TWENTY-FIVE COMMON MOSSES OF WATAUGA COUNTY, NORTH CAROLINA

A Thesis

Presented to

the Faculty of the Department of Biology

Appalachian State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

---

by

Charles Robert Bagnell, Jr.

May 1969

TWENTY-FIVE COMMON MOSSES OF WATAUGA COUNTY, NORTH CAROLINA

---

by

Charles Robert Bagnell, Jr.

Approved by:

L. W. Carpenter, Jr.
Director of Thesis

Homer H. Hurley
Associate Professor of Biology

Dannie H. Ing
Assistant Professor of Biology

Roy Derrick
Chairman of Biology Department

Grady Williams
Dean of Graduate School

ABSTRACT

This investigation was undertaken in order to provide a stimulus to the better use of mosses in high school and college biology teaching, and to lay the groundwork for further development of mosses as teaching aids. Twenty-five mosses commonly found in Watauga County are described. A simple dichotomous key to their identification is given. Photographs of habitat and distinctive characteristics for each moss are included. Applications of mosses as teaching aids are pointed out. A glossary to technical terms is provided.

ACKNOWLEDGMENTS

The author wishes to gratefully acknowledge the guidance and assistance given to him by Dr. I. W. Carpenter, Jr., without whose encouragement this work could not have been completed. The author also wishes to thank Dr. Homer H. Hurley who willingly gave his time and knowledge to help the author overcome many of the technicalities involved in making the key. Lastly, the author wishes to express his deep appreciation to his wife who was tireless in the correction of grammar and spelling, in the preparation of the preliminary drafts and countless other time-consuming tasks.

TABLE OF CONTENTS

LIST OF FIGURES

Figure Page

Figure Page

CHAPTER I

A. THE PROBLEM

Introduction to the problem. Mosses are given only superficial treatment in most high school and introductory college biology courses. As a result of such casual treatment, this interesting division of plants is little known or appreciated by a great majority of our population. Several reasons for this neglect are apparent: 1. Few teachers have undertaken advanced studies of mosses and are therefore unaware of the potential which mosses have as teaching aids. 2. A majority of general biology texts present only a perfunctory treatment of the life cycle and anatomy of a very limited number of species (1-14). 3. Simplified keys and identification manuals to a limited number of mosses are not available.

Mosses have a great, but largely unrealized, potential as teaching aids. Seed plants are traditionally used for such purposes as the study of anatomy and physiology of plant cells, the teaching of taxonomic procedures and the use of a key, the development of microscopic techniques and observational skills. Mosses have several attributes which should not be overlooked when a plant is needed for exercises which are not specifically related to a given plant group: 1. Mosses can be found and collected almost everywhere. 2. Mosses are green during all seasons. 3. Many mosses lend themselves to microscopic study much more readily than do seed plants, the leaves being only one cell layer thick. 4. Many

Fig. 1. Peristome teeth

Fig. 2. Protonema

mosses are easily collected and stored in paper envelopes. 5. Dry mosses can be revived years after collection by placing them in warm water.

Aside from the above attributes, mosses have many unique interesting and useful qualities: 1. The peristome teeth of mosses provide an excellent demonstration of hygroscopic action and may create unusual interest on the part of students (Fig. 1). 2. The close resemblance of moss protonema to filamentous algae provides an excellent tool for sharpening observational powers during studies of the latter (Fig. 2). 3. Mosses are great harborers of invertebrate organisms and should be kept in mind during invertebrate studies.

The author does not pretend that the above examples have even scratched the surface of the potential which mosses hold as teaching aids, but has merely intended to demonstrate that such potential does exist.

Statement of the problem. The objective of this investigation is to provide a stimulus to the better use of mosses in high school and college biology teaching, and to lay the groundwork for further development of mosses as teaching aids.

Importance of the investigation. It is anticipated that the results of this investigation will lead to a greater use of mosses in the general biology laboratory, and eventually to a better appreciation of this plant division by the general population.

Limitations of the investigation. Only twenty-five mosses of Watauga County are considered in this study. Many mosses are commonly

found in the county and the selection of only twenty-five is, therefore, in part arbitrary. Some criteria were used in the selection, however, and these are pointed out in Section C, Procedure, along with other difficulties which a student may encounter in using this work.

It is the author's hope that his work will be improved and expanded by those students who follow him.

B. ORGANIZATION

In order to provide the groundwork for the use and further development of mosses as teaching aids, the following steps were taken: 1. A list of twenty-five common mosses of Watauga County was prepared with descriptive notes on each. 2. A simplified key to these mosses was constructed. 3. Photographs of the habitat, the general habit, and distinguishing characteristics for each moss were made.

C. PROCEDURES

The twenty-five mosses in this study were taken from a list of mosses from Watauga County (33) containing 464 collections resulting in 61 generic determinations made by Dr. I. W. Carpenter, Jr., and Mrs. M. L. Hicks from 1963 to 1966, and by the author during the summer and fall of 1968. Four criteria for selection were used in the following order of importance: 1. Frequency of collection. 2. Ease of identification. 3. Usefulness in laboratory work. 4. Special or interesting characteristics. With the exception of Climaceum, all the mosses in the present

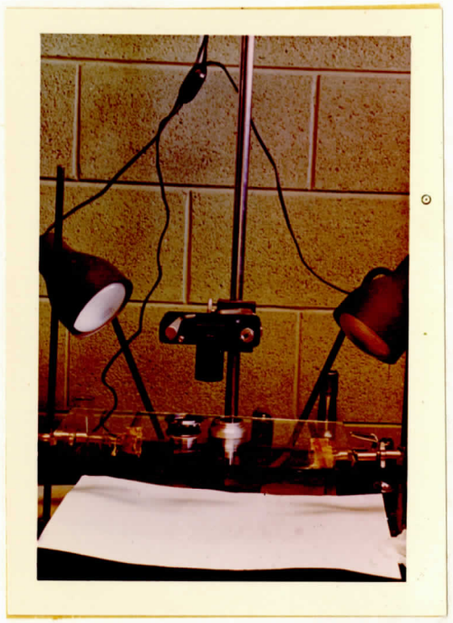

Fig. 3. Photocopy stand

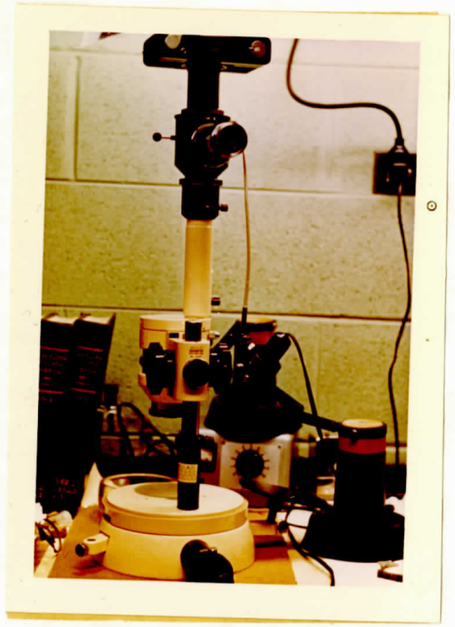

Fig. 4. Wild M-5

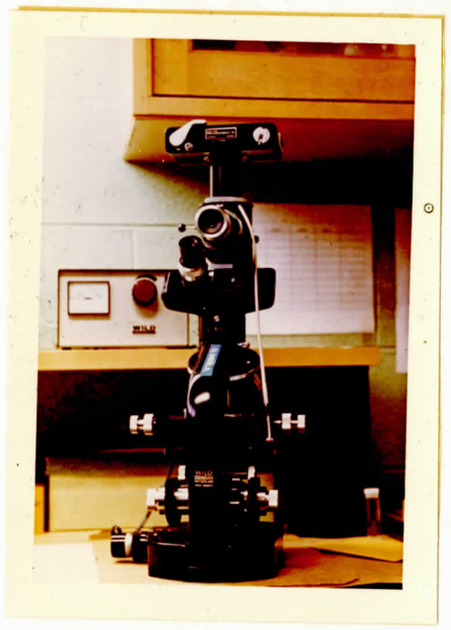

Fig. 5. Wild M-20

work were reported by A. J. Grout from a small collection which he made during a short stay in the mountains of Western North Carolina in 1907 (31).

