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Processing Bryophytes

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Summary

This document describes the procedures, training, and resource materials used to process and identify bryophytes for the ABMI. A two step process has been implemented to identify bryophytes. First, from each microhabitat sampled, ABMI field technicians identify specimens of the most common and/or easily identifiable species and classify the remaining specimens into taxonomic groups. To maintain accuracy, field technicians go through rigorous training and their sorting results are checked regularly by a qualified lab supervisor. Second, after the initial sorting by field technicians, the specimens are sent to experts and identified to genus/species. Random samples of the specimens identified by experts are subsequently re-identified by a second expert to assess accuracy.

Data Management

Transferring Data from the Sample Tracking Log to the Sorting Database

All bryophyte samples received by the Sample Processing Centre (RAM) are tracked using the Sample Tracking Log (Appendix 1). At the conclusion of the field season, sample information that was recorded in the Sample Tracking Log is transferred to the Bryophyte Sorting Database (Appendix 2). The ABMI lab coordinator checks to ensure that bryophyte information for all ABMI sites is present.

Data Entry During Sorting

Technicians are responsible for entering information into the data sheets (Appendix 3) while sorting specimens. Upon completing the sorting of a site, the sorter checks the data sheet against the specimen envelops to ensure all specimens are accounted for and then enters the information on the data sheets into the Bryophyte Sorting Database. If more that one species has been identified in an individual sample, the lab technician inserts a new row below the original row in the database, and fills in the required information for each species present. Indicate if the specimen is a voucher, residual or to be sent for advanced ID by placing an "X" in the appropriate column.

Checking and Storing Data During Sorting

Data sheets are transferred to the lab supervisor at the completion of data entry. The lab supervisor checks data sheets to ensure that all data fields are filled in and legible. Data sheets that are not legible will be re-written, and both copies kept on file. Data sheets are stored in a secure location in the sorting lab. Data sheets are transferred to the lab coordinator at the completion of bryophyte sorting. Original copies of the data sheets are stored in a secure location and do not subsequently leave that location. If data entry occurs away from the secure location, then the data sheets are photocopied and data entry occurs from the photocopies.

The lab supervisor also checks the database to ensure that all information is recorded accurately and that all data fields are filled in. Data entry is verified by comparing the electronic information to information on the original data sheets. In addition, electronic verification routines are preformed on the database to ensure that data are consistent with allowable codes. A copy of the Bryophyte Sorting Database is transferred to the ABMI lab coordinator at the end of each day. All copies of the database are stored on a secure computer with a back-up stored in a different building.

Data Entry During Advanced Identification

The ABMI lab coordinator sends an electronic copy of the Bryophyte Sorting Database to the taxonomic expert. The taxonomic expert fills in the required information (gray columns) as specimens are identified. If more that one species is identified from an individual sample, the expert inserts a new row below the original row and fills in the required information for each species present. The ABMI lab coordinator records the data transfer in the Sample Tracking Log.

Transferring Data from the Taxonomic Expert to the ABMI Information Centre

Once the advanced ID has been completed, the expert returns the completed electronic copy of the Sorting Database to the lab coordinator. A hard copy is also printed and sent to the lab coordinator along with the identified samples. The lab coordinator checks the database for omissions or errors, stores it on a secure computer with a back-up stored in a different location, sends a copy of the database to the ABMI Information Centre, and records the data transfer in the Sample Tracking Log.

Specimen Management

Bryophyte samples pass through a variety of facilities during processing. To ensure that samples are not lost, all specimens received by the Sample Processing Centre (RAM) are tracked using the Sample Tracking Log (Appendix 1). All subsequent transfers of specimens, samples and data are recorded in the log.

Specimen Management in the Field

- Package all the small paper bags containing bryophytes from each plot and microhabitat at an ABMI site into one larger paper bag, and on the outside of the large bag record the ABMI site number and number of bags that that are present. Cross reference with the field data sheets to ensure that all samples are included for each site.

Specimen Transfer from the Field to the Sample Processing Centre

- At the end of each field shift, the paper bags for the sites are packaged into cardboard boxes, and the boxes shipped via courier to the Sample Processing Centre (see Terrestrial Protocols for Mosses). The number of cardboard boxes in the shipment and the identity of sites within each box are recorded onto the Sample Shipping Checklist (Appendix 4).
- Samples are logged-in when they arrive at the Sample Processing Centre. Each shipment is assigned a "lot number", and the contents of each lot tracked by that number.
- The Sample Tracking Log includes information about the date the lot arrived, the location where the samples are stored, the ABMI sites where the samples were collected, the number of samples of each type in the lot, and a detailed listing of the information about each sample (Appendix 1).
- The ABMI lab coordinator ensures that all specimens listed on the Sample Shipping Checklist are present, organized, and recorded in the sample tracking log.
- After being logged in, samples are frozen (-20^{o}C for 24 hrs.) and then stored at room temperature prior to being sorted.

Specimen Transfer from the Sample Processing Centre to the Taxonomic Expert

- Boxes containing bryophyte plant samples are shipped via courier to the taxonomic expert for advanced identification to the lowest taxonomic level possible.
- The ABMI lab coordinator records the new location and the date of transfer in the sample tracking log.

Specimen Transfer from the Taxonomic Expert to the Sample Processing Centre

- All specimens and materials received from the Sample Processing Centre are returned after species have been identified.
- Samples are packed and shipped in the same manner as listed above.
- The ABMI lab coordinator checks to ensure that all samples have been returned and are properly labelled. Samples are organized and boxed for storage at the Sample Processing Centre.
- The ABMI lab coordinator records the new location and the date of transfer in the sample tracking log.

Long-term Specimen Curation at the RAM

- All specimens collected by the ABMI are gifted to, and where appropriate curated by, RAM.
- RAM retains all ABMI materials for 2 years.
- After 2 years, reference specimens from each genus/species (or taxonomic group if the specimens were not identified to genus/species) and training specimens are retained by the RAM for use by the ABMI. All other ABMI specimens can be loaned, traded, distributed, or disposed of at the discretion of the RAM project manager.
- A policy describing the procedure RAM will use to loan and gift ABMI specimens is under development.

Sample Processing

Field data collection is finished by the end of July, with the result that field crews have August to sort specimens. Technicians receive training so the can effectively separate moss/liverwort specimens from debris in the sample bags, and sort the specimens into species/groups. Training and quality control are conducted by a qualified lab supervisor

Laboratory Equipment

ABMI Lab Protocols & data sheets
Reference books
Bryophyte reference collections
Dissecting microscope with incident and transmitted light
#5 Forceps, razor blades, scalpel, water bottle, high-edged sorting trays
Sorting envelopes

Supervision of Bryophyte Sorting

- A qualified lab supervisor oversees all stages of training and sorting by field staff.
- To be classified as a qualified lab supervisor, the person must have:
  1. More than 1 year's experience identifying bryophytes found in Alberta.
  2. Worked with the RAM-appointed bryophyte expert for at least two days to ensure that bryophyte sorting will be effective for the expert.
  3. Successfully completed an exam by identifying representative specimens from the bryophytes that are sorted for the ABMI (Appendix 7). The exam consists of at least 100 specimens (with at least one specimen from each of the species/groups that are sorted by technicians). More than 95% of the specimens on the test must be identified correctly.

Sorting Specimens into Common Species and Taxonomic Groups

The goal is to identify/isolate as many moss/liverwort species as possible from each microhabitat at each ABMI site. Some moss/liverwort species are relatively easy to identify; these are identified to species by the field technicians (see Appendix 7). Other bryophyte species are not easily identified by field technicians; these are isolated and sent to experts for identification.

General Procedure

- Select an ABMI site to process (only work on one site at a time).
- For the selected site, open the large paper bag and ensure that all samples for each plot/microhabitat are present (note that a photocopy of the Sample Shipping Checklist is required to determine the number and type of micro-habitat bags that should be present).
- Sort through each microhabitat one at a time, and within each microhabitat sort the samples in the order listed on the Sample Shipping Checklist (i.e. NE, NW, SE, SW)
- Empty the contents of a single microhabitat sample into the sorting tray.
- Sort the mosses/liverworts into basic growth forms (see Appendix 5).
- Use Appendix 7, and the moss/liverwort reference collection to sort specimens into genera and morphological groups and identify the common moss/liverwort species.

Mosses/Liverworts that can be Identified to Species

- Specimens that are to be identified to species (listed in Appendix 5) typically account for 50-60% of moss/liverwort specimens collected at an ABMI site. These pre-determined specimens are distinctive and possess characteristics that make them easily identifiable by technicians with the appropriate training.

- In each microhabitat bag, identify the pre-determined moss/liverwort species.
- Species names are recorded onto laboratory data sheets (Appendix 3) using 7-letter species codes.
- The first time a species in is encountered at an ABMI site; it is separated as a voucher specimen. Record a unique specimen number for the voucher on the data sheet. (Note that a voucher is created for each new species at each site.)
- Place the voucher specimen in an envelope and label the envelope with the specimen number, specimen type, ABMI site number, date collected, collector, microhabitat, plot, and species (see Appendix 8).
- After a voucher has been collected at an ABMI site, subsequent specimens of the same species are not made into vouchers; instead, they are recorded on the data sheet and returned to the original collection bag. The original collection bags are placed in cardboard boxes labeled with the year, sample type and "Residual".
- However, if the first voucher for a species at an ABMI site is of low quality (i.e., lacking key features), and a better quality specimen is subsequently encountered from the same ABMI site, make an additional voucher.
- All voucher specimens are stored in cardboard boxes labeled with the year, sample type and "Vouchers".

All Other Mosses/Liverworts

- Place all remaining moss/liverwort specimens that cannot be identified to species into separate envelopes (see Appendix 8 for labeling examples) for further processing and/or for expert identification.
- Specimen envelopes for further processing are labeled using a pre-made stamp with a unique specimen number, ABMI site number, date collected, collector, microhabitat type, plot number, and tentative family/genus for the specimen inside.
- Envelopes containing unknowns are recorded onto the laboratory data sheet using their tentative name and unique specimen number (Appendix 8).
- If unknown specimens cannot be separated from known specimens, then the unknown specimen (e.g., *Dicranum spp*.) as well as all other mosses/liverworts that have been identified is listed on the envelope (see Appendix 8).
- All specimens for advanced ID are placed in cardboard boxes labeled with the year, sample type and "Advanced ID".

Training – Week 1

- New field technicians must undergo the training and have their identification accuracy assessed by the lab supervisor before they start to sort mosses/liverworts from ABMI sites. Training requires approximately one week.
- Technicians that return from previous years usually require less training. If after reviewing the reference material, returning technicians are confident in moss/liverwort identification, and they pass an assessment by the lab supervisor, they start to sort mosses/liverworts during the first week.

Day 1: Goals and Expectations

- ABMI technicians understand the ecology and basic forms of mosses/liverworts.
- Technicians know the parts (characteristics) and terminology of mosses/liverworts that will help them identify species.
- Technicians know how to separate, sort, and identify selected species of pleurocarpous mosses and identify the difference between the four bryophyte growth forms.

Training Schedule:

Lab Safety

1. Review lab safety protocols

Introduction to Bryophytes

1. Read Mosses, Lichens and Ferns of Northwest North America: Their Structure and Biology. *Vitt et. al. (1988)* – Pages 32-38.

