L.~~

On cow dung. Bog hole on wood road to Aunt Betty's Pond, Youngs District (Rand, Faxon). On rotten wood. Woods north of Long Pond (Theodore G. White).

Tribe PHYSCOMITRIEÆ.

FUNARIA, Schreb.

F. hygrometrica (~~L.~~), ~~Sibth.~~

On ground; common, especially on burnt soil (Rand, White).

Tribe BARTRAMIEÆ.

BARTRAMIA, Hedw.

B. pomiformis (L.), Hedw.

Rocks and shady banks. Sargent Mt. Gorge (Walter L. Burrage); — Beech Mt. Notch; High Head; Western Mt. (Rand); — Triad Pass (Theodore G. White).

Var. crispa (Swz.), Schimp.

Browns Mt. Notch (Rand); — between Hadlock farm and Frenchman Camp (Redfield).

PHILONOTIS, Brid.

P. Muhlenbergii, Brid.

Wet places. Sargent Mt.; Browns Mt. (Faxon & Rand); — Beech Hill (Rand).

P. fontana (L.), Brid.

Wet places and moist rocks; common (Rand, Faxon, White).

Tribe BRYEÆ.

LEPTOBRYUM, Schimp.

L. pyriforme (L.), Wils.

Ox Hill, Seal Harbor (Theodore G. White).

WEBERA, Hedw. (*Pohlia* Hedw.)

W. nutans (Schreb.), Hedw. *Pohlia nutans* (Schreb.), Lindb.

On ground, and rock hollows on mountains; common (Faxon, Rand, White).

BRYUM, L.

B. bimum, Schreb.

Moist places: — Somesville (Redfield, Rand); — shore of Northwest Arm, Great Pond (Rand).

B. cæspiticium, ~~L.~~ Hedw.

On ground. Long Pond, Eden; High Head (Rand); — Seal Harbor (Theodore G. White).

B. capillare, ~~L.~~ Hedw.

In rich soil. Triad Pass; banks of Somes Stream (Rand).

B. pseudotriquetrum (Hedw.), Schwaegr. *B. ventricosum*, Dicks.

Shores. Ripples Pond; Northwest Arm, Great Pond (Rand).

MNIUM, L. (*Astrophyllum*, Neck.)

M. cuspidatum, Hedw. *Astrophyllum sylvaticum*, Lindb.

On ground, shady places; common (Rand, White).

M. rostratum, Schwaegr. *Astrophyllum rostratum* (Schrad.), Lindb. M. longirostrum Brid.

Seal Harbor (Theodore G. White).

M. affine, Bland. ex Fonck. sensu lato *Astrophyllum cuspidatum* (L.), Lindb.

In moist ground, shady places by watercourses, etc; common (Burrage, Rand).

M. hornum, ~~L.~~ Hedw. *Astrophyllum hornum* (L.), Lindb.

Moist, shady woods. Seal Harbor (Redfield); — Otter Cliffs; High Head; Norwood Cove; head of The Barcelona meadow; Somesville (Rand); — Barr Hill; Great Cranberry Isle; Sutton Island (Theodore G. White).

M. cinclidioides (~~Blytt), Hueben.~~ Hüb. *Astrophyllum cinclidioides* (Blytt), Lindb.

Woods, Beech Hill road, Southwest Harbor (Rand).

M. punctatum (~~L.~~) Hedw. *Astrophyllum punctatum* (L.), Lindb.

Moist woods and wet places; common (Rand, Redfield, White). A small form, Browns Mt. Notch (Rand).

AULACOMNIUM, Schwaegr. (*Sphærocephalus*, Neck.)

A. palustre (~~L.~~) Hedw., Schwaegr. *Sphærocephalus palustris* (L.), Lindb.

Marshy places; common (Burrage, Rand, White).

Var. polycephalum, Bruch & Schimp.

Frequent. Near Northwest Cove (E. Faxon); — Beech Hill; near Ripples Pond, and elsewhere (Rand); — near Long Pond (Theodore G. White).

