

1973

# Bryophytes of Turkey Run State Park, Indiana

Michael A. Ellis

*Eastern Illinois University*

This research is a product of the graduate program in [Botany](#) at Eastern Illinois University. [Find out more](#) about the program.

---

## Recommended Citation

Ellis, Michael A., "Bryophytes of Turkey Run State Park, Indiana" (1973). *Masters Theses*. 3726.  
<https://thekeep.eiu.edu/theses/3726>

This is brought to you for free and open access by the Student Theses & Publications at The Keep. It has been accepted for inclusion in Masters Theses by an authorized administrator of The Keep. For more information, please contact [tabruns@eiu.edu](mailto:tabruns@eiu.edu).

PAPER CERTIFICATE #2

TO: Graduate Degree Candidates who have written formal theses.

SUBJECT: Permission to reproduce theses.

The University Library is receiving a number of requests from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow theses to be copied.

Please sign one of the following statements.

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

May 17 / 1973  
Date

I respectfully request Booth Library of Eastern Illinois University not allow my thesis be reproduced because \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Date

\_\_\_\_\_  
Author

Bryophytes of Turkey Run

---

State Park, Indiana

---

(TITLE)

BY

Michael A. Ellis

B.S. in Ed., Eastern Illinois University, 1971

**THESIS**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF

Master of Science

---

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY  
CHARLESTON, ILLINOIS

1973

---

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING  
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

May 17, 1973  
DATE

May 17, 1973  
DATE

Table of Contents

ACKNOWLEDGMENTS . . . . .	1
PHYLOGENETIC LIST OF BRYOPHYTES . . . . .	2
ALPHABETICAL LIST OF BRYOPHYTES . . . . .	7
INTRODUCTION . . . . .	12
REVIEW OF LITERATURE . . . . .	14
MATERIALS AND METHODS . . . . .	16
DESCRIPTIONS OF BRYOPHYTES . . . . .	18
DISCUSSION . . . . .	164
CONCLUSION AND SUMMARY . . . . .	170
LITERATURE CITED . . . . .	172
OUTLINE MAP OF TURKEY RUN STATE PARK . . . . .	174
COUNTY MAP OF INDIANA . . . . .	175

### Acknowledgments

I wish to express my gratitude to Dr. Charles B. Arzeni for acting as my advisor during my graduate research, and for assisting me throughout this study. I also wish to thank Dr. J.E. Ebinger and Dr. Wesley C. Whiteside for their constructive criticisms of this manuscript.

Phylogenetic List of Bryophytes

Division: Bryophyta  
 Class 1: Musci  
 Order: Bryales

Tetraphidaceae

<u>Atrichum angustatum</u> (Brid.) B.S.G. . . . .	19
<u>Atrichum undulatum</u> (Hedw.) Beauv. . . . .	20
<u>Pogonatum pensilvanicum</u> (Hedw.) Paris . . . . .	21
<u>Polytrichum commune</u> Hedw. . . . .	22
<u>Polytrichum ohioense</u> R. & C. . . . .	24

Fissidentaceae

<u>Bryoxiphium norvegicum</u> (Brid.) Mitt. . . . .	25
<u>Fissidens bushii</u> Card. & Ther. . . . .	26
<u>Fissidens minutulus</u> Sull. . . . .	27
<u>Fissidens obtusifolius</u> Wils. . . . .	28
<u>Fissidens osmundioides</u> Hedw. . . . .	30
<u>Fissidens taxifolius</u> Hedw. . . . .	32

Ditrichaceae

<u>Ceratodon purpureus</u> (Hedw.) Brid. . . . .	34
<u>Ditrichum pallidum</u> (Hedw.) Hampe . . . . .	36
<u>Ditrichum pusillum</u> (Hedw.) E.G.B. . . . .	37

Dicranaceae

<u>Dicranella heteromalla</u> (Hedw.) Schimp. . . . .	38
<u>Dicranella hilariana</u> (Mont.) Mitt. . . . .	40
<u>Dicranella varia</u> (Hedw.) Schimp. . . . .	41
<u>Dicranum flagellare</u> Hedw. . . . .	42
<u>Dicranum viride</u> (S. & L.) Grout. . . . .	43
<u>Dicranum scoparium</u> Hedw. . . . .	44

Leucobryaceae

<u>Leucobryum glaucum</u> (Hedw.) Schimp. . . . .	45
---	----

Pottiaceae

<u>Barbula fallax</u> Hedw. . . . .	46
<u>Barbula unguiculata</u> Hedw. . . . .	47

	<u>Didymodon trifarius</u> (Hedw.) Brid. . . . .	48
	<u>Gymnostomum calcareum</u> N. & H. . . . .	49
	<u>Tortella humilis</u> (Hedw.) Jenn. . . . .	50
	<u>Weisia viridula</u> Hedw. . . . .	52
	<u>Desmatodon porteri</u> James . . . . .	53
Grimmiaceae		
	<u>Hedwigia ciliata</u> Hedw. . . . .	54
Buxbaumiaceae		
	<u>Diphyscium foliosum</u> (Hedw.) Mohr. . . . .	56
Timmiaceae		
	<u>Timmia megapolitana</u> Hedw. . . . .	57
Aulacomniaceae		
	<u>Aulacomnium heterostichum</u> Hedw. . . . .	59
Bartramiaceae		
	<u>Bartramia pomiformis</u> Hedw. . . . .	60
Bryaceae		
	<u>Bryum argenteum</u> Hedw. . . . .	62
	<u>Bryum caespiticium</u> Hedw. . . . .	63
	<u>Bryum pendulum</u> (Hornsch.) Schimp. . . . .	64
	<u>Pohlia wahlenbergii</u> (W. & M.) Andr. . . . .	65
	<u>Rhodobryum roseum</u> (Hedw.) Limpr. . . . .	67
Mniaceae		
	<u>Mnium affine</u> Bland. . . . .	69
	<u>Mnium cuspidatum</u> Hedw. . . . .	70
	<u>Mnium punctatum</u> Hedw. . . . .	71
	<u>Mnium serratum</u> Brid. . . . .	73
Hypnaceae		
	<u>Amblystegiella confervoides</u> Brid. Leoske. . . . .	75
	<u>Amblystegium serpens</u> (Hedw.) Bry. Eur. . . . .	76
	<u>Amblystegium varium</u> (Hedw.) Lindb. . . . .	77
	<u>Brachythecium compestre</u> Bry. Eur. . . . .	78
	<u>Brachythecium oxycladon</u> (Brid.) J. & S. . . . .	79
	<u>Brachythecium salebrosum</u> (W. & M.) Bry. Eur. . . . .	80
	<u>Brotherella recurvans</u> (Mx.) Fleisch . . . . .	81
	<u>Bryhnia graminicolor</u> (Brid.) Grout . . . . .	82

<u>Campyllum hispidulum</u> (Brid.) Mitt. . . . .	83
<u>Chamberlainia acuminata</u> (Hedw.) Grout. . . . .	84
<u>Cirriphyllum bosci</u> (Schu.) Grout. . . . .	86
<u>Climacium americanum</u> Brid. . . . .	87
<u>Entodon cladorrhizans</u> (Hedw.) C.M. . . . .	88
<u>Entodon compressus</u> (Hedw.) C.M. . . . .	89
<u>Entodon seductrix</u> (Hedw.) C.M. . . . .	90
<u>Eurhynchium hians</u> (Hedw.) J. & S. . . . .	91
<u>Eurhynchium serrulatum</u> (Hedw.) Kindb. . . . .	93
<u>Hypnum cupressiforme</u> Hedw. . . . .	95
<u>Hypnum curvifolium</u> Hedw. . . . .	97
<u>Hypnum imponens</u> Hedw. . . . .	98
<u>Leptodictyum trichopodium</u> (Schultz) Warnst . . . . .	100
<u>Plagiothecium denticulatum</u> (Hedw.) Bry. Eur. . . . .	101
<u>Plagiothecium micans</u> (Sw.) Paris . . . . .	103
<u>Plagiothecium muellerianum</u> (Hampe) Bry. Eur. . . . .	105
<u>Plagiothecium roeseanum</u> (Hampe) Bry. Eur. . . . .	106
<u>Platygyrium repens</u> (Brid.) Bry. Eur. . . . .	107

Leskeaceae

<u>Anomodon attenuatus</u> (Hedw.) Hueben . . . . .	108
<u>Anomodon minor</u> (Beauv.) Lindb. . . . .	109
<u>Anomodon rostratus</u> (Hedw.) Schimp. . . . .	110
<u>Haplohymenium triste</u> (Cesati) Kindb. . . . .	111
<u>Leskea gracilescens</u> Hedw. . . . .	112
<u>Myurella careyana</u> Sull. . . . .	113
<u>Thelia asprella</u> Sull. . . . .	114
<u>Thuidium delicatulum</u> (Hedw.) Mitt. . . . .	115
<u>Thuidium pygmaeum</u> Bry. Eur. . . . .	117
<u>Thuidium recognitum</u> (Hedw.) Lindb. . . . .	118

Leucodontaceae

<u>Leptodon trichomitrium</u> (Hedw.) Mohr. . . . .	120
---	-----

Fabroniaceae

<u>Fabronia ravenelii</u> Sull. . . . .	121
<u>Schwetschkeopsis denticulata</u> (Sull.) Broth. . . . .	122

Fontinalaceae

<u>Fontinalis duriaei</u> Schimp. . . . .	123
---	-----

Class 2: Hepaticae  
Order: Jungermanniales

Ptilidiaceae

<u>Blepharostoma trichophyllum</u> (L) Dumort. . . . .	125
--	-----



	<u>Telaranea nematodes</u> G. ex Aust. . . . .	126
	<u>Tricholea tomentella</u> (Ehrh.) Dumort. . . . .	127
Lepidoziaceae		
	<u>Bazzania trilobata</u> (L) S. F. Gray . . . . .	128
	<u>Lepidozia reptans</u> (L) Dumort. . . . .	129
Calypogeiaceae		
	<u>Calypogeia trichomanis</u> (L) Corda . . . . .	130
Cephaloziaceae		
	<u>Cephalozia bicuspidata</u> (L) Dumort. . . . .	132
	<u>Nowellia curvifolia</u> (Dicks) Mitt. . . . .	131
Cephaloziellaceae		
	<u>Cephaloziella byssaceae</u> (Roth) Warnst. . . . .	134
	<u>Cephaloziella hampeana</u> (Nees) Schiffn. . . . .	136
Jungermanniaceae		
	<u>Jamesoniella autumnalis</u> (DC) Steph. . . . .	137
	<u>Lophozia ventricosa</u> (Dicks) Dumort. . . . .	139
	<u>Plectocolea hyalina</u> (Lyell) Mitt. . . . .	141
	<u>Pedinophyllum interuptum</u> Nees . . . . .	142
Harpanthaceae		
	<u>Lophocolea heterophylla</u> (Schrad.) Dumort. . . . .	144
Plagiochilaceae		
	<u>Plagiochila asplenioides</u> (L) Dumort. . . . .	148
Scapaniaceae		
	<u>Scapania nemorosa</u> (L) Dumort. . . . .	149
Radulaceae		
	<u>Radula complanata</u> (L) Dumort. . . . .	151
Frullaniaceae		
	<u>Frullania eboracensis</u> Gottsche . . . . .	152
	<u>Frullania riparia</u> Hampe . . . . .	153
Lejeuneaceae		
	<u>Cololejeunea biddlecomiae</u> (Aust.) Evans . . . . .	154

Order: Metzgeriales

Pelliaceae

Pellia neesiana (Gottsche) Limpr. . . . . 156

Metzgeriaceae

Metzgeria furcata (L) Dumort. . . . . 157

Order: Marchantiales

Marchantiaceae

Asterella tenella (L) Dumort. . . . . 158

Conocephalum conicum (L) Wiggers . . . . . 159

Mannia fragrans (Balb.) Frye & Clark . . . . . 160

Marchantia polymorpha L. . . . . 161

Reboulia hemisphaerica (L) Raddi . . . . . 162

Class 3: Anthocerotae

Order: Anthocerotales

Anthocerotaceae

Anthoceros laevis L. . . . . 163

Alphabetical List of Bryophytes

<u>Amblystegiella confervoides</u> (Brid.) Loeske . . . . .	75
<u>Amblystegium serpens</u> (Hedw.) Bry. Eur. . . . .	76
<u>Amblystegium varium</u> (Hedw.) Lindb. . . . .	77
<u>Anomodon attenuatus</u> (Hedw.) Hueben . . . . .	108
<u>Anomodon minor</u> (Beauv.) Lindb. . . . .	109
<u>Anomodon rostratus</u> (Hedw.) Schimp. . . . .	110
<u>Anthoceros laevis</u> L. . . . .	163
<u>Asterella tenella</u> (L) Beauv. . . . .	158
<u>Atrichum angustatum</u> (Brid.) B.S.G. . . . .	19
<u>Atrichum undulatum</u> (Hedw.) Beauv. . . . .	20
<u>Aulacomnium heterostichum</u> Hedw. . . . .	59
<u>Barbula fallax</u> Hedw. . . . .	46
<u>Barbula unguiculata</u> Hedw. . . . .	47
<u>Bartramia pomiformis</u> Hedw. . . . .	60
<u>Bazzania trilobata</u> (L) S.F. Gray . . . . .	128
<u>Blepharostoma trichophyllum</u> (L) Dumort. . . . .	125
<u>Brachythecium compestre</u> Bry. Eur. . . . .	78
<u>Brachythecium oxycladon</u> (Brid.) J. & S. . . . .	79
<u>Brachythecium saldbrosum</u> (W. & M.) Bry. Eur. . . . .	80
<u>Brotherella recurvans</u> (Mx.) Fleisch. . . . .	81
<u>Bryhnia graminicolor</u> (Brid.) Grout . . . . .	82
<u>Bryoxiphium norvegicum</u> (Brid.) Mitt. . . . .	25

<u>Bryum argenteum</u> Hedw. . . . .	62
<u>Bryum caespiticium</u> Hedw. . . . .	63
<u>Bryum pendulum</u> (Hornsch.) Schimp. . . . .	64
<u>Calypogeia trichomanis</u> (L) Corda . . . . .	130
<u>Campylium hispidulum</u> (Brid.) Mitt. . . . .	83
<u>Cephalozia bicuspidata</u> (L) Dumort. . . . .	132
<u>Cephaloziella byssacea</u> (Roth) Warnst. . . . .	134
<u>Cephaloziella hampeana</u> (Nees) Schiffn. . . . .	136
<u>Certodon purpureus</u> (Hedw.) Brid. . . . .	34
<u>Chamberlainia accuminata</u> (Hedw.) Grout . . . . .	84
<u>Cirriphyllum bascii</u> (Schw.) Grout . . . . .	86
<u>Climacium americanum</u> Brid. . . . .	87
<u>Cololejeunea biddlecomiae</u> (Aust.) Evans . . . . .	154
<u>Conocephalum conicum</u> (L) Wiggers . . . . .	159
<u>Desmatodon porteri</u> James . . . . .	53
<u>Dicranella heteromalla</u> (Hedw.) Schimp. . . . .	38
<u>Dicranella hilariana</u> (Mont.) Mitt. . . . .	40
<u>Dicranella varia</u> (Hedw.) Schimp. . . . .	41
<u>Dicranum flagellare</u> Hedw. . . . .	42
<u>Dicranum viride</u> (S. & L. Grout) . . . . .	43
<u>Dicranum scoparium</u> Hedw. . . . .	44
<u>Didymodon trifarius</u> (Hedw.) Brid. . . . .	48
<u>Diphyscium foliosum</u> (Hedw.) Mohr. . . . .	56
<u>Ditrichum pallidum</u> (Hedw.) Hampe . . . . .	36
<u>Ditrichum pusillum</u> (Hedw.) E.G.B. . . . .	37

<u>Entodon cladorrhizans</u> (Hedw.) C.M. . . . .	88
<u>Entodon compressus</u> (Hedw.) C.M. . . . .	89
<u>Entodon seductrix</u> (Hedw.) J. & S. . . . .	90
<u>Eurhynchium hians</u> (Hedw.) J. & S. . . . .	91
<u>Eurhynchium serrulatum</u> (Hedw.) Kindb. . . . .	93
<u>Fabronia ravenelii</u> Sull. . . . .	121
<u>Fissidens bushii</u> Card. & Ther. . . . .	26
<u>Fissidens minutulus</u> Sull. . . . .	27
<u>Fissidens obtusifolius</u> Wils. . . . .	28
<u>Fissidens osmundioides</u> Hedw. . . . .	30
<u>Fissidens taxifolius</u> Hedw. . . . .	32
<u>Fontinalis duriaei</u> Schimp. . . . .	123
<u>Frullania eboracensis</u> Gottsche . . . . .	152
<u>Frullania riparia</u> Hampe. . . . .	153
<u>Gymnostomum calcareum</u> N. & H. . . . .	49
<u>Haplohymenium triste</u> (Cesati) Kindb. . . . .	111
<u>Hedwigia ciliata</u> Hedw. . . . .	54
<u>Hygroamblystegium irriguum</u> (Wils.) Loeske. . . . .	94
<u>Hypnum cupressiforme</u> Hedw. . . . .	95
<u>Hypnum curvifolium</u> Hedw. . . . .	97
<u>Hypnum imponens</u> Hedw. . . . .	98
<u>Jamesoniella autumnalis</u> (DC) Steph. . . . .	137
<u>Lepidoyia reptans</u> (L) Dumort. . . . .	129
<u>Leptodictyum trichopodium</u> (Schultz) Warnst. . . . .	100
<u>Leptodon trichomitrium</u> (Hedw.) Mohr. . . . .	120
<u>Leskea gracilescens</u> Hedw. . . . .	112

<u>Leucobryum glaucum</u> (Hedw.) Schimp. . . . .	45
<u>Lophocolea heterophylla</u> (Schrad.) Dumort. . . . .	144
<u>Lophocolea minor</u> Ness . . . . .	146
<u>Lophozia ventricosa</u> (Dicks.) Dumort. . . . .	139
<u>Mannia fragrans</u> (Balb.) Frye & Clark . . . . .	160
<u>Marchantia polumorpha</u> L. . . . .	161
<u>Metygeria furcata</u> (L) Dumort. . . . .	157
<u>Mnium affine</u> Bland.. . . .	69
<u>Mnium cuspidatum</u> Hedw. . . . .	70
<u>Mnium punctatum</u> Hedw. . . . .	71
<u>Mnium serratum</u> Brid. . . . .	73
<u>Myurella careyana</u> Sull. . . . .	113
<u>Nowellia curvifolia</u> (Dicks.) Mitt. . . . .	131
<u>Pedinophyllum interruptum</u> Nees . . . . .	142
<u>Pellia neesiana</u> (Gottsche) Limpr. . . . .	156
<u>Plagiochila asplenioides</u> (L) Dumort. . . . .	148
<u>Plagiothecium denticulatum</u> (Hedw.) Bry. Eur. . . . .	101
<u>Plagiothecium micans</u> (Sw.) Paris . . . . .	103
<u>Plagiothecium muellerianum</u> (Hampe) Bry. Eur. . . . .	105
<u>Plagiothecium roeseanum</u> (Hampe) Bry. Eur. . . . .	106
<u>Platygyrium repens</u> (Brid.) Bry. Eur. . . . .	107
<u>Plectocolea hyaline</u> (Lyell) Mitt. . . . .	141
<u>Pogonatum pensilvanicum</u> (Hedw.) Paris . . . . .	21
<u>Pohlia wahlenbergii</u> (W. & M.) Andr. . . . .	65
<u>Polytrichum commune</u> Hedw. . . . .	22
<u>Polytrichum ohioense</u> R. & C. . . . .	24

<u>Radula complanata</u> (L) Dumort. . . . .	151
<u>Reboulia hemisphaerica</u> (L) Raddi. . . . .	162
<u>Rhodobryum roseum</u> (Hedw.) Limpr. . . . .	67
<u>Scapania nemorosa</u> (L) Dumort. . . . .	149
<u>Schwetschkeopsis denticulata</u> Sull. Broth. . . . .	122
<u>Sphenolobus hellerianus</u> (Nees) Steph. . . . .	143
<u>Telaranea nematodes</u> G. ex Aust. . . . .	126
<u>Tetraphis pellucida</u> Hedw. . . . .	18
<u>Thelia asprella</u> Sull. . . . .	114
<u>Thuidium delicatulum</u> (Hedw.) Mitt. . . . .	115
<u>Thuidium pygmaeum</u> Bry. Eur. . . . .	117
<u>Thuidium recognitum</u> (Hedw.) Lindb. . . . .	118
<u>Timmia megapolitana</u> Hedw. . . . .	57
<u>Tortella humilis</u> (Hedw.) Jenn. . . . .	50
<u>Tricholea tomentella</u> (Ehrh.) Dumort. . . . .	127
<u>Weisia viridula</u> Hedw. . . . .	52

## Introduction

The purpose of this study is to do a taxonomic survey of the bryophytes of Turkey Run State Park. Turkey Run State Park is located in Parke County, Indiana, on Indiana state highway 47, two miles east of U.S. route 41, and ten miles north of Rockville, Indiana. The park covers an area of 1,815 acres. It was established in 1916 by the state of Indiana with the donation of 288 acres of land by John Rusk. The state of Indiana has enlarged the park to its present size through the acquisition of contiguous parcels of land surrounding the original 288 acres. Today the park is visited by thousands of people every year. Tourists and local visitors are drawn to the park to enjoy its beautiful scenery. The deep gorges, water falls, cliffs, and ravines of the park which attract so many tourists, also provide a vast variety of habitats for the large number of bryophytes which inhabit the park.

The park is situated on a 500-600 foot deposition of sandstone known as the Mansfield formation. This formation consists of sediments from the Pennsylvanian age, the lower layers of which are clay and a four-foot layer of coal, over which the 500-600 foot sandstone deposits were laid. Very early in its history the park was a fairly smooth plane, but has since been eroded 100-200 feet, thus accounting for the deep gorges and ravines. The park has several small streams and a major river (Sugar Creek) which divides the park roughly in half.

Various regions of Turkey Run State Park have been collected to a



minor degree, and up until now no bryological surveys of the park have been made. This work will contribute to an understanding of the bryophyte flora of the region under study.

## Review of the Literature

A review of the literature reveals that no thorough studies of the bryophytes of Turkey Run State Park, Indiana, have been reported; however, in several publications, species have been reported from Park County, even though no intensive bryological studies of the county have been done.

Indiana has a rich bryological history starting in the later part of the 19th century. Underwood (1894) published a list of cryptograms known to inhabit the state of Indiana at that time which contained 53 species of mosses and 32 liverworts. Pickett (1915) contributed to the knowledge of Indiana mosses with the publication of a list of 79 species of mosses from Monroe County. Yunker (1921) compiled the second list of Indiana mosses with 130 species included. Ten years later Andrews (1931) published a list of 13 liverworts collected at Spring Mill Park, Indiana. This was the first since Underwood's study of 1894 which considered the liverworts of Indiana. However, the list of liverworts published by Parker (1937), contained only 9 species for the flora of Indiana. It is interesting to note that most of the studies in Indiana bryophytes deal exclusively with mosses, and that the number of publications which consider the liverworts of the state are relatively few.

Dr. Winona Welch, the most prominent Indiana bryologist and one of the leading bryologists of the United States, started a series of publications entitled "Studies in Indiana Bryophytes" I-XIV (1934-1969), in

which several genera of Indiana mosses were treated. She followed this with an illustrated manual of the mosses of Indiana (1957), which is the most comprehensive study on Indiana mosses. In this manual are listed 217 species, 34 varieties, and 9 forms, representing 92 genera, and 24 families of mosses. In 1962 Welch increased the list to 227 species, 37 varieties, and 9 forms, representing 97 genera, and 27 families. Dr. Welch's work on Indiana bryophytes has added tremendous value to the bryological history of Indiana, and she is currently active in bryological research in Indiana.

The American Bryological Society conducted a two-day foray, under the guidance of Winona H. Welch, into Putnam and Parke Counties (Miller and Thomson, 1959). This study produced a list of 94 species of mosses, 6 of which were suspected to be new state records, and 28 liverworts. The areas covered included "Fern Cliff", Dr. L.M. Underwood's famous collecting site for cryptograms in Putnam County during the later part of the 19th century.

The American Bryological Society conducted another foray in the High Bridge area of Warren County (Welch, 1962). This expedition was led by S.N. Postlethwait and resulted in a list of 78 mosses and 13 liverworts.

## Materials and Methods

The mosses and liverworts were collected from Turkey Run State Park in Parke County, Indiana, from selected areas which represent a wide variety of habitats within the park. The division of the park into collecting areas follows Mertz (1971). He did a survey of the lichens in the park, and divided the park into areas which give representative samples of the different habitats located within the park. These areas were covered by the author in a total of ten collecting trips over a period of seven months from April 1972 to October 1972. Verbal permission to collect was received from the park naturalist.

Collecting equipment included a vasculum, a hunting knife, a field notebook, standard letter envelopes, a pen, and a hand lens which was used to make tentative on-the-spot identifications. Each specimen collected was placed in an envelope and labeled, stating the date, location, and habitat. Each specimen was numbered and recorded in the field notebook.