Moss/Liverwort Growth Forms and Terminology

1. Read Mosses, Lichens and Ferns of Northwest North America: Their Structure and Biology. *Vitt et. al. (1988)* – Pages 32-38.
2. Read Appendix 6: Terminology and Morphology of Bryophytes.
3. See Appendix 5: ABMI Simplified Flow Chart to Growth Forms and Species to be Identified
4. Look at the reference collection.

Sorting ABMI Bryophyte Collections

1. Read Appendix 7: Selected Bryophyte Species for Identification in the Laboratory (Section 1; this appendix is ordered by ease of identification and should be followed in the order it appears).
2. Look at reference collection.

Hands On Experience

1. Sort through a prepared sample of "unknown" pleurocarpous specimens (in pairs) using the reference collection; check results with lab supervisor.

Quality Control:

- The lab supervisor verifies all identifications of the test specimens to ensure the technicians achieve an accuracy of ≥95%.
- Technicians having trouble achieving ≥95% accuracy are given an opportunity to review the training material and then retest.
-

Days 2-3: Goals and Expectations

- Field technicians understand how to identify the 9 pleurocarpous mosses and 5 acrocarpous mosses selected for identification.
- Technicians learn the basic characteristics for identifying 6 different *Genera*.
- Technicians understand how to sort mosses/liverworts into known genus groups and further into specific morphological categories.
- Technicians understand how to sort specimens that do not fit into known categories into 'unknown Pleurocarp' or 'unknown Acrocarp'.
- Technicians are able to identify between thalloid and foliose liverworts and identify 1 and 2 species of each, respectively.

Training:

Pleurocarpous Mosse

1. Review Appendix 7: Selected Bryophyte Species for Identification in the Laboratory (Section 1)
2. Look at the reference collection

Acrocarpous Mosses

1. Read Appendix 7: Selected Bryophyte Species for Identification in the Laboratory (Section 2)
2. Look at reference the collection.
3. Sort through a prepared sample of "unknown" pleurocarpous and acrocarpous specimens (in pairs); check results with supervisor.

Liverworts

1. Read Mosses, Lichens and Ferns of Northwest North America: Their Structure and Biology. *Vitt et. al. (1988)* – Pages 140-142.
2. Read Appendix 7: Selected Bryophyte Species for Identification in the Laboratory (Section 3)
3. Look at the reference collection.

Sorting Mosses by Genus

1. Read Appendix 7: Selected Bryophyte Species for Identification in the Laboratory (Section 4)

Quality Control:

- The lab supervisor verifies all identifications of pleurocarpous, acrocarpous, and liverwort test specimens to ensure the technicians achieve an accuracy of ≥95%.

- The lab supervisor verifies all identifications of genus and morphological groupings of test specimens to ensure the technicians achieve an accuracy of ≥80%.
- Technicians having trouble achieving ≥95% accuracy are given an opportunity to review the training material and then retest.

Days 4-5: Goals and Expectations

- Technicians are familiar with all bryophyte growth forms, capable of identifying 17 predetermined moss and liverwort species with 95% accuracy and are able to sort the remaining mosses into genus groups with ≥80% accuracy.
- Technicians are able to create a voucher specimen for all positively identified species from each ABMI site.
- Technicians are able to sort through ABMI collection bags, record identified species onto datasheets, and sort unknown specimens into envelopes.
- Technicians are able to label envelopes correctly.
- Each technician has sorted at least one ABMI site completely.

Training:

Differentiate between Foliose and Thalloid Liverworts

1. Read Mosses, Lichens and Ferns of Northwest North America: Their Structure and Biology. *Vitt et. al. (1988)* – Pages 140-142.
2. Look at the reference collection

Labeling Envelopes for Further Processing

1. Read Appendix 8: Labeling of Envelopes for Unknown and Voucher Specimens

Hands On Experience

1. Sort one ABMI site in pairs
2. Start sorting ABMI sites individually

Quality Control:

- The lab supervisor verifies sorting and all identifications from the first 2 ABMI sites.
  - The technician must have detected ≥80% of the bryophyte species from each site, and identified ≥95% of the target species correctly.
  - If accuracy is lower than required, the technician undergoes additional training and re-sorts the ABMI sites, until the competency is reached.
- For each technician, the lab supervisor verifies the first 10 identifications of each species/taxonomic group.
  - Depending on results from the verifications, the lab supervisor continues verifying identifications until 5 consecutive identifications are correct for each species/taxonomic group.

Sorting & Identification – Weeks 2 & 3

- Most technicians will have completed training and passed the tests from the lab supervisor by the end of week 1. Technicians sort the specimens from ABMI sites into genera and morphological groups and identify the common moss species during weeks 2 and 3.

Goals and Expectations:

- Based on the training and instructional guidelines learned from week 1, technicians should be sorting ABMI sites at an average rate of one site every 1-2 days during week 2.
- On average technicians are expected to have completed sorting/identification of at least 4 ABMI sites by the end of the second week in the laboratory.
- By week 3, technicians will have become efficient at sorting mosses and are should have increased their sorting rate to an average of one ABMI site per day.
- On average technicians are expected to have completed sorting/identification of 9 ABMI sites by the end of week 3.

- At least some of the technicians will need to continue sorting ABMI sites during week 4. These technicians are expected to have completed sorting/identification of at least 14 ABMI sites by the end of week 4.

Quality Control:

- If a technician has achieved the minimum sorting or identification competency during week 1, then training and assessment are continued during week 2.
- If competency has been achieved, the technician sorts mosses and liverworts from ABMI sites during weeks 2 and 3.
- The lab supervisor verifies sorting and all identifications from the first 2 ABMI sites.
  - The technician must have detected ≥80% of the bryophyte species from each site, and identified ≥95% of the target species correctly.
  - If accuracy is lower than required, the technician undergoes additional training and re-sorts the ABMI sites, until the accuracy is reached.
- For each technician, the lab supervisor verifies the first 10 identifications of each species/taxonomic group.
  - Depending on results from the verifications, the lab supervisor continues verifying identifications until 5 consecutive identifications are correct for each species/taxonomic group.
- If the required accuracy of specimen sorting cannot be achieved by a technician by the end of the second week, he/she is re-assigned to other tasks.
- After a technician has achieved the required competency for specimen sorting and identification, the lab supervisor performs quality control by verifying results at random ABMI sites.
  - The lab supervisor randomly chooses one out of every five ABMI sites sorted by each technician.
  - Five microhabitat bags are randomly chosen from the chosen sites and these are checked to ensure that ≥80% of species in the bags were detected by the technician.
  - In addition, all voucher specimens, for the target species, from the chosen bags are verified to ensure accuracy to ≥95%.
  - If accuracy is lower than required during any verification, the technician undergoes additional training and re-sorts all sites since the previous acceptable evaluation.

Advanced Identification – Week 4

- Some technicians need to continue sorting ABMI sites during week 4 to complete the first round of sorting. Methods for weeks 2 & 3 are continued for these technicians.
- If possible, a few technicians will be assigned to advanced identification, and the following methods apply.
- During advanced identification, technicians work through the envelopes containing unknowns and identify 2-4 of the more difficult species from a particular genus.
- Envelopes are sorted into similar groups and ordered by ABMI site number.
- Each technician works with a particular genus and identifies a few additional species.

Goals and Expectations:

- Working with a specific genus from the sorted specimens, technicians are able to identify a few more species.
- Identification of species from the genus continues until the end of August.
- Specimen envelopes are prepared to be sent to an expert for further species identification.

Training:

1. Technicians are assigned a genus to work with.
2. Read Appendix 7: Selected Bryophyte Species for Identification in the Laboratory
3. Review the reference collection of the selected species.

Quality Control:

- Specimens must be identified with >95% accuracy.
- The lab supervisor verifies the first 5 identifications of each advanced species for each technician.

- If any of the first 5 verifications for a species are incorrect, the supervisor continues verifying that species until 5 consecutive identifications are correct.
- After the technician has achieved 5 consecutive correct identifications, the lab supervisor continues to randomly check identifications.
    - Each day, the lab supervisor randomly chooses 10% of specimens identified by the technician and verifies these to ensure ≥95% accuracy.

Taxonomic Nomenclature

Taxonomy for all groups identified to species, genus or family (Appendix 7) follows Vitt *et. al.* 1988.

Advanced Identification of Specimens to Genus/Species

Selecting the Expert

- The ABMI will select experts who are known specialists in the field of bryophyte taxonomy. To ensure the highest of standards, and to maintain ABMI's level of credibility, the ABMI will only select experts who can meet at least one of the following criteria:
  1. Expert is endorsed by the Royal Alberta Museum, or an associated museum (e.g.., Canadian Museum of Nature), as capable of identifying bryophytes with ≥95% accuracy.
  2. Expert is endorsed by 2 members of the scientific community, recognized in the field of bryophyte taxonomy, as capable of identifying bryophytes with ≥95% accuracy.

Identifying Bryophyte Specimens

- All specimens are to be identified to the lowest taxonomic level possible. Species names must be determined based on the Species References/Authorities listed below.
- RAM maintains the References/Authorities list, and if there is discrepancy between keys determines their order of precedence.
- Whenever possible, specimens are to be identified to species, with the following exceptions;
  - *Brachythecium* – these are only identified to genus by the ABMI.
  - *Bryum* – these are only identified to genus by the ABMI.
- Specimens that the expert is unable to identify to species, due to the specimen being immature, damaged, too small, or lacking key features for proper identification, are recorded in the database at the lowest taxonomic level the expert is sure of
  - Specimens identified to Genus are entered into the Genus & Species column of the database as *Genus sp.*
  - Specimens identified to Family are entered into the Family column of the database and "UID" (unable to identify) entered into the Genus & Species column.
  - The reason the specimen was not identified to species is recorded in the "Expert Comments" column (e.g. sample not mature, missing key features etc.).
- Excluding the exceptions above, the expert will make every reasonable effort to identify all specimens to species.
  - The expert should be able to identify most specimens based on his/her existing knowledge and literature he/she has available.
  - If required, the specimen is identified based on a literature search for recent revisions, and comparison of the specimen to reference or herbarium specimens.
  - For specimens that cannot be identified by the expert, one other expert who is a specialists in that particular group, is contacted and the specimen identified based on this consultation. If specimens cannot be identified based on this consultation, no further action is taken.
  - Specimens that are not identified to species are recorded in the database at the lowest taxonomic level the experts are sure of, and the reason the specimen was not identified to species is recorded in the "Expert Comments" column (e.g. could not identify with assistance from specialist).
  - If during the process of identifying a specimen additional reference literature is needed, the expert will note this additional literature in the database by recording the literature in the "Reference Used" column.
  - If during the process of identifying a specimen another expert is consulted, the expert will note this in the database by recording the second expert's initials in the "Verified By" column.
- Specimens are examined, identified, and the species name(s) written directly on the envelope (or a separate stick-on label) along with the identification date and expert's initials.
- If more species are present than has been indicated on the envelope label (and in the database), insert a new row below the original row in the database, and fill in the required information for each species present.

- If it is necessary to isolate a specimen from the original envelope, label the new envelope with all of the information from the original envelope and amend the new specimen number(s) by adding sequential letters to the original number (e.g., samples isolated from envelope 136 become 136a, 136b etc.).
- Isolate a voucher specimen for every unique species/taxon identified from each site, and label the new specimen as indicated above with the word "Voucher" on the label. Organize all voucher specimens in separate boxes for return to the Sample Processing Centre.
- Enter all required information in the Bryophyte Sorting Database (Appendix 2).
- The expert will ship the specimens back to the Sample Processing Centre, via the method above, and e-mail a digital copy of the Bryophyte Sorting Database to the ABMI lab coordinator.
- The ABMI lab coordinator will add the 7-letter species codes to the electronic database.