Tribe POLYTRICHEÆ

ATRICHUM, Beauv. (*Catharinea*, Ehrh.)

A. undulatum (~~L.~~) Hedw., Beauv. *Catharinea undulata* (L.), Web. & Mohr.

In damp ground. Beech Mt. Notch; brookside, Southwest Valley road; Stanley Brook; Somesville (Rand); — Great Cranberry Isle (Theodore G. White).

A. angustatum, ~~Bruch & Schimp.~~ *Catharinea angustata*, Brid. 7 356.

On ground. Beech Mt. Notch; High Head; Seal Harbor; Southwest Valley road (Rand).

POGONATUM, Beauv.

P. brevicaule, Beauv. *P. tenue* (Menz.), E. G. Britton.

P. pensilvanicum (Hedw.) P. Beauv.

On clay banks. Wood road to Great Pond, Southwest Harbor; Beech Cliff road, Somesville (Rand); — Southwest Harbor (M. L. Fernald).

P. alpinum (~~L.~~) Hedw., Roehl.

On rocks. Browns Mt. (Walter L. Burrage); — Ovens; Browns Mt. Notch (Rand); — slope of Green Mt. (D. C. Eaton); — Triad Pass (Theodore G. White).

POLYTRICHUM, L.

P. Ohioense, Ren. & Card. *P. formosum*, Lesq. & J., Mosses N. A., 264 in part.

Stem erect, simple or bipartite, 3–6 cm. long, a little tomentose below; leaves spreading when moist, erect-flexuous when dry, from a sheathing base, linear-acuminate, cuspidate, serrate; lamellæ about 50, each in section of a row of 5-7 cells, the marginal one much larger, transversely dilated, about twice broader than high, very slightly convex, often almost plane; perichætial leaves longer, with a longer hyaline base. Pedicel 4–8 cm. long, reddish below, pale above; capsule erect, finally horizontal, tetragonal or pentagonal, rarely hexagonal, acute-angled, rather narrowed toward the base, with a very small or indistinct hypophysis; length 5-7 mm., diameter 2–2½ mm.; lid conic-acuminate, red at margin. Distinguished from *P. formosum* by the form of the capsule, more or less narrowed toward the base, and with an indistinct hypophysis; and further chiefly by the form of the marginal cells of the lamellæ. Ren. & Card., Rev. Bryol. (1885), 11. Bot. Gaz., xiii. 199. Macoun, Cat. Canadian Plants, part vi. 153. On ground. Woods, Hadlock Valley (Redfield).

P. piliferum, (Schreb.) Hedw.

Dry grounds, and in rock hollows. Sargent Mt.; Browns Mt. (Walter L. Burrage); — Flying Mt. (R. & R.); — Newport Mt. (Theodore G. White).

P. juniperinum, (Willd.) Hedw.

Dry, open ground. Dog Mt.; Browns Mt.; Asticou Hill (Walter L. Burrage); — Otter Creek quarries (Theodore G. White).

P. alpinum, L. *P. juniperinum*, Willd., var. *alpinum* (L.), Schimp. Pogonatum alpinum (Hedw.) Röhl
Barr Hill, and elsewhere (Theodore G. White).

P. strictum, Banks. (P. juniperinum var affine (Funck) Brid.)

Dry ground. Browns Mt. (Rand); — Southwest Harbor (A. B. Eaton); — Salisbury Cove (Walter L. Burrage); — Long Pond (Theodore G. White).

P. commune, L. Hedw.

Dry or moist ground, woods and open places; very common (Burrage, Rand, White).

Tribe BUXBAUMIEÆ.

DIPHYSCIUM, Mohr. (*Webera*, Ehrh.)

D. foliosum (Web.), Mohr. *Webera sessilis* (Schmid.), Lindb.

On clay bank, shore south of Aunt Mollys Beach (Rand).

Section II. PLEUROCARPI.

Tribe FONTINALEÆ.

FONTINALIS, L.