The bryophytes were identified and placed in standard bryological packets containing the following data: scientific name and authority for each species, whether fruiting (bearing a sporophyte) or sterile, the county and state in which the specimen was collected, specific habitat information, the collector's name, the determiner's name (if different), the date collected, and the collection number. Taxonomic keys used in the determination of the bryophytes were written by Welch (1957), Conard

(1956), Macvicar (1926), and Grout (1929-1940, 1903). The author's determinations of all specimens were corroborated by Dr. Charles B. Arzeni.

Descriptions of the external morphology as well as microscopic morphology were made for each species. The descriptions included the following gametophyte characteristics: general color range and habit of plant, leaf arrangement on the stem, branching patterns of stems, leaf morphology, and aerolation studies of the leaves. Sporophyte characteristics which were considered included seta characters such as size and color; capsule color, shape, and size; operculum shape; the peristome characteristics, color, and number of teeth; and the spore size and morphology. The habitat was also recorded for each species. Measurements of all microscopic characteristics were made with a calibrated ocular micrometer.

The descriptions of the Musci are arranged phylogenetically as given by Grout (1940). The Hepaticae follow the arrangement by Evans (1940).

FAMILY: TETRAPHIDACEAE

Tetraphis pellucida Hedw.

Plants in wide tufts and sods, yellowish green; protonema of a green scale, not filamentous; stems erect, 1-3 cm. long, simple or branched, densely radiculose at base; barren shoots frequently with terminal gemmiferous cups, about 1 mm. in diameter, formed of 4-5 broadly cordate, obovate, or reniform leaves, truncate to apiculate, containing lenticular, many-celled, stalked gemmae; central strand present; upper leaves larger than the minute basal leaves, close, ovate from a narrow base, 1-1.3 mm. long, 0.5-0.75 mm. wide, slightly concave, subdecurrent, costa wide, ending below apex, apices mostly acute, margins plane, entire; median cells of leaves almost isodiametric, rounded hexagonal, 8-20 u in diameter, incrassate; autoicous; inflorescence apical; calyptra whitish, conical, acute, enclosing the entire capsule; seta erect, 1-1.5 cm. long; capsule reddish, erect to ascending; operculum lustrous, acutely conical, cleft on one side; urn green when young, bright reddish brown when ripe, usually symmetrical, rarely subarcuate, narrowly cylindrical, 2-2.7 mm. long, persistent; annulus none; peristome reddish to brown, single teeth 4, linear-triangular, thick, up to 0.9 mm. long; spores 8-12 u in diameter, slightly papillose, mature in spring to early fall.

Habitat: In deep shade or moist woods, on humus, peaty soil, wet rotten wood, or porous sandstone.

FAMILY: POLYTRICHACEAE

Atrichum angustatum (Brid.) B.S.G.

Plants medium in size to moderately robust, in clusters or tufts, dark green; reddish brown with age; stems erect from a branched rhizome, simple, 1-5 cm. high, usually up to 3 cm.; lower leaves of stem smaller than upper leaves curled when dry, erect when moist, linear-lanceolate, 3-4.5 mm. long, 0.6-0.75 mm. wide, blade with few to many teeth on the lower surface of undulations, costa subprecurrent, toothed near apex on lower surface, lamillae on upper surface 4-8, the costa and lamillae together composing  $1/4$ - $1/3$  of the median width of the blade, on upper  $3/4$  of the blade 6-9 cells high, the marginal or top cells smooth, apices of leaves bluntish acute, ending in a tooth, blades bordered with 2 rows of elongate incrassate cells, almost entire length of the blade, margins serrate on upper  $1/2$ , teeth incrassate, often in pairs; upper cells of leaves rounded hexagonal, 7-15 u in diameter, smooth, papillose; dioicous; calyptra cucullate, slenderly rostrate, 4-7 mm. long, split  $1/3$  of its length; hispid at tip, chestnut brown, almost erect, operculum hemispheric, slenderly rostrate, 2-2.5 mm. long; annulus none; peristome single, teeth 32, linear-lanceolate, obtuse, 145-300 u long; spores spherical, pale green to reddish yellow, pellucid, smooth to slightly roughened, 10-18 u in diameter, mature in late fall and winter.

Habitat: On sandy soil, clay, or shale, partially shaded or in woods.

FAMILY: POLYTRICHACEAE

Atrichum undulatum (Web. and Mohr.)

Plants medium in size, in clusters, yellowish green to brown, stems erect, up to 8 cm. high, generally 3-4 cm., central strand present; leaves of stems minute below, size increasing above, upper leaves crispate when dry, widely spreading when moist, ligulate to lanceolate, 5-9 mm. long, 1-1.3 mm. wide, blade conspicuously transversely undulate, with teeth on lower surface of undulations, costa percurrent, with teeth near apex on lower surface, lamellae along upper surface of costa, costa and lamellae together composing 1/7-1/11 of median width of blade, lamellae on upper 1/4-3/4 of blade 2-6 cells high, the marginal cells smooth, apices of leaves subacute, ending in a tooth, margins bordered with 1 row of elongate incrassate cells, serrate along almost all of the leaf, teeth incrassate, in pairs, upper cells quadrate-hexagonal, 18-40 u in diameter, smooth; polyoicous, calyptra pale, cucullate, slenderly rostrate covering 1/2 of urn; seta reddish, erect, straight, 2-5 cm. long, capsule castaneous, inclined; urn slightly curved 4-5 mm. long, 0.7-1.3 mm. in diameter; annulus absent, peristome single, teeth 32, linear-lanceolate, pale spores spherical, yellowish green to orange, 9-19 u in diameter, almost smooth, mature in late fall.

Habitat: Moist, shaded soil, especially clay.



FAMILY: POLYTRICHACEAE

Pogonatum pensilvanium (Hedw.) Paris

Plants in cluster, forming thin sods, greenish to brown, on a green felt-like persistent protonema; stems erect, very short, 1-2 mm. high, sometimes up to 8 mm. long, simple, with rhizoids at base; central strand present; lower leaves bract-like, upper few, erect when dry; ascending when moist, lanceolate-subulate from a sheath-like base, 3-4 mm. long, 0.28 mm. wide, sheath about half length of leaf, costa percurrent, smooth to slightly toothed on lower surface, with 10-15 lamellae along upper surface, apices of leaves long acuminate, serrulate, margins of blades plane to erect, entire below, serrate in upper half; cells of blades at upper 3/4 quadrate to oval, 10-20 u in longest diameter, incrassate; dioicous; calyptra cucullate, extending well below capsule, light yellow or gray, densely hairy; seta yellowish to reddish, solitary, erect, 1-2.5 cm. long; capsule erect to inclined; operculum briefly conic, the beak slightly curved; urn cylindrical, symmetrical, about 4 mm. long and 0.8 mm. wide, minutely mammillose with bulging cells, without stomata; annulus none; peristome single, teeth 32, basal membrane about 50 u high; spores yellowish brown, 8-12 u in diameter, smooth, maturing in late fall, about November.

Habitat: On bare, clay banks, especially if moist and shaded; frequently on clay roadside banks where soil is covered with dense felt of protonema.

FAMILY: POLYTRICHACEAE

Polytrichum commune Hedw.

Plants large, loosely tufted in large masses or dense sods, dark olive-green; stems chestnut-brown, erect, rigid, usually simple, 10-20 cm. high, sometimes up to 40 cm. in height, with 5 or more angles, not tomentose at base to slightly so, from a 3-angled rhizome; central stand present; leaves of stems small below, gradually larger above, upper leaves appressed-erect when dry or with the tips spreading, spreading to recurved when moist, lanceolate to linear-lanceolate from an oblong sheathing base, blades 8-12 mm. long, sheath up to 3 mm. in length, costa excurrent, sharply serrate near tip on lower surface, with 40-70 lamellae along upper surface, in cross section the lamellae 4-9 cells high, the terminal or marginal cells slightly wider, depressed in middle or 2-forked, apices brown or red, acuminate, serrate, margins of blades plane, about 1 row of cells, serrate to sheath; cells of unistratose border of blade quadrate to elliptic; cells in middle of sheathing base linear, 10-20:1; dioicous; perichaetial leaves up to 20 mm. long; calyptra densely hairy, yellow or brownish, glossy, entirely covering the capsule; seta reddish brown to light golden brown, erect, 6-12 cm. long; capsule first erect, later inclined, with age cernuous, light to dark brown; operculum low conic, beak straight or slightly curved; urn almost cubical, sharply 4-angled, 3-6 mm. long, neck deeply constricted, hypophysis distinct, discoid; annulus none; peristome single, teeth reddish, pellucid,

64, basal membrane about 100  $\mu$  high; spores yellowish, 8-10 in diameter, smooth, mature in midsummer.

Habitat: On damp soil, especially near ponds or lakes, in marshly places, pastures, open fields, and woods.

FAMILY: POLYTRICHACEAE

Polytrichum ohioense Ren. and Card.

Plants in loose turfs, bluish-green; stems chestnut-brown, erect, rigid, 2.5-5 cm. long, usually simple, 5-angled, from a 3-angled rhizoid, rhizoids at base of stems; central strand present; leaves rather crowded, appressed to erect-spreading and somewhat contorted when dry, spreading to recurved when moist, linear-lanceolate from an oblong, sheathing base, blade 5-8 mm. long, costa excurrent, with a few teeth at tip of lower surface, with 32-50 lamellae along upper surface, 4-6 cells high, marginal terminal cells, oval, smooth, apices acuminate, ending in a serrate arista, margins plane to erect, serrate nearly to the sheath, marginal cells, unistratose  $\frac{3}{4}$  of way to tip, cuticle distinctly longitudinally striate, cells in middle of sheath longer than wide, dioicous, perichaetial leaves similar to upper leaves, calyptra light yellowish brown, densely hairy, shorter than capsule, not covering the base; seta dark brown below, yellowish brown above, 4-8 cm. long; capsule greenish yellow to yellow brown, erect, operculum depressed, conic  $\frac{1}{2}$ - $\frac{2}{3}$  as long as urn, beak curved, approximately 1.5-3 mm. long; urn oblong, 3-6 mm. long, 1.5-3 mm. in diameter, narrowed toward base; annulus none; peristome single, teeth pale yellow with darker axis, 64, spores spherical, yellowish white, 8-17  $\mu$  in diameter, finely punctate, mature in midsummer.

Habitat: On soil, in moist, deep woods, in open woods, and in old fields.

FAMILY: FISSIDENTACEAE

Bryoxiphium norvegicum (Brid.) Mitt.

Plants slender, flat, about 2 mm. wide, densely cespitose, green or yellowish green, glossy; stems erect, stiff, 1-2.5 cm. long, simple or irregularly branching, bulb-like and radiculose at base; central strand present; leaves of stems closely imbricate, in two vertical rows, on opposite sides of stem, in one plane, flat, conduplicate, boat-shaped portion clasping the stem and frequently a portion of adjacent leaf above, leaves of middle portion of stem lanceolate, up to 2 mm. long, keeled, costa persurrent, with narrow dorsal or inferior lamina not extending to base of blade, the apical lamina only slightly developed, apices acute to subulate, margins entire below and serrulate at apex; cells of leaves smooth, the upper triangular, chlorophyllose, the basal rectangular, hyaline, the marginal linear, forming a distinct border; dioicous, perichaetium terminal, perichaetial leaves 2, prolonged subulate-acuminate from an ovate base, costa excurrent, with a complete dorsal and inferior lamina, margins serrulate; calyptra cucullate, covering 1/3 of urn, smooth; seta flexuous, about 2 mm. long; capsule pale yellow, inclined to horizontal; operculum reddish at base, subconvex, rostrate, attached to columella, long persistent; urn obovoid to globular, smooth, mouth reddish; annulus none; peristome none; spores brownish, about 11.9  $\mu$  in diameter, smooth or nearly so, mature in summer.

Habitat: On shaded, moist, usually vertical, faces of sandstone.

FAMILY: FISSIDENTACEAE

Fissidens bushii Card. & Ther.

Plants medium, loosely cespitose, pale green or yellowish green; stems erect, short 5-8 mm. long, simple or branching; central strand present; leaves distichous, those of stems oblong to oblong-lanceolate, 1.2-1.4 mm. long, about 0.45 mm. wide, vaginant lamina boot-shaped, flat, conduplicate, 1/2-2/3 length of leaf, clasping stem and usually a portion of adjacent leaf above, costa slender, 40 u wide at base, subpercurrent to percurrent, apices rounded obtuse and apiculate to broadly acute, interior or dorsal lamina rounded at base, not undulate, margins entire to finely crenulate below, and evenly crenulate-serrate above by projecting cell angles; median cells of superior lamina opaque, slightly rounded to rounded hexagonal, small, 6-10 u in diameter, cells of superior lamina usually minutely pluripapillose, rarely smooth, marginal cells not translucent to slightly so, border lacking; monoicous; calyptra small, conical; sporophyte lateral from near base of plant; seta golden, reddish yellow, or reddish brown, short 6-9 mm. long; capsule erect, brown to red; operculum conic, rostrate; urn ovoid, contracted beneath mouth when dry and empty; annulus present; peristome single, teeth 16, cleft to middle into 2 subulate, appendiculate divisions, marked with fine longitudinal lines, slightly papillose; spores brownish, 15-20.4 u in diameter, finely papillose to smooth, mature in summer.

Habitat: On soil.

FAMILY: FISSIDENTACEAE

Fissidens minutulus Sull.

Plants very small or minute, green; stems erect, .9-3 mm. long, simple, reddish; leaves usually 3-5 pairs, sometimes up to 7 pairs, distichous, increasing in size from base to apex of stem, upper leaves narrowly oblong-lanceolate, erect, incurved, upper leaves 1-2 mm. long; .24-0.3 mm. wide, vaginant lamina boat-shaped, flat, conduplicate, about 1/2 length of leaf, clasping stem and frequently a portion of adjacent leaf above, costa strong, ending below apex, percurrent in upper leaves, scarcely decurrent, apices subacute to acute, margins entire below, usually finely serrulate in apical portion, border narrow, or 1-3 rows of narrowly linear cells, commonly ending below apex; cells of leaves incrassate, median irregularly quadrate, varying greatly in shape and size, 8-15 u in diameter; usually dioicous; calyptra small, narrowly conical, sporophyte terminal; seta yellowish to reddish, erect, 2-6 mm. long; capsule yellowish to dark chestnut brown color, usually erect, symmetric; operculum conic, apiculate to rostrate, approximate length of urn; the urn oval oblong, .7-0.9 mm. long, often shorter, contracted beneath mouth when dry and empty, tapering abruptly at base; peristome dark red to chestnut color, single, densely papillose; spores pellucid, pale yellowish red, spherical, 14-17 u in diameter, smooth or nearly so, mature in autumn.

Habitat: Usually on damp or wet rock, in cool, shaded places; on moist banks occasionally.

FAMILY: FISSIDENTACEAE

Fissidens obtusifolius Wils.

Plants small, scattered to densely gregarious, sometimes in cushions, pale green or glaucous-green; stems of fertile plants 2-3 mm. high, sterile up to 1 cm., simple or sparingly branched; central strand present; leaves distichous, those of fertile plants 4-8 pairs, sterile 6-12 pairs, increasing in size from base to apex of stem, the upper crowded, ascending to erect, oblong-lingulate to oblong, about 1 mm. long, rarely up to 1.5 mm., 0.3-0.4 mm. wide, vaginant lamina boat-shaped, flat, conduplicate, 1/2-1/3 length of leaf, clasping stem and portion of adjacent leaf above, costa ending a few cells below apex, dorsal of inferior lamina narrowing toward base, sometimes not quite reaching stem, apices rounded obtuse, margins entire, border or band of elongated cells, a faint border of a few inconspicuous elongated cells present at extreme base of vaginant lamina of majority of upper and perichaetial leaves; cells of leaves smooth, pellucid, irregularly rounded hexagonal to oblong; dioicous; calyptra small, narrowly conical; sporophyte terminal; seta brownish, erect, 1.5-3 mm. long; capsule brownish, erect, symmetric; operculum conic, apiculate; urn oblong-obovoid, up to 0.5 mm. long, contracted below mouth when dry and empty; annulus present; peristome yellowish pellucid, single, teeth 16, lanceolate, acuminate, cleft into 2 obscurely spirally thickened, papillose, subulate divisions; spores spherical, 18-25  $\mu$  in diameter, smooth, mature in autumn.



Habitat: On wet or damp rocks.

FAMILY: FISSIDENTACEAE

Fissidens osmundioides Hedw.

Plants medium in size, in dense tufts, olive-green to dark green, matted at base with brown rhizoids; stems erect, mostly 1-5 cm. high, rarely up to 15 cm., simple branched; central strand present; leaves distichous, numerous, close, cultiform, lingulate, or oblong-lanceolate, upper leaves often the larger, 1-2 mm. long, vaginant lamina boat-shaped, flat, conduplicate, 1/2-2/3 length of leaf, clasping stem and portion of adjacent leaf above, costa ending 5-10 cells below apex of leaf, ending with a single long cell; dorsal lamina commonly ending abruptly at base, not decurrent, apices rounded obtuse, often apiculate to broadly acute, margin entire below, finely crenulate above, border of narrowly elongated cells absent; cells of leaves incrassate, median cells of the superior lamina irregularly hexagonal to rounded hexagonal or oval, 10-20  $\mu$  in diameter, bulging, the marginal smaller, the basal rectangular; dioicous; calyptra small, narrowly conical, many lobed at base, covering the operculum; sporophyte terminal; seta yellowish to chestnut-red, 5-14 mm. long; capsule chestnut-brown, erect and symmetric or inclined; operculum conic, beak needle-like, approximate length of urn; the urn oblong-ovoid; annulus of 1 row of large cells; peristome single, teeth 16, up to 0.6 mm. long, papillose; spores greenish brown, spherical, 16-25  $\mu$  in diameter, finely papillose to nearly smooth, mature summer to autumn.

Habitat: On moist shaded soil.

FAMILY: FISSIDENTACEAE

Fissidens taxifolius Hedw.

Plants small, gregarious, light green when young, darker with age; stems erect to spreading, usually 5-10 mm. high, sometimes up to 2 cm., sparingly branched from the base; central strand present; leaves of stems distichous, close, in many pairs, ascending, oblong-ovate, the median usually longest, up to 2 mm. in length, vaginant lamina boat-shaped, flat, conduplicate,  $1/2 - 2/3$  length of leaf, clasping stem and portion of adjacent leaf above, costa strong, widening at apex, usually filling apiculus in mature leaves excurrent into a short mucro, in lower and immature leaves percurrent to excurrent, dorsal lamina ending abruptly, usually reaching stem and somewhat decurrent, apices rounded obtuse, apiculate, margins finely and evenly crenulate throughout with projecting cell angles, border absent; median cells of superior lamina incrassate, rounded hexagonal, mostly 7-10  $\mu$  in diameter, one or two rows along costa larger, marginal cells smaller, basal cells of superior lamina and especially near costa conspicuously mammillose to conically papillose; autoicous; calyptra cucullate, covering  $1/2$  of urn; sporophyte lateral, arising near base of stem; seta yellowish to red, or castaneous, ascending 18-15 mm. long; capsule castaneous to dark brown, erect to subpendulous, unsymmetric; operculum conic, obliquely rostrate, the beak about  $1/2$  length of capsule; the urn oblong, contracted below mouth when dry and empty, tapering abruptly to the seta; annulus of 1-2 rows of

cells; peristome red-chestnut to red, single, teeth 16, up to 0.55 mm. long, cleft from apex  $\frac{3}{4}$  their length into 2 subulate divisions, strongly nodulose, marked with very fine oblique lines between nodes, papillose; spores pale yellowish pellucid, spherical, 12-20 u in diameter, smooth, mature in late fall or winter.

Habitat: On damp, shaded soil, especially clay.

FAMILY: DITRICHACEAE

Ceratodon purpureus (Hedw.) Brid.

Plants perennial, cespitose; in wide mats, green when young, brownish with age; stems erect, usually 1-2 cm. long, often branched; central strand present; leaves rather loosely imbricated, slightly twisted to crispate and appressed when dry, erect-spreading when moist, broadly triangular-ovate, lanceolate, or linear-lanceolate, the upper up to 2 mm. long, the lower shorter and more distinct, concave to carinate, costa strong, at base  $1/6 - 1/4$  width of leaf, percurrent to briefly excurrent, apices acute to acuminate, margins revolute and entire from base to near the apex, then plane and entire, becoming serrate in the apex; all cells usually smooth, exceptionally the lower surface of upper cells slightly papillose, median cells regularly quadrate, hexagonal-quadrate, or irregular, short, small, 8-10  $\mu$  wide, thick walled; perichaetial leaves sheathing; dioicous, rarely autoicous; calyptra cucullate; seta dark reddish brown, yellowish in varieties; lustrous, erect, 1-2.5 cm. long; capsule dark reddish brown, lustrous, erect when young, inclined to horizontal when mature; operculum elongate conic, about  $1/4$  length of urn, often curved, sulcate and 4-5 angled when dry, with a small but distinct struma at base; annulus distinct, of 2-3 rows of cells, deciduous; peristome single, teeth dark red below, 16, hyaline above, papillose, confluent at the base, bifid nearly to base into 32 filiform, nodose divisions; spores yellowish pellucid, 10-16  $\mu$  in

diameter, smooth, mature spring to summer.

Habitat: On bare compact soil, along paths, roadside, in vacant lots, lawns, on burnt-over ground, old roofs, old wooden platforms of wells, walks, sidewalks, and also in swamps.

FAMILY: DITRICHACEAE

Ditrichum pallidum (Hedw.) Hampe

Plants small, caespitose or gregarrous, green; stems erect or nearly so, from a prostrate base, short, about 5 mm. long, usually simple; central strand large; leaves of stems slightly contorted when dry, erect-spreading, secund, long linear-subulate from a lanceolate or ovate base, 3-5 mm. long, concave below, channeled above costa strong, long excurrent, serrulate toward apex, margins distantly serrulate in upper part of base; median cells rectangular, thin-walled, smooth, composing a narrow margin on either side of costa, basal cells oblong-hexagonal; paroicus, calyptra cucullate, slenderly rostrate, straight, smooth, up to 2.5 mm. long; seta orange, erect, slender, 1-4 cm. long; capsule light brown, ascending to inclined; operculum conic, obtuse, 0.6-1 mm. long, sporophyte slightly unsymmetric, oblong-ovoid, 1-2.5 mm. long, narrowed near mouth, faintly strumose at base; annulus of 1-3 rows of cells deciduous; peristome single, reddish, teeth 16, about 0.5 mm. deeply bifid into filiform, spores brownish, spherical, 14-18  $\mu$  in diameter, papillose to coarsely warty, mature in early spring.

Habitat: On dry, sandy soil, especially in fields, or on bare soil in woods.



FAMILY: DITRICHACEAE

Ditrichum pusillum (Hedw.) E.G. Britton

Plants small, in dense sods, light green to yellowish green, often dark with age; stems erect, mostly simple, radiculose at base, 5-10 mm. high, sometimes more; central strand present; lower leaves of stem lanceolate, about 1 mm. long, the upper slightly contorted when dry, lanceolate-subulate from an ovate-lanceolate base, 2-3 mm. long, concave at base, canaliculate above, costa broad, percurrent to excurrent into a denticulate, subulate apex, in upper part of blade occupying 1/3 - 1/2 width of leaf, margins narrowly revolute, more or less serrulate, especially in apex; median cells of upper leaves rectangular to quadrate, about 2:1, thick walls, smooth, basal cells linear-rectangular, 2-5:1, the alar similar; perichaetial leaves slightly sheathing at base; dioicous; calyptra cucullate, extending to base of capsule; seta reddish to brown, erect or nearly so; urn oblong to oblong-cylindric or ovoid abruptly narrowed to seta; operculum conic, rostellate, beak more or less oblique; annulus of 1 row of large cells; peristome reddish, single, teeth 16, cleft nearly to base into linear-subulate, papillose divisions, united below into a narrow basal membrane; spores yellowish pellucid, 10-18  $\mu$  in diameter, smooth, mature autumn or winter.

Habitat: On moist bare soil, especially recently exposed clay; banks of ditches and roadsides, and in fields.

FAMILY: DICRANACEAE

Dicranella heteromalla (Hedw.) Schimp.

Plants small, glossy, cespitose or in wide mats, yellowish to dark green; stems erect, 0.5-4 cm. long, frequently branched; leaves numerous, generally falcate-secund, ovate-lanceolate to lanceolate, upper part of blade subulate, broadest at attachment to stem and gradually narrowing to a filiform, channelled, rough awn, 2-4 mm. long, upper half of leaf toothed on lower surface, concave below, costa percurrent to excurrent, broad, often  $1/5$  -  $1/3$  of width of leaf base, leaf margins plane, usually entire below and faintly to sharply denticulate above, rarely entire nearly to tip, with a few teeth at the point; median cells short rectangular or rectangular or rectangular-oblong, with oblique end walls, 1.5-2:1, alar cells not differentiated or only slightly so; dioicous; calyptra cucullate; seta usually greenish yellow to pale yellow, sometimes dark red with age, erect to curved, 0.5-3 cm. long; capsule inclined; operculum convex, long and obliquely rostrate, beak 1-1.5 mm. long, curved downward; urn castaneous to dark brown, glossy unsymmetric, ovoid to oblong-cylindric, strongly sulcate when dry and empty, contracted beneath mouth much more strongly on lower side, thus producing an oblique mouth, 1-1.5 mm. long; annulus poorly developed; peristome single, papillose, teeth 16, dark red, 2-3 cleft to middle or below, strongly striate below the subulate divisions; spores yellowish, 10-15  $\mu$  in diameter, smooth, mature autumn to winter.