The key is eclectic, taken from four standard keys (18, 19, 20, 21). Complicated terms have been replaced with more familiar ones and only the most obvious distinguishing characteristics have been employed. Vegetative characteristics have been used in so far as possible. This key is limited in that its general characteristics may apply to genera not included in this work. The author therefore urges the use of photographs and descriptions in making a final identification from the key.

The moss descriptions are condensed from A. J. Grout's Mosses With a Hand-lens and Microscope (21), and Grout's Moss Flora of North America (19).

Black and white photographs were made on 35 mm. Kodak Panatomic X film using a photocopy stand (Fig. 3), a Wild M-5 dissecting microscope (Fig. 4), and a Wild-M-20 compound microscope (Fig. 5). Color prints were made from 35 mm. Agfachrome and Ektachrome X transparencies.

CHAPTER II

REVIEW OF THE LITERATURE

Books which attempt to simplify the study of mosses are not infrequent. The Observers Book of Mosses and Liverworts by A. L. Jewell (22) represents the simplest group of such works. Intended for the weekend naturalist, no key is included in this work. Identification is more or less based on matching the moss with color drawings in the book. A second group of manuals attempts to bridge the gap between the very simple works and the very complex works. A key and frequently generic descriptions are included in these manuals. Bodenberg's Mosses: A New Approach to the Identification of Common Species (15), Conard's How to Know the Mosses and Liverworts (18), and Grout's Mosses With a Hand-lens (20) are excellent in this capacity. These works attempt to deal with a great number of mosses however and thus must resort to more complicated ideas than are necessary in a work containing only a few mosses. All the above are excellent for reference and should be available to the biology teacher.

In searching the literature for keys and manuals, the author could find no specific works on Western North Carolina. This author found that three manuals, which include the mosses of Western North Carolina, were frequently mentioned throughout the periodic literature pertinent to bryology: 1. H. S. Conard's How to Know the Mosses and Liverworts (18) is a widely used key, but it does not contain generic descriptions. Although this is a relatively simple key, more time is required in learning

to use it than most teachers wish to spend. 2. A. J. Grout's Mosses with a Hand-lens and Microscope (21) provides keys to the families, genera, and species of many North American mosses. Family, generic, and species descriptions are included plus a noteworthy collection of excellent illustrations. This work should be available as a reference, but is too detailed to be used as an initial elementary source. 3. Moss Flora of North America North of Mexico (19) by A. J. Grout is generally considered the most complete work on North American mosses today. This three volume treatise describes the families, genera and species of mosses of North America and provides keys to them. It is not entirely complete or accurate, however, which is pointed out by Anderson (30). Only an ardent bryologist should attempt to use this work. It is certainly not suitable as a primary source of useful information to general biology teachers.

CHAPTER III

ECLECTIC KEY TO TWENTY-FIVE COMMON MOSSES OF WATAUGA COUNTY, NORTH CAROLINA

1. a. Plants constantly submerged in running water, 12 or more cm. long, flowing in the current . . . . . Fontinalis (pg. 30)
1. b. Plants not constantly submerged in running water . . . . . 2.

2. a. Plants growing on rocks, concrete or masonry . . . . . A.
2. b. Plants not growing on rocks, concrete or masonry . . . . . 3.

3. a. Plants growing on living trees . . . . . B.
3. b. Plants growing on soil or rotting wood . . . . . C.

A.

1. a. Plants silvery-white . . . . . Bryum argenteum (pg. 22)
1. b. Plants green to black . . . . . 2.

2. a. Plants very dark, often black . . . . . 3.
2. b. Plants green . . . . . 5.

3. a. Leaves having colorless tips . . . . . 4.
3. b. Leaves without colorless tips . . . . . Andrea (pg. 14)

4. a. Leaves having a midrib . . . . . Grimmia (pg. 34)
4. b. Leaves without a midrib . . . . . Hedwigia (pg. 36)

5. a. Plants creeping . . . . . 6.
5. b. Plants erect . . . . . 8.

6. a. Plants regularly pinnately branched . . . . . 7.
6. b. Plants not regularly pinnately branched . . . . . Plagiothecium (pg. 48)

7. a. Leaves having a midrib . . . . . Thuidium (pg. 58)
7. b. Leaves without a midrib . . . . . Hypnum (pg. 38)

8. a. Plants bushy; leaves elongated . . . . . Dicranum (pg. 26)
8. b. Plants slender, leaves short . . . . . Philonotis (pg. 46)

B.

1. a. Plants growing in trees, never extending to the ground. . . . . 2.
1. b. Plants growing around the base of trees, extending to the ground . . . . . 3.

2. a. Plants growing in small rounded tufts . . . . . Ulota (pg. 60)
2. b. Plants growing in spreading patches . . . . . Leucodon (pg. 42)

3. a. Plants regularly pinnately branched . . . . . 4.
3. b. Plants not regularly pinnately branched . . . . . Anomodon (pg. 16)

4. a. Leaves sickle-shaped and all curved downward . . . . . Hypnum (pg. 38)
4. b. Leaves not sickle-shaped and not all curved downward . . Thuidium (pg. 58)

C.

1. a. Plants whitish when dry, having a pale light green appearance . . 2.
1. b. Plants green, yellow-green to black when dry . . . . . 3.

2. a. Plants growing in bogs, forming huge mats . . . . . Sphagnum (pg. 56)
2. b. Plants growing in moist, shaded places, forming rounded tufts . . . . . Leucobryum (pg. 40)

3. a. Plants growing on decaying wood . . . . . 4.
3. b. Plants growing on soil . . . . . 9.

4. a. Plants creeping . . . . . 5.
4. b. Plants erect . . . . . Dicranum (pg. 26)

5. a. Plants regularly pinnately branched . . . . . 6.
5. b. Plants not regularly pinnately branched . . . . . 7.

6. a. Leaves sickle-shaped and all turned downward . . . . . Hypnum (pg. 38)
6. b. Leaves not all sickle-shaped and not all turned downward . . . . . Thuidium (pg. 58)

7. a. Leaves having a midrib . . . . . Anomodon (pg. 16)
7. b. Leaves without a midrib . . . . . 8.

8. a. Stems densely leafy . . . . . Entodon (pg. 28)
8. b. Stems not densely leafy . . . . . Plagiothecium (pg. 48)

9. a. Plants resembling miniature trees branching near the top . . . . . Climaceum (pg. 24)
9. b. Plants not tree-like and not branching near the top . . . . . 10.

10. a. Plants creeping . . . . . 11.
10. b. Plants erect . . . . . 16.

11. a. Plants regularly pinnately branched . . . . . 12.
11. b. Plants not regularly pinnately branched . . . . . 13.