F. antipyretica, L., var. gigantea, Sulliv.

Frequent on stones in brooks. Cold Brook; brook, Clark Valley, and elsewhere (Rand); — Bubble Pond (Redfield).

F. Dalecarlica, Bruch & Schimp.

On stones in brooks; common (Burrage, Rand). Also in still water on the shore of Great Pond (Rand).

F. Novæ-Angliæ, Sulliv.

Rivulet flowing into Denning Pond (E. Faxon); — Somes Stream (Rand); — Hunters Brook (Theodore G. White).

? F. Lescurii, Sulliv. F. novae-angliae

Doctors Brook (Redfield).

F. Sullivantii, Lindb.

In swift and still water. Long Pond, Eden (E. Faxon); — runlet near head of Denning Pond (Rand).

DICHELYMA, Myrin.

D. pallescens, Bruch & Schimp.

On twigs in wet hole in woods, head of The Barcelona meadow (Rand).

Tribe NECKEREÆ.

NECKERA, Hedw.

N. pennata (L.), Hedw.

On trees; frequent. Seal Harbor (Redfield); — Canada Valley; Upper Breakneck Pond, etc. (Rand); — slopes of Green Mt. (D. C. Eaton); — Southwest Harbor (M. L. Fernald); — Barr Hill (Theodore G. White).

Tribe LEUCODONTEÆ.

LEUCODON, Schwaegr.

L. sciuroides (L.), Schwaegr. L. brachypus var. andrewsianus Crum + Anders.

On willow trees, Somesville (Rand).

Tribe LESKEEÆ.

MYURELLA, Bruch & Schimp.

M. julacea (Vill.), Bruch & Schimp.

On ground. Southwest Harbor (Rand).

LESKEA, Hedw.

L. tristis, Cesati.

On trees. Deer Brook, near Jordan Pond (Rand).

Tribe ORTHOTHECIEÆ.

PLATYGYRIUM, Bruch & Schimp. (*Entodon*, C. Mueller.)

P. repens, Bruch & Schimp. *E. palatinus* (Neck.), Lindb.

On willow trees, Somesville (Rand).

PYLAISIA, Bruch & Schimp.

P. polyantha (Schreb.), Bruch & Schimp.

On old plank, Southwest Harbor (Rand).

P. velutina, Bruch & Schimp.

On trees. Canada Valley; West Branch of Hadlock Brook; Deer Brook; Intervale Brook (Rand).

CLIMACIUM, Web. & Mohr. See Horton + Vitt 1976

C. dendroides (L.), Web. & Mohr.

On ground. Woods, head of The Barcelona meadow; Clark Valley (Rand).

C. Americanum, Brid.

On ground. Moist thicket, Somes Stream (Rand).

Tribe HYPNEÆ.

HYPNUM, L.

Subgenus THUIDIUM.

H. recognitum, Hedw.

On ground, rocks, etc.; common (Walter L. Burrage, Rand).

H. delicatulum, L.

On ground, rocks, etc. Western Mt.; Cold Brook (Rand); — Triad Pass (Theodore G. White).

Subgenus BRACHYTHECIUM.

H. lætum, Brid.

On trees. West Branch of Hadlock Brook (Rand).

H. salebrosum, Hoffm. *H. plumosum*, Huds.

On trees. Roadside near Ripples Pond; near Seal Harbor reservoir; Clark Valley (Rand).

Var. palustre, Lesq. & J.

Wet ground. Woods, head of The Barcelona meadow; junction of Prettymarsh and Seal Cove roads (Rand).

H. velutinum, L.

On ground. Dry woods, Seal Harbor (Theodore G. White).

H. rutabulum, L.

On rocks or stumps. North of Beech Mt.; Northwest Arm woods (Rand); — on Jordan Stream (Theodore G. White).

H. campestre, Bruch.

On ground, rocks, and logs. Near head of Denning Pond; Southwest Harbor; Intervale Brook; woods, Upper Breakneck Pond; Western Mt. (Rand).