Habitat: On moist clayey and sandy places, roadsides, and on soil-covered logs and rocks, in shaded places.

FAMILY: DICRANACEAE

Dicranella hilariana Mont.

Plants in loose mats; stems 2-5 mm. long, simple or branching; stem leaves erect spreading when moist, the upper larger, reaching 2 mm. in length, narrowly long-lanceolate, gradually narrowed to a blunt serrulate apex, concave, with margins recurved and serrulate below the apex, costa stout, occasionally rough on the back at apex; upper leaf cells subquadrate, the lower much longer and clearer, 6-10 u wide; perichaetial leaves little different; seta 5-10 mm. long, yellowish when young, brown when old; capsule nearly or quite erect, ovoid, light brown, becoming darker with age and oblong-cylindric when empty; operculum long-rostrate, nearly as long as the urn; annulus large; urn about 1 mm. long; peristome teeth reaching 0.2 mm. in length, papillose in indistinctly spiral lines above; spores finely papillose, 15-18 u in diameter, mature in spring.

Habitat: On moist shaded soil and occasionally on walls of sandstone.

FAMILY: DICRANACEAE

Dicranella varia (Hedw.) Schimp.

Plants in loose tufts, bright green or yellowish green; stems erect to ascending, 5-10 mm. long, sometimes higher, branching below, leaves recurved, linear-lanceolate, lower about 1 mm. long, upper 1.5-2 mm. long, concave below, plane above costa about 1/5 width of leaf base, composing a large portion of the acumen, apices slenderly acute to narrowly obtuse, margins narrowly revolute, entire throughout, denticulate at the base, median cells of upper leaves narrowly rectangular, 4-6 u wide, upper cells bistratose, alar cells not differentiated; dioecious; calyptra cuculate; seta reddish or castaneous, erect 5-10 mm. long; capsule reddish to light castaneous, more less cernous, 1-1.25 mm. long; operculum restrate, approximate length of the urn; the urn ovoid to short oblong, usually less than 1 mm. long, curved; annulus none; peristome red, single teeth 16, lance-subulate, up to 0.4 mm. long, spores yellowish, 18-24 u in diameter, mature in late autumn or winter.

Habitat: On moist claying soil, banks of ditches, and sometimes in crevices of rocks, in fields and woods.

FAMILY: DICRANACEAE

Dicranum flagellare Hedw.

Plants in dense cushions or sods, green or yellowish green above, brownish below; stems erect, 1-5 cm. high, radiculose, often erect, straight, flagelliform branches in axils of upper leaves; central strand present; leaves of stems crispate and subsecund when dry, flaccate-secund when moist, lanceolate, gradually narrowed into a linear, subtubulose acumen, 3-4 mm. long, concave, costa subpercurrent to percurrent, strong, serrate above on lower surface; margins above strongly incurved, often almost touching, serrate, lower margins entire; cells of leaves not papillose, the median cells short rectangular, the alar well differentiated, usually inflated and brownish, extending nearly to costa; dioicous; calyptra cucullate, extending to middle of capsule, fugacious; seta reddish to yellowish brown, erect; operculum obliquely and long rostrate, more than 1/2 length of urn; the urn cylindrical, symmetric, 2-3 mm. long, sometimes slightly curved and striate when dry and empty; annulus narrow; peristome single, teeth 16, reddish, pale and faintly papillose above, cleft from apices at least 2/3 length of teeth; spores spherical, yellowish, 15-22  $\mu$  in diameter, slightly roughened, mature in summer.

Habitat: On decayed logs and stumps, bases of trees, peaty banks, in moist, shady places.

FAMILY: DICRANACEAE

Dicranum viride (Sull, & Lesq.) Lindb.

Plants generally rather small to medium in size, densely caespitose, often in compact cushions, yellowish green to dark green; stems erect-ascending, usually 1-2 cm. high, simple or dichotomously branched, brown radiculose below; central strand present; leaves of stems brittle; crisped when dry, spreading or recurved when moist, scarcely secund, close to crowded, lanceolate-subulate, long acuminate, 3-4 mm. long, entire, concave below, tips of leaves often broken off, excepting the younger upper blades, the broken leaves often producing protonema from broken end, costa strong, persurrent to excurrent; cells of leaves not porose, bistratose in upper part of leaf, median and upper cells small, incrassate, the alar brown, inflated, sometimes extending to costa; dioicous; calyptra cucullate; seta yellowish, erect, about 2.5 cm. long; capsule yellowish brown, erect, solitary; operculum conic, beak long; urn oblong to cylindric, symmetric, 2-2.75 mm. long, tapering to seta, slightly contracted beneath mouth when dry and empty, smooth until dry, then shrunken and furrowed; annulus narrow, of 1 row of cells; peristome yellowish in basal half, hyaline in upper half, single, teeth 16; spores slightly roughened to smoothish, 10-22 u in diameter, mature in summer.

Habitat: On decaying wood and base of trees, in moist woods.

FAMILY: DICRANACEAE

Dicranum scoparium (Hedw.)

Plants large, loosely tufted, in wide sods, glossy, brownish below, stems erect, 2-10 cm. high; central strand present; leaves of stems strongly falcate-secund, narrowly lanceolate, 4-9 mm. long, sometimes up to 12 mm. concave below, subtubulose above, costa strong, at base  $1/4 - 1/3$  width of leaf, ending in apex, in upper part with 2-4 rather prominent, serrulate lamellae, apices long, narrowly subulate, margins of approximate upper  $1/2$  strongly serrate, entire below; leaf cells elongate and more or less porose, median cells; elongate-rectangular incrassate, the alar inflated, orange-brown, not extending to the costa, dioicous, calyptra cucullate, conic-rostrate, 6-7 mm. long; seta reddish brown, erect, solitary, 2.5-4 cm. long, inclined, operculum, low conic, long rostrate, beak often oblique, about 2.5 mm. long, urn cylindrical, arcuate, 3-4 mm. long, 0.8 mm. in diameter, usually neck distinct, short; annulus none, peristome reddish brown, single, teeth 16, cleft from apices to middle, spores spherical, slightly rough, 20-24  $\mu$  in diameter, mature late summer to autumn.

Habitat: On soil, rock and decaying wood, in shaded places.



FAMILY: LEUCOBRYACEAE

Leucobryum glaucum (Hedw.) Schimp.

Plants robust, in dense, spongy, rounded, glaucous cushions upper portion alive, lower portion dead, grayish brown, peaty, stems very fragile, erect, dichotomously forked, often 6-7 cm. high, central strand absent; leaves erect-appressed, crowded, in many rows, oblong-lanceolate, concave, 3-10 mm. long, from an oblong base gradually narrowed to a narrower, subtubular portion, consisting almost entirely of the broad thick costa, the hyaline lamina on each side of midrib up to several rows of linear, thick walled cells, costa in cross-section consisting of two kinds of cells, central chlorocyst cells with leucocysts above and below, apices acute, margins entire, but slightly denticulate at the tip; dioicous; calyptra inflated, cucullate, longer than the capsule; seta erect, castaneous; operculum long rostrate from a conical base 1.5-2 mm. long, urn oblong to cylindrical, peristome dark red to reddish brown, single, teeth 16, lanceolate, united at base into a tube, cleft from above to the middle into 2 lance-subulate prongs, vertically striate and papillose, spores slightly roughened 15-20  $\mu$  in diameter, mature in autumn.

Habitat: On soil or rocks, in shaded places, especially in moist or swampy woods, but often found in drier situations.

FAMILY: POTTIACEAE

Barbula fallax Hedw.

Plants densely and widely cespitose, dull brownish or reddish green; stems slender, 1-3 cm. high, usually branched; central strand large; leaves distant, appressed, closely imbricate, twisted when dry, spreading to recurved when moist, lanceolate from an ovate base, gradually tapering from near base to a slender, subacute or acute apex, keeled, often faintly plicate at base on each side of leaf, in cross section showing 2-6 central guide cells and two stereid bands, cells of the upper surface elongate in surface view, margins entire, revolute in lower half at least and usually to above the middle; upper cells of leaves small, obscure, rounded to hexagonal, incrassate, strongly papillose, basal cells slightly longer and wider, smooth; dioicous; calyptra cucullate; seta erect, red, 1.1-5 cm. long; capsule mostly erect, brownish; operculum often as long as urn, actually rostrate-subulate; urn elongated ovoid to subcylindric, nearly symmetric; annulus none; peristome red, teeth 16, cleft into 32 delicate, long filiform, papillose divisions, much twisted, from a narrow basal membrane; spores yellowish green, 10-14  $\mu$  in diameter, smooth, maturing from late autumn to early spring.

Habitat: Usually on moist, calcareous substrata, on soil, rocks, or walls.

FAMILY: POTTIACEAE

Barbula unguiculata Hedw.

Plants densely caespitose, glaucous-green, or yellowish green; stems erect, usually 0.5-1 cm. high, rarely up to 2-3 cm., branching; central strand large, leaves appressed and variously contorted when dry, sometimes spirally twisted, erect-spreading when moist, oblong-lanceolate to lingulate from an ovate base, up to 2.5 mm. long, slightly keeled below and plane above; costa strong, excurrent as a short, yellow, rounded mucro, very papillose on lower surface, apices generally obtuse, margins entire, recurved in basal half, plane above; upper cells of leaves small, 8-10  $\mu$  in diameter, rounded quadrate, incrassate, densely papillose, very obscure, the basal elongate-rectangular, yellowish pellucid to somewhat hyaline; propagula absent; dioicous; calyptra cucullate, with long beak; seta dark red, erect, 0.5-2.5 cm. long; capsule erect; operculum conic, rostrate about 1/3-1/2 as long as urn, beak straight to slightly curved; urn oblong cylindrical, about 1.8 mm. long; annulus absent; peristome dark, clear red, teeth 16, cleft into 32 long, filiform, papillose divisions, twisted in at least two complete spiral turns, basal membrane narrow; spores yellowish, smooth, 9-12  $\mu$  in diameter, maturing in winter to early spring.

Habitat: On moist soil, especially calcareous, and that which is disturbed periodically, as in fields, old paths, on roadside banks; also on stones and walls, but usually not on the vertical faces.

FAMILY: POTTIACEAE

Didymodon trifarius (Hedw.) Brid.

Plants densely caespitose, dull dark green to brownish green; stems short, up to 1 cm. long, somewhat branched, radiculose below; central strand present; leaves erect to closely imbricated when dry, scarcely twisted, erect-spreading when moist, broadly ovate-lanceolate, upper longer than lower, up to about 1.6 mm. long, concave, costa strong, ending in or just below apex of leaf, apices of lower leaves obtuse and the upper acute, margins entire, revolute at base and sometimes nearly to apex; cells of leaves small, hexagonal to rounded quadrate, 6-9 u in diameter, incrassate, not papillose, distinct; dioicous; calyptra mitrate, smooth, soon falling; seta red, up to 1 cm. high; capsule light brown, erect; operculum conic, about 1/4 length of urn, beak short, usually straight, sometimes oblique, its cells in straight rows; urn oblong to short cylindric; annulus none; peristome yellowish to reddish, finely papillose to almost smooth, teeth 16, slender, linear lanceolate, up to 0.1 mm. long, not united at base, entire or irregularly cleft above, free or partially and irregularly united; spores yellowish, 10-14 u in diameter, finely papillose or smooth, maturing in winter.

Habitat: On soil and rock, usually calcareous.

FAMILY: POTTIACEAE

Gymnostomum calcareum Nees & Hornsch.

Plants densely cespitose, grayish green or yellowish green above, rust-colored below; stems erect, 1-10 mm. high, occasionally up to 3 cm. high, branched, radiculose at base; central strand absent; leaves spreading and slightly recurved when moist, lingulate, or elongate-oblong-lanceolate to lanceolate, 0.8-1 mm. long, increasing in size from base upward to the terminal tuft, subconcave, costa strong, ending below apex, apices usually rounded obtuse, sometimes subacute, margins plane; upper cells of leaves rounded quadrate, small, 0.6-0.7 u in diameter, incrassate, densely papillose, obscure, the basal near costa rectangular, smooth, pellucid or hyaline, 2-3:1; dioicous; calyptra cucullate; seta straw-colored to yellowish, erect, 3-5 mm. long; capsule pale brown, erect, symmetric; operculum conic, beak oblique, 1/2-1/3 length of urn; urn usually tapering below, often slightly contracted below mouth when dry and empty; annulus none; peristome none; spores yellowish, 8-11 u in diameter, smooth, mature in summer.

Habitat: On moist rocks, usually shaded and calcareous.

FAMILY: POTTIACEAE

Tortella humilis (Hedw.) Jennings

Plants in loose to dense tufts, green to yellowish green above, brown below; stems erect, from very short to 1.3 cm. high, simple, sometimes branching, densely brownish radiculose below; leaves crowded, crispate when dry, erect-spreading when moist, lower leaves oblong-lanceolate, about 2 mm. long, the upper linear-lanceolate, 1.5-4.5 mm. long, subconcave, concave, or carinate, costa strong, yellowish, ex-current, sometimes denticulate, glossy when dry, apices abruptly narrowed, acute, acuminate, or obtusely mucronate because of costa, margins entire, crenulate, sometimes undulate, involute above sometimes; median cells of leaves chlorophyllose, obscure, rounded hexagonal, 8-9  $\mu$  long, 6-8  $\mu$  wide, papillose on both surfaces, the upper cells similar, the cells of lower 1/4-1/3 of blade hyaline, smooth, sharply differentiated from the upper, elongated, 25-100  $\mu$  long, 9-18 wide, linear near margins, extending obliquely higher up margins than costa, forming a V-shaped line of demarcation; monoicous; calyptra smooth, cucullate, rostrate, usually covering about 1/2 of capsule; seta reddish when mature, erect, 1-2 cm. long; capsule yellowish to reddish brown, erect; operculum narrowly conic, rostrate, about 1/2 length of urn; urn oblong-cylindric, 1.5-2.5 mm. long, about 0.5 mm. in diameter, symmetric, tapering at base; annulus of 3-4 rows of cells, deciduous in pieces; peristome single, teeth 32, red, filiform, papillose, usually twisted 2-3 times, basal

membrane narrow; spores greenish yellow, translucent, spherical, 7-11  
u in diameter, smooth, mature in spring to early summer.

Habitat: On soil, rock, decaying wood, and bases of trees, in  
woods, often in calcareous regions.

FAMILY: POTTIACEAE

Weisia viridula Hedw.

Plants small, in dense sods, green to yellowish green; stems erect, simple or branching, up to 5 mm. long; central strand present; leaves increasing in size from base of stem upward, the upper leaves crispate when dry, erect-spreading when moist, lanceolate, up to 3 mm. long and 0.5 mm. wide, concave at base and tubulose above, costa strong, 30-40 u wide at base, excurrent into a sharp subhyaline point, apices acute, margins entire, strongly involute; upper cells of leaves rounded hexagonal, densely papillose on both surfaces, obscure, the basal elongated, rectangular, mostly smooth, distinct; autoicous usually; calyptra cucullate, covering 1/2 of capsule; seta yellow, reddish with age, lustrous, 3-10 mm. long; capsule erect, symmetric; operculum conic, long rostrate; urn light to reddish brown, ovoid to oblong-cylindric, slightly contracted beneath mouth when dry and empty; annulus narrow, persistent; peristome single, teeth various, 16 when present, yellowish red to red, lanceolate, smooth to strongly papillose; spores pellucid, orange to brown, spherical, 12-19 u in diameter, rarely up to 22 u, rather coarsely papillose, mature in spring.

Habitat: On bare soil in various situations.



FAMILY: POTTIACEAE

Desmatodon porteri James

Plants minute, in compact tufts, tawny green; stems 1-3 mm. high; leaves contorted and incurved when dry, spreading when moist, upper leaves oblong-lanceolate, up to 2 mm. long, concave, costa stout, subpercurrent to percurrent, papillose on lower surface in apical portion, apices acute, often apiculate with 1-2 clear smooth cells, margins entire, plane, in mature blades bordered with a band of 2-3 rows of lighter-colored or pellucid, slightly papillose cells; upper cells of leaves irregularly quadrate-hexagonal, 8-12 u in longest dimension, obscure, the papillae small, sometimes C-shaped, the lower cells rectangular to elongate-hexagonal, smooth; dioicous; calyptra large, cuculate, long rostrate; seta orange-yellow when young, darker with age, erect 7-10 mm. long; capsule erect, symmetric or nearly so, operculum conic, rostrate, 0.5-0.75 mm. in length; urn cylindric, about 2 mm. long; annulus conspicuous, persistent; peristome teeth 16, papillose, irregularly cleft, nearly to base, into 2 divisions, rarely 3, up to 0.75 mm. long, sometimes irregularly united, basal membrane projecting above annulus; spores about 8 u in diameter, smooth, mature in early spring.

Habitat: On rocks, often limestone.

FAMILY: GRIMMIACEAE

Hedwigia ciliata Hedw.

Plants in loose patches, grayish green or glaucous-green, somewhat hoary because of colorless tips of the leaves, especially so in late summer or in autumn; stems spreading, rather slender, 2-10 cm. long, with rhizoids at base, irregularly divided into rather short branches; central strand absent; leaves in 8 rows, imbricate when dry, with apices recurved, spreading when moist, unistratose, ovate, concave, 1.5-3 mm. long, costa none, apices subobtusate to long acuminate, subhyaline to hyaline, papillose denticulate to spinosely denticulate, margins revolute; cells of leaves with thick walls, oblong, subquadrate, quadrate, rectangular, the median and upper cells papillose, in longitudinal rows, rounded or hexagonal, lower ones elongated, those near the base quadrate, the median basal cells yellowish pellucid, not papillose, narrowly linear, walls porose, cells toward margins subquadrate to rectangular, cells in angles of leaves often brownish and larger; autoicous; perichaetial leaves larger, conspicuously ciliate toward apex; calyptra small, subcullate, covering only the operculum, fugacious, seta yellowish, erect, very short; capsule immersed, sessile, erect; operculum broad, convex, sometimes mammillate; urn globose, 0.5-1 mm. in diameter; peristome none; spores yellowish, shallowly pitted, with vermiform striations, 25-32  $\mu$  in diameter, mature in spring.

Habitat: On dry exposed places, on siliceous walls and rocks,

occasionally on trees, rarely on limestone.

FAMILY: BUXBAUMIACEAE

Diphyscium foliosum (Hedw.) Mohr.

Female plants densely clustered in mats, dark or brownish green; stems very short, 1-2 mm. high; leaves crisped when dry, subconcave, narrowly lingulate, 3-4 mm. long, consisting of two or more layers of cells, costa broad and flattened, especially at base, ending just below apex, margins plane, crenulate papillose, often slightly irregular above; cells of leaves obscure, strongly papillose on both surfaces, upper cells rounded-quadrate, basal cells less obscure, rectangular, hyaline, and smooth; the male plants minute, scattered; dioicous; perichaetial leaves very large, long, ovate-lanceolate, membranes at margins and whitish almost without chlorophyll, costa golden brown, very broad, excurrent in long, rough arista, margins lacerate with denticulate cilia in apical portion; calyptra small, covering operculum; seta very short; capsule golden brown when mature, inclined, almost sessile, immersed in or slightly emergent from the perichaetial leaves, resembling a grain of wheat in size and appearance; operculum acture conical, curved, urn conic-ovoid, ventricose, very unsymmetric, 4-6 mm. long; annulus present, small; the outer peristome lacking or rudimentary, the inner a whitish, 16-plicate, truncate cone, thickened and papillose on the ridges; spores minute, 7-10 u in diameter, mature from early summer to early fall.

Habitat: On moist, shaded banks and clayey hillsides.

FAMILY: TIMMIACEAE

Timmia megapolitana Hedw.

Plants moderately robust, often in dense tufts, green to yellowish green above, brown below; stems erect to ascending, 3-10 cm. long, brown; central strand distinct; leaves crisped when dry, spreading when wet, linear-lanceolate to lanceolate, gradually narrowed to the acute apex, concave to carinate, 5-10 mm. long, 1-1.5 mm. wide, sheath hyaline to yellowish, about 1/6 length of leaf, usually wider than blade above, smooth to slightly papillose in upper part, costa strong, forming ridge on back of leaf, often appearing white in field, percurrent or ending a few cells below apex, smooth on back in lower part, papillose above, margins involute or slightly so, strongly toothed from apex to sheath, in upper 1/3 with broad teeth often composed of several cells; upper cells 10-14  $\mu$  in diameter, rounded, somewhat collenchymatous, median cells hexagonal to quadrate, 12-16  $\mu$  in diameter, cells of sheath nearly uniform, elongate and thin-walled, 60-120  $\mu$  long, 10-12  $\mu$  wide, without chlorophyll; autoicous; calyptra erect from seta behind capsule, cucullate, or split at middle and entire below; seta dark red, 2-2.5 cm. long; dry capsule yellowish brown, nearly erect to cernuous; operculum rounded, apiculate; urn oblong, usually unsymmetric, furrowed with age, about 3 mm. long and 1.25 mm. wide; annulus of 3-4 rows of cells, deciduous; peristome double teeth, yellowish pellucid, slightly papillose in lower half, more coarsely papillose and sometimes perforate in upper half,

inner peristome with basal membrane extending about 1/2 length of teeth and 64 cilia united into groups of 4 each, opposite to and approximate length of teeth; spores yellowish brown, slightly papillose to almost smooth, 12-18 u in diameter, mature in late spring.

Habitat: On moist banks, bases of trees, and on soil in crevices of rocks, in shade, often in calcareous areas.

FAMILY: AULACOMNIACEAE

Aulacomnium heterostrichum (Schwaegr.)

Plants loosely tufted, 4-5 cm. high, green above, primary stems about 1 cm. long, leaves dense, erect, inclined to one side, not curled when dry, elongate-ovate, 2-3 mm. long, 1-1.5 mm. wide, bases decurrent, costa stout at base, narrowing above, ending below apex, apices obtuse, margins plane or slightly recurved, coarsely toothed in upper 1/2-2/3, median cells of leaves rounded-quadrangle or ellipsoidal, 8-16 u in diameter, papillae single, autoicous, calyptra cucullate, long rostrate; seta reddish brown, inclined, operculum convex; obtuse, short rostrate, annulus present, teeth of peristome pale yellow, almost smooth in lower 2/3, hyaline; spores slightly papillose, 9-12 u in diameter, mature in late summer.

Habitat: On shaded, moist, rich soil, in woods, especially at bases of trees.

FAMILY: BARTRAMIACEAE

Bartramia pomiformis (Hedw.)

Plants in tufts, soft, green or yellowish green, densely tomentose below with brown papillose rhizoids; stems erect, branched, 1.5-8 cm. long; leaves crowded, crisp when dry, spreading when moist, narrowly lanceolate to linear-lanceolate, canaliculate, 4-7 mm. long, base ovate, costa stout, prominent on lower surface of leaf, strongly spinulose above, terete point, margins revolute, bistratose above and doubly serrate, serrate on both margin and recurved surface; median cells rounded quadrate, incrassate, upper cells of leaf oblong, elliptical, approximately 7 in. wide, papillose on upper and lower surfaces; basal cells oblong to linear, papillose on both ends; perigonia borne below and very close to perichaetium, calyptra narrowly cucullate, about 2 mm. long, fugacious; seta reddish brown, erect, up to 2 cm. long; capsule usually above stem tips, inclined or cernuous, unsymmetric, reddish to chestnut brown; operculum short, convex urn globose to ovoid, deeply furrowed when dry, 1.5 mm. long and 1.5 mm. in diameter; no annulus or very incomplete, peristome double, lanceolate, slightly papillose, about .4 mm. long, keeled, from a high basal membrane, 2/3 length of teeth, cilia poorly developed, 2-3 rudimentary or none; spores reddish brown, spherical to reniform, coarsely papillose, 20-26 u in diameter, mature in May or June.

Habitat: On moist, shaded soil and in moist crevices or rocks; in



woods, shaded ravines, canyons, on cliffs, and on swampy ground.

FAMILY: BRYACEAE

Bryum argentum (Hedw.)

Plants small, densely clustered silvery, stems short, erect, red, with central strand, the foliated branches terete, julaceous, leaves numerous, closely imbricate, very concave, broadly ovate, upper half colorless, lower have chlorophyllose, slightly or not at all decurrent, costa slender, ending in upper 1/3 of leaf except in variation lanatum, apices generally acuminate in a slender point, margins plane but slightly reflexed in basal part, upper cells of leaves rhomboid-hexagonal, with thin walls; lower rectangular, with thicker walls and especially thickened walls, up to 50 u long and 15 u wide, basal cells broader and short rectangular; dioicous, calyptra small, cucullate, fugacious; seta reddish, erect, slender, 1-1-5 cm. long; capsule reddish to light or dark brown, operculum convex or low conical, apiculate; urn oblong with short rounded neck, 1.5-2 mm. long, annulus of 3 rows of cells, deciduous; peristome double, up to 0.45 mm. high, teeth brownish yellow, linear-lanceolate, inner peristome pale yellowish, pellucid, spores yellowish, nearly smooth, 10-18 u in diameter, mature in winter or early spring.

Habitat: On dry compact soil, soil-covered rocks, ashes, and in crevices of brick and stone pavements, walks, or walls.

FAMILY: BRYACEAE

Bryum caespiticium Hedw.