Verification Process

- Specimens that have been identified by experts will undergo a verification process by their peers to ensure accuracy.
- For each expert identifying ABMI bryophytes, 10% of the identified specimens (up to a maximum of 200) will be randomly selected for verification. Note that at least one randomly selected specimen from each species (or higher taxonomic group if the specimens are not identified to species) will be included.
- The ABMI lab coordinator will re-label each specimen with a reference number and send the specimens to a second expert that meets the above credibility criteria.
- The second expert will identify the specimens and record the species name beside the matching reference number on a provided data sheet.
- The second expert will ship the specimens back to the ABMI, and email the data sheet to the ABMI lab coordinator.
- The ABMI lab coordinator will compare the data between the two experts.
- Discrepancies are reviewed by both experts (plus additional experts if necessary) to determine the identification based on the most recent literature. If a discrepancy cannot be resolved, the specimen in question will be recorded in the database at the lowest taxonomic level that is agreed upon by the experts.
- If, after all discrepancies have been resolved, there is ≥5% error on the part of the initial taxonomic expert, then the genera/species with ≥5% mis-identifications are highlighted. All individuals the initial expert identified from the highlighted species are re-identified to confirm their identity.

Specimen Storage

- All bryophyte specimens are stored for 2 years.
- After 2 years, all specimens are given to the Royal Alberta Museum.
- The ABMI will retain vouchers, and enough reference specimens of each species plus additional specimens for training purposes.

Species References/Authorities

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Appendix 1: Sample Tracking Log

Note: This is a portion of the complete Sample Tracking Log that shows only the columns relevant to the receiving and processing of bryophyte samples.

RAM ACCESSION INFO						ABMI SAMPLE COLLECTION INFO					BRYOPHYTES	
Data Series Count	Project	Year	Group	RAM Lot #	Date Received	Sample Type	Site #	Sub-site	Collector	Date Collected	Habitat / Stratum	Collection Status
1												
2												
3												
4												
5												
6												
7												
8												
9												

SAMPLE DISPOSITION									
Data Transferred to Database	Samples Sent for Sorting	Samples Returned from Sorting	Samples Sent for Advanced ID or Processing	Samples Returned from Advanced ID or Processing	Database Sent to Information Centre	Current Sample Disposition	Current Residual Disposition	Samples Transferred to RAM's TMS	Comments

Appendix 2: Bryophyte Sorting Database

BRYOPHYTE SORTING														
RAM Lot No.	ABMI Site Number	Sub-site / Plot	Habitat / Stratum	Collected By	Field Collection Date	Coarse Sorting Morphotype	Date Sorted	Sorted By	Voucher Location	Residual Box #	Advanced ID Box #	Sample Disposition	Field Crew Comments	Lab Comments

ADVANCED IDENTIFICATION							
Identified By	Family	Genus & Species	ABMI Species Code	Reference Used	Advanced ID Comments	Verified By	Verification Date

Appendix 3: Data Sheets for Sorting/Identifying Bryophytes

Entered by: _____ Date: _____

ABMI Site	Sub-site / Plot #	Habitat / Stratum	Collected By	Collection Date	Specimen Number	Date Sorted	Sorted By	ABMI Species Code	Verified By	Comments

Appendix 4: Sample Shipping Checklist

Sample Shipping Checklist
Terrestrial Protocol – Summer

Crew ID: _______________ **Site Block #:** __________ **Sites Completed in Block:** ____**of**____

Shipping Date: __________ **Shipping Method:** ____________ **Waybill #:** __________________________

Type and Total # of Containers: ____

Complete one sheet for each site block in the shipment. Complete one section for each site completed in the block.
You must fill in all fields in each completed section - Record "VNA" for any fields that do not apply.
If shipping by Bus or Courier, save a copy of your waybill for future reference. If dropping off at RAM – enter the date samples are dropped off as the shipping date, enter "Delivered" as the shipping method, and enter the initials of the person dropping it off as the waybill #.

Site # _________ **Field Collection Date** _________ **Prairie Protocol**[1] (circle) Y N **Field Crew Initials** __________

Total Plant Specimens Collected[2] ________ **Plant Press ID**[3] ______________________________________ Collected by: __________

Moss[4]: Collected by: __________ **Lichen**[4]: Collected by: __________ **Tree Cores**[5]: Collected by: ___________

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: ____

Site # _________ **Field Collection Date** _________ **Prairie Protocol**[1] (circle) Y N **Field Crew Initials** __________

Total Plant Specimens Collected[2] ________ **Plant Press ID**[3] ______________________________________ Collected by: __________

Moss[4]: Collected by: __________ **Lichen**[4]: Collected by: __________ **Tree Cores**[5]: Collected by: ___________

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: ____

Site # _________ **Field Collection Date** _________ **Prairie Protocol**[1] (circle) Y N **Field Crew Initials** __________

Total Plant Specimens Collected[2] ________ **Plant Press ID**[3] ______________________________________ Collected by: __________

Moss[4]: Collected by: __________ **Lichen**[4]: Collected by: __________ **Tree Cores**[5]: Collected by: ___________

	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: ____

Site # _________ **Field Collection Date** _________ **Prairie Protocol**[1] (circle) Y N **Field Crew Initials** __________

Total Plant Specimens Collected[2] ________ **Plant Press ID**[3] ______________________________________ Collected by: __________

Moss[4]: Collected by: __________ **Lichen**[4]: Collected by: __________ **Tree Cores**[5]: Collected by: ___________

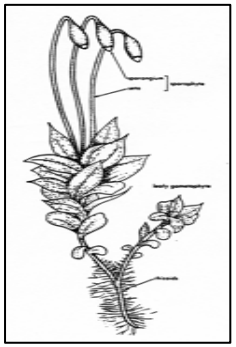
	NE	NW	SE	SW		NE	NW	SE	SW		NE	NW	SE	SW
Log/stump					Log/stump					1°				
Tree/other					Tree/other					2°				
Wetland					Wetland									
Upland					Upland					1 ha				

Comments: ____

1 – Circle "No" if the site was not sampled using prairie protocols – if yes, circle "Yes" and enter "VNA for Moss and Lichen.
2 – Record the total number of unknown vascular plant specimens collected from this site. If no unknown plant specimens were collected, indicate "None". List unique specimen ID numbers for all unknown plants collected on the appropriate Plant Press Log.
3 – Record the Plant Press ID number where the specimens are located.
4 – For each quadrant, record "C" if a sample was collected, "None" if no specimens were found, or "VNA" if the stratum was not present.
5 – Indicate species for tree cores or cookies that were collected. Indicate "None" if not collected (include comments indicating why the sample was not collected).

Appendix 5: ABMI Simplified Flow Chart to Growth Forms and Species to be Identified

1) Acrocarpous



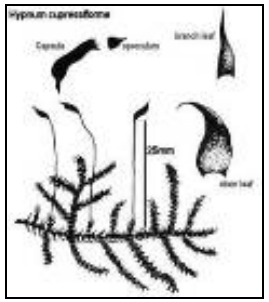
Sort by *Genus* Group:

- *Pohlia* spp.
- *Ceratodon* spp.
- *Dicranum* spp.
- *Mniaceae* spp.
- *Orthotrichum* spp.
- *Plagiomnium* spp.
- *Polytrichum* spp.
- *Sphagnum* spp.

ID to Species:

1. *Aulacomnium palustre*
2. *Ceratodon purpurea*
3. *Dicranum polysetum**
4. *Dicranum undulatum**
5. *Dicranum flagellare**
6. *Dicranum fragilifolium**
7. *Pohlia nutans*
8. *Polytrichum juniperinum**
9. *Polytrichum commune**
10. *Polytrichum strictum**
11. *Polytrichum piliferum**
12. *Orthotrichum obtusifolium*
13. *Tetraphis pellucida*

2) Pleurocarpous



Sort by *Genus* Group:

- *Brachythecium* spp.
- *Bryum* spp.
- *Pleurozium* spp.
- *Hylocomium* spp.
- *Ptilium* spp.
- *Sanionia* spp.

ID to Species:

1. *Pleurozium schreberi*
2. *Hylocomium splendens*
3. *Ptilium crista-castrensis*
4. *Sanionia uncinata*
5. *Pylaisiella polyantha*
6. *Tomenthypnum nitens*
7. *Platygyrium repens*
8. *Climacium dendroides*
9. *Eurhynchium pulchellum*

3) Foliose "bearing leaves" (Liverworts)

Sorted by *Genus* Group:

- Most of these are sent for advanced ID
- *Ptilidium spp.*
- *Liverwort spp. (general)*

ID to Species:

1. *Ptilidium pulcherrimum*
2. *Ptilidium cilliare*

4) Thalloid 'plants strap like & w/o leaves' (Liverworts)

Sorted by *Genus* Group:

- Most of these are sent for advanced ID

ID to Species:

1. *Marchantia polymorpha*

Appendix 6: Terminology and Morphology of Bryophytes

Acrocarpous Producing the sporophyte at the end of a stem or main branch, as opposed to *pleurocarpous*; acrocarpous mosses generally grow erect in tufts (rather than mats) and are sparsely branched.

Alar cells Cells at the basal angles of a leaf, often differentiated in shape, size or color.

Brood body Asexual reproductive structures, usually borne either in the leaf axils or at the tip of the stem.

Capsule The spore case, often differentiated into an upper spore-bearing urn and a sterile basal neck. Borne at the end of the seta.

Costa Central thickened portion of the leaf, analogous to the midrib in vascular plants.

Gemma cup Cup-shaped structure formed from modified leaves, bearing asexual reproductive structures.

Pinnate Branching pattern resembling that of a feather, where branches are arranged regularly on either side of a stem.