H. Novæ-Angliæ, Sulliv. & Lesq.

On ground. Asticou Hill; Baker Island (Theodore G. White); — Seal Harbor; Cold Brook (Rand).

H. plumosum, Swz. *H. pseudoplumosum*, Brid.

On rocks. Road to Beech Hill, Somesville (Rand); — Newport Mt. (Theodore G. White).

SUBGENUS EURHYNCHIUM.

H. strigosum, Hoffm. Eurhynchium pulchellum (Hedw.) Jenn.

Bog hole, Prettymarsh road west of Ripples Pond (E. Faxon).

H. Sullivantii, Spruce. Brachythecium gramini color (Brid.) Grout

On ground. Woods at Salisbury Cove (Walter L. Burrage).

SUBGENUS RAPHIDOSTEGIUM.

H. recurvans (Mx.), Schwaegr.

On tree roots and old logs. Foot of Western Mt.; Salisbury Cove (Walter L. Burrage); — woods, Norwood Cove; Upper Breakneck Pond (Rand).

H. cylindricarpum, C. Mueller.

On trees. Browns Mt. (R. & R.).

H. Jamesii, Lesq. & J.

On ground. Triad Pass (Theodore G. White).

SUBGENUS RHYNCHOSTEGIUM.

H. deplanatum, Schimp. Taxiphyllum deplanatum

On decaying wood. Jordan Pond trail from Northeast Harbor (Rand). (Bruch + Schimp. ex Sull.) Fl.

H. serrulatum, Hedw.

On wet rocks. Western Mt. On wet ground. Near Ripples Pond (Rand).

H. rusciforme, Weis.

Wet rocks. East Branch of Hadlock Brook (Walter L. Burrage); — Browns Mt. (Redfield); — Sargent Mt.; West Branch of Hadlock Brook (Rand).

SUBGENUS PLAGIOTHECIUM.

H. micans, Swz. Isopterygium tenerum (Sw.) Mitt.

On decaying wood. Seal Harbor (Theodore G. White).

H. turfaceum, Lindb. Herzogiella turfacea (Lindb.) Iwats.

On ground and old logs in woods; common (Redfield, Rand, White).

H. elegans, Hook.

Crevices of rocks. Dog Mt. (Rand); — Seal Harbor (Theodore G. White).

H. denticulatum, L.

On decaying tree trunks. Browns Mt. Notch; Norwood Cove (Rand); — Browns Mt. (Redfield); — woods north of Long Pond (Theodore G. White). On rocks. Northern foot of Beech Mt. (Rand).

H. Muhlenbeckii, Spruce. *H. striatellum*, Brid.

On rocks; frequent (Rand).

SUBGENUS AMBLYSTEGIUM.

H. serpens, L.

On decaying wood. Southwest Harbor (Rand).

H. orthocladon, Beauv.

On old trees. Woods, Intervale Brook (Rand).

H. Lescurii, Sulliv.

On wet rocks. Intervale Brook, near bridge (Rand).

H. riparium, L.

On decaying wood, Stanley Brook (Rand); — immersed among *Fontinalis Dalecarlica*, shore of Northwest Arm, Great Pond (Rand).

Var. flaccidum, Lesq. & J.

Deep woods, Little Cranberry Isle (Redfield).

Subgenus CAMPYLIUM.

H. hispidulum, Brid.

On wet rocks. Western Mt. (Rand).

H. chrysophyllum, Brid.

On tree roots in moist ground. Long Pond (Theodore G. White); — meadow on Sunken Heath Brook (Rand).

Var. rupestre, Aust.

Plants large, in dense cushions; stems usually long, branching; generally sterile. Austin, Musci App., No. 396 (1870). On rocks in brooks. Sargent Mt. Gorge (Walter L. Burrage).

Var. cæspitosum, Aust.

Plants slender, densely cæspitose. Austin, Musci App., No. 395 (1870). About tree roots. Seal Harbor (Theodore G. White).