Plants in tufts, yellowish green; stems erect, rarely more than 1 cm. high, reddish above, central strand present, with abundant growth of brown radicles below; leaves small below, larger and densely tufted above, slightly shrunken and twisted when dry, ovate to lanceolate, concave, 3-3.5 mm. long, 1 mm. wide, costa strong, red at base, excurrent, apices narrowly acuminate, margins revolute, entire; median cells of leaves narrowly rhomboidal, with thin walls, 70 u long by 10 u wide, marginal cells forming a faint border; dioicous; calyptra small, cucullate, fugacious; seta red or reddish at least below, 2-4 cm. long; capsule inclined, yellowish; operculum short conical; urn oblong-pyriform, contracted under the wide mouth when dry, the neck composing almost 1/2 the capsule; annulus of 2-3 rows of cells, deciduous; peristome double, teeth yellowish, minutely papillose, inner peristome hyaline, yellowish, finely papillose, segments almost as long as teeth, very wide, basal membrane 1/2 height of teeth, cilia as long as segments or nearly so; spores yellowish pellucid, small, usually 7-14 u in diameter, nearly smooth, generally maturing from May to July.

Habitat: On soil, stones, and walls.

FAMILY: BRYACEAE

Bryum pendulum (Hornsch.) Schimp.

Plants in tufts, yellowish to dark green; stems erect, red, about 5-9 mm. high, densely brown radiculose below; central strand present; leaves shrunken and twisted when dry, progressively larger from base to summit of stem, upper leaves close, erect-spreading, arranged in a rosette, narrowly ovate-lanceolate, reddish at base, costa red at base, very strong, excurrent, apices long, acuminate, margins revolute throughout, entire below, denticulate at apex, median cells of leaves hexagonal, with thick non-pitted walls; usually synoicous, sometimes subautoicous; calyptra small, cucullate, fugacious; seta erect, castaneous, 2-3 cm. long; capsule horizontal, brownish, 4-5 mm. long; operculum rather persistent, small conic, apiculate; urn elongate oval-pyriform, tapering into a neck about 1.5 mm. long; annulus wide, deciduous; peristome double, teeth brown, hyaline and papillose above, the inner peristome adherent to the teeth in lower 2/3 or more, coarsely papillose, carinate split, basal membrane about 2/5 height of the teeth, cilia sometimes absent, if present 2-3, short and imperfect or rudimentary; spores brownish, papillose, large, 20-35 u in diameter, maturing in early summer.

Habitat: On soil, rock, walls, and decaying logs.

FAMILY: BRYACEAE

Pohlia wahlenbergii (Web. & Mohr)

Plants slender, in large, soft, lax, glaucous-green or whitish green tufts, not glossy; stems erect, reddish to castaneous, bright red with age, 2-8 cm. long, branched below and matted with abundant brownish tomentum; leaves numerous, distant, shrunken when dry, spreading, narrowly to broadly ovate-lanceolate up to 3.5 mm. long and 1 mm. wide, narrowed at base and slightly decurrent, costa strong, green, or red at base and reddish above, ending below apex, margin plane, entire below, serrate above; median cells of leaves pellucid, rhombic-hexagonal, approximately 100 u long, 15-25 u wide, with thin walls, basal cells often reddish; dioicous; male plants often branching by innovations; antheridial clusters terminal, discoid, perigonial bracts wide spreading; calyptra small, cucullate, fugacious; seta erect, yellowish to reddish brown, 2-4 cm. high, abruptly hooked at the summit; capsule pendent, reddish brown when ripe, about as broad as long; operculum convex, apiculate; urn oval to broadly pyriform, 1.5-2.5 mm. long, the neck inconspicuous, short and broad, mouth wide when urn is dry and empty; annulus none; peristome double, teeth brownish yellow, pellucid, subhyaline and papillose at apex, inner peristome yellowish, same length as teeth, basal membrane about 1/2 height of teeth, cilia 2-4, approximate length of segments; spores brownish yellow, nearly smooth to papillose, walls rather thin, 14-24 u in diameter, maturing in late or early summer.

Habitat: In water and in wet places, such as ditches, springs,  
and wet clay banks.

FAMILY: BRYACEAE

Rhodobryum roseum (B.S.G.) Limpr.

Plants loosely tufted dark green; stems stout, erect from long creeping rhizome-like stolons, 2-5 cm. high, with minute appressed bract-like leaves up to the summit, densely purplish brown radiculose below; leaves numerous, in a conspicuous terminal rosette about 1 cm. in diameter, contorted when dry, spreading when moist, obovate-spatulate from a narrow base, up to 5 mm. long, costa strong at base, ending slightly below apex of leaf, percurrent in the sharp point, ending abruptly and narrowed and acuminate, twisted, margins revolute  $\frac{3}{4}$  length of leaf, plane above, entire below, sharply pinnulose-dentate above; median cells elongate-hexagonal, up to 100  $\mu$  long and 40  $\mu$  wide with thick walls, strongly pitted, diminishing in width toward margins, forming a border of 1-2 rows of narrow cells; dioicous; calyptra small, cucullate, fugacious, setae erect, reddish-brown, lustrous, 2-5 cm. long; capsule pale brown, horizontal to pendulous, up to 7 mm. long, operculum convex-conical, apiculate; urn oblong-cylindrical to cylindrical, incurved slightly, 2-4 cm. long, slightly contracted beneath mouth when empty and abruptly narrowed below, neck narrow, incurved, approximately  $\frac{1}{3}$  length of rest of capsule; annulus wide, didymous; peristome double, teeth large, yellowish to brown, linear-lanceolate, tapering to hyaline tip, narrowly bordered, inner peristome yellow, carinately split, spores brownish yellow, slightly roughened, 18-25  $\mu$  in diameter, mature

in late autumn or winter.

Habitat: In moist, shaded spots, on soil, on decayed logs, rich humus, bark of trees, and occasionally on stones.



FAMILY: MNIACEAE

Mnium affine (Bland.)

Plants moderately large, close tufts, green; fertile stems erect or nearly so, up to 3 cm. or more high, radiculose below, central strand present; leaves small and distant below, becoming larger and closer above and forming a terminal rosette, irregularly distorted when dry, spreading, on fertile stems ovate, 6-10 mm. long, bases narrowed, decurrent, costa strong, precurrent, apices cuspidate, border unistratose, of 2-5 rows of linear, prosenchymatous cells, margins usually toothed throughout with a row of sharp, distinct, slender teeth of 1-4 cells each, median cells of leaves hexagonal, in rows, radiating from costa, cell walls moderately thick, usually 20-40  $\mu$  largest cells near costa; dioicous; antheridial flower terminal, discoid, calyptra cucullate, fugacious; seta erect, capsule pendulous, operculum short, urn oblong, narrowed to a short neck 4-5 mm. long, annulus biseriate, peristome double, teeth greenish-yellow, 16, densely papillose, up to 1 mm. long, inner peristome orange to brownish, pellucid, densely papillose, cuspidate, spores yellowish pellucid, finely papillose, 22-32  $\mu$  in diameter, maturing in spring.

Habitat: On moist, shaded rock, soil, logs, stumps, and tree trunks, in woods, meadows and swamps.

FAMILY: MNIACEAE

Mnium cuspidatum Hedw.

Plants often in large mats or tufts, light to yellowish green; fertile stems reddish, simple, erect, 1.5-3 cm. high, radiculose below, often with sterile elongated shoots, suberect, creeping or deflexed; leaves few, distant, smaller at basal portion of stem, progressively more numerous, closer and larger upward and in the terminal rosette, crisped when dry, spreading when moist, obovate to oblong-oval, 2-4 mm. long, bases narrow, decurrent, costa rather strong, ending slightly below apex, percurrent, or confluent with border in apiculate apex, apices acute, short cuspidate or briefly acuminate, border unistratose, of 2-5 rows of linear, incrassate cells, margins serrate in upper 1/2-2/3 with single 1-celled, acute teeth; median cells of leaves irregularly rounded hexagonal, with thick, non-pitted walls, 20-25 u in diameter; synoicous; calyptra cucullate, inconspicuous, fugacious; seta single, erect, up to 3 cm. high; capsule subpendulous to pendulous, yellow to brownish yellow when mature; operculum rather large, conic, obtuse, urn oblong to oval of 3-4 rows of cells; peristome double, teeth greenish yellow, 16, papillose, ending in an awn-like tip; spores yellow, faintly papillose, 20-28 u in diameter, maturing in April and May.

Habitat: In moist, shaded places, on soil, stones, and rotten wood.

FAMILY: MNIACEAE

Mnium punctatum Hedw.

Plants rather large, in loose tufts, whitish green to dark green, sometimes reddish; stems erect, rigid, reddish, mostly simple, 2.5-7.5 cm. high, densely brown tomentose near to apex; central strand present; leaves distant except in terminal rosette, distorted when dry, lower smaller, rounded ovate, the rosulate spreading, oval, broadly obovate, or obovate-spatulate, 6-9 mm. long, 4-5 mm. wide, gradually narrowing to base, not decurrent to slightly so, costa strong below, percurrent, ending in apiculus, or ceasing just below tip, the apices broadly rounded to slightly emarginate, usually apiculate, border purplish or reddish, of 1-5 rows of elongated, incrassate cells, one to several layers of cells in thickness, margins entire; median cells of leaves irregularly hexagonal, or nearly rhomboidal, 50-150  $\mu$  long, 30-50  $\mu$  wide, incrassate and pitted or thin and without pits, corners not thickened, often in obliquely ascending rows from costa to border; usually dioicous, sometimes synoicous; calyptra cucullate, inconspicuous, fugacious; seta erect, purplish brown or reddish, rather glossy, 2-4 cm. long, 1-3 from same perichaetium; capsule horizontal to pendulous, yellowish or brown with age; operculum conic, acutely rostrate; urn ovoid, up to 5 mm. long, slightly furrowed when dry, neck short and inconspicuous; annulus of 1-3 rows of cells; peristome double, teeth 16, yellowish brown, about 0.6 mm. long, pellucid, papillose, the inner peristome

yellow, pellucid, finely papillose, basal membrane up to 1/2 height of segments, cilia 2-3, somewhat nodulose, slightly shorter than segments; spores brownish yellow, nearly smooth to roughened, 28-40 u in diameter, maturing in winter or spring, April and May.

Habitat: On soil, sand, and rocks, in damp woods, ravines, and swamps; often on moist stones in beds of brooks.

FAMILY: MNIACEAE

Mnium serratum Brid.

Plants rather slender, in soft, loose tufts, green to dark green; stems erect, often reddish, moderately short, 1.5-3 cm. high, simple, or with erect branches below; central strand present; leaves few, rather distant, erect-spreading, the comal close but not forming a rosette, crisped and twisted when dry, the lower ovate-lanceolate, often reddish, the upper oblong-ovate to oblong-spatulate, 4-5 mm. long, about 1.5 mm. wide, strongly decurrent, costa strong, reddish in upper leaves, percurrent and confluent with the border in the apiculus, in lower and middle leaves and often in upper leaves of sterile shoots ending below apex, the apices acuminate, border strong, reddish, of more than one layer of narrow cells, margins sharply serrate, teeth short, in pairs; median cells of leaves irregularly rounded to sub-quadrate, 20-35  $\mu$  in diameter, walls thin to somewhat incrassate, strongly collenchymatous, tending to be arranged in longitudinal rows; normally synoicous; calyptra cucullate, inconspicuous, fugacious; seta reddish below, erect, up to 2 cm. long, mostly single; capsule horizontal to subpendulous, yellowish to brown, up to 7 mm. long; operculum short rostrate, up to 2 mm. long; urn oval-oblong to oblong-cylindrical, up to 5 mm. long, abruptly narrowing into neck; annulus biseriate, deciduous; peristome double, teeth 16, yellowish or rusty brown, linear-lanceolate, papillose above, about 0.9 mm. long, inner peristome almost orange, densely papillose,

segments slender, ending in a cuspidate point, carinate, slightly shorter than teeth, basal membrane high, slightly more than 1/2 height of inner peristome; spores yellowish, finely roughened, 24-32 u in diameter, mature in May.

Habitat: Usually near streams on shaded banks or wet rocks, also on soil in woods, or in moist crevices of rocks.

FAMILY: HYPNACEAE

Amblystegiella confervoides (Brid.) Loeske

Plants dark green; stems filiform; irregularly branched; central strand absent; leaves distant, appressed when dry, erect-spreading when moist, ovate-lanceolate, narrowed to the insertion, about 0.25 mm. long and 0.1 mm. wide, ecostate, apices acute, margins entire; median cells oval to rhomboidal, averaging 21  $\mu$  long and 7  $\mu$  wide, alar cells quadrate to irregular, outer cells in rows extending up the leaf margin, about 3 rows of 5-10 cells each; monoicous; seta 5-8 mm. long; capsule inclined to horizontal, dark brown; operculum conic-apiculate; urn ovoid to cylindrical, symmetric to slightly curved, often contracted below mouth when dry and empty; annulus of 1 row of cells; peristome perfect, teeth 16, yellowish, confluent at base, inner peristome yellowish, segments not carinately split to narrowly so basal membrane 0.12 mm. high, cilia usually 1-2, as long as segments; spores yellowish, 7-9  $\mu$  in diameter, smooth, mature late summer to autumn.

Habitat: On moist, shaded rock, especially limestone.

FAMILY: HYPNACEAE

Amblystegium serpens (Hedw.) B.S.G.

Plants slender, very small; stem prostrate, irregularly branching; central stem present; leaves rather close; not widely spreading, ovate-lanceolate, subconcave, up to 1.2 mm. long and 0.5 mm. wide, commonly smaller, narrowed at insertion, slightly decurrent, costate to middle of leaf or slightly beyond, apices long tapering to a point, margins slightly serrate, marginal cells oblong-hexagonal, 30-35 u long, marginal alar cells quadrate to elongate, calyptra small, conical, dull brown, seta 1-3 cm. long, capsule light brown, cernuous, cylindric, 1.5-2 mm. long; operculum convex, conical, apiculate, annulus of 2-3 rows of cells, peristome perfect, teeth pale brown, 16, trabeculate, transversely striate below, margin hyaline, segments about as long as teeth; urn strongly curved; spores papillose, 14-18 u in diameter, mature in spring.

Habitat: On moist substrata, especially decaying wood.



FAMILY: HYPNACEAE

Amblystegium varium (Hedw.) Lindb.

Plants light green in younger portions, darker with age; stems irregularly divided, central strand present; leaves rather close, erect-spreading, broadly ovate to ovate-lanceolate, rapidly narrowed into acumen, slightly concave, usually 1.2 mm. long and 0.5 mm. wide, narrowed at insertion and slightly decurrent, costa strong, precurrent or nearly so, narrowing from base to apex, the apices long, margins entire, median cells of leaves rhomboidal-hexagonal, 2-5:1, with ends somewhat rounded, alar cells frequently in rows parallel with leaf margin, alar cells rectangular; monoicous; seta 1-3 cm. long; capsule brownish, cernuous, 1.5-2 mm. annulus of 2-4 rows of cells, deciduous, peristome perfect, hypnacious, teeth 16, united at base, about 0.4 mm. long, transversely striate below, hyaline and papillose above, trabeculate, segments as long as teeth, carinate, slightly split along keel, cilia 1-2, spores slightly papillose, 8-18  $\mu$  in diameter, mature in late spring.

Habitat: On moist, shaded substrata.

FAMILY: HYPNACEAE

Brachythecium campestre B.S.G.

Plants in wide yellow green mats; robust, prostrate or ascending up to 6 cm. or more in length, irregularly divided; central strand present; leaves of branches equally spreading, sometimes slightly falcate-secund, ovate-lanceolate, concave, 1.4-2 mm. long, costa extending to middle of blade or beyond, apices long acuminate, margins strongly serrate above; median cells of linear-flexuose, basal cells shorter and broader, alar cells quadrate; leaves of stems ovate-lanceolate, strongly plicate, about 2 mm. long, 0.6-1.1 mm. wide, apices long subfiliform-acuminate; autoicous; calyptra narrowly cucullate, extending to middle of urn; fugacious; seta reddish brown, long, smooth at base and slightly rough above; capsule reddish brown, inclined to horizontal, 2.5-3 mm. long, operculum long conic, apiculate; urn oblong-ovoid, unsymmetrical, generally curved, annulus narrow, peristome hypnaceous, perfect teeth, 16, spores brownish, slightly papillose, 15-20  $\mu$  in diameter, mature in late fall or in winter.

Habitat: On soil, stones, roots, bases of trees, and rotten wood, in moist, shaded places.

FAMILY: HYPNACEAE

Brachythecium oxydladon (Brid.) Jaeger and Sauerb.

Plants in wide mats, yellowish green, glossy; stems prostrate, irregularly divided; branches erect, leaves close, loosely imbricate, erect-spreading, plicate, concave, alar portion decurrent, costa extending to middle of leaf or beyond, apices slenderly acuminate, leaves of stems ovate-lanceolate, 1.5-2 mm. long, 0.45-0.8 mm. wide, margins serrulate throughout, leaves of stems ovate, 2-2.5 mm. long, 0.9-1.2 mm. wide, margins serrulate, median cells of leaves narrowly linear, flexuose, basal cells shorter, broader, subquadrate to quadrate, alar cells numerous, small, quadrate, rather thick-walled; generally dioicous; calyptra narrowly cucullate, extending to middle of urn, fugacious, seta reddish brown, smooth, 1.5-2.5 cm. long, capsule reddish brown, suberect, often inclined when dry, 3-4 mm. long, operculum conic, urn oblong, subarcuate, slightly contracted below mouth when dry, neck gradually narrowed to seta, 2.5-3.5 mm. long, annulus none, peristome hypnaceous, perfect, teeth 16, light reddish brown, 0.65 mm. long, segments carinately split, cilia 2, basal membrane broad, spores finely papillose, about 15  $\mu$  in diameter, mature in autumn or winter.

Habitat: On soil, rock, roots, on bases of trees in woods.

FAMILY: HYPNACEAE

Brachythecium salebrosum (Web. and Mohr.) B.S.G.

Plants in wide mats, dark yellow-green, glossy, stems prostrate, 6 cm. or longer, irregularly divided, branches usually terete-foliate; central strand present, leaves of branches erect-spreading, lanceolate, plicate, concave, 1.8-2.3 mm. long, 0.5-0.65 mm. wide, not decurrent, costa extending beyond middle of blade, apices abruptly acuminate, margins serrate above, entire to subserrulate below and reflexed, median cells linear, 8-21:1, basal cells shorter, broader, usually 2-3 rows of large subquadrate cells numerous, subquadrate with thin walls, leaves of stems erect-spreading, ovate lanceolate, concave, plicate, 1.5-2.2 mm. long, 0.6-1.1 mm. wide; autoicous, calyptra narrowly cucullate; seta reddish brown, smooth, 1-2 cm. long; capsule reddish brown, inclined to horizontal, operculum conic-apiculate to conic-acuminate, about 1 mm. long, annulus very narrow, inconspicuous, often remaining attached to the operculum; peristome hypnaceous, perfect teeth, 16, permanently margined, 0.55-0.7 mm. long, segments about as long as teeth, split, spores brownish, slightly papillose to nearly smooth, 15-20  $\mu$  in diameter, mature in autumn or early winter.

Habitat: On soil, stones, roots and trunks of trees, and rotten wood, in moist, shady places.

FAMILY: HYPNACEAE

Brotherella recurvans (Mx.) Fleisch.

Plants in mats, yellowish green, very glossy; stems prostrate, reddish, irregularly pinnately divided; central strand present; leaves close, imbricate at base, strongly complanately falcate-secund and turned downwards; leaves of stems ovate-lanceolate, slightly concave, 1.2-1.5 mm. long, not decurrent, costa absent or short and double, apices slenderly long acuminate, margins often narrowly recurved below, sharply serrate above; median cells of leaves linear-flexuose, about 90  $\mu$  long, basal cells yellowish or brownish, shorted, wider, alar cells hyaline or colored, 4-8 very much enlarged and inflated, 3-4 along leaf margin and 3-4 transversely, the group bordered above by a few subquadrate, smaller cells; dioicous; calyptra cucullate, smooth, fugacious; seta brown, glossy, 1-2 cm. long; capsule pale chestnut-brown, the tapering base darker, obliquely inclined to almost horizontal; operculum conic, long rostrate; the urn oblong-oval, slightly curved when young, strongly arcuate with age, 1.5-2 mm. long; annulus absent; peristome hypnaceous, perfect, teeth 16, segments about as long as teeth, basal membrane about  $\frac{2}{5}$  height of teeth, cilia 1-2; spores brownish, granulose, 16-18  $\mu$  in diameter, mature in late autumn.

Habitat: On soil, humus, bases of trees, and on decayed wood, in moist, shady places.

FAMILY: HYPNACEAE

Brhynia graminicolor (Brid.) Grout

Plants slender in mats, yellowish green above, brownish below, stems prostrate, irregularly divided, 1-2.5 cm. long; branches erect, terete-foliate; central strand present; leaves of branches loosely imbricate, ovate-lanceolate, concave, decurrent costa extending past the middle of the leaf, apices long acuminate, lower surfaces of blade strongly papillose at distal end of cell, median cells of leaves linear, fuxulose, alar cells few, subquadrate; leaves of stems larger and more slenderly acuminate, 0.75-1 mm. long, 0.5-0.15 mm. wide; dioicous; sporophytes not frequent; calyptra cucullate, smooth, fugacious, seta reddish brown, 10-15 mm. long, rough, capsule reddish brown, inclined, operculum long conic to short rostrate, about 1/2 length of urn; urn subglobose to ovoid, annulus simple; peristome hypnaceous, perfect, teeth 16, confluent at base, inner peristome yellowish, spores nearly smooth, 13-15  $\mu$  in diameter, probably maturing in autumn.

Habitat: On soil, or rocks, in moist, shady places.

FAMILY: HYPNACEAE

Campylium hispidulum (Brid.) Mitt.

Plants slender, in tufts, bright green, yellowish below, stems prostrate, irregularly divided; central strand present; leaves widely spreading, triangular-cordate, abruptly narrowed to acumen, 0.5-0.8 mm. long, decurrent, costa none, acumen slender, 1/3 to as long as main body of the leaf, margins subserrulate throughout, more strongly serrulate at base; median cells of leaves elongate-oblong with blunt ends, 5-6 u wide, basal cells shorter, wider, alar cells numerous, subrectangular to quadrate; leaves of branches similar, less broadly ovate, more gradually acuminate; autoicous, calyptra narrowly cucullate, smooth, fugacious; seta chestnut-brown, 1.5-2 cm. long; capsule cernuous, 1.4-2 mm. long, yellowish brown, darker with age; operculum ~~con~~apiculate or convex-conic with an upturned apiculation; urn oblong, curved or slightly so, contracted beneath mouth and furrowed when dry and empty; annulus of 1 row of cells; peristome hypnaceous, perfect, teeth 16, yellowish, about 0.45 mm. long, inner peristome high, cilia 2-3, nodose to slightly appendiculate, approximate length of segments; spores yellowish, minutely papillose, 10-14 u in diameter, mature in late spring or summer.

Habitat: On roots and bases of trees, decaying wood, and humus, in moist shaded places.

FAMILY: HYPNACEAE

Chamberlainia acuminata (Hedw.) Grout

Plants slender, in wide mats, green, dark green, yellowish green; stems prostrate, up to 8 cm. in length, distantly and irregularly divided; branches unequal, ascending to erect, terete-foliate, subjulaceous, tapering to acute ends, 1-3 cm. long; central strand present; leaves of branches erect-spreading when moist, erect-imbricate and appressed when dry, lanceolate to ovate-lanceolate, concave, slightly plicate, 1-1.6 mm. long, 0.4-0.6 mm. wide, bases narrowed, slightly decurrent, costa extending to above middle of blade, apices acuminate, margins frequently slightly revolute, entire below, serrulate above; leaves of stems similar; median cells of leaves linear-flexuose to oblong-rhomboidal, 5-10:1, basal cells enlarged, thin-walled, a distinct area extending from margin to costa; dioicous; calyptra glabrous, narrowly cucullate, extending to middle of urn, fugacious; seta reddish brown, smooth, 1-2 cm. high; capsule brown, erect, 1.5-3 mm. long; operculum conic, acute to short rostrate; urn cylindrical, usually symmetric, occasionally slightly curved, tapering at base, 1.5-3 mm. long; annulus none; peristome hypnaceous, teeth 16, carinately split, about length of teeth, basal membrane about 1/4 height of segments; spores chestnut-brown, papillose, 12-18  $\mu$  in diameter, mature in autumn or winter.

Habitat: On soil, rock, bases of trees decaying wood, and humus,



in moist, shady places.

FAMILY: HYPNACEAE

Cirriphyllum boscii (Schwaegr.) Grout

Plants in mats; golden green; stems 8-10 cm. long, often with stolons, central strand well differentiated; branch leaves erect-spreading when moist, loosely imbricate when dry, broadly ovate, spoon-shaped, very concave, 2-2.5 mm. long, 1.4-1.5 mm. wide, bases decurrent with angles subauriculate, costa single and extending 1/2 length of blade, apices rounded and abruptly acuminate, the acumination filiform and twisted one-half turn, margins serrate to the middle; median leaf cells narrowly linear-rhomboidal, basal cells shorter, alar cells not differentiated; dioicous; calyptra narrowly cucullate, smooth fugacious; seta reddish brown, smooth, 1.5-3 cm. long; capsule brown, inclined, unsymmetric, gradually narrowing into the seta, 3-4 mm. long, operculum conic, long rostrate, about 1/2 length of sporophyte, the urn oblong, about 2 mm. long and 1 mm. in diameter, contracted beneath mouth when dry and empty, annulus of 2 rows of cells; peristome hypnaceous, perfect teeth 16, spores nearly smooth, about 16  $\mu$  in diameter, mature in autumn.