12. a. Leaves sickle-shaped and all curved downward . . . . . Hypnum (pg. 38)
12. b. Leaves not sickle-shaped and not all curved downward . . Thuidium (pg. 58)

13. a. Leaves having a midrib . . . . . 14.
13. b. Leaves without a midrib . . . . . 15.

14. a. Leaves transparent with a strong midrib . . . . . Mnium (pg. 44)
14. b. Leaves not transparent; midrib not prominent . . . . . Anomodon (pg. 16)

15. a. Stems densely leafy . . . . . Entodon (pg. 28)
15. b. Stems not densely leafy . . . . . Plagiothecium (pg. 48)

16. a. Plants having a whorl of large, broad leaves atop an otherwise leafless stem . . . . . Rhodobryum (pg. 54)
16. b. Plants without a whorl of large, terminal leaves; stems bearing leaves to the base . . . . . 17.

17. a. Plants growing on very dry, sandy, or disturbed ground where little other vegetation is growing . . . . . 18.
17. b. Plants growing on moist, undisturbed ground with other vegetation . . . . . 21.

18. a. Plants silvery-white . . . . . Bryum argenteum (pg. 22)
18. b. Plants green . . . . . 19.

19. a. Plants rising from a green felt-like mat (protonema) which covers the ground . . . . . Pogonatum brevicaule (pg. 50)
19. b. Plants not arising from a persistent protonema . . . . . 20.

20. a. Capsule erect, straight, symmetrical . . . . . Weisia (pg. 62)
20. b. Capsule horizontal, curved, unsymmetrical . . . . . Funaria (pg. 32)

21. a. Leaves all pointed in one direction as if blown by the wind . . . . . Dicranum (pg. 26)
21. b. Leaves not all pointed in one direction . . . . . 22.

22. a. Plants short (5 to 10 mm.) . . . . . Atrichum (pg. 18)
22. b. Plants tall (2 to 20 cm.) . . . . . 23.

23. a. Plants dichotomously branched . . . . . Bartramia (pg. 20)
23. b. Plants not branched . . . . . Polytrichum (pg. 52)

Fig. 6. Dichotomously branched stems of Andrea (4x)

CHAPTER IV.

DESCRIPTIONS OF THE MOSSES

ANDREA (The Black Moss)

Fig. 7. Andrea habitat

Plants black, 0.5 to 1.5 cm. high; growing on durable, non-calcareous rock outcroppings in mountainous or frigid regions, forming small tufts or cushions.

Stems erect, dichotomously branched, crowded, very brittle (Fig. 6).

Leaves lanceolate, crowded, spreading when moist, slightly appressed when dry, midrib present or absent according to species.

The rock mosses Grimmia (Page 34) and Hedwigia (Page 36) may be confused with Andrea. Andrea is much blacker and much more brittle. When dry, a clump of Andrea will crumble to a powder if squeezed.

Fig. 8. Anomodon plant with primary and secondary stems (2x)

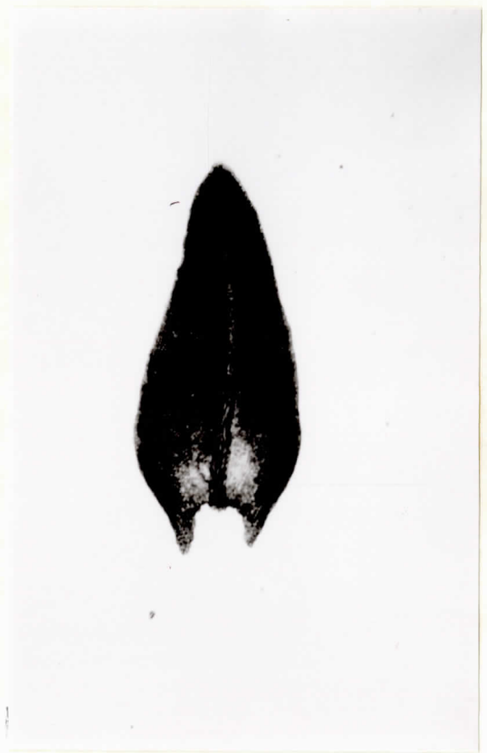

Fig. 9. Anomodon leaf (50x)

ANOMODON (The Apron Moss)

Fig. 10. Anomodon habitat

Plants dark-green, 2 to 6 cm. long; growing in cool moist woods, forming broad, thick, flattened mats which encircle the lower trunks of trees skirting them to the ground (Fig. 8).

Stems prostrate, irregularly branched; secondary branches arising from a nearly leafless primary stem, secondary branches also branched.

Leaves long-ovate, acuminate, spreading slightly when dry or moist, overlapping one another, midrib present (Fig. 9).

Fig. 11. Atrichum plant with sporophyte (3x)

Fig. 12. Atrichum leaf (20x)

ATRICHUM (The Hairless Cap Moss)

Fig. 13. Atrichum habitat

Plants green, 1 to 5 cm. high, older plants brownish-red; growing on cool, moist ground and stream banks; forming small patches (Fig. 11).

Stems erect, unbranched; arising from a twisted, underground stem.

Leaves linear-lanceolate, spreading when moist, distinctly wrinkled and distorted when dry; midrib present (Fig. 12).

The name A-trichum means "without hairs" and refers to the scale-like calyptra, a characteristic quite different from its close relative Poly-trichum (Page 52).

Fig. 14. Bartramia plant with sporophyte (1.5x)

Fig. 15. Bartramia leaf (40x)

BARTRAMIA (The Wooly Moss)

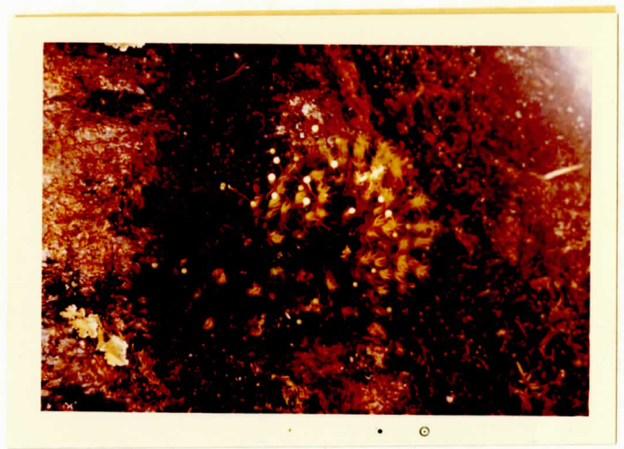

Fig. 16. Bartramia habitat

Plants bright-green, 2 to 12 cm. high; growing in loose to dense tufts on cool, moist cliffs and shady stream banks; looking much like patches of "green wool" (20). (Fig. 14).

Stems erect, irregularly branched.

Leaves lanceolate, long acuminate, spreading when moist, curled when dry; midrib present (Fig. 15).

An easily identifiable Bartramia is B. pomiformis (L.) Hedw. whose spherical, apple-like capsules are a positive identifying mark.