H. polygamum, Wils.

In wet ground. Somesville (Rand).

Subgenus HARPIDIUM.

H. aduncum, Hedw.

In wet ground. Sea Wall; Beech Cliff; Somes Pond (Rand).

H. uncinatum, Hedw. *H. aduncum*, L.

On ground, rocks, and decaying wood; very common. (Burrage, Rand, Redfield.)

Var. gracilescens, Bruch & Schimp.

On ground in woods, Great Cranberry Isle (Rand).

H. fluitans, L.

In ditches, bog holes, and wet places. Near Spruce Point, Eden (E. Faxon); — Sea Wall (Redfield); — Ripples Pond; Pemetic Mt.; Jordan Mt.; Browns Mt., a very slender form (Rand).

Subgenus CTENIUM.

Ptilium

H. Crista-castrensis, L.

On ground and old logs; frequent. Upper Hadlock Pond (Walter L. Burrage); — Sargent Mt. (Faxon & Rand); — High Head (H. S. Rand); — Southwest Valley road, etc. (Rand); — between Hadlock farm and Frenchman Camp (Redfield); — Great Head (Theodore G. White).

Subgenus HYPNUM, proper.

H. reptile, Mx.

On ground or on trees. South end of Great Pond; Cold Brook; Southwest Valley road; Western Mt.; Beech Mt.; Northwest Arm woods; Intervale Brook (Rand).

H. fertile, Sendt.

On moist rocks, old logs, etc. Browns Mt. Notch; Intervale Brook (Rand); — woods, north of Long Pond (Theodore G. White).

H. imponens, Hedw.

On ground, old logs, etc. Canada Valley; Norwood Cove; Northwest Arm woods; Intervale Brook (Rand); — The Cleft (Theodore G. White).

H. cupressiforme, L.

On rocks, old trees, etc.; common and variable. Hadlock Upper Pond (Walter L. Burrage); — south end of Great Pond, and elsewhere (Rand); — Seal Harbor; Sutton Island (Theodore G. White).

Var. filiforme, Brid.

On Jordan Stream (Theodore G. White).

Var. ericetorum, Bruch & Schimp.

Northwest Arm woods (Rand).

Var. resupinatum (Wils.), Schimp.

Cæspitose, pale green; leaves falcate or curved, yellow at angles; capsule suberect or incurved, lid rostrate. On Jordan Stream (Theodore G. White); — woods, Intervale Brook (Rand).

H. curvifolium, Hedw.

Wet rocks and old logs. Waterfall, East Branch of Hadlock Brook (Theodore G. White); — Somes Pond; Intervale Brook (Rand).

H. pratense, Koch.

In wet ground, Seal Cove road, Southwest Harbor (Rand).

H. Haldanianum, Grev.

Wet clayey ground and on tree trunks. Ripples Pond; between Bass Harbor and Southwest Harbor (Rand); — Prettymarsh (Theodore G. White).

Subgenus LIMNOBIUM.

H. palustre, Huds.

On rocks. Woods on Intervale Brook (Rand).

H. molle, Dicks. *H. dilatatum*, Wils.

On wet rocks. Brook, Western Mt. (Walter L. Burrage); — Browns Mt. Notch (Rand).

H. eugyrium, Schimp.

Woods, north of Long Pond (Theodore G. White); — Intervale Brook (Rand).

H. ochraceum, Turn.

In cold mountain brooks. North of Sargent Mt.; near head of Denning Pond (Rand); — at waterfall, East Branch of Hadlock Brook (Theodore G. White). A very slender form, head waters of Gilmore Brook (E. Faxon).

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Subgenus CALLIERGON.

H. cordifolium, Hedw.

Common in swamps and wet boggy ground. (E. Faxon, Rand, White.)

H. Schreberi, Willd. *H. parietinum*, L.

On ground; common. (Burrage, E. Faxon, Rand, Redfield, White.)

H. stramineum, Dicks.

Among sphagnum in bogs. Little Cranberry Isle (Redfield); — Breakneck Ponds; Great Cranberry Isle (Rand).