Habitat: On soil and rocks, in moist woods and in fields.

FAMILY: HYPNACEAE

Climacium americanum Web. and Mohr.

Plants robust, loosely cespitose, yellowish green, glossy, primary stems prostrate, secondary stems erect, 5-8 cm. high, irregularly divided into a cluster of spreading foliated, terete branches, 1.5-2.5 cm. long, tips acute, central strand present, paraphyllia present, conspicuous on branches and secondary stems; erect spreading when moist, broadly lanceolate, upper leaves oblong-lanceolate, upper leaves ovate-lanceolate, bases broad, costa nearly to apex, apices acute, margins denticulate below, sharply serrulate above; median cells of leaves oblong-hexagonal, ends rounded, alar cells quadrate along margin to diamond-shaped elsewhere; apical and upper marginal cells larger than median and rhombic-oblong, dioicous; calyptra inclosing capsule, cleft on one side to apex; seta erect, chestnut brown, cylindrical 5-6 mm. long, operculum conic, about 1 mm. long; urn nearly smooth, slightly contracted below mouth when dry and empty; annulus none; peristome double, teeth orange, 16, slender, segments yellowish, longer than teeth, granular-papillose, basal membrane very narrow, spores yellowish, minutely roughened, 16-18  $\mu$  in diameter, mature in autumn.

Habitat: On rotten logs, stumps, wet soil, and rocks; in damp, shady woods, and in stumps.

FAMILY: HYPNACEAE

Entodon cladorrhizans (Hedw.) C. Muell.

Plants in wide, yellow green, glossy mats; stems about 5 cm. long, subpennately divided, densely foliated and flattened, 2-3 mm. wide, attenuate at tips; leaves of branches imbricate, oblong-ovate very concave, 1-2 mm. long, 0.5-1 mm. wide, costa none or indistinct, short and double, apices acute, frequently slightly turned backwards, margins plane, entire, or slightly serrulate at apex; median cells linear-fusiform, 6 u wide, 10-15:1, alar cells numerous, quadrate-rectangular, 8-10 along the margin; leaves of stems larger, bases broader, and apices more abruptly acute; monoicous; calyptra cuculate; seta erect, smooth, reddish brown, glossy, 8-20 mm. long; capsule chestnut brown, erect, symmetric, 2.5-3.5 mm. long, 4-6:1; operculum conic-rostrate, 0.4-1 mm. long; urn oblong-cylindric, 2-2.7 mm. long, tapering abruptly to seta, slightly contracted below mouth; annulus large, of 2-3 rows of cells, deciduous; peristome double, deeply inserted below mouth, teeth chestnut brown, 16, about 0.45 mm. long with 15-20 cross-bars, basal membrane none; spores castaneous, papillose, 14-20 u in diameter, mature in late autumn or early winter.

Habitat: On bases of trees, old logs, and sometimes on soil rich in humus.

FAMILY: HYPNACEAE

Entodon compressus (Hedw.) C. Muell.

Plants in wide yellowish green mats, sometimes dull; foliated stems and branches flattened, when dry the leaves often slant downward from both sides of ridge extending along the shoot, up to 1 mm. in width, stems subpinnately divided; central strand present; leaves of branches imbricate, very concave, oblong-ovate, 1-1.1 mm. long, 0.4-0.5 mm. wide, costa none to short and double, apices acute to broadly obtuse, margins entire; median cells of leaves linear, basal cells shorter and broader, alar cells numerous, quadrate, extending almost to middle of leaf base, 8-10 along the margin; leaves of stems larger, about 1.5 mm. long, 0.9-1 mm. wide; monoicous; calyptra cucullate; seta erect, 0.6-1.5 cm. long; capsule erect, brown; operculum conic-rostrate, beak slender, curved; urn ovoid to elliptic, 2-2.5 mm. long, 0.6-0.7 mm. in diameter, contracted toward mouth; annulus large, of 2 rows of cells; peristome almost orange, double, teeth 16, cross-bars close and regularly arranged, densely and minutely papillose, inner peristome fragile, carivately split, densely and minutely papillose, basal membrane not evident, cilia none; spores mature from autumn to early winter.

Habitat: On decaying logs and soil, in the shade, and on the roots of trees near water.

FAMILY: HYPNACEAE

Entodon seductrix (Hedw.) C. Muell.

Plants in wide yellowish green mats, glossy; stems about 5 cm. long, subpinnately divided, juleaceous, 5-25 mm. long; leaves imbricate; deeply concave, oblong-elliptical to ovate, narrowed at the insertion, 0.8-1.4 mm. long, about 0.7 mm. wide, costa short and double, apices short apiculate, margins plane or slightly reflexed at the base, entire, or slightly serrulate at apex, median cells of leaves linear, 6 u wide, alar cells numerous, quadrate, 10-20 along the margin, sometimes extending along the margin 1/4 length of the leaf; leaves of stems larger, ovate, monoicous, calyptra cucullate, covering about 1/2 of the capsule; seta reddish brown, erect, glossy, about 1.5 cm. long, capsule reddish brown, erect, symmetric; operculum conic-rostrate, frequently suboblique, 0.5-0.8 mm. long; sporophyte cylindric, 2-3.5 mm. long, annulus rather indistinct, 2-3 rows of small cells, peristome double, teeth 16, deeply inserted below mouth, with 7-10 crossbars appearing above mouth of capsule; spores yellowish, minutely roughened, 14-18 u in diameter, mature from late summer to winter.

Habitat: On decaying wood, bases of trees, moist soil and rocks, but frequently in rather dry situations.

FAMILY: HYPNACEAE

Eurhynchium hians (Hedw.) Jaeger & Fauerb.

Plants slender, in mats, often appearing flattened, green to yellowish green, slightly glossy; stems prostrate, 3-10 cm. long, irregularly to subpinnately divided; branches ascending, 3-12 mm. long; leaves erect-spreading, appearing complanate when dry, ovate, plane to concave, .8-1.1 mm. long, 0.5-0.7 mm. wide, sometimes papillose because of projections of cell walls, not decurrent, costa distinct, extending  $1/2$ - $4/5$  length of leaf, ending in a dorsal spine, apices obtusely acute to short acuminate, often twisted, margins sharply serrate to base; apical cells rhombic, 2-4:1, median cells of leaves linear-oblong, 5-10:1, basal cells shorter, alar cells indistinct; stem leaves rather distant, ovate, 1-1.6 mm. long, 0.75-1.2 mm. wide, bases clasping, not decurrent, costa  $1/2$ - $4/5$  length of blade, ending in a dorsal spine, apices abruptly acute to shortly acuminate, margins sharply serrate nearly to base; dioicous; calyptra narrowly cucullate, glabrous, fugacious; seta dark reddish brown, 1-2.5 cm. long, very rough with papillae; capsule reddish brown, inclined to horizontal, curved; operculum long rostrate,  $3/4$  length of urn; urn oblong-cylindric, 2-2.5 mm. long, about 1 mm. in diameter, annulus narrow, of 2 rows of cells; peristome hypnaceous, teeth 16, about .6 mm. long, inner peristome fragile, segments narrowly carinately split, approximate length of teeth; spores yellowish green, 10-16  $\mu$  in diameter, smooth to slightly papillose, mature in late autumn or early winter.

Habitat: On soil, in moist, shady places.



FAMILY: HYPNACEAE

Eurhynchium serrulatum (Hedw.) Kindb.

Plants flattened, in thin mats, green to bright yellowish green or pale green, slightly glossy when dry; stems prostrate, irregularly divided; branches elongated, somewhat 2-ranked; central strand present; leaves of branches complanate, distant, thin, slightly contorted when dry, ovate-lanceolate, subconcave to concave, 1.5-2 mm. long, not decurrent, costa narrow, extending to middle of blade or beyond, apices long acuminate and often twisted, margins plane, strongly serrulate from below the middle to the tip, median cells of leaves 7-10:1, apical cells not conspicuously different but slightly shorter and broader, basal cells somewhat broader and shorter, alar cells not especially differentiated; leaves of stems cordate-triangular, abruptly and narrowly acuminate, apices very slender, margins subserrulate above; autoicous; calyptra narrowly cucullate, glabrous, fugacious; seta chestnut-brown, smooth, about 2.5 cm. long; capsule pale yellow to dark chestnut-brown, cernuous; operculum conic, 1/3-1/2 length of urn, slenderly rostrate, beak long, recurved; urn curved, about 2 mm. long, contracted below mouth when dry and empty; annulus large deciduous; peristome hypnaceous, perfect, teeth 16, yellowish brown, narrowly lanceolate, basal membrane approximately 1/2 height of segments, cilia usually 3; spores yellowish, finely papillose, 9-12  $\mu$  in diameter, mature in early fall.

Habitat: On humus, rotten logs, in moist, shaded places.

FAMILY: HYPNACEAE

Hygroamblystegium irriguum (Wils.) Loeske

Plants medium in size, dark green to blackish green; stems rigid, irregularly divided; central strand well developed; paraphyllia few, at the intersection of branches with stems; leaves erect-spreading to spreading, elongate-triangular to triangular-ovate, 1-1.5 mm. long, narrowed to the insertion, slightly decurrent, costa thick and wide, narrowing into the acumen, percurrent or merging into the apex and becoming indistinct, apices gradually and long acuminate, the tip acute or subacute, margins plane, entire to subserrulate; median cells of leaves elongate-hexagonal or hexagonal-rhomboidal, 9-20  $\mu$  long, basal cells wider, quadrate to subrectangular, with walls thicker and often colored, frequently but not always one or more rows of basal cells enlarged and slightly inflated, alar cells not forming distinct auricles; autoicous or dioicous; calyptra small, conical, fugacious; seta brownish, 1.5-2.5 cm. long; capsule brownish, almost cernuous, subcylindric, strongly arcuate; operculum about 0.9 mm. high, convex-conic, apiculate; urn arcuate and contracted below mouth when dry and empty; annulus 3 rows of cells; peristome perfect, hypnaceous, teeth 16, orange, united at base, basal membrane 0.25-0.3 mm. high, cilia 2-3; spores papillose, 14-20  $\mu$  in diameter, mature in spring, or early summer.

Habitat: On various substrata, in water or very moist places.

FAMILY: HYPNACEAE

Hypnum cupressiforme Hedw.

Plants very variable in form, in mats, yellowish, grayish green or brownish green, occasionally tinged with red, glossy; stems prostrate, greenish, irregularly pinnately divided, up to 10 cm. long, outer cells in cross section small and thick-walled; branches spreading to ascending, often curved; central strand small; paraphyllia few, narrowed; leaves of stems closely imbricate, falcate-secund, oblong-lanceolate, rather abruptly narrowed into long acumen, about 2.4 mm. long and 0.6 mm. wide, concave at base, slightly tapering to insertion, costa absent or very short, apices long and filiform-acuminate, curved toward substratum, margins plane, usually entire throughout, occasionally denticulate near apex; median cells of leaves linear-flexuose, about 5 u wide and 10-15:1, alar cells numerous, rather opaque, subquadrate, 6-10 in marginal row, 2-3 of these at extreme basal angle inflated, not forming distinct auricles; dioicous; calyptra succullate, glabrous, fugacious; seta red, about 1.5-4 cm. long; capsule brown, suberect, 3-4 mm. long; operculum convex, with an acuminate to subrostrate apex; urn unsymmetric or curved, subcylindric to oblong, slightly contracted below mouth when dry and empty; annulus of 1-2 rows of cells; peristome hypnaceous, perfect, teeth 16, rust-colored, coarsely papillose, inner peristome yellowish, papillose, basal membrane 1/3 height of teeth, cilia 2-3, papillose, nodose; spores olive-green, 14-18 u in diameter, papillose,

mature in late autumn or early winter.

Habitat: On soil, rock, roots, and bases of trees, in moist, shaded places.

FAMILY: HYPNACEAE

Hypnum curvifolium Hedw.

Plants robust, complanate, resembling braids, in wide mats, green to yellowish green above, brown below, glossy; stems prostrate, regularly or irregularly pinnately divided; branches short, unequal; central strand small; paraphyllia few to none; leaves in two rows, falcate-secund, stem leaves oblong-ovate to elongate-triangular-ovate, concave, 1.4-2 mm. long, 0.7-0.8 mm. wide, abruptly narrowed at the cordate to subcordate base, slightly decurrent, costa absent or short and double, apices gradually long acuminate, channelled, margins plane, entire throughout or serrulate near apex and base; median cells of leaves linear-flexuose, 35-75 u long, 5-7 u wide, basal cells shorter, broader, thick-walled, pitted, often colored, a few alar cells subquadrate; dioicous; calyptra narrowly cucullate, glabrous, fugacious; seta reddish brown below, about 2.5 cm. long; capsule light brown to dark brown, inclined to horizontal; operculum conic, apiculate; urn oblong, curved, plicate, slightly contracted beneath mouth when dry and empty; annulus of 3 rows of cells, deciduous; peristome hypnaceous, perfect, teeth 16, apices hyaline, papillose, basal membrane about 1/3 height of teeth, cilia 2-3, hyaline, papillose; spores yellowish, finely roughened, 19-23 u in diameter, mature in early spring,

Habitat: On decaying wood, stones, and soil, in moist, shaded places.

FAMILY: HYPNACEAE

Hypnum imponens Hedw.

Plants robust, somewhat flattened, in broad mats or sheets, dark green to yellow-green above; stems prostrate to suberect, red to reddish brown, stiff, 10 cm. or more long, regularly pinnately divided; central strand present; paraphyllia numerous, broad, often ciliate; leaves of stems strongly falcate-secund to circinate, broadly triangular-oblong, gradually narrowed to apex, concave, about 2 mm. long, 0.5-0.7 mm. wide, not decurrent to slightly so, narrowed and slightly rounded to insertion, costa none or very short, apices curving toward substratum, slenderly long acuminate, margins plane, or slightly recurved at base, serrulate; median cells of leaves linear-flexuose, 6-15:1, basal cells wider, thick-walled, colored, often orange-brown, alar cells small, subquadrate to quadrate, 4-6 along margin, at extreme angles 3-4 marginal cells larger, slightly inflated, auricles small, distinct; dioicous; calyptra narrowly cucullate, glabrous, fugacious; seta chestnut-brown, 1.5-3.5 cm. long; capsule suberect, brown with age, 3-4 mm. long; operculum conic, long apiculate to rostellate, beak often oblique; urn cylindrical, about 2.4 mm. long and 1 mm. in diameter, slightly curved; annulus of 2-3 rows of cells; peristome hypnaceous, perfect, teeth 16, golden yellow, about 0.54 mm. long, tips papillose, inner peristome yellowish, finely papillose, basal membrane about 0.18 mm. high, segments carinately split, cilia 1-2; spores yellowish, minutely roughened, 13-18  $\mu$  in diameter,

mature in late autumn or early winter.

Habitat: Chiefly on rotting wood but also on roots, soil, and rocks, in moist, shaded places.

FAMILY: HYPNACEAE

Leptodictyum trichopodium (Schultz) Warnst.

Plants in loose tufts or mats, light green or yellowish; stems 2-4 cm. long, with branches prostrate to erect-ascending; central strand present; leaves moderately distant, widely spreading, nearly at right angles to stem, ovate to ovate-lanceolate, widest in basal 1/8, abruptly long acuminate, plane or nearly so, costa strong, ending before apex, acumen ending in 1 cell, margins often slightly serrulate by projecting cells; median cells of leaves elongate-hexagonal, with thin walls, basal cells wider, rectangular to oblong, in several rows, alar cells scarcely different, monoicous; calyptra small, conical, fugacious; seta 25-4 cm. long; capsule light brown, darker with age, cernuous; operculum conic-apiculate; urn ovoid to oblong-cylindric, unsymmetric to subarcuate, 2-3 mm. long; annulus present; peristome perfect, hypnaceous, teeth 16, brownish yellow, about 0.6 mm. long, inner peristome yellowish, segments, approximate length of teeth, carinately split, basal membrane 0.24 mm. high, cilia 1-4; spores minutely roughened, 14-18 u in diameter, mature from late autumn to early spring.

Habitat: On moist earth.



FAMILY: HYPNACEAE

Plagiothecium denticulatum (Hedw.) B.S.G.

Plants moderately robust, in flattened mats, green to pale green, glossy; stems prostrate, irregularly divided; branches prostrate to ascending; central strand of few small cells; median leaves of well developed branches complanate, overlapping wet or dry, oblong ovate, broadest slightly above base, slightly concave and unsymmetric, 1.5-3 mm. long, bases slightly narrowed to insertion, strongly decurrent, costa none to short and double, occasionally forking with one branch reaching 1/3 length of leaf, apices acute, margins plane or sometimes narrowly recurved below, entire except a few occasional short teeth near apex; median cells of leaves linear to linear-rhomboidal, 10-15  $\mu$  wide, 10-15:1, usually chlorophyllose, basal cells broader and shorter, pellucid, alar cells subrectangular, slightly inflated, hyaline, and strongly decurrent, not forming distinct auricles; calyptra small, cucullate, smooth, fugacious; seta 2.5-4 cm. long; capsule sub-erect to horizontal, 2-3 mm. long, usually smooth when dry; operculum long conic to short rostrate; urn cylindric, 1.5-2 mm. long, somewhat unsymmetric or curved, with a distinct neck, contracted below mouth when dry and empty; annulus large, deciduous, of 2-3 rows of cells; peristome perfect, teeth 16, 0.6 mm. long, hyaline and papillose above, yellowish below, segments slender, sometimes carinately split, as long as teeth, basal membrane as high as peristome; spores yellowish or

green, smooth, 8-13 u in diameter, mature in summer.

Habitat: On rock, humus, and rotten logs, in moist, shaded places.

FAMILY: HYPNACEAE

Plagiothecium micans (Sw.) Paris

Plants slender in thin mats, whitish green to yellowish green; stems prostrate, 2-4 cm. long, irregularly divided; branches prostrate; central strand absent; bunches of filaments often present in leaf axils; median leaves of well developed branches rather distant, complanate to subcomplanate, erect-spreading, often twisted and usually curved to one side, very unsymmetric, often somewhat contorted when dry, ovate-lanceolate, subconcave, 0.75-1.2 mm. long, not decurrent, costa usually lacking, apices shortly and abruptly acuminate, margins serrulate near apex only; stem leaves gradually long acuminate; median cells of leaves linear-flexuose, 6-8  $\mu$  wide, 9-15:1, at insertion of leaf and stem, usually a row of conspicuously shorter and broader cells extending across base, alar cells few, subquadrate, occasionally 1-2 inflated cells at the angles; monoicous; calyptra small, split on one side, whitish to straw-colored, smooth, fugacious; seta orange to reddish brown, 1-1.7 cm. long; capsule small, light chestnut-brown, darker with age, unsymmetric, cernuous; operculum conic-apiculate to very short rostrate, the beak oblique; urn ovoid to short oblong, without neck, up to 1 mm. long, somewhat contracted under mouth when dry and empty; annulus lacking; peristome hypnaceous, perfect, teeth 16, yellowish below, hyaline and papillose above, segments of inner peristome not carinately split, approximate length of teeth, cilia 1-2, nodose, basal membrane up to 0.09 mm. high; spores yel-

lowish green, papillose, 11-16 u in diameter, mature from early to midwinter.

Habitat: On rotten wood, bark, and soil, in moist woods.

FAMILY: HYPNACEAE

Plagiothecium muellerianum Schimp.

Plants slender, in thin mats, yellowish green, flattened, very glossy; stems irregularly divided, branches 5 cm. or more long, often tapering into stolons; central strand absent; median leaves of well developed branches complanate, extending forward and curved upward near tips, ovate-lanceolate, subconcave to concave, 1.4-1.8 mm. long, not decurrent, costa none to faint, apices rather long apiculate or abruptly acuminate, margins plane, entire; median cells of leaves linear, 80-100 u long, 3-6 u wide, basal and alar cells scarcely differentiated; dioicous; calyptra small, split on one side, short; capsule reddish yellow to brown, erect to slightly inclined; operculum conic-rostellate, at least 1/2 length of urn; the urn symmetric, obovoid, with long neck, contracted beneath mouth when dry and empty; annulus of 1-2 rows of cells; peristome perfect, teeth yellowish, 16, apices papillose, inner peristome pale, finely papillose, basal membrane up to 0.14 mm. high, cilia 2, short, unequal, fugacious; spores yellow, smooth, 10-14 u in diameter, mature in autumn.

Habitat: On moist soil and rocks, especially in ravines.

FAMILY: HYPNACEAE

Plagiothecium roeseanum (Hampe) B.S.G.

Plants caespitose, pale green to yellowish green, slightly glossy; stems and branches ascending to erect; median leaves of well developed branches close, imbricate, erect-spreading, not at all complanate, but not quite equally spreading, ovate oblong, concave, about 2 mm. long and 1 mm. wide, decurrent, costa absent to faint or strong, apices usually abruptly, briefly, and slenderly acuminate, acumen often ending in a hyaline hair-point, margins entire, rarely subserrulate near apex; median cells shorter and broader, alar cells not inflated; dioicous; calyptra small, split on one side, smooth, fugacious; seta red, usually 2-3 cm. long; capsule erect to slightly inclined; operculum 0.8-1 mm. long, conic-apiculate to obliquely short rostrate; urn yellowish green to brown, cylindric-oblong, smooth or faintly longitudinally furrowed, urn with neck; annulus large, of 1-2 rows of small cells, deciduous; peristome hypnaceous, perfect, of 16 teeth, inner peristome whitish, densely papillose, segments small, sometimes carinately split, basal membrane about 0.14 mm. high, cilia very strong, 1-3, usually 2, about as long as segments; spores olive green, 10-14  $\mu$  in diameter, roughened, mature in summer.

Habitat: On soil and stones, in moist, shady places.

FAMILY: HYPNACEAE

Platygyrium repens (Brid.) B.S.G.

Plants in rather thin mats, glossy, dark green; stems prostrate, 2-6 cm. long, irregularly divided, branches short, cylindrical, ascending, slightly curved; leaves imbricate when dry, erect spreading when moist, oblong-ovate, concave, decurrent, costa short, apices acuminate, margins recurved below, entire; linear-rhomboidal, alar cells numerous, quadrate, extending up margin of leaf, dioicous, calyptra cucullate, long, glabrous, seta erect, chestnut brown, glossy, smooth, 1-2 cm. long; capsule erect, brown, operculum long conic, obliquely rostrate; urn chestnut brown, erect, peristome teeth 16, linear-lanceolate, with hyaline margins, raised lines at base, nearly as long as teeth, carinate split, spores minutely roughened, 12-18  $\mu$  in diameter, mature in early autumn.

Habitat: Commonly on bark, also soil.

FAMILY: LESKEACEAE

Anomodon attenuatus (Hedw.) Hueben.

Plants slender, in loose, wide tufts, primary stems prostrate, secondary stems abundantly branching, many branches slender, no central strand, leaves of stems appressed when dry, spreading when moist, broadly ovate at base, gradually narrowed to upper sublinguate portion, concave, 0.8-1.8 mm. long, bases narrowed to insertion, costa strong, pellucid, ending near apex, apices subacute, margins entire below, slightly serrulate near apiculus; median cells of leaves obscure, densely papillose on both sides, irregularly hexagonal to rounded quadrate, 6-9  $\mu$  in diameter; dioicous; calyptra cucullate; seta 1.5-2 cm. long; capsule erect; operculum long rostrate, 1/2 length of urn; urn 2-3 mm. long, 0.6 mm. in diameter, with stomata; annulus lacking peristome double, teeth 16, yellow, narrowly lanceolate, 0.4 mm. long, segments of inner peristome yellowish, filiform, spores greenish brown, almost smooth, 7-9  $\mu$  in diameter, mature in autumn.

Habitat: On rocks, bases of trees and stumps, in woods.



FAMILY: LESKEACEAE

Anomodon minor (Beauv.) Linbd.

Plants in loose mats, green above, brownish below; primary stems prostrate, flagellate, secondary stems erect or nearly so, up to 4 cm. long, central strand present; leaves of secondary stems 2-ranked, appressed when dry, spreading when moist, broadly lingulate from a broadly ovate base, opaque, concave at base, costa strong, pellucid, ending below apex, apices rounded, margins entire; majority of cells of leaves densely papillose on both surfaces, papillae small, median cells rounded, basal median cells elongate, usually not papillose; dioicous; calyptra cucullate, extending to middle of urn or farther; seta erect, about 1 cm. long; capsule erect, symmetric, 2-3 mm. long; operculum conic, acuminate; the urn chestnut-brown in color, oblong-cylindric, about 2.4 mm. long, without stomata, mouth small; annulus of 2 rows of cells; peristome teeth 16, narrowly linear-lanceolate, about 0.32 mm. long, hyaline, faintly papillose, segments of inner peristome very short to rudimentary to none, from a very narrow basal membrane, cilia none; spores brownish, papillose, 9-18  $\mu$  in diameter, mature in late autumn or winter.