Fig. 17. Leaf arrangement on moist Bryum argenteum (20x)

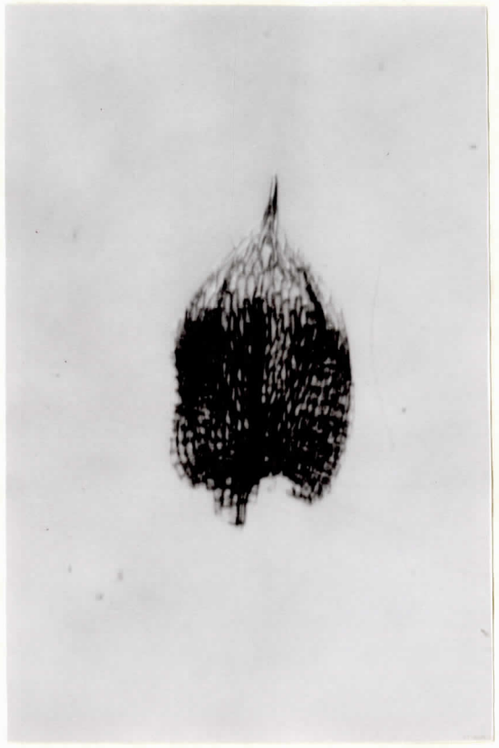

Fig. 18. Bryum argenteum leaf (50x)

Fig. 19. Bryum argenteum habitat

Bryum is a complex genus containing a great number of closely related species. The description below is of a single species, B. argenteum (the silver moss) and is not intended to be representative of the entire genus.

Plants distinctly silvery-gray, 1 to 2 mm. high; growing on compact sandy soil, in sidewalk cracks, and on bricks and masonry (Fig. 17).

Stems erect, branching irregularly; branches short, compact, difficult to observe.

Leaves broad-ovate, tapering abruptly to a narrow point; pressed tightly to the stem and overlapping one another whether dry or moist; few on the lower portion of the stem, more on the upper portion; midrib present; older leaves silvery-white due to the absence of chlorophyll (Fig. 18).

Fig. 20. Dry Climaceum with underground stem (1.5x)

Fig. 21. a. Climaceum branch leaf; b. Climaceum stem leaf (2x)

CLIMACEUM (The Tree-like Moss)

Fig. 22. Climaceum habitat

Plants bright green to dark green, 7 to 9 cm. tall; growing on soil that is wet most of the time; crowded close together forming broad, thick mats.

Stems of two types: creeping underground stem branches irregularly giving rise to erect main stems which terminate in many branches (Fig. 20).

Leaves of the main upright stem large, ovate-lanceolate, thin with little chlorophyll (Fig. 21a). Leaves of the terminal branches smaller, lanceolate, contain chlorophyll (Fig. 21b). Stem and branch leaves pressed toward the stem and overlapping when dry, spreading when moist, midrib present.

The upright main stem and terminal branches give Climaceum a distinct tree-like appearance. This moss may, at first, be mistaken for ground pine (Lycopodium).

Fig. 23. Wind-blown nature and dichotomous branching of Dicranum (2x)

Fig. 24. Dicranum leaf, side view (20x)

DICRANUM (The Two-headed Moss)

Fig. 25. Dicranum habitat

Plants yellow-green, 2 to 25 cm. high; growing on rich, shaded soil; forming thick mats or patches which have a bushy appearance (Fig. 23).

Stems erect, dichotomously branched, branches quite long, rarely branched a second time.

Leaves linear-lanceolate, sickle-shaped, all oriented in the same direction without change when moist or dry, midrib present (Fig. 24).

Dicranum may be easily recognized by the windblown appearance of its leaves. The common name, "Two-headed moss" is derived from Dicranum's distinctly dichotomous branching.

Fig. 26. Flattened branch of Entodon (3.5x)

Fig. 27. Entodon leaf (90x)

ENTODON (A Flat Moss)

Fig. 28. Entodon habitat

Plants soft, glossy, yellow-green; 3 to 8 cm. long; growing on decaying logs, exposed roots of trees and moist woodland soil; forming flattened, irregular mats or patches (Fig. 26).

Stems creeping, irregularly branched, appearing flattened.

Leaves oblong-ovate, appearing flattened into one plane, dense and overlapping without change when dry or moist, midrib absent (Fig. 27).

Entodon may be confused with Plagiothecium (Page 48), another flattened moss. The dense leaf arrangement in Entodon and the distant arrangement in Plagiothecium makes the separation positive.

Fig. 29. Dry Fontinalis attached by rhizoids (2x)

Fig. 30. Fontinalis leaf (24x)

FONTINALIS (A Water Moss)

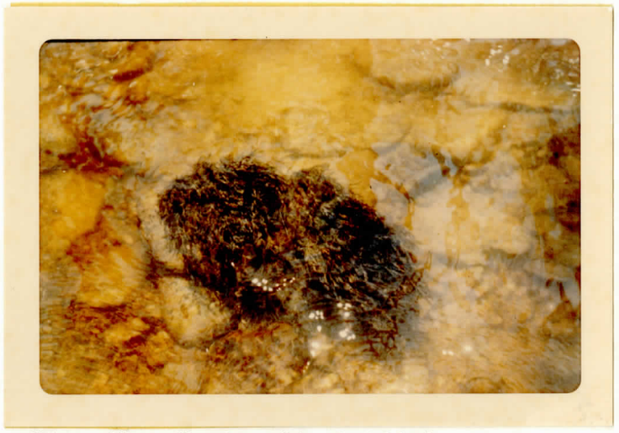

Fig. 31. Fontinalis habitat

Plants dark green, 10 cm. long and longer; growing submerged in streams or ponds where water is flowing, forming long trailing masses.

Stems horizontal, floating, attached at one end by rhizoids; freely, irregularly branched.(Fig. 29).

Leaves lanceolate, 3 to 8 mm. long, spreading when dry or wet, midrib present or absent according to species (Fig. 30).

Fontinalis requires running water and therefore may not be suitable for in vivo laboratory experiments.

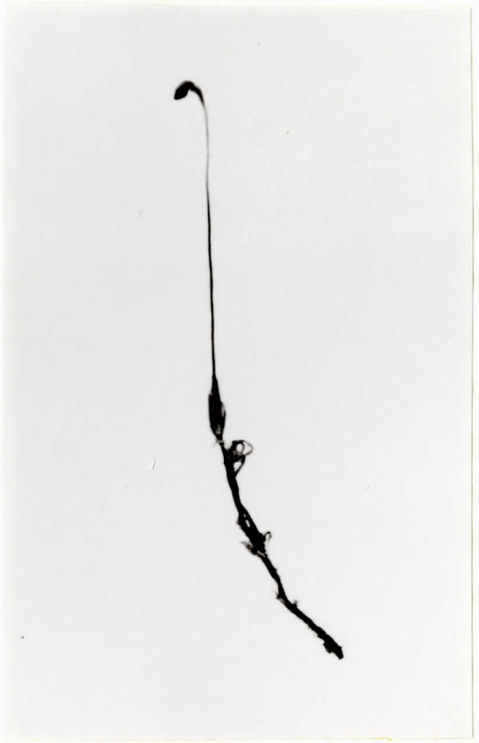

Fig. 32. Funaria plant with sporophyte (4x)

Fig. 33. Funaria seta and capsule (20x)

FUNARIA (The Chord Moss)

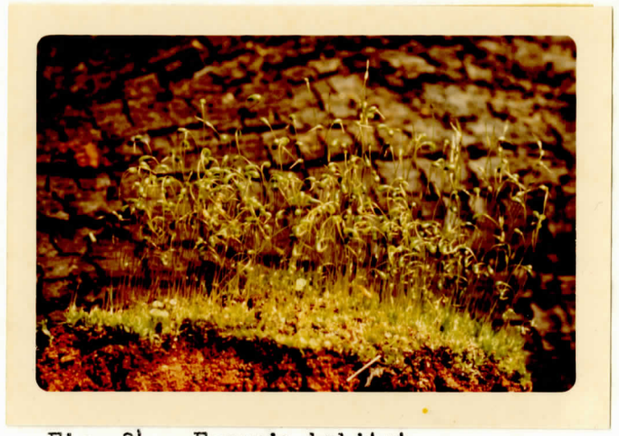

Fig. 34. Funaria habitat

Plants green, 3 to 10 mm. high; growing in waste places such as newly burned-over ground, forming thick beds (Fig. 33).