Subgenus PLEUROZIUM.

H. splendens, Hedw. *H. proliferum*, L.

Moist rocks and on ground in woods; common. (Burrage, Redfield, Rand, White.)

H. brevirostre, Ehrh.

Gorge, West Branch of Hadlock Brook (Rand).

Subgenus HYLOCOMIUM.

H. squarrosum, L.

On ground. Cold Brook (Rand).

H. triquetrum, L.

Woods, on ground; common. (Burrage, Rand.)

Division II. HEPATICÆ; LIVERWORTS.

List prepared by Edward L. Rand under the supervision of Dr. L. M. Underwood, by whom many annotations and some necessary descriptions have been furnished. Plants collected by Edward L. Rand and others; determined by Dr. Underwood. The arrangement followed is that given in the sixth edition of Gray's Manual.

JUNGERMANNIACEÆ. Scale Mosses.

FRULLANIA, Raddi.

F. Eboracensis, Lehm.

Common on trees; sometimes on rocks.

F. Asagrayana, Mont.

On spruce trees, Beech Mt. (Rand); — on rocks, near Little Harbor (Redfield); — among moss on old log, Great Pond (Rand).

JUBULA, Dumort.

J. Hutchinsiæ (Hook.), Dumort., var. Sullivantii, Spruce.

Wet rocks in Intervale Brook (Rand).

PORELLA, L.

P. platyphylla (L.), Lindb. *Madotheca platyphylla*, Dumort.

Frequent, usually on trees. Seal Harbor (Redfield); — Deer Brook; Hadlock Brook; Breakneck road (Rand).

PTILIDIUM, Nees.

P. ciliare (L.), Nees.

Very common on ground, rotten trees, etc. Variable. An unusually small form on old log, path to Beech Cliff (Rand). A large form, among sphagnum in bog hole on The Heath, Great Cranberry Isle, appears to be *P. pulcherrimum* (Web.), Nees.

TRICHOCOLEA, Dumort.

T. tomentella (Ehrh.), Dumort.

In moss, Cold Brook (Rand).

BAZZANIA, S. F. Gray.

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

Very common on ground in damp woods. A very delicate form on wet rocks, northern end of Beech Mt. (Rand).

LEPIDOZIA, Dumort.

L. reptans (L.), Dumort.

On wet rocks among moss, northern end of Beech Mt.; on ground, Norwood Cove (Rand).

L. setacea (Web.), Mitt.

In sphagnum, border of Aunt Bettys Pond (Faxon & Rand). This seems to be a floating form.

BLEPHAROSTOMA, Dumort.

B. trichophyllum (L.), Dumort.

On clay banks, Stanley Brook, Seal Harbor (Rand).

CEPHALOZIA, Dumort.

C. Virginiana, Spruce.

In wet ground. Southern end of Great Pond (Rand).

C. multiflora, Spruce.

In wet ground. Sunken Heath; Sunken Heath Brook; Beech Mt. (Rand).

C. bicuspidata (L.), Dumort.

On the ground. Jordan Pond trail from Northeast Harbor; Norwood Cove (Rand).

C. curvifolia (Dicks.), Dumort.

On rotten logs. Northwest Arm woods (Rand).

C. fluitans (Nees), Spruce.

Very abundant in shallow pools and among sphagnum, Sunken Heath (Faxon & Rand); — Sunken Heath Brook (Rand).

C. divaricata (Sm.), Dumort.

On rocks with Andreæa, Sargent Mt. (Rand).

KANTIA, S. F. Gray.

K. Trichomanis (L.), S. F. Gray.

On ground. Wood road to Western Mt.; Jordan Pond path, Seal Harbor (Rand).

SCAPANIA, Dumort.

S. undulata (L.), Dumort.

On stones in brooks, usually submersed; frequent.

S. irrigua (Nees), Dumort.

On rocks in water. Jordan Pond; Stanley Brook (Rand).