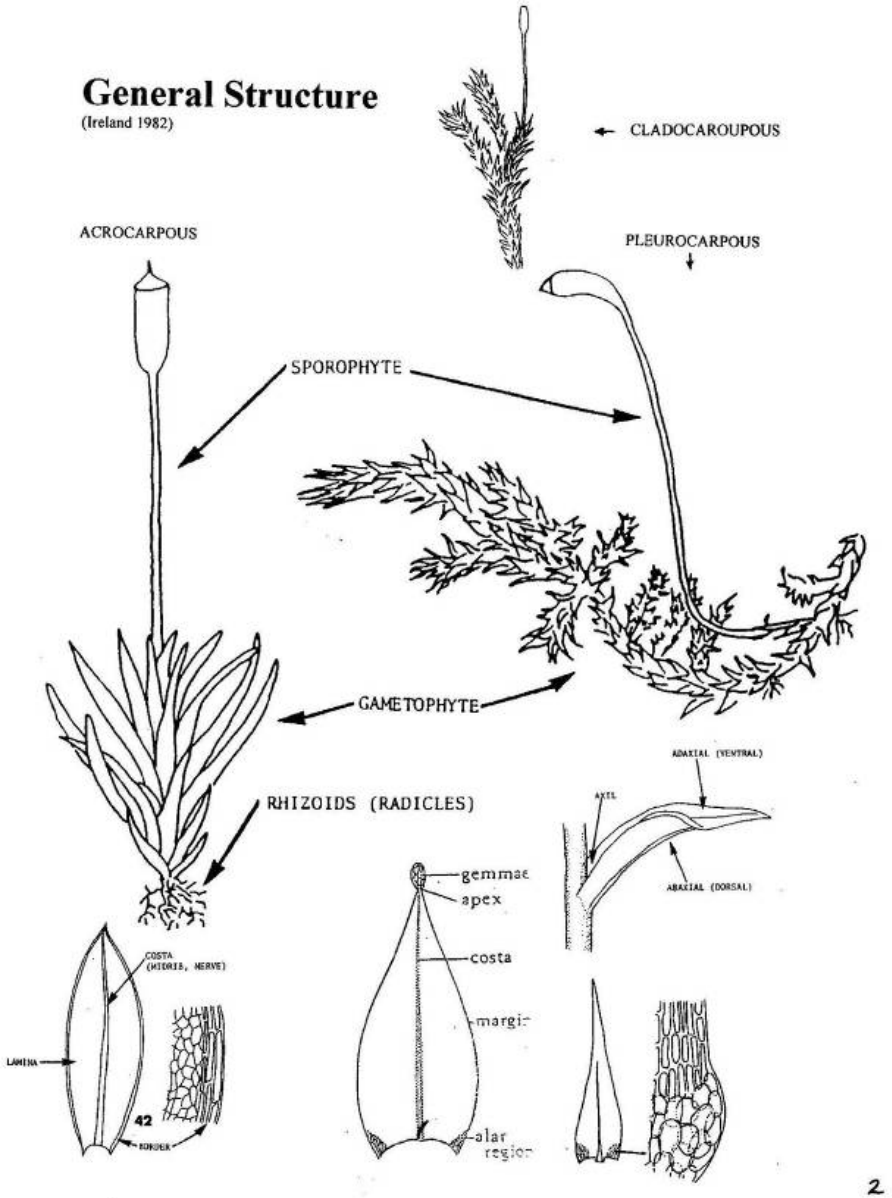
Pleurocarpous Producing the sporophyte(s) laterally along the main stem, as opposed to *acrocarpous*; pleurocarpous mosses generally grow prostrate and are extensively branched.

Seta Basal portion of the sporophyte; elevates the spore-bearing capsule.

Tomentum Felt-like protective structure fully or partially covering the stem.

General Structure

(Ireland 1982)



2

Leaf arrangement and stance; Branching

Ireland (1982)

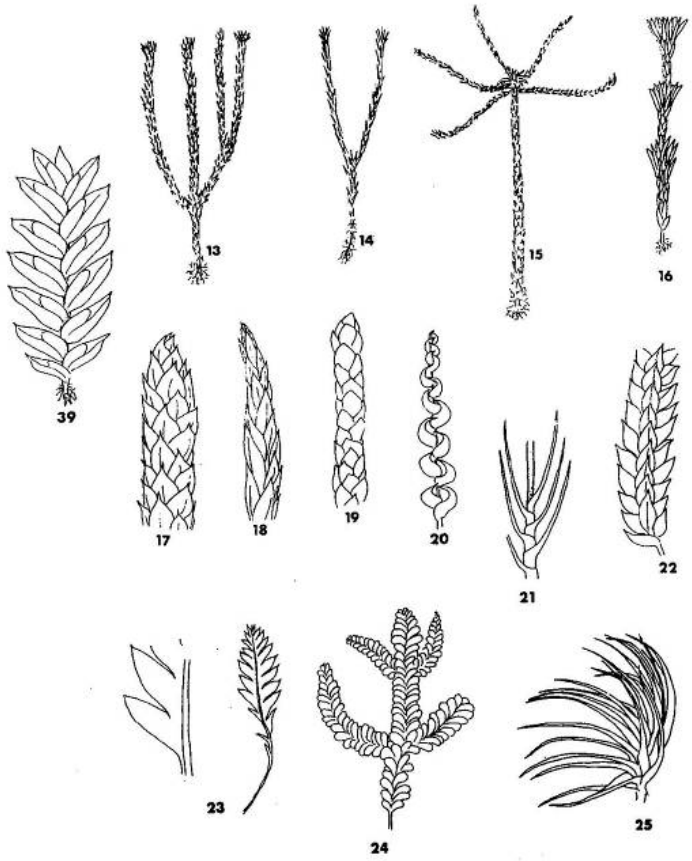


Plate 400. **13.** Fastigiate. **14.** Dichotomous. **15.** Whorled. **16.** Annotinous. **17.** Imbricate. **18.** Appressed. **19.** Julaceous, terete. **20.** Catenulate. **21.** Amplexicaul. **22.** Trifarious. **23.** Confluent, frondiform. **24.** Complanate. **25.** Falcate-secund **39.** Distichous.

6

Leaf forms

(Ireland 1982)

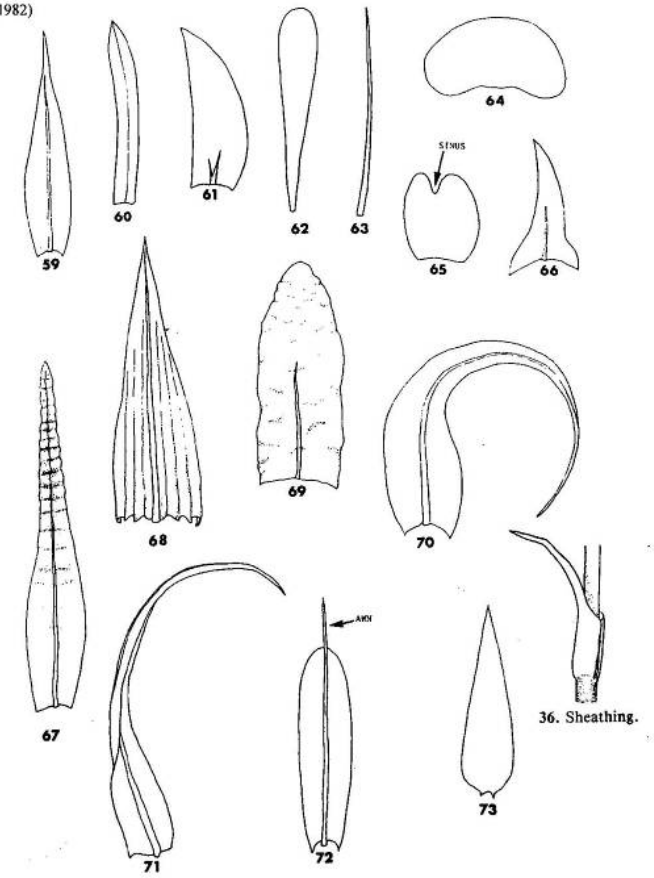


Plate 404. **59.** Lanceolate. **60.** Ensiform. **61.** Cultriform, scalpelliform. **62.** Clavate. **63.** Acicular. **64.** Reniform. **65.** Bilobed. **66.** Hastate. **67.** Undulate. **68.** Plicate. **69.** Rugose. **70.** Circinate, gyrate, uncinate. **71.** Falcate. **72.** Aristate, piliferous.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

Leaf forms

(Ireland 1982)

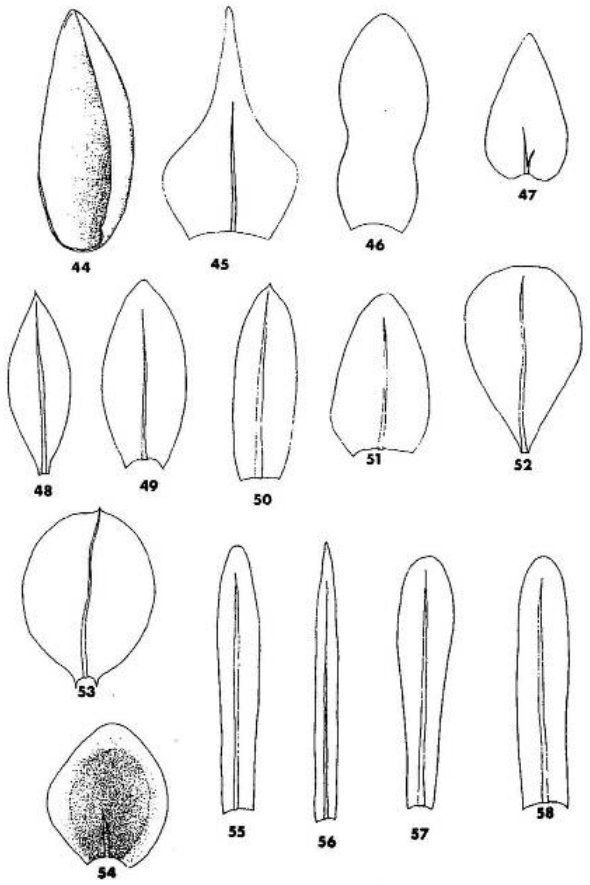
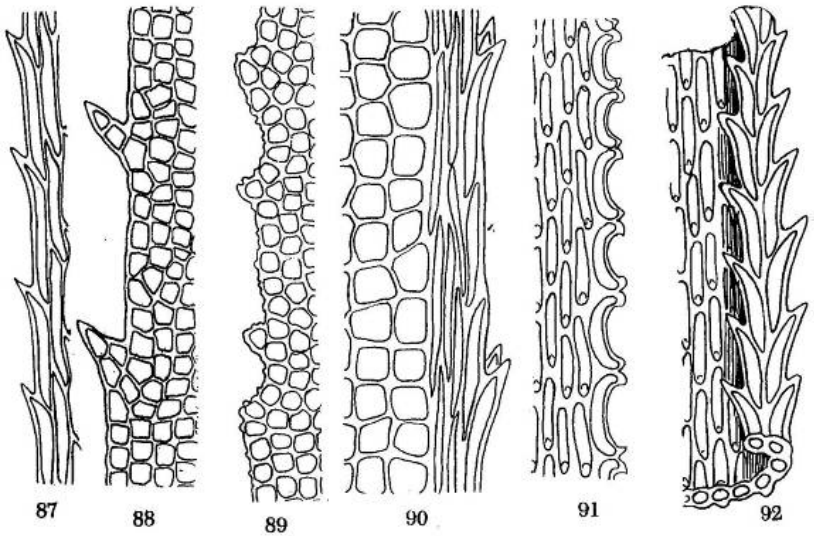


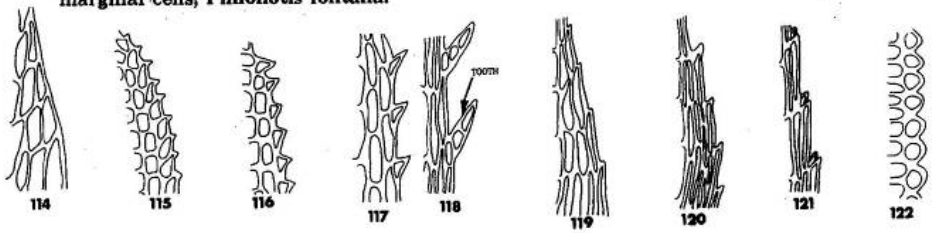
Plate 403. **44.** Cymbiform, navicular. **45.** Deltoid. **46.** Panduriform. **47.** Cordate. **48.** Elliptic. **49.** Oval. **50.** Oblong. **51.** Ovate. **52.** Obovate. **53.** Orbicular. **54.** Cochleariform. **55.** Ligulate. **56.** Linear. **57.** Spatulate. **58.** Lingulate.