Stems erect, little branched.

Leaves oblong-ovate, pressed toward the stem when dry, spreading when moist, midrib present.

Funaria is more easily recognized by its persistent sporophyte than by its gametophyte. The sporophyte of F. hygrometrica is typical of of the genus and is described below. Refer to the Glossary (Page 63) for unfamiliar terms.

Seta 2 to 5 cm. long, strongly twisted (Fig. 32).

Capsule horizontal, unsymmetrical, curved, wrinkled irregularly when moist, becoming more so when dry; mouth oblique, almost parallel to the capsule axis (Fig. 33).

The Latin name Funis means "rope" or "chord" and refers to Funaria's twisted seta.

Fig. 35. Grimmia moist plant (3x)

Fig. 36. Grimmia leaf with colorless point (40x)

GRIMMIA (A Rock Moss)

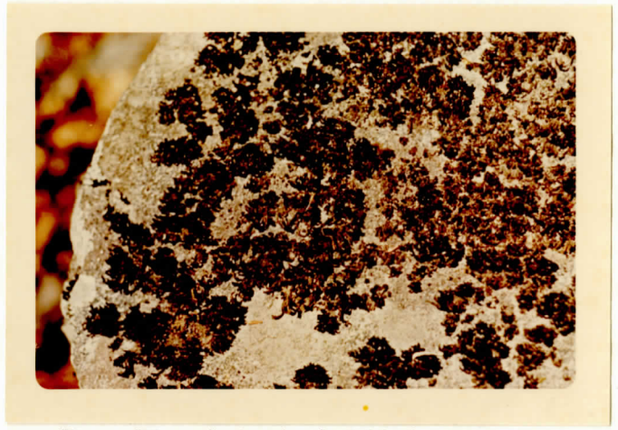

Fig. 37. Grimmia habitat

Plants dark green to grayish-black, 0.5 to 3 cm. long; growing exclusively on durable, non-calcareous rocks and rock outcrops; forming spreading cushions (Fig. 35).

Stems semi-erect, dichotomously branched with branches growing quite long, curving and twisting.

Leaves lanceolate, long-acuminate; upper and lower leaves spreading when moist, midrib present; upper leaves green, ending in a colorless point (Fig. 36); lower leaves reddish-brown to black.

The rock mosses Andrea (Page 14) and Hedwigia (Page 36) may be confused with Grimmia. The colorless tip of the upper leaves of Grimmia distinguish it from Andrea, and the absence of a midrib in the leaves of Hedwigia makes this distinction.

Fig. 38. Hedwigia moist plant (3x)

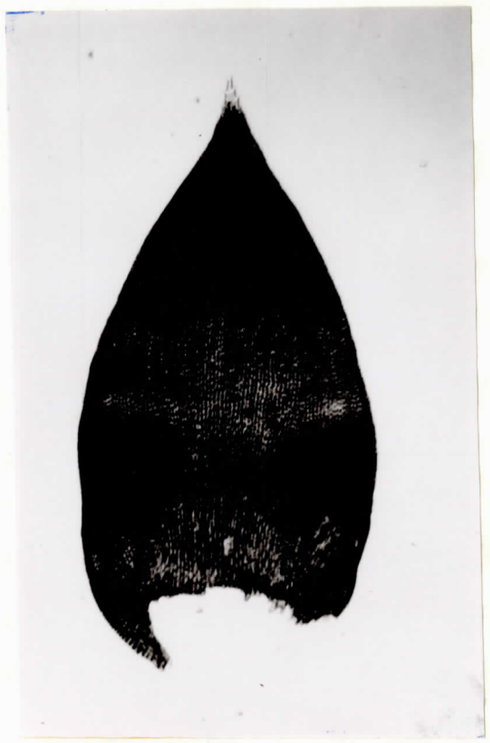

Fig. 39. Hedwigia leaf with colorless point (60x)

HEDWIGIA (A Rock Moss)

Fig. 40. Hedwigia habitat

Plants dark green near the tip, becoming black on the lower stem, 3 to 5 cm. long; growing on large rocks and rock outcrops, stone walls and other dry, exposed places; forming flattened mats or tufts (Fig. 38).

Stems creeping, branching irregularly, branches bent or curved; lower stem nearly leafless, rhizoid-like.

Leaves ovate, acuminate, ending in a colorless point, appressed and overlapping when dry, dramatically spreading when moist, midrib absent (Fig. 39).

The rock mosses Andrea (Page 14) and Grimmia (Page 34) may be confused with Hedwigia. The colorless tip of the leaves of Hedwigia distinguishes it from Andrea and the presence of a midrib in the leaves of Grimmia makes this distinction.

Fig. 41. Hypnum plant (4x)

Fig. 42. Hypnum leaf (40x)

HYPNUM (A Log Moss)

Fig. 43. Hypnum habitat

Plants bright green and shiny, several cm. long; growing in cool, shaded places, mainly on rotting logs, also in rich soil and on the base of trees; forming thick, cushiony mats (Fig. 41).

Stems prostrate, regularly pinnately branched, branches often curving upward.

Leaves sickle-shaped, all curved in one direction without change whether dry or moist, midrib absent or very short (Fig. 42).

Hypnum curvifolium (Hedw.) is used in flower shops as a packing around plants and is therefore easily accessible. H. curvifolium and Thuidium delecetulum (Hedw.) often grow together on logs and are called "log moss" (32).

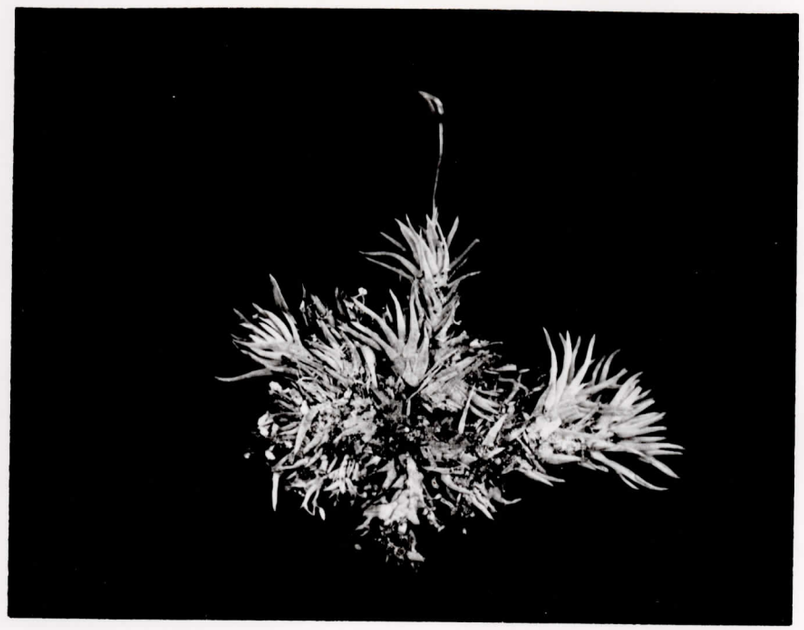

Fig. 44. Dichotomous branching of moist Leucobryum (2x)