S. nemorosa (L.), Dumort.

On wet rocks and damp ground; very common.

DIPLOPHYLLUM, Dumort.

D. albicans (L.), Dumort.

This species is distinguished from *D. taxifolium* "by the presence in the two lobes of a pseudo-nerve, which is often colorless, and consists of a series of from 4 to 6 elongated cells. A cross-section of the leaf shows the cells to be of equal diameter as the others, only with the outer walls thickened considerably." Pearson, Canadian Hepaticæ, 15. On rocks. Browns Mt. Notch (Rand).

D. taxifolium (Wahl.), Dumort. *D. albicans*, Dumort., var. *taxifolium*, Nees. Gray, Man., 6th ed., 715.

On rocks. West Branch of Hadlock Brook (Rand).

D. Dicksoni (Hook.), Dumort.

Stems prostrate, copiously rooting below, mostly simple with ascending apices; leaves deeply 2-lobed, spreading or somewhat involute when dry, pale or becoming whitish, the lower lobe obliquely ovate or ovate-lanceolate, somewhat falcate, the upper lobe a half smaller, lanceolate, acute; leaf cells rather large, nearly uniform; perianth ovate, with a plicate-laciniate mouth. On rocks. Northern end of Beech Mt. (Rand).

GEOCALYX, Nees.

G. graveolens (Schrad.), Nees.

On rotten stumps. Beech Mt. (Rand).

LOPHOCOLEA, Dumort.

L. bidentata (L.), Dumort.

In rill by roadside, near head of Great Pond (Rand).

CHILOSCYPHUS, Corda.

C. polyanthos (L.), Corda.

On ground. Southern end of Great Pond; Cold Brook (Rand).

Var. rivularis, Nees.

On dripping rocks, northern end of Beech Mt. (Rand).

PLAGIOCHILA, Dumort.

P. asplenoides (L.), Dumort.

On wet rocks. Cold Brook; Intervale Brook; northern end of Beech Mt. (Rand).

MYLIA, S. F. Gray.

M. Taylori (Hook.), S. F. Gray.

Among sphagnum, shore of Aunt Bettys Pond (Rand).

M. anomala (Hook.), S. F. Gray.

Differs from *M. Taylori*, of which it may be only a variety, in its rather distant leaves, which are obtuse, acute, or ovate-acuminate on the same stem, and thinner in texture, in its longer perianth, and in its ovate involucral leaves. Among sphagnum, Freeman Heath (E. Faxon).

JUNGERMANNIA, L.

J. Schraderi, Mart.

On ground and old logs; common.

J. pumila, With.

On ground. Woods near Somes Pond (Rand).

J. barbata, Schreb.

On rocks. Western Mt. (Rand). A variety on wet rocks, northern end of Beech Mt. (Rand).

J. attenuata, Lindenb. *J. barbata*, var. *attenuata*, Mart. Gray, Man., 6th ed., 719.

On rocks, northern end of Beech Mt.; on old tree, The Heath, Great Cranberry Isle (Rand).

J. ventricosa, Dicks.

On old log, northern end of Beech Mt. (Rand).

J. excisa, Dicks.

On decaying logs. Jordan Mt.; The Heath, Great Cranberry Isle (Rand).

J. incisa, Schrad.

On the ground and on decaying logs. Southern end of Great Pond (Rand).

J. inflata, Huds.

On ground and rocks; frequent. Variable. Browns Mt.; Beech Mt.; Sargent Mt. (Rand). A variety on wet rocks, Sargent Mt. (Rand). A form with very small compressed leaves, Robinson Mt. (E. Faxon). An aquatic form, pools on summit of Beech Mt.; on logs in water, Sunken Heath Brook (Rand).

* J. Marchica, Nees.