Leaf margins

(Flowers 1973, Ireland 1982)



Figs. 87–92. Leaf margins, ×120. 87. Serrate by the projection of the upper ends of the marginal cells, **Brachythecium lamprochryseum.** 88. Serrate, the teeth formed by 1–3 cells, **Timmia bavarica.** 89. Margin irregularly notched, **Trichostomum tenuirostre.** 90. Margins bordered with narrow cells and doubly serrate **Mnium marginatum.** 91. Margin doubly serrate, **Philonotis fontana.** 92. Margins doubly serrate by the projection of the upper ends of the marginal and submarginal cells, **Philonotis fontana.**

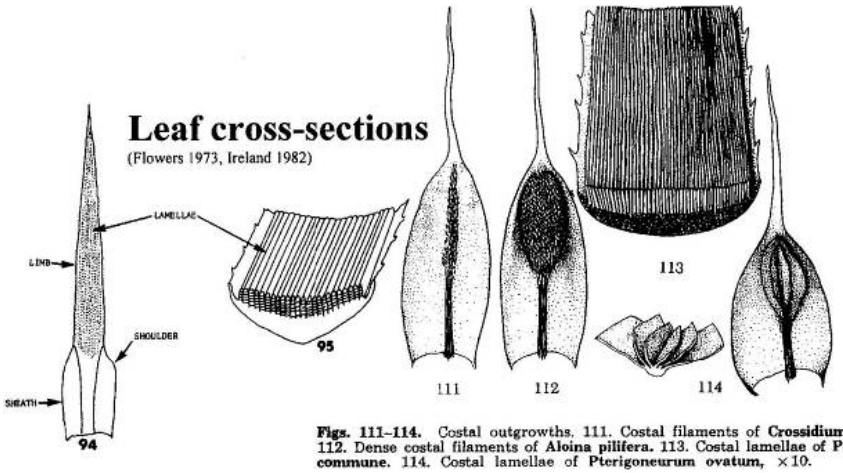


114–122. Leaf margins. **114.** Entire, edentate. **115.** Denticulate. **116.** Dentate. **117.** Spiculose. **118.** Spinose, toothed. **119.** Serrulate. **120.** Serrate. **121.** Doubly serrate. **122.** Crenate.

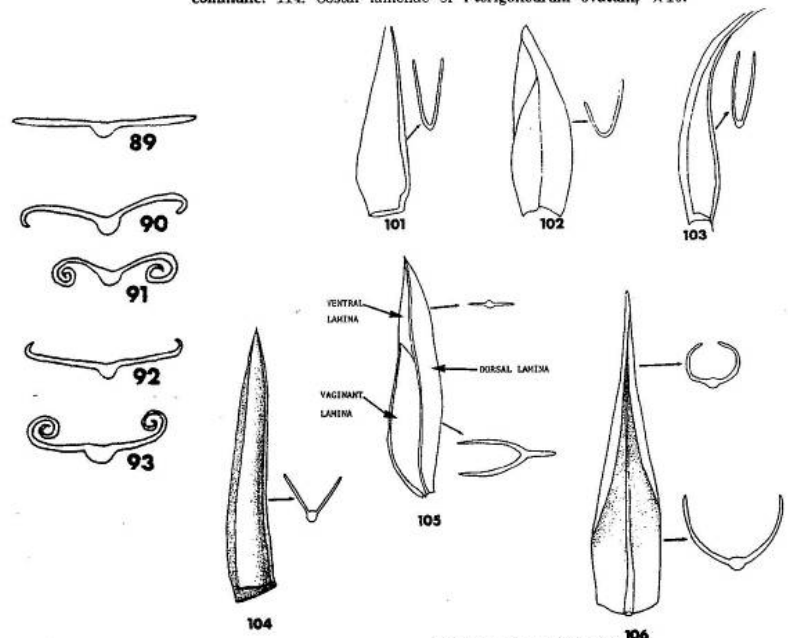
14

Leaf cross-sections

(Flowers 1973, Ireland 1982)



Figs. 111–114. Costal outgrowths. 111. Costal filaments of **Crossidium aberrans.** 112. Dense costal filaments of **Aloina pilifera.** 113. Costal lamellae of **Polytrichum commune.** 114. Costal lamellae of **Pterigoneurum ovatum,** ×10.



89–93. Cross-sections of leaves. **89.** Plane. **90.** Deflexed, recurved, reflexed. **91.** Revolute. **92.** Incurved, inflexed. **93.** Involute. **94.** Lamellae on *Polytrichum* leaf. **95.** Section of lamellae on *Polytrichum* leaf.
101. Conduplicate. **102.** Complicate. **103.** Complicate-carinate. **104.** Carinate, keeled. **105.** Equitant. **106.** Canaliculate, tubulose.

16

Capsule forms

(Ireland 1982)

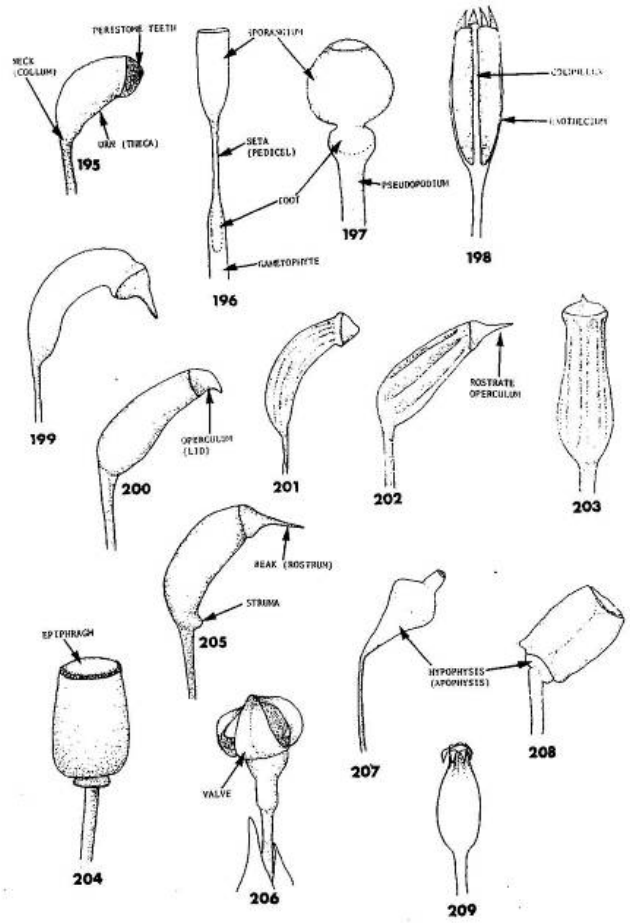
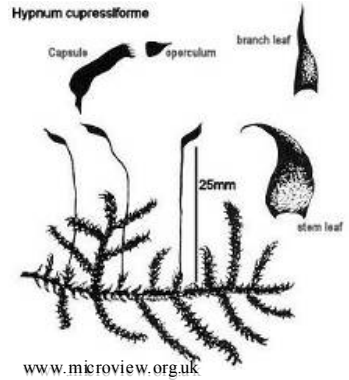


Plate 413. **195.** Capsule. **196–197.** Sporophyte. **198.** Columella (seen in longitudinal section of capsule). **199–209.** Capsules. **199.** Arcuate. **200.** Inclined. **201.** Striate. **202.** Sulcate. **203.** Ribbed. **204.** Epiphragm of Polytrichaceae capsule. **205.** Strumose. **206.**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

22

Appendix 7: Selected Bryophyte Species for Identification in the Laboratory



Section 1: Pleurocarpous Mosses

- The sporophyte arises laterally (stems usually prostrate and much-branched)

Pleurozium schreberi PLEUSCH

Big red stem, Schreber's moss

Growth form: Pleurocarpous

Habitat: Humus, soil, and other substrates, in dry, open woods and also in bogs and wet coniferous forests

Field characters:

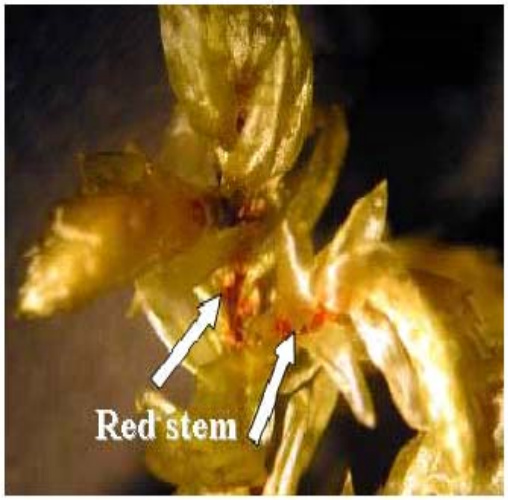
- **Stems and branches red**
- Leaves concave, smooth, and **shiny when dry**
- Branches 1-pinnate
- One of the most common mosses

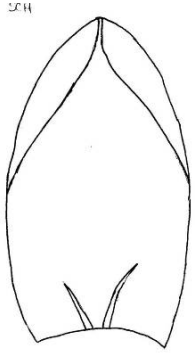
Similar Species:

Hylocomium splendens (stair step) – is 2-3-pinnate
Climacium dendroides (tree moss) – has tree-like form
Rhytidiadelphus triquetrus (frightened cat tail moss) – has large, wide-spreading leaves

Vitt et. al.: 107

Notes:





Climacium dendroides CLIMDEN

Tree moss, everlasting herb, common longevity moss, palm moss

Growth form: Pleurocarpous

Habitat: On soil or humus in moist, shady places in swamps, or depressions in forests, often along streams or at the edges of pools..

Field characters:

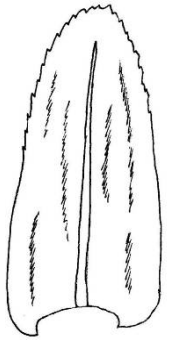
- Plants have a tree-like form, with branches crowded at the tops of the stems
- Leaves are concave and shiny when dry

Similar Species:

C. dendroides looks a lot like *Pleurozium schreberi* (big red stem), especially when it's dry, because of the red branches, but only *C. dendroides* has a tree-like form (vs. singly pinnate in *P. schreberi*).

Vitt et. al: 113

Notes:



Hylocomium splendens HYLOSPL

Stair-step, mountain fern moss, glittering feathermoss

Growth form: Pleurocarpous

Habitat: Soil, humus, and old logs, in forests and wooded peatlands

Field characters:

- Branches 2-3 pinnate
- **Plants have 'stair-case' form, with horizontal fronds connected by upward-angling stems**
- Stems and branches red

Similar Species:

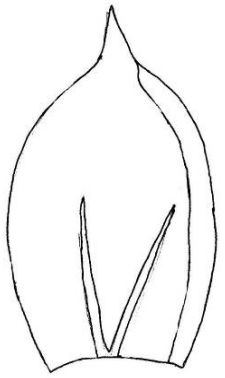
Rhytidiadelphus triquetrus (frightened cat tail moss) – has large, wide-spreading leaves

Pleurozium schreberi (big red stem) – is singly pinnate

Climacium dendroides (tree moss) – has tree-like form

Other common 2-3-pinnate species:

Thuidium recognitum – usually has green stems, no 'stair steps'



Vitt et. al.: 107

Notes:

Ptilium crista-castrensis PTILCRI

Knight's plume, ostrich plume moss, comb moss

Growth form: Pleurocarpous

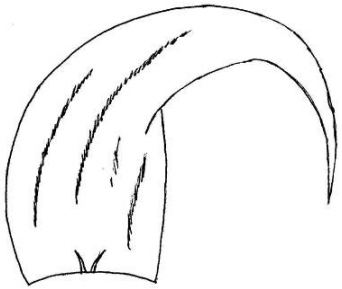
Habitat: On humus and old logs in dry to swampy, coniferous or mixed wood forests

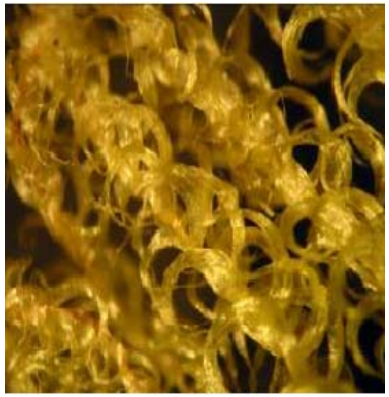
Field characters:
- Leaves hooked and longitudinally creased
- Branches strictly singly pinnate
- Plants light green-yellow

Similar Species:
- *Sanionia uncinata* which also has hooked, longitudinally folded leaves, but which is much less regularly pinnate.