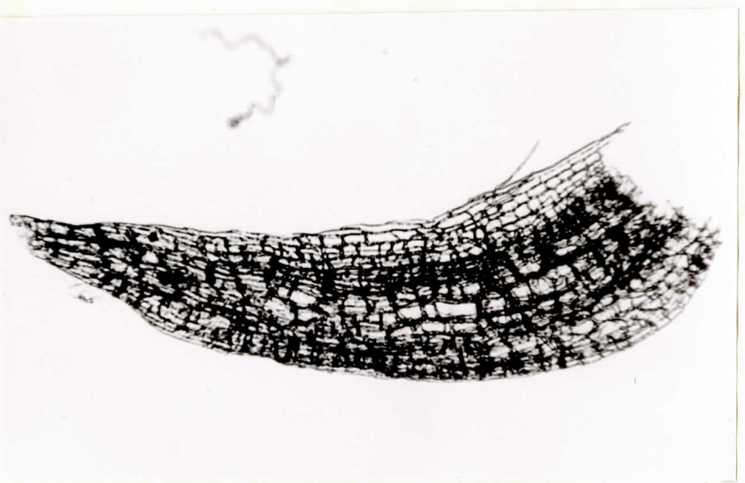

Fig. 45. Leucobryum leaf (75x)

LEUCOBRYUM (The White Tuft Moss)

Fig. 46. Leucobryum habitat

Plants white, tinged with green, 0.5 to 20 cm. tall; growing on moist or swampy ground usually on the brink of banks and cliffs, forming distinctively rounded cushions or tufts.

Stems erect, dichotomously branched, tightly crowded together, those near the center of a tuft being longer than those near the edge (Fig. 44).

Leaves oblong-lanceolate, brittle and appressed when dry, pliable and spreading when moist; midrib quite large, comprising the major portion of the leaf and therefore hardly distinguishable in the leaf (Fig. 45)

Fig. 47. Secondary and main stems of Leucodon (4x)

Fig. 48. Leucodon leaf (60x)

LEUCODON (A Tree Moss)

Fig. 49. Leucodon habitat

Plants grayish-green, 2 to 6 cm. long; growing almost exclusively on the bark of deciduous trees, four to six feet off the ground and higher; forming thin patches.

Stems creeping; main stem long, slender, nearly bare, held to the bark by rhizoids; secondary branches arising irregularly from the main stem, sub-erect to horizontal, drooping, often turning outward (Fig. 47).

Leaves of the main stem small, sparse; leaves of the secondary branches larger, ovate-lanceolate, crowded, appressed when dry, spreading when moist; midrib present (Fig. 48).

Fig. 50. Mnium plant

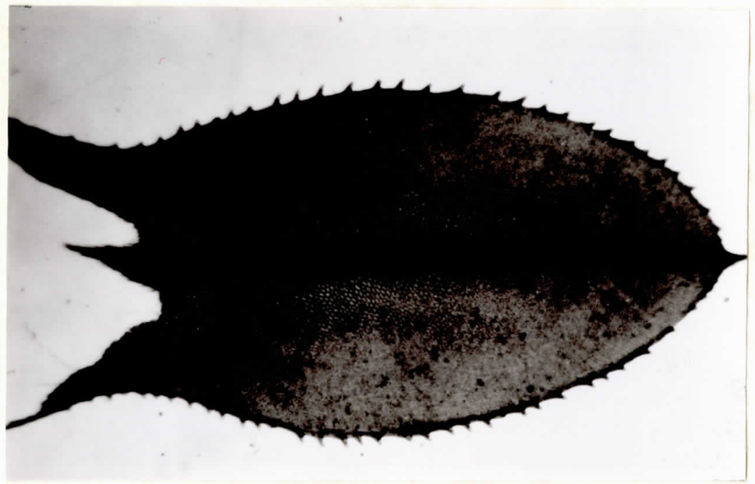

Fig. 51. Mnium leaf (25x)

MNIUM (The Spring Moss)

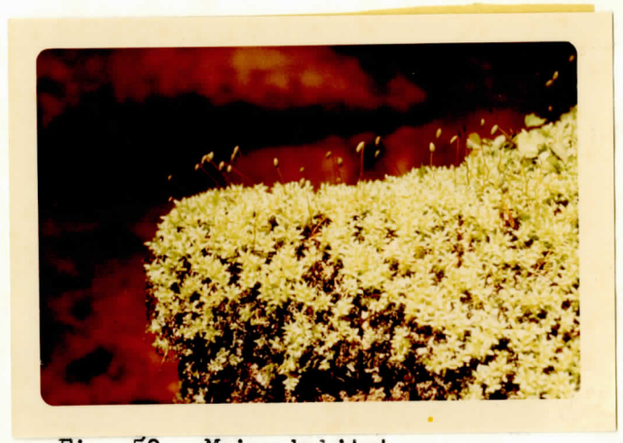

Fig. 52. Mnium habitat

Plants green, robust, several cm. long; growing on cool, moist, shaded ground, rich in humus and on decaying wood; forming thick, spreading mats (Fig. 50).

Stems of two types: fertile stems erect, unbranched; sterile stems creeping to ascending, attached to the sub-stratum by rhizoids, branching occasionally.

Leaves broad-ovate, large in most species, transparent, separated, spreading when moist, distorted when dry; terminal rosette forming on antheridial plants, distinct midrib present (Fig. 51).

The Mniums are among the first greenery of spring to emerge from under the snow. Their large leaves are excellent for laboratory study.

Fig. 53. Rhizoids on lower stem of moist Philonotis (exact size)

Fig. 54. Rosette surrounding antheridial head of Philonotis (3x)

PHILONOTIS (A Water-loving Moss)

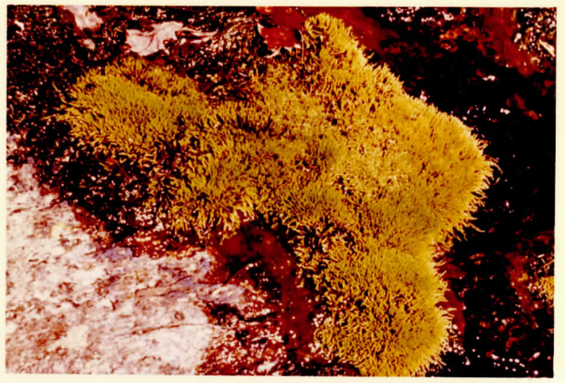

Fig. 55. Philonotis habitat

Plants distinctly yellow-green, 1 to 10 cm. tall; growing on stream banks, wet cliffs, damp meadows and other wet soil; forming dense, spreading clumps.

Stems erect, slender; tips stubbily branched, lower portion forming rhizoids (Fig. 53).

Leaves broad-ovate to narrow-lanceolate; spreading when moist, appressed when dry; terminal rosette forming on antheridial plants; mid-rib present (Fig. 54).