Habitat: Usually at base of trees, occasionally on rocks; in woods.

FAMILY: LESKEACEAE

Anomodon rostratus (Hedw.) Schimp.

Plants slender, dense mats, yellowish green, primary stems slender, up to 4 mm. long, slender, julaceous; central strand small; leaves densely imbricate, lanceolate from an ovate base, concave, 0.75-0.9 mm. long, distinct costa extending almost to the apex, apices acuminate, hyaline, smooth, margins frequently recurved, crenulate-papillose; median cells of leaves rounded, opaque, papillose with several papillae on each surface, 8-10  $\mu$  wide, median basal cells elongated, smooth slightly papillose, dioicous; calyptra cucullate; seta erect, 6-10 mm. long, castaneous; capsule erect, symmetrical, chestnut brown; operculum obliquely rostrate; annulus present, peristome teeth 16, linear-lanceolate, about 0.22 mm. long, papillose, segments of inner peristome linear, about as long as teeth, spores brownish, nearly smooth, 7-10  $\mu$  in diameter, mature in autumn.

Habitat: On bases of trees and on rocks, in moist places.

FAMILY: LESKEACEAE

Haplohymenium triste (Cesati) Kindb.

Plants very slender, in thin, loose mats, dull green; stems prostrate or pendent, irregularly to subpinnately divided; branches erect to ascending; central strand absent; leaves appressed when dry, squarrose-spreading when moist, very brittle, apices often broken off in dried specimens, the leaves of stems lanceolate from an ovate sub-clasping to clasping base, concave, 0.5-0.8 mm. long, costa narrow, extending to middle of blade, papillose on lower surface, apices acute, short apiculate, or obtuse, margins plane, crenulate because of turgid, bulging, papillose cells; median cells of leaves pellucid, turgid, with several papillae on each surface, oblong-rectangular to rounded polygonal; leaves of branches narrowly lingulate to lanceolate from an ovate base, apices rounded to apiculate, margins crenulate because of turgid, bulging, papillose cells; sporophytes not available.

Habitat: Usually on bark, occasionally on rocks.

FAMILY: LESKEACEAE

Leskea/gracilescens (Hedw.)

Plants in thin mats, dark green, brown below, stems prostrate, up to 4 cm. long, pinnately divided, branches numerous, simple, erect, no central strand, paraphyllia few, leaves of stem appressed-imbricate when dry, erect-spreading when moist, ovate, straight, symmetric, costa subpercurrent, apices acute, margins entire, cells of leaves unipapillate on lower surface, usually smooth on upper, median cells quadrate-hexagonal, 8-10 u wide, alar and basal cells quadrate; autoicous; calyptra cucullate; seta red, 8-10 mm. long, capsule erect, reddish, operculum conic, obtuse, urn oblong-cylindric, tapering at base, annulus of 2 rows of cells, deciduous; peristome double, teeth 16, whitish, linear-lanceolate, about 0.4 mm. long, spores smooth, 8-11 u in diameter, mature in early summer.

Habitat: On base of trees, rotten wood, rocks, and soil.

FAMILY: LESKEACEAE

Myurella careyana Sull.

Plants very slender, in cushions or loose mats, pale glaucous-green; stems prostrate to ascending or erect, irregularly divided; branches numerous, often flagelliform at end, brittle when dry; central strand absent; paraphyllia none; leaves of stems moderately distant, loosely imbricate to erect-spreading, broadly ovate to rounded, very concave, bases strongly narrowed to insertion, costa short to none, apices rather abruptly apiculate to slenderly and long acuminate, margins spinulose-dentate throughout; median cells of leaves pellucid, with a large papilla over lumen on lower surface of each cell, elliptic-rhomboid or rounded rhombic, about 24  $\mu$  long and 10  $\mu$  wide, basal and apical cells nearly smooth, elongated; dioicous; calyptra small, disappearing; seta up to 1 cm. long; capsule suberect, nearly symmetric; operculum conic; urn oblong-ovoid, about 1 mm. long when including neck; annulus present; peristome perfect, hypnaceous, teeth yellowish, 16, segments of the inner peristome approximate length of teeth, cilia 2, slightly shorter than teeth; spores small, rarely seen.

Habitat: In crevices and hollows of moist shaded limestone.

FAMILY: LESKEACEAE

Thelia asprella Sull.

Plants small, in densely interwoven mats, 1-2 cm. deep, glaucous-green or grayish green; stems prostrate, 5 cm. or more in length, irregularly pinnately divided; branches numerous, close, short, up to 5 mm. long, julaceous; central strand present; paraphyllia various; leaves of stems broadly ovate to subcircular, 0.8-1 mm. long, 0.5-0.75 mm. wide, very concave, decurrent, costa extending to middle of leaf, apices abruptly and narrowly acuminate, margins bordered throughout with long cilia; cells of leaves usually papillose, median cells pellucid, rhomboid-elliptic, each with a long, 2-3 pointed papilla on lower surface, the apical linear, the alar quadrate to rectangular, almost smooth; dioicous; calyptra cucullate; seta red, 5-10 mm. long; capsule erect, symmetric; operculum conic-rostrate; urn oblong-cylindric, 2-2.5 mm. long, about 0.5 mm. in diameter; annulus absent; peristome whitish, teeth, very slender, finely papillose, inner peristome papillose, consisting of basal membrane about 1/3 height of teeth, segments and cilia lacking; spores pale yellow, smooth, 12-15 u in diameter, mature in autumn.

Habitat: On bark of trees on stumps, in woods.

FAMILY: LESKEACEAE

Thuidium delicatulum (Hedw.) Mitt.

Large plants, in interwoven mats, bright green or yellowish above, fern-like in appearance; stems prostrate or arched, elongate, up to 12 cm. in length, regularly twice to thrice pinnately divided; paraphyllia very numerous, simple to branched, linear to multiform, apical cells with 2-4 papillae, majority of lateral papillae at center of cell or approximately so; leaves of stems appressed when dry, erect-spreading when moist, furrowed, triangular-ovate, 0.8-1 mm. long, 0.75-0.9 mm. wide, subcordate at base, costa strong at base, gradually thinner toward tip of leaf, disappearing in apex of leaf, apices gradually acuminate, margins recurved, papillate-serrate; median cells of leaves oblong-quadrate, 7-8 u wide, 1-3:1, usually unipapillate on both surfaces, the papillae up to 6.8 u long; leaves of branches smaller, ovate, about 0.6 mm. long and 0.3 mm. wide, acuminate, apical cells with 2-4 papillae; dioicous; in perichaetial leaves ciliate; calyptra cucullate; seta brown, 2-3 cm. long; capsule yellowish, inclined to horizontal; operculum conic-rostrate, 1.5-2 mm. long; urn curved, cylindrical, 2.5-4 mm. long; annulus of 2-3 rows of cells; peristome large, teeth 16, up to 0.9 mm. long, segments of inner peristome lanceolate, about as long as teeth, basal membrane about 1/3 height of peristome; spores brownish yellow, very slightly roughened, 14-18 u in diameter, mature in late autumn or winter.

Habitat: On soil, rotten wood, and stones, in moist woods.



FAMILY: LESKEACEAE

Thuidium pygmaeum B.S.G.

Plants very small, in thin mats, olive-green, or dark green; stems prostrate, pinnately to bipinnately divided, 1-2 cm. long; branches very slender, papillose; central strand present; paraphyllia few, simple, linear, 2-5 cells long, apical cells with 2-4 papillae; leaves of stems distant, triangular-ovate, 0.24-0.41 mm. long, 0.1-0.3 mm. wide, subdecurrent, costa strong, ending below apex, the apices long and narrowly acuminate, margins often slightly recurved below; median cells of leaves quadrate-hexagonal, about 6  $\mu$  wide, incrassate, pluripapillate; leaves of branches appressed-incurved when dry, ovate to ovate-lanceolate, 0.15-0.4 mm. long, 0.23-0.38 mm. wide, apices obtuse to subacute, margins papillose-crenulate, apical cells with 2-4 papillae; autoicous; calyptra cucullate, straw-colored to whitish, 9-15 mm. long; capsule inclined to horizontal; operculum conic, obliquely rostrate; urn oblong, unsymmetric, about 1 mm. long, arcuate, mouth wide; annulus large; peristome gynaceous, perfect, yellowish brown below, hyaline and papillose above, teeth 16, lanceolate, filiform at apex, segments of inner peristome, carinately split, approximate length of teeth, basal membrane about 0.15 mm. high, cilia 3, short; spores brownish, 6.8-10.2  $\mu$  in diameter, mature in autumn.

Habitat: Usually on stones in calcareous regions, occasionally on soil.

FAMILY: LESKEACEAE

Thuidium recognitum (Hedw.) Lindb.

Plants large, in interwoven mats, yellowish green above, darker below, stiff when dry, fern-like in appearance; stems prostrate or arched, elongate, up to 12 cm. in length, pinnately to bipinnately divided; primary branches approximately equal in length; central strand present; paraphyllia numerous, simple or branched, linear to multiform, apical cells with 2-4 papillae, majority of lateral papillae at ends of cells; leaves of stems broadly triangular, 0.6-1.5 mm. long, up to 1 mm. wide, cordate at base, costa subpercurrent to percurrent, strong throughout the blade, often filling the apex, apices abruptly acuminate, margins serrulate, usually plane; median cells of leaves oblong-rhombic to rounded-quadrate, about 9  $\mu$  wide, usually unipapillate on both surfaces; branch leaves ovate to ovate-lanceolate, up to 0.4 mm. long and 0.3 mm. wide, apical cells with 2-4 papillae; dioicous; inner perichaetial leaves not ciliate; calyptra cucullate; seta chestnut brown, 2-2.5 cm. long; capsule chestnut brown, somewhat inclined, up to 4 mm. long; operculum short rostrate, about 1.2 mm. in length; urn curved, oblong-cylindric, 2.5-3 mm. long; 0.6-0.7 mm. wide; annulus of 3 rows of cells; peristome large, teeth 16, up to 0.9 mm. in length, segments of inner peristome pale, lanceolate, approximate length of teeth, basal membrane about 1/3 height of peristome, cilia 2-3 nodose, finely papillose; spores yellowish, granular-roughened, 10-14  $\mu$  in diameter, mature

in summer.

Habitat: On soil, rotten wood, and rocks, in moist shaded woods, often in limestone regions.

FAMILY: LEUCODONTACEAE

Leptodon trichomitrium (Hedw.) Mohr

Plants dark to yellowish green, in wide, loose tufts; primary stems prostrate, filiform; secondary stems numerous, outwardly curved, abundantly and subpinnately branched, densely foliate; leaves of secondary stems close, loosely erect-spreading, subplicate when dry, concave at base, ovate to ovate-lanceolate, 1.5-2 mm. long, slightly decurrent, costa single, thin, extending to middle of blade, or short and double, apices rather short acuminate to acute, margins reflexed, entire or nearly so; median cells of leaves oblong fusiform, about 8 u wide and 30 u long, median basal cells 45-50 u long apical and upper marginal cells oval, oblong, or rhomboidal, 2-3:1; leaves of branches smaller, apical margins frequently serrulate; autoicous; perichaetial leaves as long as seta or longer, sheathing, slenderly acuminate; calyptra cucullate, extending to below middle of capsule; seta short, slightly longer than the capsule; the capsule emergent; operculum short rostrate, extending about 1/2 length of capsule; urn ovoid-cylindric to oblong-ovoid, slightly narrowed below, approximately 1.5 mm. long; peristome teeth 16, whitish, tips very slender, inner peristome a membrane, commonly adhering to teeth; spores orange, almost smooth, about 23-25 u in diameter, mature late autumn to winter.

Habitat: On trees, in woods, occasionally on rocks.

FAMILY: FABRONIACEAE

Fabronia ravenelii Sull.

Plants small, in thinly cespitose mats or patches; branch leaves symmetrically erect-spreading when moist, ovate-lanceolate, coarsely and irregularly serrate-dentate by single marginal cells of varying length, 0.6-1 mm. long, costa about 1/2 length of leaf, rather thin in vanishing in elongated cells; leaf cells linear rhombic to oblong-hexagonal, 8-10 u wide; basal cells quadrate to short-hexagonal; monoicous; seta 4-7 mm. long; capsule ovoid to urn-shaped when empty, with a thick neck, about 1 mm. long, operculum mammillate; peristome single, teeth 16, at first united in pairs, broad, obtuse, in folded when wet, spreading to reflexed when dry; calyptra cucullate, small deciduous; spores 17 u in diameter, maturing in spring.

Habitat: On bark of trees and decaying logs.

FAMILY: FABRONIACEAE

Schwetschkeopsis denticulata (Sull.) Broth.

Plants small, very slender, soft, in thin tufts, light green; stems 2-4 cm. long, irregularly divided, slightly flattened to subjulaceous; leaves of stems close, erect-spreading, concave, ovate to ovate-lanceolate, 0.4-0.9 mm. long, 0.3-0.4 mm. wide, costa none, apices abruptly short and narrowly acuminate, margins plane, serrulate throughout, leaves of branches smaller, more gradually acuminate to acute; median cells oblong-oval, or oblong-linear, 5-8 u wide, 2-8:1, unipapillate on dorsal surface, the papillae small; alar cells quadrate to short rectangular, extending through most of the leaf base; marginal row of cells quadrate to rhombic, extending nearly to base of acumination; dioicous; calyptra cucullate; seta erect, yellowish red, 4-8 mm. long; capsule erect or suberect, symmetric; operculum conic, rostrate, approximately 2/3 length of urn; the urn oblong-ovoid, 2-3:1; annulus none; peristome double, teeth 16, yellow, lanceolate, segments with approximate length and width of teeth, cilia absent; spores about 15 u in diameter.

Habitat: Usually on bases of trees, occasionally on rocks.

FAMILY: FONTINALACEAE

Fontinalis duriaei Schimp.

Plants aquatic, submerged to emerged, slender to medium, green to brownish green; stems flaccid, up to 30 cm. long, irregularly pinnately divided; branches erect-spreading; leaves distant, bases up to 2 mm. apart, blades erect-spreading, flaccid to firm, occasionally subconcave at base, broadly ovate-lanceolate to oval-lanceolate, usually 3-5 mm. long, occasionally up to 6 mm. in length, rarely up to 7 mm., 1-3 mm. wide, costa none, apices generally short and broadly acuminate, leaf tips usually acute, margins often entire throughout, commonly serrulate in apices; median cells of leaf linear or narrowly rhomboidal, 8.5-17  $\mu$  wide, 6-8:1; alar cells enlarged, rectangular, quadrate, or hexagonal, group of alar cells subrectangular in outline and parallel with margin of blade if auricles absent, or suborbicular if auricles distinct, auricles of some degree frequently present, leaf bases frequently rounded, not decurrent to briefly so; dioicous; perichaetium oval to oblong; upper perichaetial leaves suboval to suborbicular, apices usually broadly obtuse; calyptra long conical; seta .25 mm. in length; capsule immersed to slightly emergent; operculum obtuse conical, .8-1.25 mm. long; urn suboval, or oblong, 1.5-2.5 mm. long, 1-1.5 mm. in diameter, 1.7-2:1, occasionally contracted beneath mouth when dry and empty; peristome teeth brownish orange, linear-acuminate, often united in pairs at apex, 0.75-1 mm. long, muricate, trellis brownish orange, approximate length

of teeth, muricate, perfect; spores green to yellowish brown, finely muricate to smooth, 13.6-20 u in diameter; mature in summer.

Habitat: Normally submerged but frequently exposed by recession of water.



FAMILY: Ptilidiaceae

Blepharostoma trichophyllum (L.) Dum.

Plants in scattered stems among mosses or less frequently in small compact patches, pale green in color; paroicous and monoicous; stems 8-20 mm. long, filiform, flexuous, ascending or procumbent, usually sparingly branched, the branches lateral; rhizoids long and colorless, rather scarce; leaves somewhat distant, widely spreading, divided nearly to the base into 3-4 rigid setaceous segments composed of 8-12 uniseriate cells; underleaves transversely inserted, resembling the leaves but rather smaller, 2-3-partite on the branches; female inflorescence terminal on the stem and branches; involucre bracts larger than the leaves, deeply divided into several forked laciniae which are 2-3 cells broad at base, otherwise uniseriate; bracteole rather smaller; perianth longly exserted, cylindrical-clavate, obtusely trigonous above, the mouth slightly contracted, with rigid cilia, the cilia to 7 cells long; capsule oval, purplish-brown, the wall bi-stratose; spores 9-11  $\mu$  in diameter, minutely verruculose; elaters bispiral, reddish-brown; male bracts immediately or some distance below the involucre bracts, or at apex of the branches, and resembling the bracts; antheridia solitary, rarely in pairs, oval-globose, small, on a pedicel of nearly equal length, without paraphyses.

Habitat: On moist rocky banks and occasionally on stumps.

FAMILY: LEPIDOZIACEAE

Telaranea nematodes (G. ex Aust.) Howe

Plants arachnoid, 300-450 u wide, very minute, prostrate, excessively delicate, pale to whitish-green, quite transparent; stems 120-150 u wide, 90-105 u high; cortical cells of main stems normally in 10-12 rows; leaves on main stems 3-4 lobed, 350-500 u long, the linear lobes uniseriate, 5-8 cells long; cells thin-walled, delicate, in middle of lobes 20-40 u wide, 90-110 u long; oil bodies subglobular, glistening, minute, several per cell; cuticle smooth; underleaves smaller than leaves, 2-3 lobed to base; autoecious; male inflorescences usually on short lateral branches; female inflorescence terminal, usually on very short postical branches; the bracts and bracteoles in 2-3 series; bracts deeply 3-4 lobed, to within 1-3 cells of base; perianth terete below, somewhat narrowed in the obtusely trigonous distal portion, mouth very longly ciliate, cilia sharp; capsule with wall 3-stratose, epidermal cells narrowly rectangular; spores 14-16 u in diameter, pale brown, delicately areolate; elaters 180-240 u long, 9-13 u in diameter, 9-10 u when 2-spiral; spirals red-brown, 4 u wide, rather tightly wound.

Habitat: A species largely of hygrophytic sites, particularly frequent in costal swamps, along slow-moving coastal streams and on mossy banks.

FAMILY: PTILIDIACEAE

Trichocolea tomentella (Ehrh.) Dum.

Plants in large pale green or cream-colored patches frequently of one to two feet in diameter; dioicous; stems 5-12 cm. or longer, yellowish-green, brownish below, flexuous, suberect or procumbent, 2-3 pinnate, the branches lateral, the apex of stem and of the principal branches thickened, paraphyllia composed of simple or branched cell-threads numerous on the front and side of stem; rhizoids absent except a few at base of stem; leaves distant or approximate on the stem, imbricate on the branches, patent, almost transversely inserted, divided nearly to the base into two unequal lobes, each divided into narrow lobes with numerous capillary segments; cells hyaline, at base of leaf rectangular and thin-walled, narrowly cylindrical on the segments and appearing as if jointed; cuticle straiite-punctuate; underleaves hardly as broad as the stem, about half the size of the leaves, subquadrate, female inflorescence terminal on the stem or principal branches; calyptra cylindrical-clavate, fishy, covered with capillary, branched, coarsely striate-punctuate paraphyllia; capsule oblong, purplish brown, the wall of several layers of cells, pedicel long; spores 10-15 u in diameter, reddish-brown, smooth; elaters bispiral; male bracts on the end of the principal branches, resembling the leaves but with more connivent lobes; antheridia large, globose, generally in pairs.

Habitat: On wet banks in sheltered ground and in marshes.

FAMILY: LEPIDOYIACEAE

Bazzania trilobata (L.) Gray

Plants in large yellowish-green patches, becoming whitish-green when dry; stems 3-10 cm. long, stout, green, rigid, erect or procumbent, furcately branched, the branches somewhat circinate at apex, flagella several, frequently branched; dioicous; rhizoids colorless, scarce, almost absent above; leaves 3-4 mm. long, imbricate, convex, horizontal, very obliquely inserted, asymmetrically oblong-ovate, the antical base strongly arched, slightly decurrent, the apex narrowed and truncate-trilobed, sinus lunate or acute, lobes triangular, acute or apiculate, sometimes subobtuse; cells 28-36  $\mu$ , rounded-hexagonal swollen at the margin, trigones large; cuticle finely granulate; underleaves large, suberect, slightly broader than long, the apex irregularly 4-5 lobed, the margins inciso-lobate; female inflorescence on a short postical branch; involucral bracts broadly ovate, 1/3-1/2 laciniate-ciliate; peristome lanceolate, trigonous above, the mouth contracted and obtusely 3-lobed; capsule oblong-oval, composed of five layers of cells; spores 12-15  $\mu$ , brown, thickly papillose; elaters bispiral, reddish-brown, androecium on a short postical branch, shortly spicate, bracts small, concave, the apex truncate or dentate; antheridia generally single.

Habitat: On moist shaded rocky banks and on rocks.

FAMILY: LEPIDOZIACEAE

Lepidozia reptans (L.) Dum.

Plants in loose, less frequently compact, green patches; stem 1.5-3 cm. long, prostrate or with the apex ascending, loosely pinnate and occasionally slightly bipinnate, sometimes flagelliferous at the apex, postical flagella long, mostly near base of stem; rhizoids somewhat numerous below, scarce above; leaves approximate to imbricate, convex, obliquely inserted, almost quadrate, the antical base rounded but not semicordate and only crossing half of the stem, 3-4-lobed to 1/3, lobes triangular, acute or subobtuse, incurved, 4-8 cells wide at base; cells 22-30 u in diameter, quadrate-hexagonal, walls slightly thickened; cuticle nearly smooth; under-leaves, quadrate, 4-lobed to 1/4-1/3, lobes short, obtuse or subacute, incurved; female inflorescence on short postical branches; involucral bracts much larger than the leaves, hyaline, rotund-ovate, the apex irregularly 3-6 dentate; bracteole broadly oval, irregularly dentate; perianth hyaline, cylindrical-fusiform, plicate at the apex, the mouth contracted; capsule cylindrical-oblong, yellowish-brown; spores 11-14 u, yellowish-brown, thickly papillose; elaters reddish-brown, bispiral; androecia on very short postical branches; antheridia generally solitary, oval-globose, brown, shortly pedicellate.

Habitat: Moist banks, stumps and sandstone rocks.

FAMILY: CALYPOGEIACEAE

Calypogeia trichomanis (L.) Corda

Plants in thin, flat, green to bluish-green or brownish-green patches; stems 2-4 cm. long, thick, prostrate, or ascending at the apex, sparingly branched; paroicous; rhizoids long and colourless, numerous from the base of the underleaves; leaves very obliquely inserted, patent at an angle of about 60 degrees, imbricate, slightly convex, broadly ovate to cordate, slightly or not decurrent; cells 40-50 u, hexagonal, pellucid, the walls thin or slightly thickened, trigones generally absent; cuticle smooth or nearly so; underleaves orbicular, scarcely twice as broad as the stem, slightly decurrent, 1/4 bilobed, the sinus narrow, rounded-obtuse at the base, lobes rounded obtuse, the margins entire; female inflorescence on very short branches, proceeding from the axils of the underleaves; capsule longly pedicellate, cylindrical, brown, the wall of two layers of cells; spores 10-13 u, smooth, pale brown; elaters 8-10 u broad, reddish-brown, bispiral; androecia on very short branches from the axils of the underleaves; bracts in 2-3 pairs, concave, 2-3-lobed; antheridia 1-2, oval; gemmae in subglobose clusters on the attenuate and small-leaved apices of the stem or branches, rotund to elliptical, 1-2 celled, yellowish-green.

Habitat: Banks, side of ditches, logs, and peat moors, ascending to 3000 feet altitude.

FAMILY: CEPHALOZIACEAE

Nowellia curvifolia (Dicks.) Mitt.

Plants in flat rosy-purple or green patches, usually on decaying wood; monoicous and dioicous; stems 10-18 mm. long, slender, pellucid, flexuous, nearly simple, the few branches ascending; rhizoids long, colourless, scattered, to apex of stem; leaves laxly imbricate, antically secund, ascending, very concave, almost transversely inserted with a narrow base, obliquely obovate, the antical margin slightly curved, not decurrent, the postical margin semi-cordate at the base with the margin broadly incurved, sacculate, bilobed to beyond the middle, sinus broad, usually lunulate, lobes triangular at base, ending in long incurved capillary segments composed of a single series of 8-10 cells; cells 17-24 u, subquadrate to quadrate-hexagonal, the walls thickened; cuticle smooth; involucre bracts large, oblong-oval, conduplicate and channelled, with the margins reflexed in the upper part, free or slightly connate at the base, 1/2 bilobed, lobes sharply acuminate; bracteole nearly similar to the bracts; perianth large, oblong, deeply trigonous, the mouth broad, truncate, spinous-ciliate, the cilia 3-4 cells long; capsule broadly oval, reddish brown; spores 7-9 u, pale yellowish-brown; androecium at the apex of short branches; bracts in 4-6 pairs, imbricate, conduplicate, bilobed, resembling the leaves but more symmetrical and with shorter laciniae, the antical margin with a tooth; antheridia solitary, globose; gemmae at the apex of the stem, globose-oblong, colourless, 1-celled.