Vitt et.al: 106

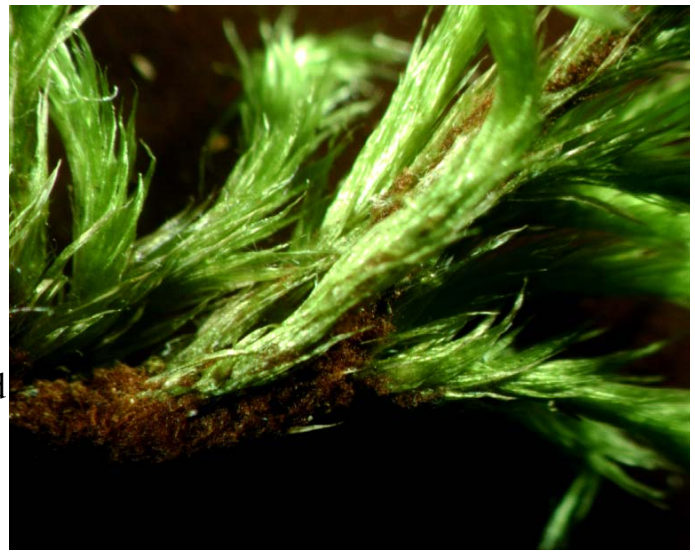
Notes:





Tomenthypnum nitens TOMENIT

Shining feather moss, golden moss



Growth form: Pleurocarpous

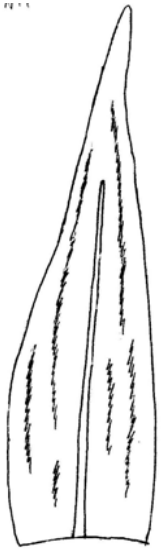
Habitat:Calciphile of muskeg, tundra, rich fens. Commonly found with *Campylium stellatum, Aulacomnium palustre,* and *Helodium blandowii*.

Field characters:

- Leaves golden to light green in colour
- Leaves straight, narrowly pointed, erect or erect-spreading, and creased longitudinally
- **Stems 'felted' on under surface with thick brown tomentum**

Similar Species:

Aulacomnium palustre (Ribbed bog moss) also has brown tomentum and inhabits similar types of sites. However, *A. palustre* is acrocarpous and has shorter, blunter leaves that are dull waxy-yellow as opposed to than the shiny golden appearance of *Tomenthypnum nitens*.



Vitt et.al.: 97

Notes:

Platygyrium repens PLATREP

Common flat-brocade moss, copper lustrous moss

Growth form: Pleurocarpous

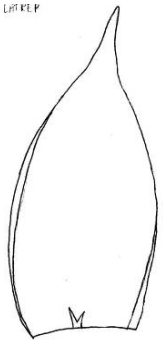
Habitat: Logs, stumps, and tree bases and trunks, in dry to moist forests

Field characters:

- **Branch tips often ascend from substrate and bear tiny 'pom-pom' clumps of brood bodies**
- Plants have a shiny, 'greasy' look, especially when shaded
- Capsules erect and cylindrical

Similar species:

• *Pylaisiella polyantha* is more common (in boreal Alberta) and also occurs at tree bases and woody debris, has erect capsules, and upward-curling branch tips but lacks clusters of brood bodies at the branch tips (visible, with practice, using a hand lens).



Vitt et. al.: 105

Notes:

Eurhynchium pulchellum EURHPUL

Elegant feather moss, common beautiful-beak moss, little rib moss

Growth form: Pleurocarpous

Habitat: Forest floors (usually deciduous or mixed wood) on rotten wood or humus and at the bases of trees.

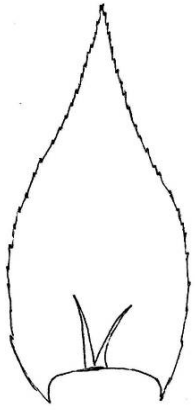
Field characters:

- Leaves often standing out from stems and branches
- Colony wide spreading – frizzy looking
- Plants frilly and light green
- Leaves (especially stem leaves) quite triangular

Similar Species:

• Like *Brachythecium* spp. but generally smaller, and leaf apices are blunter.

Vitt et.al.: 94



NOTES:

Sanionia uncinata SANIUNC

(formerly ***Drepanocladus uncinatus*****)**
Sickle moss, hook moss, circle-leaf moss

Growth form: Pleurocarpous

Habitat:On thin soil or humus; often over rock, decaying wood, and bark at the base of trees; under a range of moisture conditions, but most commonly in upland habitats

Field characters:
- **Leaves often hooked almost to the point of forming circles**
- Leaves longitudinally creased
- Plants usually light yellowish- to brownish-green
- Similar to *Drepanocladus aduncus* and *P. crista-catrensis*. Branching pattern is not as regular as it is in *P. crista-castrensis*.
- Fairly common everywhere

Vitt et.al.: 90

Notes:

Pylaisiella polyantha PYLAPOL

Aspen moss, stocking moss

Growth form: Pleurocarpous

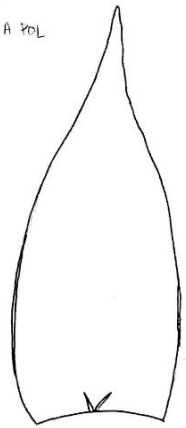
Habitat:Bases and trunks of deciduous trees, especially aspens, or on recently fallen wood. Occasionally on coniferous trees or rocks.

Field characters:

- Capsules erect and cylindrical
- **Branch tips curve upward**
- Leaves shiny green when dry
- Colonies form 'stockings' on tree bases

Similar species:

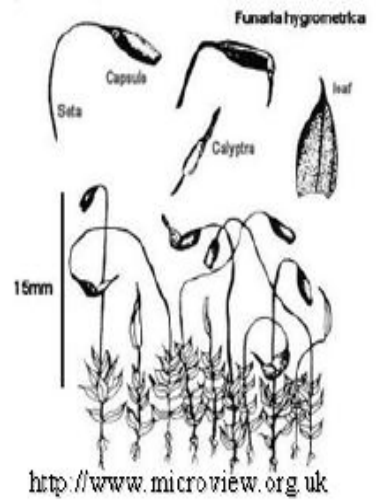
Platygyrium repens, though less common, often also occurs at tree bases, and has erect capsules, and has upward-curling branch tips. *P. repens*, however, has a more greasy, scraggly appearance and has clusters of brood bodies at the branch tips (visible with a hand lens).



Vitt et.al.: 105

Notes:

Section 2: Acrocarpous Mosses



- Sporophyte (capsule and stalk) arising from plant apex (note stems usually erect and quite simple)

Orthotrichum obtusifolium ORTHOBT

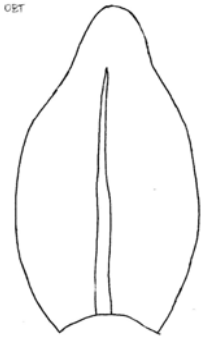
Blunt-leaved bristle moss, Round-leafed erect rib moss, Obtuse-leaf wood-bark moss, Blunt hood moss

Growth form: Acrocarpous

Habitat: Found mainly on bark of mature poplar trees.

Field characters:
- Leaf apices blunt
- Leaf margins erect
- Leaves expand when sprayed with water
- Easy moss to identify

Similar species:
• *O. speciosum* which also grow on trees but which have **pointed** leaf apices and lack gemmae. (also easy to I.D. once you have a handle on the two; see reference specimens to compare).



Vitt et.al.: 65

Notes :

Aulacomnium palustre AULAPAL

Neon moss, ribbed bog moss, bog thread moss, marsh thread moss

Growth form: Acrocarpous

Habitat: Wet places - fens, marshes, meadows, wooded swamps, bogs, and brush thickets around ponds or along streams

Field characters:

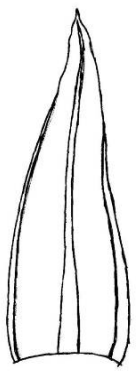
- Leaves yellowish or yellow-green, 'waxy' when wet
- **Stems 'felted' with thick brown tomentum**
- Plants sometimes bear clusters of brood bodies on green stalks where sporophytes would normally be
- **Strong costa**

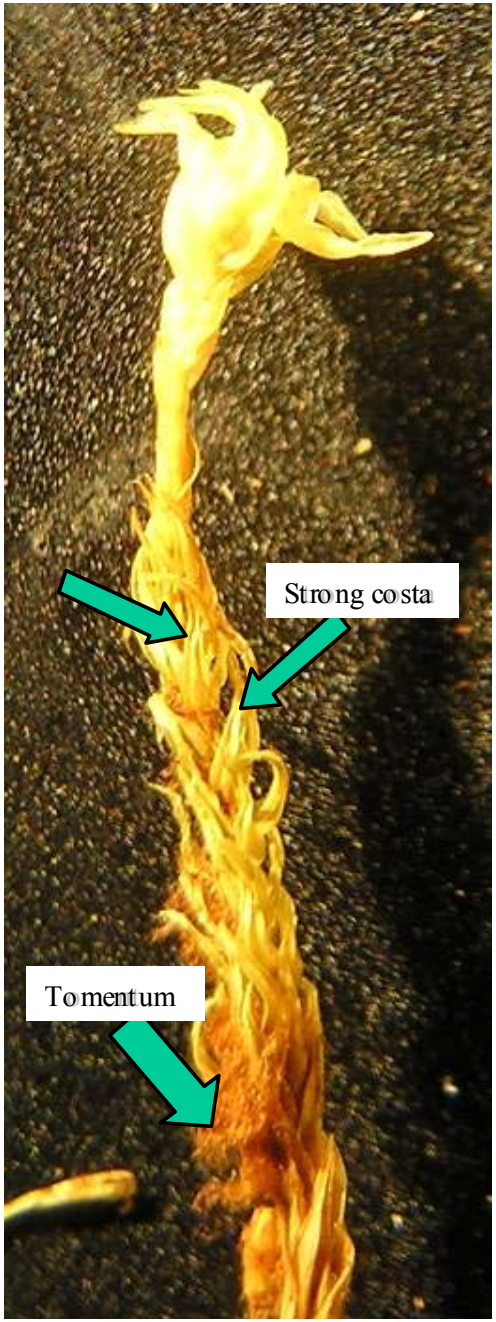
Similar Species:

This species is quite distinctive, and not much can be confused with it. *Tomenthypnum nitens* (golden moss) also occurs in wetlands and features brown tomentum but the overall form and leaves of plants are very different.