Fig. 56. Two-ranked leaves of dry Plagiothecium (4x)

Fig. 57. Plagiothecium leaf (40x)

PLAGIOTHECIUM (A Flat Moss)

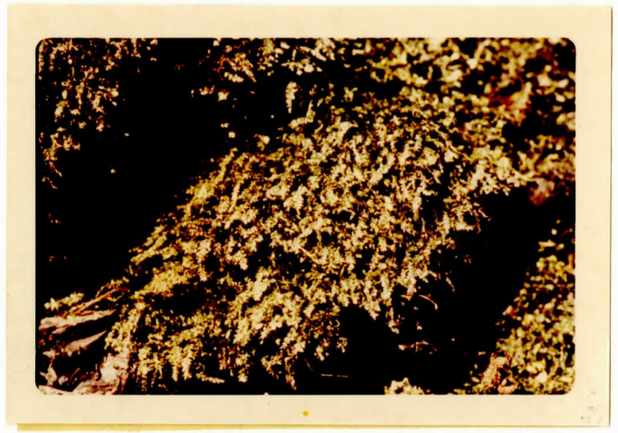

Fig. 58. Plagiothecium habitat

Plants glossy green, 1 to 5 cm. long; growing on damp soil and rotting wood, occasionally on stones and over exposed roots of living trees; forming thick, flattened mats.

Stems creeping, irregularly branched, flattened (Fig. 56).

Leaves ovate to ovate-lanceolate, separated, flattened into one plane, without change whether dry or moist, midrib absent or difficult to observe (Fig. 57).

Plagiothecium may be confused with Entodon (Page 28), another flattened moss. The distant arrangement of the leaves in Plagiothecium and the dense arrangement in Entodon makes the separation positive.

Fig. 59. Pogonatum plant with sporophyte; calyptra covering the left capsule (7x)

POGONATUM (The Bare Bank Moss)

Fig. 60. Pogonatum habitat

P. brevicaule (Bird.) is the species described below and is not intended to represent the entire genus.

Plants green, 1 to 8 mm. tall; growing on freshly disturbed dirt, usually banks, where other vegetation has not gained a foothold.

Stems erect, unbranched (Fig. 59).

Leaves narrow, lanceolate, spreading when moist, slightly appressed when dry, midrib present.

Banks of P. brevicaule appear to be covered with green felt (protonema) out of which rises an occasional plant. The sporophyte plant, whose capsule is covered by a white, hairy calyptra is easily recognized (Fig. 59). The persistent protonema of P. brevicaule is extremely useful in the laboratory, especially when considering the moss life cycle.

Fig. 61. a. Polytrichum dry plant; b. Polytrichum moist plant (1.5x)

Fig. 62. Polytrichum leaf (20x)

POLYTRICHUM (The Hair-cap Moss)

Fig. 63. Polytrichum habitat

Plants dark green to olive green, 7 to 20 cm. tall; growing on a variety of soils, usually in open places; forming tightly packed to loosely assorted beds.

Stems erect, stiff, unbranched when moist, resembling bottle brushes (Fig. 61b).

Leaves lanceolate to linear-lanceolate, erect and appressed when dry (Fig. 61a), greatly spreading when moist (Fig. 61b), terminal cup-like rosette forming on antheridial plants, strong midrib present (Fig. 62).

The name Poly-trichum means "many hairs" and refers to the hairy calyptra covering the young four-sided capsule.

Fig. 64. Rosette, main leafless stem; underground stem of Rhodobryum (4x)

RHODOBRYUM (The Rose Moss)

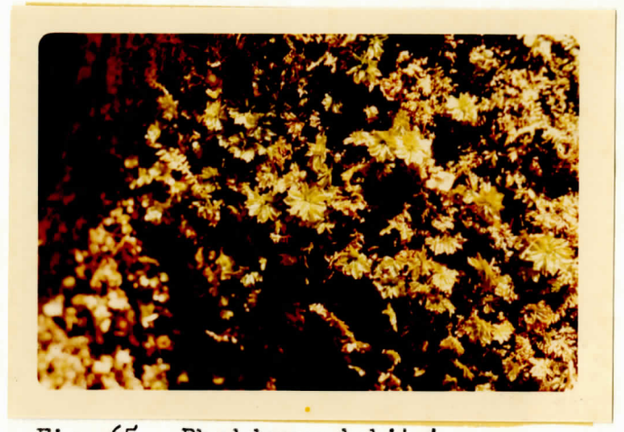

Fig. 65. Rhodobryum habitat

Plants green, robust, 2 to 3 cm. high; growing on rich shady soil near the base of trees and on rotting wood, forming patches.

Stems erect, stiff, unbranched, but producing many runners at the base (Fig. 64).

Leaves of two types: terminal leaves large, broad-ovate, forming distinctive rosettes, spreading when moist, distorted when dry, midrib; lower leaves reduced to scale-like appendages.

The beautiful rosette and nearly barren stem of Rhodobryum gives this moss the appearance of a miniature long-stemmed rose in full bloom.

The apical leaves are excellent for laboratory study.

Fig. 66. Sphagnum dry plant (2x)

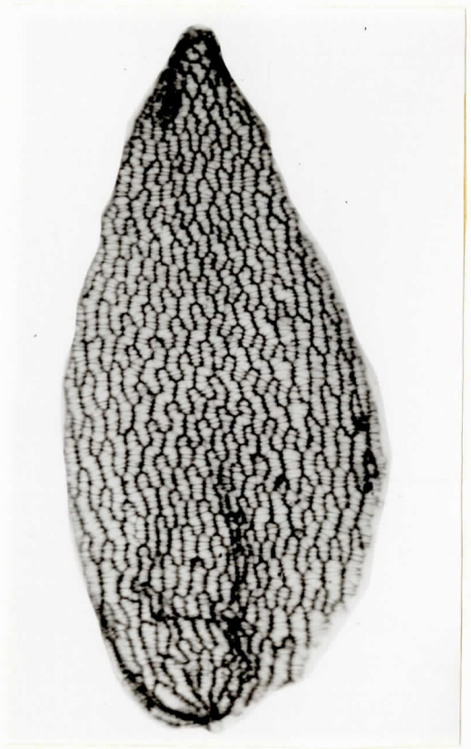

Fig. 67. Sphagnum leaf (20x)

SPHAGNUM (The Sponge Moss)

Fig. 68. Sphagnum habitat

Plants white, tinged with green, several cm. long; growing on soggy substrata in boggy places, forming huge mats and cushiony floors which often spread out over the water of ponds (Fig. 66).

Stems flaccid, often entangled, three main types of branches: short numerous apeical branches, lower branches at right angles to the main stem, and other lower branches twisted about the main stem.

Leaves either ovate-acuminate or spoon-shaped, slightly spreading when moist, slightly appressed when dry, midrib absent (Fig. 67).

The leaves of Sphagnum consist mainly of hollow cells, which accounts for its color and for its tremendous water-holding capacity.

Fig. 69. Doubly pinnate branching of moist Thuidium (3x)

Fig. 70. Stem and branch leaves of Thuidium (75x)

THUIDIUM (The Fern-like Moss)

Fig. 71. Thuidium habitat

Plants greenish-yellow, 2 to 5 cm. long; growing on rotting logs, shaded ground, soil-covered stones and around the base of trees; forming cushiony, flattened mats.

Stems creeping, main stem regularly, pinnately or bi-pinnately branched (Fig. 69).

Leaves of the main stem ovate-triangular to oblong-lanceolate; branch leaves smaller, ovate to ovate-lanceolate; stem and branch leaves spreading when moist, somewhat appressed when dry; midrib present (Fig. 70).

The pinnate branching of Thuidium gives it an unmistakably feathery or fern-like appearance.

Fig. 72. Dichotomous branching and persistent sporophyte of moist Ulota (3x)

Fig. 73. Ulota leaf (45x)

ULOTA (A Tree Moss)

Fig. 74. Ulota habitat

Plants blackish-green below, light green at the tip, 1 to 3 cm. tall; growing on trees, rarely on rocks and rock outcrops; forming stubby, rounded tufts.