Under leaves (amphigastria) none; stem creeping, radiculose, flexuous, subsimple or with offshoots at the apex, rather thick, soft; leaves semi-vertical, spreading, very lax, subquadrate, repand, entire, pale, bifid with an angular sinus, retrorsely gibbous and with divergent obtuse lacinim (or more rarely trifid); fruit unknown. Nees, Europ. Lebermoose, ii. 77. On *Sphagnum Russowii*, Beech Mt. (Rand). Spec. in herb. C. Warnstorf.

Nees did not include this species in the later work, Synopsis Hepaticorum, nor is it mentioned in other works of importance.

Dr. Warnstorf, however, writes that the discovery is a very important one, since it is the second or third time that this species has been collected. He evidently regards it as a good species.

MARSUPELLA, Dumort.

M. sphacelata (Giesecke), Dumort.

On rocks. Summit of Green Mt. (D. C. Eaton); — Beech Cliff (Rand).

M. emarginata (Ehrh.), Dumort.

Wet rocks; frequent.

M. adusta (Nees), Spruce.

Wet ledges, Green Mt. (E. Faxon).

NARDIA, S. F. Gray.

N. crenulata (Sm.), Lindb.

On decaying wood. The Heath, Great Cranberry Isle (Rand).

FOSSOMBRONIA, Raddi.

F. Dumortieri, Lindb.

Pond shores, on ground. Jordan Pond; Ripples Pond; Great Pond (Rand).

PALLAVICINIA, S. F. Gray.

P. Lyellii (Hook.), S. F. Gray. *Steetzia Lyellii*, Lehm.

Forming mats under water, Sunken Heath Brook (Rand).

PELLIA, Raddi.

P. epiphylla (L.), Nees.

On damp ground, pond shores, brooksides, etc.; common.

ANEURA, Dumort.

A. palmata (Hedw.), Dumort.

Dioecious, generally proliferous, small, opaque; thallus short and narrow; branches linear, palmately divided, usually narrow-

ing gradually towards the apex, subacute and scarcely emarginate, biconvex; cells small, rounded, thickened; bracts numerous; calyptra small, densely verrucose; antheridia linear. Lindb., Not. pro Fauna et Fl. Fen., xiii. 375. On old tree, West Branch of Stanley Brook (Rand).

MARCHANTIACEÆ. Liverworts.

MARCHANTIA, L.

M. polymorpha, L.

On the ground, especially after fires; frequent. Beech Hill; High Head; Somesville, and elsewhere (Rand).

CONOCEPHALUS, Neck.

C. conicus (L.), Dumort.

On damp ground. Aunt Mollys Beach (Rand); — Bar Harbor (Kate Furbish).

Class III. THALLOPHYTA.

Division I. CHARACEÆ.

NITELLA, Ag.

N. opaca, Ag.

Ponds and streams; common. Smith Brook, High Head; Deer Brook; Canada Brook; Jordan Stream (Rand); — Long Pond, Eden (E. Faxon); — at outlet Hadlock Lower Pond (Isaac Holden).

N. flexilis, Ag.

Specimens of a Nitella, probably this species, have been found in several localities. Mouth of Hunters Brook; Somes Stream; Deer Brook (Rand); — Great Pond (Isaac Holden).

Division II. ALGÆ.

List prepared by Frank S. Collins. Plants collected by Frank S. Collins and Isaac Holden.

So far as fresh water algæ are concerned, the following list contains only a few species which have come under the notice of the collectors; to make even an approximately representative list would take careful collecting and study for years; this must be left for future students. In the representation of marine algæ, the list is more satisfactory, but here also it is undoubtedly far from perfect. For instance, there will be noticed three species which find a place here only on authority of minute fronds observed on other specimens; it is more than likely that there are other species equally deserving of a place, but not equally fortunate in securing it.

The fact that thus far collecting has been done almost entirely in the summer months accounts for the absence of some species, which there is every reason to expect in this locality. Still, allowing for these deficiencies, the list gives a fairly good idea of the marine flora of the Island, — that sub-arctic flora characteristic of the northern New England coast.

The arrangement of species, genera, etc., is based chiefly on Engler and Prantl's "Natürlichen Pflanzenfamilien," which