Vitt et.al.: 78

Notes:





Ceratodon purpureus CERAPUR

Ceratodon, purple horn-tooth, burn moss, purple fork moss, red roof moss

Growth form: Acrocarpous

Habitat: Common in montane and boreal forests on disturbed soils; in open areas it prefers sandy soils.

Field characters:

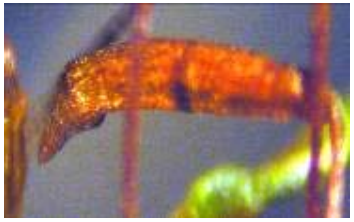
- **Capsules and setae dark wine-red**
- Capsules curved, 8 ribbed, horizontal, ridged
- Leaves lanceolate and margins recurved
- Plants small with leaves contorted when dry, reddish tinge

Similar Species:

• *Pohlia nutans:* whose leaves are not recurved and are toothed along the margin.

Vitt et. al.: 130

Notes:



Pohlia nutans POHLNUT

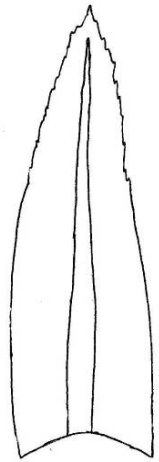
Copper wire moss, nodding pohlia, sponge gourd moss

Growth form: Acrocarpous

Habitat: Everywhere - on rotten logs, tops of rotten stumps and old *Sphagnum* hummocks, also on soil or humus at the base of trees or on banks and in the crevices of cliffs. Sometimes found on charred wood. In dense forests and open places.

Field characters:

- Setae shiny, copper-coloured
- Red stem
- Capsule nodding
- **No revolute leaf margins**
- **Serrulate margins**
- Costa ending below apex



Similar Species:

- *Ceratodon purpureus:* recurved margins, not toothed at apex
- *Bryum* spp. (which also have nodding capsules and reddish stem).

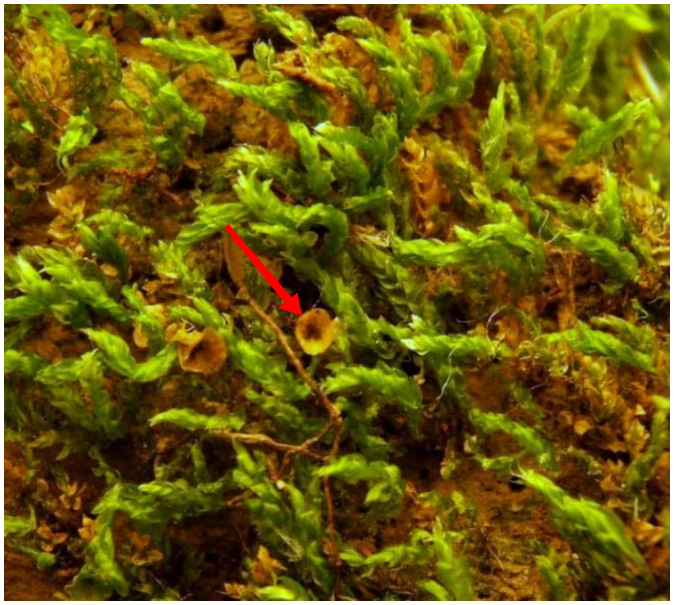
*Bryum*s often have recurved leaf margins and a more pronounced, excurrent costa.

Vitt et.al.: 70

Notes:

Tetraphis pellucida TETRPEL

Pellucid four-tooth moss, pellucid tetraphis



Growth form: Acrocarpous

Habitat: Acidophile, most commonly on shaded, old, soft, rotten stumps or logs.

Field characters:

- Leaves broad (in relation to their length)
- **Gemmae cups common at plant apices**
- **Capsules 4-toothed** (visible with hand lens)

Similar Species:

This species might remind one of a miniature *Mnium*-type species because of its broad leaves. It almost always has gemmae cups or sporophytes, both of which differentiate it from *Mnium* sp.

Vitt et.al.: 61

Notes:

Section 3: Liverworts

- Thalloid liverworts have a gametophyte consisting of a flattened, dorsi-ventral thallus
- Leafy (foliose) liverworts grow mostly horizontal and have three ranks of leaves; two lateral and one ventral

Ptilidium pulcherrium PTILPUL

Growth form: Foliose

Habitat: Common on living and dead wood.

Field characters:
- plant tightly appressed to substrate
- Leaves deeply divided, fringed with cilia
- dark olive green to reddish brown

Similar Species:
Similar to *P. ciliare*, however *P. ciliare* is not appressed to its s

Vitt et. al.: 145

Notes:

Ptilidium ciliare PTILCIL

Growth form: Foliose

Habitat: Common in dry tundra, mountain summits, and acid wetlands, also deciduous, coniferous and mixed upland and lowland forests, and dry thin soil over rock surfaces or humus. Rare on living or dead wood.

Field characters:
- plant rising from substrate
- leaves less divided than *P. pulcherrimum*, fringed with cilia
- light green to reddish brown

Similar Species:
Similar to *P. pulcherrimum*; however, leaves are larger and less finely divided and plant is less appressed to the substrate

Vitt et. al.: 145

Notes:

Marchantia polymorpha MARCPOL

Growth form: Thallose

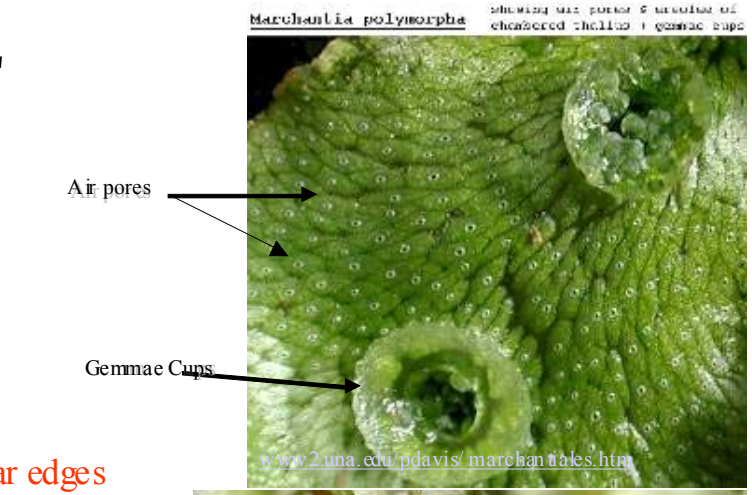
Habitat: Swampy areas, often abundant after a fire

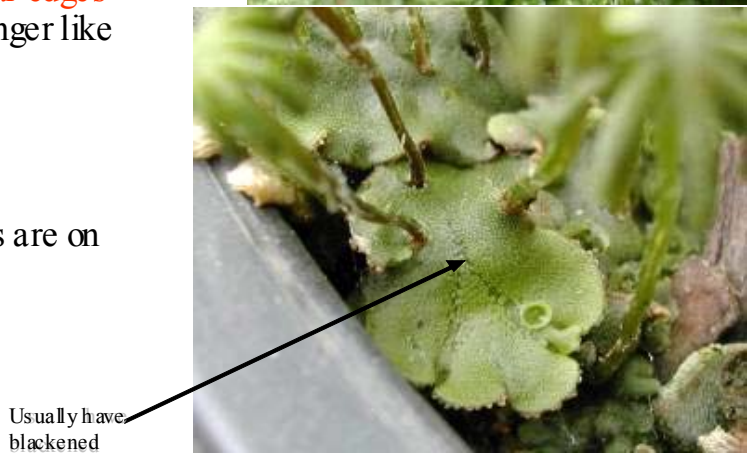
Field characters:
- One of the largest thalloid liverworts
- Pores are obvious on the thallus and gemmae cups are often present near edges
- Unisexual: Males have lobed discs produced on stalks, females have finger like lobes

Similar Species:
- *Preissa quadrata*, but looks thicker, is smaller and only female portions are on raised stalks w/o finger-like projections; darkened midrib is absent.

Vitt et al: 154

Notes:





Section 4: I.D. Just to Genus

- *Sphagnum* spp.
- Mniaceae
  - *Mnium* spp.
  - *Plagiomnium* spp.
  - *Rhizomnium* spp.
- *Brachythecium* spp.
- *Bryum* spp.

Sphagnum spp. SPHA spp.

Peat Moss

Growth form: Sphagnum

Habitat: bogs and fens

Field characters:

- Branches clustered.
- **Branches are attached to stem in groups and are either pendant along the stem or spread outward.**
- Look like pom-poms
- Varying in color, determination of species

Vitt et.al.: 53-55

Notes:


S. fuscum


S. magellanicum

Mniaceae

Growth form: Acrocarpous

Habitat: Varies.

Field characters:

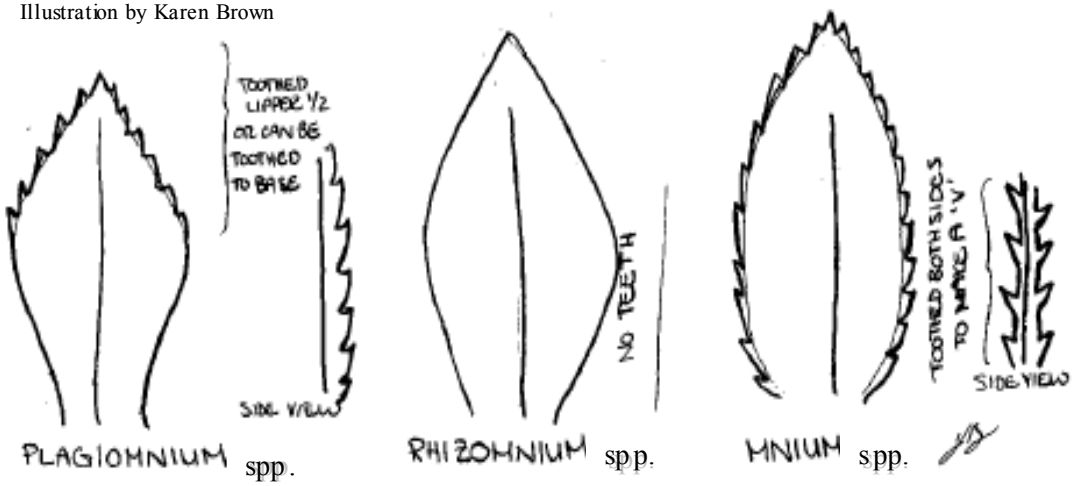
• **Leaves broad in relation to their length, and broader (when moist) than most other groups of moss; look like little plants.**

• Plagiotropic (creeping, sterile) shoots may be present

• Three genera to classify: *Plagiomnium* (toothed singly) , *Rhizomnium* (no marginal teeth) and *Mnium* (double toothed along margin; see below.

Vitt et.al.: 73-76

Illustration by Karen Brown



Three genera of this family differ by their teeth and marginal views

Brachythecium spp. BRAC spp.

Growth form: Pleurocarpous

Habitat: mesic to dry habitats, often on logs, humus and soil in montane-boreal forests.