Stems erect or rising from a main horizontal stem, dichotomously branched (Fig. 72).

Leaves lanceolate to oval, spreading when moist, appressed and distorted when dry, midrib present (Fig. 73).

Sporophytes are always present in tufts of Ulota, a fact which should come to mind when sporophytes are needed in a hurry.

Fig. 75. Weisia plant (3x)

Fig. 76. Weisia leaf (40x)

WEISIA (A Wall Moss)

Fig. 77. Weisia habitat

Plants green, 5 to 10 mm. high; growing on dry, sandy soil, occasionally on masonry; forming compact tufts or mats (Fig. 75).

Stems erect, freely branched, rhizoids arising at the base of the primary stem.

Leaves oblong-lanceolate; lower leaves smaller than upper leaves; lower and upper leaves spreading when moist, curled and distorted when dry; midrib present (Fig. 76).

In the early spring, Weisia may be found buried beneath a profusion of reddish-brown sporophytes.

GLOSSARY

Acuminate: leaf tip--tapering to a narrow point.

Antheridium: the male reproductive organ containing the sperms.

Appressed: leaf position--pressed close to or flat against the stem (Fig. 17).

Calcareous: containing calcium carbonate, calcium or lime.

Calyptra: a thin covering or hood over the upper part of a capsule (Fig. 59).

Capsule: the enlarged distal end of the sporophyte plant containing spores (Fig. 33).

Contorted: forced out of shape by twisting or bending.

Dichotomous: dividing into two parts (Fig. 23).

Gametophyte: the plant bearing the gametes, the sexual generation.

In Vivo: in a live condition.

Lanceolate: leaf shape--broadened at the base and tapering toward the apex (Fig. 30).

Linear: leaf shape--long and narrow, flattened, the sides parallel or nearly so (Fig. 24).

Midrib: the middle vein of the leaf (Fig. 51).

Oblong: leaf shape--the sides parallel or nearly so and the length two to three times the breadth (Fig. 76).

Ovate: leaf shape--egg shaped, broadest near the middle; usually, but not necessarily rounded at each end (Fig. 51).

Peristome teeth: membranous prongs attached to the fringe surrounding the mouth of a capsule (Fig. 1).

Pinnate: having numerous equidistant, spreading branches on each side, like a feather (Fig. 69).

Protonema: the green, branched, algae-like threads produced from moss spores (Fig. 2).

Rhizoids: rootlets springing from the sides and base of the stem (Fig. 29).

Rosette: a circular arrangement of leaves radiating symmetrically from a center (Fig. 64).

Seta: the stalk of the sporophyte, which supports the capsule.

Sporophyte: the plant producing the spores, the asexual generation (Fig. 32).

SELECTED BIBLIOGRAPHY

A. GENERAL BIOLOGY TEXTBOOKS

1. American Institute of Biological Sciences. Biological Sciences Curriculum Study. High School Biology. Chicago: Rand McNally & Company, 1966.

2. Gardiner, Mary S., and Sarah C. Flemister. The Principles of General Biology. Second edition. New York: The Macmillan Company, 1967.

3. Heiss, E. D., and R. H. Lape. Biology, a Basic Science. New York: D. Van Nostrand Company, Inc., 1961.

4. Kimball, John W. Biology. Second edition. Reading, Massachusetts: Addison-Wesley Publishing Company, 1968.

5. Kroeber, E., W. H. Wolff, and R. L. Weaver. Biology. Boston: D. C. Heath & Company, 1965.

6. Lauby, C. J., J. C. Sullivan, and G. M. A. Mork. Biology. New York: American Book Company, 1958.

7. Miller, D. F., and B. B. Vance. Science of Biology. New York: J. B. Lippincott Company, 1965.

8. Milne, Lorus, J., and Margery Milne. The Biotic World and Man. Third edition. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1965.

9. Moon, T. J., J. H. Otto, and A. Towle. Modern Biology. New York: Holt, Rinehart, and Winston, Inc., 1963.

10. Smith, E. T., and L. Lisonbee. Your Biology. New York: Harcourt, Brace and World, Inc., 1962.

11. Taylor, William T., and Richard J. Weber. General Biology. New York: D. Van Nostrand Company, Inc., 1961.

12. Villee, Claude A. Biology. Fifth edition. Philadelphia: W. B. Saunders Company, 1967.

13. Weisz, Paul B. Elements of Biology. Second edition. New York: McGraw-Hill Book Company, 1965.

14. Whaley, W. Gordon, et. al. Principles of Biology. Third edition. New York: Harper and Row Publishers, 1964.

B. OTHER BOOKS

15. Bodenberg, E. T. Mosses: A New Approach to the Identification of Common Species. Minneapolis, Minnesota: Burgess Publishing Company, 1954.

16. Bold, Harold C. Morphology of Plants. New York: Harper and Row Publishers, 1957.

17. Campbell, Douglas Houghton. The Structure and Development of Mosses and Ferns. Third edition. London: Macmillan & Co., Ltd., 1905.

18. Conard, Henry S. How to Know the Mosses and Liverworts. Dubuque, Iowa: Wm. C. Brown Company, Publishers, 1965.

19. Grout, A. J. Moss Flora of North America North of Mexico. Three vols. Newfane, Vermont: Published by the author, Vol. I, 1936-1939; Vol. II, 1940; Vol. III, 1928.

20. _____. Mosses with a Hand-lens. Third edition. New York: Published by the author, 1924.

21. _____. Mosses with a Hand-lens and Microscope. Ashton, Maryland: Reprinted by Eric Lundberg, 1965. Copyright 1903 by A. J. Grout.

22. Jewell, Arthur L. Observers Book of Mosses and Liverworts. London: Frederick Warne & Company, Ltd., 1955.

23. Koch, Leo F. Bryology (S. L. Bibliography Series) New York: Scholar's Library, 1961.

24. Lawrence, George H. M. An Introduction to Plant Taxonomy. New York: The Macmillan Company, 1955.

25. Lesquereux, Leo, and Thomas P. James. Manual of the Mosses of North America. Boston: S. E. Cassino & Company, 1884.

26. Smith, Gilbert M. Cryptogamic Botany; Vol. II, Bryophytes and Pteridophytes. New York: McGraw-Hill Book Company, Inc., 1938.

C. PERIODICALS

27. Anderson, Lewis E. "The Mosses of North Carolina," The Bryologist, 61:1-11, February, 1963.

28. Barnes, C. R. "Analytic Keys to the Genera and Species of North American Mosses," Bulletin of the University of Wisconsin, Science Series, 5:157-368, 1896.

29. Crum, Howard, William C. Steere, and Lewis E. Anderson. "A List of the Mosses of North America," The Bryologist, 68:377-432, Winter, 1965.

30. _____. "Some Additional New Names for North American Mosses," The Bryologist, 68:432-434, Winter, 1965.

31. Grout, A. J. "A List of Mosses Collected in the Mountains of Western North Carolina in the Summer of 1907," The Bryologist, 11:25-30, 1908.

32. Nelson, Thomas C., and I. W. Carpenter, Jr. "The Use of Mosses in the Decorative Industry," Economic Botany, 19:70, January-March, 1965.

D. UNPUBLISHED MATERIAL

33. Carpenter, I. W. Jr., and M. L. Hicks. "A List of Bryophytes for Watauga County, North Carolina." (Material compiled at Appalachian State University as a part of thesis work.)

34. Hicks, M. L. "The Hetapic Flora of Watauga County, North Carolina." (An unpublished thesis at Appalachian State University.)