FAMILY: CEPHALOZIACEAE

Cephalozia bicuspidata (L.) Dum

Plants in whitish-green or dark green, occasionally rosy patches, or scattered among mosses; monoicous; stems .5-2 cm. long, pale green, prostrate or ascending, irregularly branched, with small-leaved flagella; rhizoids scattered, colourless; lower leaves smaller and distant, upper leaves larger and subimbricate to imbricate, obliquely to nearly transversely inserted, not decurrent, concave, oval, 1/2 bilobed, sinus rounded or obtuse, lobes lanceolate, slightly unequal, straight or somewhat incurved; leaves on the branches frequently small, divergent, flat and bifid to near the base into subulate segments; cells large, 35-42 u, pellucid, irregularly polygonal, walls slightly thickened; cuticle smooth; underleaves absent; female inflorescence on a short, rarely elongate, postical branch, involucre large, 1/2 bilobed, lobes lanceolate-acuminate; bracteole resembling the bracts; perianth subfusiform, trigono-prismatic above, of one layer of cells, the mouth constricted, denticulate or setulose; capsule oblong-oval, blackish-brown; spores 12-16 u, cinnamon-brown, thickly papillose; elaters reddish-brown; androecium spicate at the middle or end of the branches; antheridia globose; gemmae rare, whitish-green, spherical, 1-celled, in clusters at the apex of the stem or branches.

Habitat: On moist soil in many situations from sea-level to 3800 feet altitude.



Habitat: On decaying wood in moist sheltered places and on moist peat, sub-alpine, ascending to 1200 feet altitude.

FAMILY: CEPHALOZIACEAE

Cephaloziella byssacea (Roth) Warnst.

Plants in patches, dark green to purple or sometimes blackish; leafy shoots about 0.2-1 mm. wide; stems 3-10 mm. long, prostrate to ascending, simple or sparingly branched, rigid, brittle, about 70  $\mu$  thick; epidermal cells of stem quadratic; rhizoids on sterile stems few, beneath the female inflorescence often numerous and long colorless; leaves alternate, transversely inserted, not decurrent, simply 2-lobed, quadrate to ovate, those of sterile stems distant, those of fertile stems subimbricate to imbricate and gradually larger toward the stem tip, the apex often incurved; margins entire; lobed equal, ovate-lanceolate, acute or subacute, 6-10 cells wide at base, entire; sinus descending  $1/2$ - $2/3$  the leaf length, acute or obtuse; cells of the leaf middle 7-12  $\mu$ , of the lobes and margin as well as the base about the same, quadrate to polygonal; walls thin or only slightly thickened; cuticle smooth; gemmae in clusters on young leaves and underleaves at the apex of the sterile stems, ovoid, 2-celled, with a wart-like projection at each end; underleaves present throughout, sometimes 2-lobed, their tips incurved; plants unisexual; male plants usually in separate patches; male inflorescence terminal or on ventral branches; female inflorescence terminal; female bracts suddenly much larger than the leaves, 2-lobed for  $1/4$ - $1/3$  their length; perianth fusiform, about  $1/2$ -emergent, 3-6-plicate, greenish to purplish below, hyaline above, rather gradually

contracted to the mouth; mouth crenulate, sporangium ovoid, very small, reddish brown; elaters 6-8  $\mu$  thick, 2-spiral; spores 6-9  $\mu$ , almost smooth, purplish brown.

Habitat: On dirt banks, on rocks, on rotten wood, and on sand.

FAMILY: CEHPALOZIELLACEAE

Cephaloziella hampeana (Nees) Schiffn.

Plants in thin green to brownish patches; monoicous; stems 3-8 mm. long, flexuous, flaccid, sparingly branched; rhizoids long and scattered, numerous; leaves on the sterile stems broader than the stem, distant and spreading, 1/2 bilobed or deeper, lobes oblong-ovate, acute to sub-acute, 4-6 cells broad at base; cells 11-14  $\mu$ , thin walled; leaves on fertile stems larger, distant, and spreading; underleaves absent; female inflorescence at the end of the stem or elongated branches; bracts larger than the leaves; involucral bracts loosely surrounding the perianth, 1/3 lobed, the lobes acute, dentate; perianth oblong-ovate to linear-oblong, 4-5 plicate, hyaline above, the mouth shortly dentate with usually elongated cells; androecia terminal or intercalary on long branches, bracts in several pairs, larger than the leaves, closely imbricate, concave, 1/3 bilobed, the lobes entire or slightly and obtusely dentate.

Habitat: On moist ground on peat mosses, sides of ditches, sandy and turfy ground.

FAMILY: JUNGERMANNIACEAE

Jamesoniella autumnalis (D.C.) Steph.

Plants in dark green or yellow-green flat patches, with frequently a rufescent tinge on the upper parts; dioicous; stems 1-3 cm. long, prostrate with ascending apex, flexuous or arcuate, simple or branched, branches preceding from the postical angle of the leaves, repeatedly innovant from below the female inflorescence; rhizoids colourless, somewhat numerous to near apex of stem; leaves horizontal or sometimes slightly secund antically and oblong-oval in the lower part of stem, rotund-oval above, imbricate, convex, entire or frequently retuse, decurrent antically; cells 26-34  $\mu$ , rounded-polygonal, walls thin, trigones rather small but distinct; marginal row small, oblong-quadrate, walls thicker; chlorophyll granules numerous; cuticle almost smooth; underleaves subulate, present only in the younger parts; involucrel bracts erect with apex squarrose, oblong to rotund-oblong, the apex entire, generally with a lacinate tooth on one or both sides near the base; bracteole large, lacinate; fertile perianth longly exserted, almost cylindrical but slightly clavate, smooth below, 4-5-plicate near the slightly contracted apex; mouth longly and unequally ciliate; capsule oval, the wall with four layers of cells, pedicel rather long; spores 11-15  $\mu$  reddish-brown, finely verruculose; elaters reddish-brown, laxly bispiral; antheridia solitary, large, on a rather long pedicel.

Habitat: On half buried stones and rocks, stumps and mossy walls

in shady places in the subalpine region.

FAMILY: JUNGERMANNIACEAE

Lophozia ventricosa (Dicks.) Dum.

Plants in bright green to yellowish-green, seldom brownish patches, or loosely tufted among mosses, generally on an inorganic substratum; dioicous; stems 1-3 cm. long, green above, usually brown or violet underneath, prostrate or ascending, simple or sparingly branched; rhizoids numerous, long, colourless, to apex of stem; leaves imbricate, slightly oblique, half embracing the stem, generally flat, horizontal, quadrate-ovate to quadrate, shortly decurrent, 1/4-1/2 bilobed, sinus rounded, obtuse, lobes acute; cells 24-30 u, nearly the same size throughout, rounded-polygonal, walls thin, trigones small; cuticle smooth; underleaves absent; involucre bracts larger than the leaves, concave, divided irregularly to about 1/3 into 2-5, most commonly 3, lobes, the sinus usually plicate, lobes unequal, acute; bracteole variable, bifid or entire; perianth longly exerted, oblong-oval, obtusely plicate at the apex, mouth hardly lobed, dentate, the teeth somewhat distant, mostly 1 cell long; capsule oblong-oval, dark reddish-brown; spores 10-14 u in diameter, cinnamon-brown, minutely verruculose; elaters bispiral, 85-125 u long by 7-9 u broad, reddish-brown; male bracts terminal, in 5-8 pairs, imbricate, transversely inserted; antheridia 1-2, oval on a pedicel of about half their length; gemmae always present, yellow-green, at the apex to the leaf-lobes, mostly 2-celled.

Habitat: On soil and among rocks, tree stems, ascending to the summit

of the tall hills.



FAMILY: JUNGERMANNIACEAE

Plectocolea hyalina (Lyell) Mitt.

Plants in patches, pale green to yellowish green or occasionally purplish; stems up to 15 mm. long, prostrate with ascending tips, little to much branched, often reddish on the ventral side; rhizoids numerous, long, hyaline to usually reddish; leaves alternate, succubous, somewhat decurrent on the dorsal margin, loosely imbricate, not lobed to hardly 2-lobed, roundish with wide base, concave; apices rounded or some retuse; margins entire but somewhat undulate; cells of the leaf middle 25-36 u, of the margin 25-30 u, of the base 35-43 u, rounded to oval-hexagonal, walls thin, trigones rather large, distinct; oil bodies 4-10, elliptical, underleaves wanting; plants unisexual; male plants more slender; male inflorescence terminal; antheridia 2-3, globose, with a very short stalk; female bracts larger than the leaves of sterile stems; perianth ovoid, the lower 1/4 united with the bracts, 2/5-1/2-emergent, 4-6-plicate above; seta 1-2 cm. long, of 3 concentric rows of cells; sporangium ovoid-globose, reddish brown, the wall 2 cells thick; elaters 8-10 u thick, short, rather suddenly attenuate, 2-spiral, reddish brown, spores 14-17 u, granular-papillate, brown.

Habitat: On damp clayey banks and on wet rocks.

FAMILY: JUNGERMANNIACEAE

Pedinophyllum interruptum (Nees) Pears.

Plants in broad, depressed, yellow-green to olive-brown patches on calcareous soil; monoicous; stems 1.5-4 cm. long, leafy throughout, flexuous, prostrate with apex ascending, irregularly branched; rhizoids long, fuscous, numerous to near apex of stem; leaves firm, imbricate, subcomplanate, nearly horizontal, oval quadrate, the apex rounded or retuse; cells 23-30  $\mu$ , opaque, the marginal row nearly quadrangular, trigones minute, usually confined to near the apex of the branches, filiform, simple or divided; involucre bracts resembling the leaves, but larger, the margins recurved; perianth shortly exserted, broadly obovate, slightly longer than broad, laterally compressed, the mouth wide, bilabiate, rounded, crenulate to denticulate; capsule oval, dark brown; spores 12  $\mu$  in diameter, reddish-brown, nearly smooth; androecium terminal median, bracts in 4-5 pairs, closely imbricate, erect, concave, saccate at base, the antical margin with a small lobe inflated at base; antheridia generally solitary, oval-globose.

Habitat: On shaded calcareous rocks.

FAMILY: JUNGERMANNIACEAE

Sphenolobus hellerianus (Nees) Steph.

Plants very small, in yellow-green to brown depressed patches on decaying wood; stems 5 mm. long, filiform, flexuous or arcuate, prostrate or ascending, simple or occasionally with several branches, rhizoids numerous, except on gemmiferous shoots, to the apex of stem, leaves small, distant, larger and imbricate towards the female inflorescence, transversely inserted, not decurrent, obtusely conduplicate-concave, 1/3 bilobed, lobes equal, triangular, acute; cells 16-24 u, rounded-quadrate, walls strongly and equally thickened; underleaves absent; involucre bracts much larger than the leaves, erect, loosely embracing the perianth, 2-3 lobed, irregularly spinous-dentate; perianth longly inserted, oblong-obovate, the mouth slightly contracted, lobed and unequally spinous-ciliate, the cilia to 8 cells long; capsule brown; male bracts terminal, in 2-3 pairs, greatly ventricose, longly apiculate; antheridia large, solitary, oval globose, the pedicel of equal length; gemmae at the apex of erect shoots having appressed deformed leaves, cubic, stellate or irregularly angled, 1-celled.

Habitat: Decaying logs and stumps in shaded ground.

FAMILY: HARPANTHACEAE

Lophocolea heterophylla (Schrod.) Dum.

Plants in flat pale yellow-green patches; paroicous; stems to 2 cm. long, closely creeping, irregularly branched, the branches sometimes with small deeply and acutely bilobed leaves; rhizoids numerous, fasciculate; leaves nearly horizontal, oblong-quadrate, variously lobed, the lower being smaller, distant or approximate, bilobed with the sinus obtuse and lobes obtuse or acute, the upper larger, imbricate with the antical margin shortly decurrent, the apex slightly narrowed; rarely all the leaves bilobed; cells 25-30 u, polygonal, the walls thin, trigones generally present, small; cuticle smooth; underleaves rather large, incurved but nearly appressed to stem, bifid to below the middle into two subulate acuminate lobes, each generally with a tooth or cilium near the base; involucral bracts erect, slightly larger than the leaves, oblong-cuneate to oblong-quadrate, shortly and irregularly 2-4-lobed; bracteole deeply bifid, the segments lanceolate with 1-3 cilia or teeth on the margin; perianth terminal on short branches, longly exserted, cylindrical-beaker shaped, sharply 3-angled above, the mouth shortly trilobate; capsule oval; spores 11-13 u, yellow-brown, nearly smooth; elaters reddish-brown; female bracts in 3-5 pairs, suberect, nearly transversely inserted, immediately below the perianth, of almost similar shape to the upper leaves but with an inflated lobule at the antical base; antheridia single, globose; gemmae rare.

Habitat: Decaying logs and stumps and on sand rocks.

FAMILY: HARPANTHACEAE

Lophocolea minor Nees

Plants in mats, yellowish green; leafy shoots 1-2 mm. wide; stems 0.5-1.5 cm. long, prostrate, slender, green, much branched, branches originating laterally; rhizoids moderately common, in tufts at the bases of the underleaves; leaves alternate, strongly succubous, rather distant to loosely imbricate, simply 2-lobed, broadly ovate to almost quadrate, 250-380  $\mu$  long, 200-250  $\mu$  wide, widest in the middle, abruptly narrowed to the base; margins entire; lobes often unequal with the ventral the larger, acute to rounded but most of them bluntly acute to obtuse; sinus descending  $1/4$ - $1/3$  the leaf length; cells of the leaf 25-30  $\mu$  in diameter, walls thin; trigones wanting to minute; oil bodies up to 6 per cell; cuticle smooth; gemmae very common and the gemmiparous leaves becoming abnormal in form, gemmae on the tips and margins of the leaves; underleaves present throughout,  $1/3$ - $1/2$  as long as the leaves, 2-lobed for  $1/2$ - $3/4$  the length, margins entire; plants mostly unisexual; male plants in separate sods or occasionally intermingled; male bracts with a saccate lobule at the base of the dorsal margin; antheridium 1; female inflorescence terminal on a main stem; female bracts larger than the leaves of sterile stems, applied to the perianth for most of its length, shortly 2-lobed; perianth small, narrow, sharply 3-angled in upper half; mouth 3-lobed, the lobes very coarsely toothed; seta about 500  $\mu$  long; elaters 8-10  $\mu$  wide, 2-spiral, reddish-brown; spores about

10 u in diameter, smooth.

Habitat: On shaded rocks, banks of streams, bases of trees, rotten logs; preferably on calcareous substratum.

FAMILY: PLAGIOCHILACEAE

Plagiochila asplenioides (L.) Dum.

Plants in dense and nearly erect tufts or extended loose patches, green to dark green; dioicous; stems 4-6 cm. long, erect or ascending, branched, with several descending nearly leafless branches, innovating from below the perianth; rhizoids colourless, almost absent on the ascending stem; leaves small and distant below, larger and imbricate above, frequently much deflexed, ovate, almost the whole margin more or less dentate to ciliate-dentate, antical margins reflexed and much decurrent, the postical margin broadly recurved and shortly decurrent; cells 24-34  $\mu$ , walls slightly and almost equally thickened, trigones being absent or small; underleaves small, subulate or bifid, or absent; involucre bracts rather larger than the leaves, irregularly spinous-dentate; perianth longly exserted, the mouth truncate, irregularly dentate-ciliate; capsule cylindrical-oval, purple brown, nearly 1.5-2 cm. long; spores 12-16  $\mu$ , reddish-brown, nearly smooth; elaters purple; androecium narrowly ovate, terminal, bracts in 4-10 pairs, smaller than the leaves, closely imbricate, erect, concave, ventricose at base, oblong with antical margin broadly inflated at base, the whole margin entire or denticulate at apex; antheridia generally in pairs, broadly oval, on a pedicel or nearly equal length.

Habitat: Rocks, banks, tree stems, ascending to 4000 feet altitude.



FAMILY: SCAPANIACEAE

Scapania nemorosa (L.) Dumort.

Plants in loose, green to olive-green, seldom brown or reddish tufts; dioicous; stems commonly 3-6 cm. long, dark brown, paler above, erect, recurved at apex, simple or sparingly branched; rhizoids scarce; leaves distant or approximate below, subimbricate to imbricate above, accrescent, patent, embracing the stem, decurrent,  $\frac{3}{4}$  divided into two unequal lobes, the antical lobe crossing the stem, broadly cordate-ovate, generally pointed somewhat convex, but occasionally patulous, ciliate-dentate, less frequently subentire; postical lobe obtuse, ciliate-dentate, the teeth usually 2-3 cells long, and 1-2 cells broad at base, the postical margin reflexed; commissure straight or slightly curved, keeled and frequently narrowly winged; cells 16-21 u, oblong-rotund to hexagonal, of nearly equal size throughout, walls most frequently thin, trigones small, the marginal cells slightly smaller, rather strongly and nearly equally thickened; cuticle nearly smooth or granular-papillate; involucre bracts larger than the leaves and more equally lobed; perianth oblong-obovate, the mouth shortly lobed, ciliate and dentate; capsule oblong-oval, brown, finely verruculose; elaters 6-8 u broad, pale reddish-brown, bispiral; androecium at the apex of the stem and branches, bracts in 4-5 pairs, imbricate; antheridia 3-6, oval, longly pedicellate, with linear and subulate paraphyses; gemmae in reddish-brown clusters at the apex of stem and upper leaves, oval, 1-celled.

Habitat: On moist, shady rocks and banks, and occasionally on decaying wood.

FAMILY: RADULACEAE

Radula complanata L.

Plants in thin, usually pale yellow-green patches; pariocous; stems 2-5 cm. long, prostrate, irregularly and laxly pinnate; rhizoids confined to the underside of the postical lobes of the leaves; leaves distant below, closely imbricate above, potent, the margins entire, unequally bilobed the antical lobe rotundate, broader than long, crossing the stem nearly flat, the postical lobe 4-5 times smaller, almost quadrate, not crossing the stem, appressed to the antical lobe, the outer angle obtuse, seldom acute; cells 20-25 u, rounded-polygonal, opaque, being filled with numerous chloroplasts and with 1-3 granular oil-bodies, walls thin, trigones small; cuticle smooth; involucral bracts embracing the perianth, the antical lobe elongate-obovate, the postical lobe about half as large, ovate to subquadrate; antheridia single, globose, shortly pedicellate; perianth terminal on the stem or branches, obconical, compressed, nearly flat, the mouth wide, truncate, entire; capsule oval, shortly pedicellate, brown, the wall of two layers of cells; spores 25-40 u in diameter, pale yellow-brown; elaters 6-7 u broad, bispiral, yellow-brown; gemmae usually scarce, on the margins of the leaves, discoid, generally multicellular with chloroplasts and an oil body.

Habitat: On trees in moist and somewhat shaded localities, also not rarely on rocks in damp and well sheltered places.

FAMILY: FRULLANEACEAE

Frullania eboracensis (Gottsche)

Dioicous; plants closely appressed to matrix, green, stems pennate; leaves imbricated, the lobe suborbicular, arching over stem and cordate at base, rounded at the slightly decurved apex, entire; locule galeate, truncate at base separated from stem by about 1/6 its width; stylus minute, 2 or 3 cells wide at base; underleaves distant, ovate, bifid about 1/3 with subacute lobes and sinus, entire or obscurely unidentate on the sides; leaf-cells of lobe rather thick-walled with trigones and intermediate thickenings, the latter becoming fewer toward base; female inflorescence terminal on stem or a main branch; bracts in 2 or 3 pairs, unequally bifid, the lobe ovate, rounded at apex, entire or slightly crenulate toward base; lobule narrower than the lobe, ovate, bearing a small tooth-like segment or stylus at about the middle, otherwise subentire; bractiole free or connate on one side with acute lobes and sinus, entire on sides, perianth obovate or obconate, more or less compressed, abruptly narrowed into a short, broad beak with a distinct, sometimes two-angled postical keel but without distinct supplementary ridges, smooth or slightly roughened on lateral keels, male spike oblong, occupying a short lateral branch, bracts in many pairs.

Habitat: Tree bark.

FAMILY: FRULLANIACEAE

Frullania riparia Hampe

Plants in patches, green to brownish; leafy stems 0.9-1.2 mm. wide, prostrate or nearly so, 1-1.5 cm. long, irregularly pinnate; branches comparatively few; leaves distant to imbricate; dorsal lobes of stem leaves ovate leaves ovate to orbicular, about 600 u long and 480 u wide, plane or nearly so, slightly cordate at base; apex rounded, sometimes slightly bent toward ventral side; margins entire or vaguely sinuate; ventral lobe of leaf saccate or usually explanate; saccate ventral lobe of stem leaf nearly parallel with the stem, 1/4-1/2 the stem width from it, wholly saccate, helmet-shaped, 125-160 u long, 160-220 u wide, without proboscis; stylus minute; stalk usually short; cells of middle of dorsal lobe of stem leaf about 18 u, of margin 15 u, of base 30 u; walls slightly thickened; gemmae sometimes present near tip of shoot, on dorsal surface of dorsal lobe of leaf; underleaves distant, 2-lobed, rhombic to orbicular, about 300 u long and wide, narrowed to base; lobes acute; sinus extending 1/4-1/2 down, acute; margins entire or with slight tooth on one or both sides; plants dioicous; male inflorescence unknown; female inflorescence terminal on a main shoot; female bracts unequally 2-lobed with the dorsal half the larger; female bracteole free, 2-lobed, narrowly ovate, lobes acute, sinus acute, margin irregularly dentate to almost entire; perianth and sporophyte unknown.

Habitat: On trees, rocks, decaying logs, mostly in shaded situations.

FAMILY: LEJEUNEACEAE

Cololejeunea biddlecomial (Aust.) Evans

Plants in patches or scattered, pale green to bright green; leafy shoots 300-765  $\mu$  wide; stems prostrate, irregularly pinnately branched, about 40  $\mu$  thick; rhizoids rather numerous, in tufts on stem when sufficiently abundant; leaves incubous, distant to imbricate, keel convex, 80-290  $\mu$  long, crenulate to strongly papillose due to projecting cells; dorsal lobe erect-spreading to spreading, ovate to narrowly ovate-lanceolate, narrowed at tip, about 350  $\mu$  long and 200  $\mu$  wide; ventral lobe folded up on the dorsal one, ovate to nearly obicular, about 170  $\mu$  long and 150  $\mu$  wide, inflated at least near keel, surface smooth, apex with a rounded to obtuse and often distinct tooth  $3/5-2/3$  up toward the tip of the keel; free margin convex to apex; stylus mostly conspicuous, usually a row of 2-10 cells, sometimes 2 cells wide for a part of its length, occasionally a mere papilla; cells of the middle of the dorsal lobe about 13  $\mu$ , of the margin about 10  $\mu$ , of the base 13 by 21  $\mu$ ; trigones usually minute; gemmae none; male inflorescence on a main shoot or on a short branch, oblong; male bracts 4-10, imbricate, similar to the leaves; antheridia 1 or 2; female inflorescence on a main shoot; female bracts unequally 2-lobed, outer surface papillose due to projecting cells; perianth emergent abovoid to oblong, about 600  $\mu$  long and 350  $\mu$  wide, not flattened, rounded to truncate to the mouth, sharply 5-keeled in the upper part, surface rough except near base due to projecting cells; mouth shortly beaked.

Habitat: In swampy places, on trees, rocks, or rocky soil, often among other bryophytes.

FAMILY: PELLIACEAE

Pellia neesiana (Gottsche) Limpr.

Plants in extended patches, nearly always tinged with dark red, especially on the midrib, translucent towards the margin; dioicous; thallus rather narrow, undulate and of equal width, not very expanded and usually lobed at the apex; in section about 12 cells thick in the middle with interlacing thickened bands; involucre forming a short complete cylinder, or occasionally split on the antical side, irregularly crenate lobulate at the mouth; calyptra more or less exerted, seldom included cylindrical with expanded apex, roughened with 2-celled scattered hairs; capsule globose, dark olive-green, of 2-3 layers of cells; pedicel hyaline to 5 cm. long; spores 80-100 u in diameter, oblong-oval, muriculate, yellow-green; elaters very long and thin, contorted, 8 u broad, mostly bispiral; elater-bearers thick, 20-30 in number, 3-4 spiral; female plant generally growing with the male plant.

Habitat: In wet grassy ground.



FAMILY: METZGERIACEAE

Metzgeria furcata (L.) Dum.

Plants forming yellow-green or green flat patches; thallus to 2.5 cm. long and .5-1 mm. broad, irregularly branched and furcate, branches short, flat or slightly convex, naked above; dioicous; antical surface of midrib 2 cells wide and slightly arched, the postical generally 4 cells wide and more highly arched with scattered straight hairs; wings with more or less scattered hairs which extend to below the margin, or almost naked, the margin with none or few and single; cells or wings hexagonal, 34-42 u in diameter, walls thin with slightly thickened angles; calyptra narrowly pyriform with rather numerous hairs; pedicel of capsule 1.5-2.5 mm. long, capsule oval-globose, reddish-brown; spores 21-28 u in diameter, granular-papillate, appearing finely punctate, greenish-yellow to brownish-yellow; elaters 5-7 u broad, the spiral pale reddish brown.

Habitat: On trees and rocks, usually in rather dry places.

FAMILY: MARCHANTIACEAE

Asterella tenella L.