Field characters:

- **shiny**
- Lanceolate leaves, strong single costa, acuminate, and often plicate leaves
- yellow-green color
- Nondescript mosses
- 15-20 species in Western Canada

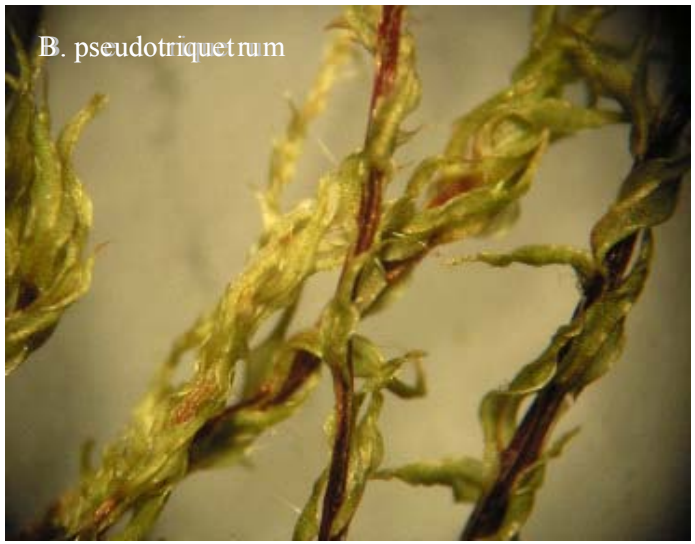
Similar species:

- *Eurhynchium pulchellum* but these mosses are usually smaller in size and form dense colonies that have a delicate, frilly appearance.

Vitt et. al: 97 – 99

Notes:

Bryum spp. BRYU spp.



Growth form: Acrocarpous

Habitat: various

Field characters:

- Capsules are cylindrical, smooth and nodding; positioned on long setae.
- **Almost all species have an excurrent costa**
- Not toothed
- **Usually with red stem**
- Leaves bordered by elongate cells
- About 50 varieties and species in Canada

Similar Species:

- *Pohlia* spp., but they have costa ending before apex and nonbordered leaves.

Notes:

Section 5: Advanced Moss I.D.

- *Dicranum* spp.
- *Polytrichum* spp.

Dicranum spp.

- Plants small to large
- In dense, tomentose tufts
- Stems simple or forked
- Leaves generally lanceolate, not bordered, usually curved; crisped when dry
- Costa well developed, narrow, ending near the apex to shortly excurrent

Dicranum polysetum DICRPOL

Wavy dicranum, wavy broom moss, wavy tail moss

Growth form: Acrocarpous

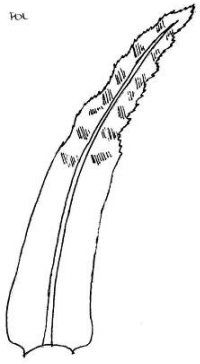
Habitat: On humus or sometimes on soil, generally in (often coniferous) forests

Field characters:

- **Stem covered in mostly white or light brown tomentum**
- **Leaves shiny, almost translucent**
- Found on upland sites
- **Leaves stick out perpendicular to stem**

Similar Species:

- Other Dicranums: *D. undulatum*, which (in contrast to *D. polysetum*) occupies generally much wetter habitats, and which has more erect leaves, forms denser colonies, and bears just one seta per plant, usually more wavy, leaves duller, with dark, rusty brown tomentum.
- *D. scoparium:* leaves lacking waves, leaves not spreading, dense white tomentum.



Vitt et.al.: 124

Notes:

Dicranum undulatum DICRUND

Electric eels

Growth form: Acrocarpous

Habitat: Peatlands, especially bogs, often growing with *Sphagnum* and black spruce; in forests in northern boreal

Field characters:
- **Stems with brown tomentum**
- Leaves dull compared to *D. polysetum*
- Leaves clustered together and point upwards

Similar Species:
• *D. polysetum* (wavy dicranum), which (in contrast to *D. undulatum*) occupies generally much drier habitats, and which has wide-spreading leaves, forms loose colonies, and bears several setae per plant, tomentum whitish.

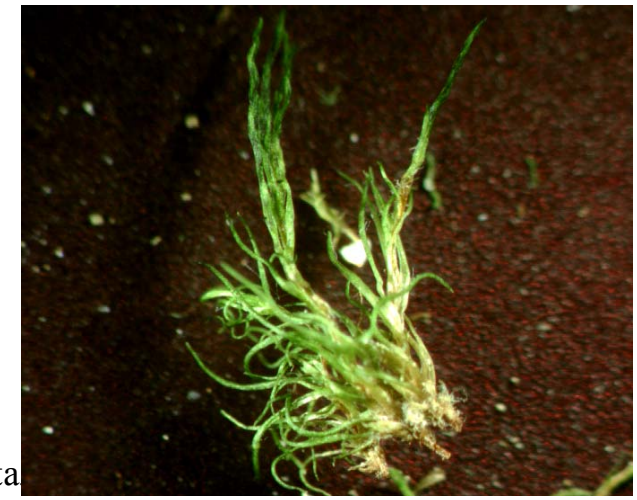
Vitt et.al.: 125

Notes:

Stem with brown tomentum

Dicranum flagellare DICRFLA

Flagellate dicranum, Whip fork moss, Upright-fruited fork moss, Flagellate fork moss, Delicate hair tie moss, Flagella broom moss



Growth form: Acrocarpous

Habitat: Common on rotten wood or sometimes on humus, peaty soil, or tree bases in upland habitats.

Field characters:

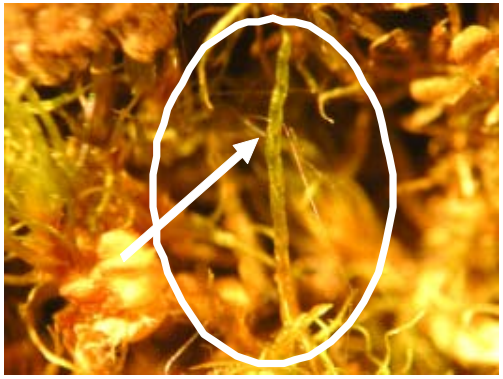
- **Clusters of flagellate (whip-shaped) branchlets among leaves**
- Capsules (when present) erect
- Leaves narrow in relation to their length
- Watch out for similarity with other species of *Dicranum* in boreal Alberta.

Similar Species:

- other *Dicranum* spp., but only one with flagellate branches.

Vitt et.al.: 126

Notes:



D. flagellare usually bears clusters of flagellate branches (indicated by arrows) among the leaves

Dicranum fragilifolium DICRFRA

Fragile Dicranum Moss

Growth form: Acrocarpous

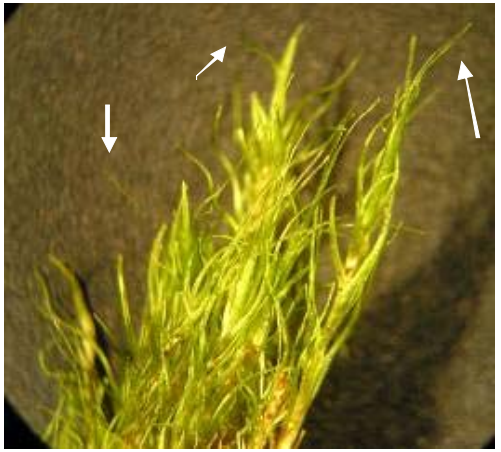
Habitat: found by rock and on wood, humus soils

Field Characters:

- **Leaves often broken at tip**
- **Leaves straight and rigid**
- Thick brown tomentum on stem base
- Very long thin leaves
- Grows on rotten wood or tree base

Similar Species:

- Like other *Dicranum* spp., but is the only one with fragile tips that break off.



Vitt et.al.: 126

Notes:

Polytrichum spp.

- Coarse and often robust
- Appear similar to small conifer seedlings
- Leaves many cells thick, may resemble conifer needles
- Stem erect, sometimes from a horizontal base
- Leaves erect or erect-spreading when dry, erect to wide-spreading and recurved when moist

Polytrichum juniperinum POLYJUN

Juniper hair-cap, juniper-leaved hair moss, juniper bear moss, juniper moss

Growth form: Acrocarpous

Habitat: On soil or humus, sometimes on stumps, characteristic of banks or trail sides in rather dry, open woods or pastures, but common in many habitats

Field characters:

- Plants resembling miniature conifers
- Capsules angled in cross-section
- **Leaf margins untoothed and folded in over ventral surface of leaf**
- Stems lacking tomentum

Similar Species:

Other common species of *Polytrichum* (all resembling miniature conifers and featuring angled capsules) in Alberta include:

P. commune (common hair cap) – has toothed leaf margins, and is usually taller than *P. juniperinum*

P. strictum (slender hair cap) – has shorter, finer leaves and taller plants than *P. juniperinum*, and grows in wet places

P. piliferum (awned hair cap) – has long, white hairs at the tip of each leaf

Vitt et.al: 57

Notes:

Polytrichum commune POLYCOM

Common hair-cap, common hair moss, large bear moss

Growth form: Acrocarpous

Habitat: On soil, humus, and rocks in wet habitats, in pastures and meadows, and at the edges of bogs or coniferous swamps

Field characters:

- Plants look like miniature conifers
- Capsules angled in cross-section
- Plants large
- **Leaf margins toothed and erect**
- **Does not have tomentum**

Similar Species:

- Other *Polytrichum* species (no others have toothed margins)
- *Pogonatum* species, which also have toothed margins, but rare, and is generally smaller in stature. Be especially careful in upland habitats.

Vitt et.al.: 56

Notes:

Polytrichum strictum POLYSTR

Slender hair-cap, narrow-leaved hair moss, bog bear moss

Growth form: Acrocarpous

Habitat: Closely associated with *Sphagnum* in open and wooded bogs and poor fens, common in boggy heaths, typically found at the top of old hummocks.

Field characters:

- Plants resembling miniature conifers
- **Stems tall**
- **White tomentum**
- Leaf margins untoothed and folded in over ventral leaf surface

Similar species:

- like other *Polytrichum* spp., only one slender with dense white tomentum

Vitt et.al.: 57

Notes:

References

Illustrations and Text:

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Appendix 8: Labeling of Envelopes for Unknown and Voucher Specimens

All specimens that cannot be identified by technicians are isolated from the main collection bags and placed into individually labeled envelopes for further processing and/or expert identification. Labeling used for the envelopes is standardized so ABMI technicians can easily review the envelopes and find particular specimens for advanced identification.

1) Single Unknown Species – Genus Known

Moss Specimen: 2008 Ref. # 138

ABMI

ABMI Site:_____
Date:_____
Crew Member:_____
Microhabitat:_____
Plot:_____

ID: Brachythecium sp.

2) Multiple Unknown Species – Genus Known

Moss Specimen: 2008 Ref. # 138

ABMI

ABMI Site:_____
Date:_____
Crew Member:_____
Microhabitat:_____
Plot:_____

ID: Brachythecium sp.
Dicranum sp.

3) Group of Species – Species ID'd and Unknown

Moss Specimen: 2008 Ref. # 138

ABMI

ABMI Site:_____
Date:_____
Crew Member:_____
Microhabitat:_____
Plot:_____

PYLAPOL
ID: unknown pleurocarp

4) Single Species – Unknown – Genus Unknown

Moss Specimen: 2008 Ref. # 138

ABMI

ABMI Site:_____
Date:_____
Crew Member:_____
Microhabitat:_____
Plot:_____

ID: unknown Sp. (Brachythecium like?)

ABMI collects one specimen (referred to as a voucher) of every species identified within a site. Technicians place these specimens into envelopes marked with a unique reference number, year, specimen type, and species name. Data sheets contain a column for documenting reference numbers (from the envelopes) for each specimen chosen as a voucher for that site.

5) Example of a Voucher Specimen Envelope

Moss Specimen: 2008 Ref. # 138
VOUCHER

ABMI

ABMI Site:_____
Date:_____
Crew Member:_____
Microhabitat:_____
Plot:_____

PYLAPOL