Plants bright green, often purplish along margins and beneath; thalli mostly 0.5-1.5 cm. long and 1.5-3 mm. wide, branching almost invariably dichotomous; vein constituting a rounded ventral keel; margin thin, undulate, purplish; ventral scales appendiculate; appendages 1-2, narrowly to broadly ovate, mostly 250-450 u long and 150-300 u wide, acute to rounded, entire or somewhat dentate; dorsal epidermal cells averaging about 25 u long and 40 u wide, sometimes with distinct trigones; air chambers not subdivided by supplementary partitions; green tissue loose; pores 1 per chamber, slightly or not at all elevated, surrounded by about 6 radiating rows of 2-3 cells each; antheridial receptacle hstfly distinct, sessile, the antheridia merely a group anterior to the female receptacle; female receptacles stalked; stalk naked, often purple, about 2 cm. long; disk 2-4 mm. wide, hemispheric, smooth or nearly so, shortly lobed; its lobes mostly 4, extending obliquely downward; involucre deeply 2-lipped; pseudoperianth mostly 8-10 cleft, white or yellowish to purple; sporangium with lid which remains intact at dehiscence; elaters mostly 10-12 u wide, yellow, with 2 spirals in the middle and one at the ends; spores mostly 80-90 u, yellow, with fine irregular lines and coarse ridges, the meshes 16-18 u wide; gemmae none.

Habitat: On wet banks, damp ground in sandy fields, and on damp rocks in the lowlands.

FAMILY: MARCHANTIACEAE

Conocephalum conicum (L.) Wiggers

Thalli mostly 10-20 cm. long and 1-2 cm. wide, thin, firm, green. Upper surface with quite distinct polygonal areas with one pore each. Ventral scales appendiculate, appendages orbicular to reniform, mostly 300-500 u long, entire, marginal cells forming a more or less distinct border. Dorsal epidermal cells averaging about 30 x 100 u. Air chambers with green filaments of which the end cells when near the pores are colorless and elongate or pyriform. Pores surrounded by several rows of cells with strongly out-curved walls. Ventral tissue of conspicuously pitted cells, with a few large slime cells. Antheridial receptacle about 5 mm. wide. Female receptacles stalked; stalk 5-10 cm. long, disk about 5 mm. high. Elaters irregular, sometimes branched, mostly 12-20 u wide. Spores mostly 70-100 u, ellipsoid, multicellular, green.

Habitat: On damp soil or wet rocks, in damp air.

FAMILY: MARCHANTIACEAE

Mannia fragrans (Balbis) n. comb.

Plants green or glaucous green in upper middle, purplish along margin, deep purple beneath; thalli usually aromatic when fresh, mostly 1-2 cm. long and 2-3 mm. wide, mostly dichotomously but sometimes ventrally branched; vein forming a rounded or bluntly angled keel beneath; margin undulate, strongly recurved when dry; ventral scales deep purple, closely imbricate, lunate, with marginal appendages; appendages 1-3, subulate, mostly 450-700 u long and 90-150 u wide, acuminate, entire; dorsal epidermis distinct; its cells averaging about 14 u wide and 17 u long, with thick walls, conspicuous trigones; oil cells few, scattered; air chambers with crowded vertical supplementary partitions; walls unistratose; green tissue compact; pores slightly elevated; surrounding cells radiately arranged in 6-8 radial rows, each of 2 or 3 cells; antheridial receptacle sessile, distinct, oval to broadly lunate; female receptacle stalked, from a somewhat elongate branch; stalk mostly 1-1.5 cm. long, somewhat purplish, with dense clusters of long lanceolate bractlets at base and at apex; disk mostly 2-3 mm. wide, shortly 3-4 lobed; elaters pale brown to dark brown, mostly 9-10 u wide, usually with 2-3 spirals in the middle and 2 at the ends; spores mostly 60-70 u; faces minutely and indistinctly punctate, coarsely areolate; name from the aromatic odor of the fresh thallus.

Habitat: On thin soil on rock, often rather exposed.

FAMILY: MARCHANTIACEAE

Marchantia polymorpha L.

Plants in extended deep green patches or smaller rosettes; dioicous; thallus 2-10 cm. long and 7-20 mm. broad, flat or slightly concave, margins sinuate-lobed, the apex emarginate, along the middle, areolae somewhat distinct; epidermal cells 5-6 angled, not thin-walled, angles not thickened; pores not visible to naked eye, little elevated with 4 superimposed concentric rings, each of 4 cells appearing oval from above with two rings of cells, and cruciate below; ventral surface, brownish, the tuberculate and the smooth yellowish rhizoids numerous; scales in three rows on each side, those at the margin broadly ligulate, hyaline or purple. Midrib scarcely prominent below; female peduncle 3-5 cm. long, dark red or green; capsule oval, the wall of one layer of cells with annular thickenings; spores 14  $\mu$  in diameter, spherical, nearly smooth; yellow; elaters 5-7  $\mu$  broad, long and attenuate, 2-spiral, yellow; male receptacle less longly peduncled, with 8 short rounded lobes; gemmae rotund-reniform, nearly flat, vertically inserted, with a 1-celled hyaline pedicel, and an open sinus at each side, in groups at the bottom of the goblet shaped gemmae-cups which have a lobed and spinous-ciliate margin.

Habitat: Moist walls, gardens and waste heaps, also in marshes and at sides of streams.

FAMILY: MARCHANTIACEAE

Reboulia hemisphaerica (L.) Raddi

Plants in small rosettes or slightly extended layers, light green with usually a purple margin; dioicous and monoicous; thallus 10-30 mm. long and 6-8 mm. broad, oblong or obcordate with emarginate or bilobed, apex, margins ascending, crenulate, dorsal epidermal cells 4-6-angled with walls slightly and angles much thickened; pores little elevated, with 5-6 concentric rings, each of 6-8 cells having thickened angles; ventral surface purple; scales imbricate, in one row on each side of the midrib, obliquely lunate, with two linear acute appendages; chlorophyll-bearing layer strongly developed, occupying about half the midrib and almost the whole of the lamina; midrib thick, gradually passing into the lamina ending in a 1-celled margin; peduncle of female inflorescence 15-25 mm. long; capsule-wall of a single layer of cells, without annular thickenings; spores 65-76  $\mu$  in diameter, rounded-tetrahedral, with a few large areolae and broad crenulate margin, brownish yellow.

Habitat: On rocks and on soil among rocks in rather dry places.

FAMILY: ANTHOCEROTACEAE

Anthoceros laevis L.

Plants in dark green patches; monoicous; thallus 5-15 mm. in diameter, nearly flat, smooth, divided into broad obovate lobes, rounded at the apex with the margins entire or crenate, not costate; transverse section 6-8 cells high in the middle without lacunae; surface cells 35-70 u long and 30-35 u wide; involucre sometimes geminate, 2-3.5 mm. long and .7-1 mm. broad, cylindrical slightly narrowed; capsule 15-25 mm. long and about .5 mm. broad, brown; stomata 70-77 u long and 25-30 u wide; spores 46-56 u in diameter, greenish-yellow thickly granular-papillate; pseudo-elaters pale brown, of 1-4 cells, each 25-45 u in length, geniculate; antheridia in groups of 2-3 in receptacles scattered on the dorsal surface of the thallus.

Habitat: Moist soil in fields, rock walls, and side of ditches.

## Discussion

Bryophytes collected on soil which was exposed to direct sunlight represented far fewer bryophyte species than those collected on soil under shaded conditions. Species which were collected on soil exposed to direct sunlight were: Brachythecium oxycladon (Brid.) J. & S., Tortella humilis (Hedw.) Jenn., Pogonatum pensilvanicum (Hedw.) Paris, Polytrichum commune Hedw., Dicranella varia (Hedw.) Schimp., and Ditrichum pusillum (Hedw.) E.G.B. Of the species listed for unshaded soils, Brachythecium oxycladon (Brid.) J. & S. was by far the most frequent. On shaded soil, the bryophytes collected were: Bryum caespiticium Hedw., Brachythecium salebrosum (W. & M.) Bry. Eur., Entodon seductrix (Hedw.) C. M., Amblystegium varium (Hedw.) Lindb., Eurhynchium serrulatum (Hedw.) Kindb., Chamberlainia acuminata (Hedw.) Grout, Bryhnia graminicolor (Brid.) Grout, Atrichum angustatum (Brid.) B.S.G., Anomodon minor (Beauv.) Lindb., Brotherella recurvans (Mx.) Fleisch, Compylium hispidulum (Brid.) Mitt., Playiothecium denticulatum (Hedw.) Bry. Eur., Eurhynchium hians (Hedw.) J. & S., Amblystegium serpens (Hedw.) Bry. Eur., Fissidens taxifolius Hedw., Climacium americanum Brid., Rhodobryum roseum (Hedw.) Limpr., Polytrichum ohioense R. & C., Thuidium delicatulum (Hedw.) Mitt., Leucobryum glaucum (Hedw.) Schimp., Mnium serratum Brid., Atrichum undulatum (Hedw.) Beauv., Dicranella hilariana (Mont.) Mitt., Dicranum scoparium Hedw., Aulacomnium heterostichum Hedw., Lophozia ventricosa (Dicks.) Dumort., and Bartramia pomiformis Hedw. Of the species collected



from shaded soil, Atrichum angustatum (Brid.) B.S.G., Mnium cuspidatum Hedw., Brachythecium salebrosum (W. & M.) Bry. Eur., and Entodon seductrix (Hedw.) C. M. were most frequently observed. The most infrequent species on shaded soils were: Climacium americanum Brid., Rhodobryum roseum (Hedw.) Limpr., and Fissidens taxifolius Hedw.

Several species of bryophytes were collected on creek and river banks. Many of these species are different from those which were reported on shaded and unshaded soil not on banks of creeks or rivers. The species collected on creek banks and river banks were: Dicranella varia (Hedw.) Schimp., Entodon cladorrhizans (Hedw.) C. M., Asterella tenella (L) Beauv., Eurhynchium serrulatum (Hedw.) Kindb., Eurhynchium hians (Hedw.) J. & S., Mnium punctatum Hedw., Bryhnia graminicolor (Brid.) Grout., Amblystegium serpens (Hedw.) Bry. Eur., Lophocolea heterophylla (Schrad.) Dumort., Anomodon rostratus (Hedw.) Schimp., Anomodon minor (Beauv.) Lindb., Fissidens taxifolius Hedw., Tricholea tomentella (Ehrh.) Dumort., Scapania nemorosa (L) Dumort., Cephalozia bicuspidata (L) Dumort., Cephaloziella hampeana (Nees) Schiffn., and Cololejeunea biddlecomiae (Aust.) Evans. Of all creek bank inhabiting mosses, Eurhynchium serrulatum (Hedw.) Kindb., Mnium cuspidatum Hedw., and Anomodon rostratus (Hedw.) Schimp., were the most frequent.

The many sandstone walls found within the park provide an excellent habitat for the following species: Anomodon minor (Beauv.) Lindb., Tetraphis pellucida Hedw., Anomodon attenuatus (Hedw.) Hueben, Bartramia pomiformis Hedw., Dicranella heteromalla (Hedw.) Schimp., Bryoxiphium norvegicum (Brid.) Mitt., Fissidens obtusifolius Wils., Gymnostomum calcareum N. & H., Blepharostoma trichophyllum (L) Dumort., Telaranea

nematodes G. ex. Aust., and Bazzania trilobata (L) S. F. Gray. Frequent thallois hepatics on sandstone walls were: Conocephalum conicum (L) Wiggers, Reboulia hemisphaerica (L) Raddi, Anthoceros laevis L., Metzgeria furcata (L) Dumort., and Marchantia polymorpha L. The species of greatest frequency which inhabited sandstone walls were: Tetraphis varia (Hedw.) Schimp., Thuidium pygmaeum Bry. Eur., Desmatodon porteri James, Didymodon trifarius (Hedw.) Brid., Amblystegiella confervoides (Brid.) Loeske, Plagiothecium roeseanum (Hampe) Bry. Eur., Pedinophyllum interruptum Nees, Cephaloziella byssacea (Roth) Warnst., and Dicranella hilariana (Mont.) Mitt.

Rock-inhabiting bryophytes are not uncommon. The following species were found growing on rocks other than sandstone: Barbula fallox Hedw., Bryum argenteum Hedw., Bryhnia graminicolor (Brid.) Grout., Weisia viridula Hedw., Hedwigia ciliata Hedw., Myurella careyana Sull., Dicranella Hedw. (base), Dicranum viride (S. & L.) Grout (base), Timmia megopolitana Hedw. (base), Haplohymenium triste (Cesati) Kindb. (base), Leptodon trichomitrium (Hedw.) Mohr. (base), Fabronia ravenelii Sull. (base), Schwetschkeiopsis denticulata Sull. Broth. (base), and Frullania riparia Hampe (bases to chest high).

The park has a large number of high ridges and deep ravines. The steep sloping sides of these ridges also have their characteristic species. In most cases the species collected on the sides of ridges were taken from shaded soil. These species were: Polytrichum ohioense R. & C., Atrichum angustatum (Brid.) B.S.G., Atrichum undulatum (Hedw.) Beauv., Cirriphyllum bosci (Schw.) Grout, Aulacomnium heterostichum Hedw., Entodon seductrix (Hedw.) C. M., Thuidium recognitum (Hedw.) Lindb., Leucobryum

glaucum (Hedw.) Schimp., Mnium affine Bland., Mnium serratum Brid., Entodon cladorrhizans (Hedw.) C. M., Amblystegium serpens (Hedw.) Bry. Eur., and Plagiothecium muellerianum (Hampe) Bry. Eur. The most frequent of these slope-inhabiting bryophytes were: Cirriphyllum boscii (Schw.) Grout, Thuidium recognitum (Hedw.) Lindb., Atrichum angustatum (Brid.) B.S.G., and Leucobryum glaucum (Hedw.) Schimp.

Several species of bryophytes are extremely diverse in their habitat requirements. These species may be found on rocks, soil, trees, or decaying logs. The species collected which fall under this habitat classification were: Bryum pendulum (Hornsch.) Schimp., Mnium affine Bland., Mnium cuspidatum Hedw., Brachythecium compestre Bry. Eur., Hypnum cupressiforme Hedw., and Calypogeia trichomanis (L.) Corda.

The trees of the park provide another habitat for a number of bryophyte species. All species reported were collected from various species of Ash, Maple, and Oak. The corticolous species collected were: Leskea gracilescens Hedw. (from base to chest high), Lophocolea heterophylla (Schrad.) Dumort. (from base to chest high), Platygyrium repens (Brid.) Bry. Eur. (from base to chest high), Entodon seductrix (Hedw.) C. M. (base), Leptodictyum trichopodium (Schultz.) Warnst. (base), Frullania eboracensis Gottsche (chest high on trunk), Thelia asprella Sull. (base), Anomodon attenuatus (Hedw.) Hueben (base), Anomodon minor (Beauv.) Lindb. (base), Dicranum flagellare pellucida Hedw., Anomodon attenuatus (Hedw.) Hueben, and Conocephalum conicum (L.) Wiggers.

Several species of bryophytes are specifically hydrophytic, and are almost always found in areas where periodic inundation occurs. Hydrophytic bryophytes collected were: Pohlia wahlenbergii (W. & M.) Andr.,

(on partially submerged rocks), Hygroamblystegium irriguum (Wils.) Loeske (on soil at edge of water), Fissidens bushii card. & Ther. (on partially submerged rocks), Fissidens minutulus Sull. (on partially submerged rocks), and Fontinalis duriaei Schimp., (completely submerged on rocks). Of the species reported, none are extremely frequent.

A few species of bryophytes tend to be found most frequently in areas which are often disturbed by man. These species include Bryum argenteum Hedw. (often found growing between the cracks in sidewalks), Ceratodon purpureus (Hedw.) Brid. (often referred to as the "roof-top moss"), and Barbula unguiculata Hedw.

Another very common habitat for a large number of bryophyte species is decaying wood. The following species were collected from decaying wood: Platygyrium repens (Brid.) Bry. Eur., Entodon cladorrhizans (Hedw.) C. M., Plagiochila asplenioides (L) Dumort., Calypogeia trichomanis (L) Corda, Jamesoniella autumnalis (DC) Steph., Dicranum viride (S. & L.) Grout, Entodon compressus (Hedw.) S. M., Hypnum curvifolium Hedw., Hypnum imponens Hedw., Plagiothecium micans (Sw.) Paris, Nowellia curvifolia (Dicks.) Mitt., and Sphenolobus hellerianus (Nees.) Steph. The most frequent species inhabiting the rotting log community were: Platygyrium repens (Brid.) Bry. Eur. and Nowellia curvifolia (Dicks.) Mitt.

Several species were collected in areas which contain a clay soil. The following species were collected almost exclusively on clay: Atrichum undulatum (Hedw.) Beauv., Pogonatum pensilvanicum (Hedw.) Paris, Ditrichum pusillum (Hedw.) E.G.B., Fissidens taxifolius Hedw., Dicranella varia (Hedw.) Schimp., and Plectocolea hyalina (Lyell) Mitt.

Of the one-hundred and fifteen bryophytes collected in this survey, Atrichum angustatum (Brid.) B.S.G. was the most frequent acrocarpus species. The most frequent pleurocarpus species was Brachythecium salebrosum (W. & M.) Bry. Eur. The most frequent thalloid liverwort was Conocephalum conicum (L) Wiggers, and the leafy liverwort Lophocolea heterophylla (Schrad.) Dumort., appeared in the collections more often than any other.

## Conclusion and Summary

A review of the literature reveals that no studies of the bryophytes of Turkey Run State Park, Parke County, Indiana have been reported. Although the state-wide bryological studies of Dr. Winona Welch have included reports of mosses from Parke County, none were specifically recorded from Turkey Run State Park.

This research involves a taxonomic survey of the bryophytes of Turkey Run State Park, Indiana. Eighty-three species of Musci were collected within the park representing forty-nine genera. Thirty-two species representing twenty-five genera of Hepaticae were collected within the boundaries of the park. The bryophytes were collected in a variety of habitats which are included in the discussion of this thesis. The collections were placed in standard bryological packets provided with standard data. The bryophytes were named and duplicates were placed in the Ernest L. Stover Herbarium, Eastern Illinois University, Charleston, Illinois. Descriptions were prepared for each specimen.

Of the 115 bryophytes collected, 104 were frequently reported in previous Indiana publications. Nine species are considered to be rare. They are: Bazzania trilobata (L), Blepharostoma trichophyllum (L) Dumort, Cephaloziella byssacea (Roth) Warnst., Cololejeunea biddlecomiae (Aust.) Evans, Dicranella hilariana (Mont.) Mitt., Fabronia ravenelii Sull., Sphenolobus hellerianus (Nees) Steph., Telaranea nematodes G. ex

Aust., and Tricholea tomentella (Ehrh.) Dumort.

Four of the species collected in Parke County are new state records from Parke County. They are: Dicranella hilariana (Mont.) Mitt., Fabronia ravenelii Sull., Telaranea nematodes G. ex Aust., and Sphenobus hellerianus (Nees) Steph.

### Literature Cited

- Andrews, F.M. 1931. Liverworts of Spring Mill Park. Proc. Indiana Acad. Sci. 40:67-68.
- Conard, H.S. 1956. How to know the mosses and liverworts. Wm. C. Brown Co., Dubuque, Iowa. 226 pp.
- Evans, Alexander W. 1940. List of Hepaticae found in the United States, Canada, and Arctic America. The Bryologist. 43:133-138.
- Freeman, O.W. 1945. Geology and Turkey Run State Park. Outdoor Indiana. 12:12-13.
- Frye, T.C. & Lois Clark. 1937-1947. Hepaticae of North America. Pub. by the University of Washington, Seattle, Washington. 6 Vols.
- Grout, A.J. 1903. Mosses with hand-lens and microscope. 1965 reprint by Eric Lundberg, Ashton, Maryland. 416 pp.
- \_\_\_\_\_. 1928-1940. Moss flora of North America north of Mexico. Pub. by author, Newfane, Vermont. 3 Vols.
- Merty, C.J. 1972. A survey of the lichen flora of Turkey Run State Park in Parke County, Indiana. M.S. Thesis, Eastern Ill. Univ. 94 pp.
- Miller, H.A. and Thomson, J.W. 1959. The 1958 foray of the American Bryological Society. The Bryologist 62:67-72.
- Parker, Dorothy. 1937. Some liverworts from Indiana. The Bryologist. 40:79-80.
- Pickett, F.L. 1915. Some mosses from Monroe County, Indiana. The Bryologist. 18:33-34.
- \_\_\_\_\_. 1925. The life history of Ricciocarpus natans. The Bryologist. 28:1-8.
- Schuster, Rudolph M. 1966-1969. The Hepaticae and Anthocerotae of North America. Columbia University Press, New York. 2 Vols.
- Underwood, L.M. 1894. List of Cryptograms at present known to inhabit the state of Indiana. Proc. Indiana Acad. Sci. 3:30-67.



- Welch, Winona H. 1933. Ecological relationships of the most common mosses in a certain vicinity near Bloomington, Indiana. *The Bryologist*. 36:11-13.
- \_\_\_\_\_. 1937. Studies in Indiana bryophytes. *Proc. Indiana Acad. Sci.* 46:72-78.
- \_\_\_\_\_. 1957. Mosses of Indiana. Bookwalter Co., Indianapolis, Indiana. 463 pp.
- Yuncker, T.G. 1921. A list of Indiana mosses. *Proc. Indiana Acad. Sci.* 30:231-242.
- \_\_\_\_\_. 1922. Additions and corrections to the list of Indiana mosses. *Proc. Indiana Acad. Sci.* 31:155-156.

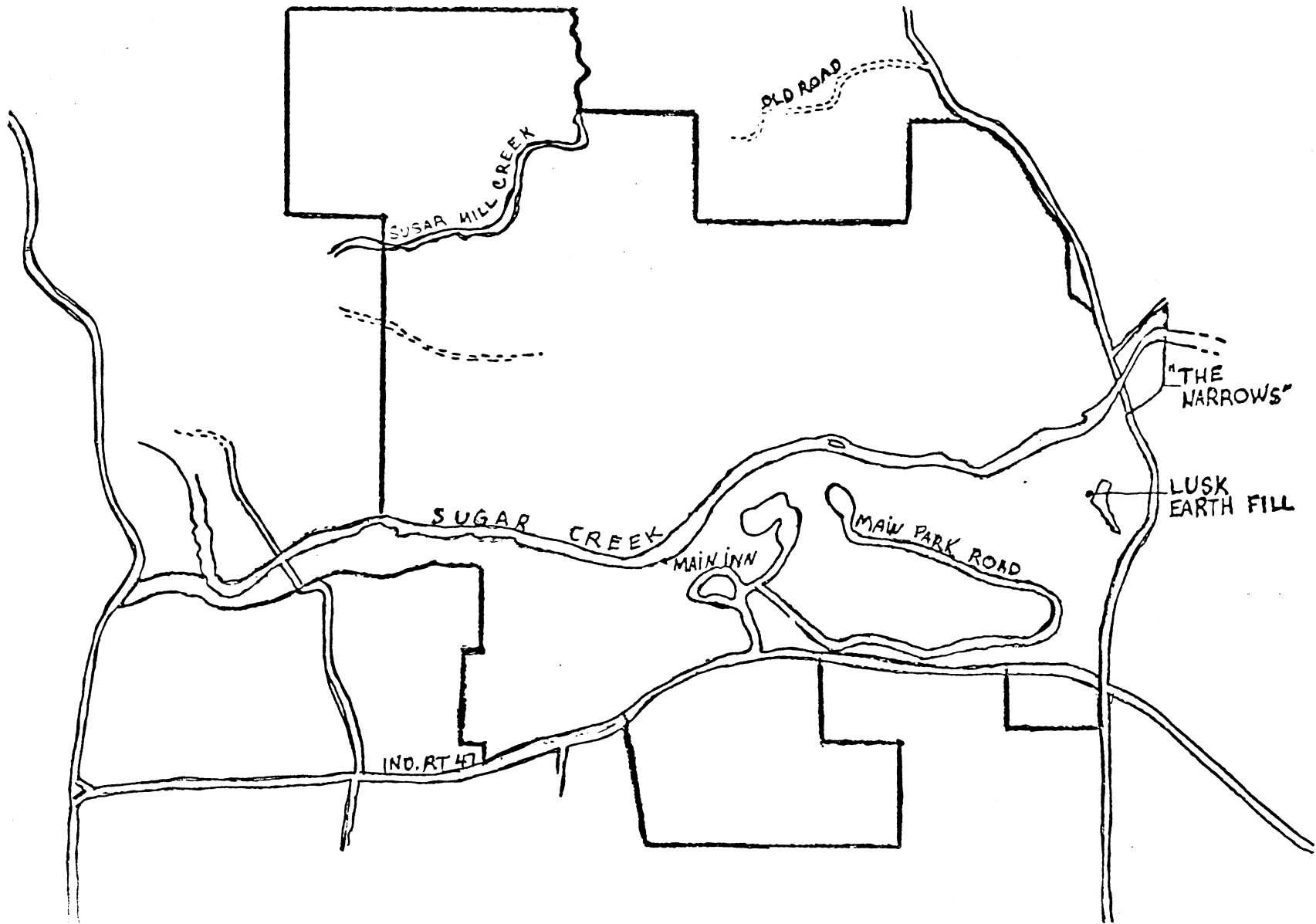


PLATE I. OUTLINE MAP OF TURKEY RUN STATE PARK, INDIANA. (From Mertz, 1971)

PLATE 2.



COUNTY MAP OF INDIANA SHOWING LOCATION OF TURKEY RUN STATE PARK. (From Mertz, 1971)