

# *Introduction*

*Revised through 18 December 2006*

## *Goals and Strategy*

The **goals** of this Guide are to create an identification system for the **intermediate level student** that:

- gives **perspective** on the **characters** used in the identification of mosses. It employs the various character options that **Mother Nature** uses, rather than forcing everything into dichotomous states. The Guide not only functions in a practical way to allow identification of genera, but also acts as a **teaching tool** to focus the student's attention on important characters to be looked for.
- gives **perspective** on the logical structure underlying the **total system**; i.e., the whole system is viewable in the Overview or on only **two pages** (Appendix B; Abbreviated Overview). If a user realizes that an error in identification has been made, then alternative routes are hopefully relatively apparent within the scheme.
- sorts out the mosses into **smaller Groups** where each of the members included in a single Group is defined by one to three major characteristics. It minimizes the problems of a dichotomous key where a single wrong choice may not be discovered until the very end of the key; here a wrong choice usually involves "backing up" only to the start of a Group. The aim is to minimize the problem that "keys are made by those that don't need them, for those that can't use them."
- is simple enough in internal structure to allow the user to correct, modify or **customize** it with relative ease. In particular, it can be **downsized** to smaller geographical or political regions by eliminating appropriate taxa. An approximation of the **geographical range** for each genus is given in two different places within the Guide to facilitate downsizing and identification of genera. We welcome **collaboration** with any individuals that might be interested in downsizing the Guide for their particular area. As "**Regional**" versions, e.g., Diana's version for Maine and surrounding areas, become available, they will be included in Appendix F.
- allows modification without undue strain for use **elsewhere** in the **world**, particularly in the Northern Hemisphere. The Guide is in a ubiquitous format (**msWord** files) to allow customization of it by the maximal number of users.

To the maximum extent possible, the **order** in which characters are used adheres to the following guidelines:

- **obvious** or **unique** characters will come **first**, and **subtle, inconspicuous** ones **last**. Characters visible to the **naked eye** will come first, followed sequentially by characters visible in the **hand lens**, then the **dissecting** microscope, and lastly by those only visible in the **compound** microscope. It must be emphasized, however, that there is variability in the amount of magnification required to see a given character, and thus some **overlap** exists between sections within the Overview.
- characters relating to **sexual** condition (dioicous, synoicous, and etc.) and **sporophytes** are used only as a **last resort** in that they are often not available for many months of the year.
- characters relating to **habitat** or **substrate** are used only as a **last resort** in that appropriate information is often not available at the bench, if suitable data were not recorded when the collections were made.

## *Parts to the Guide*

### **Introduction**

### **Overview**

An outline of the **identification system** specifying the characters leading to corresponding **Groups** in which various genera will be found.

### **Full Sub-Guides**

**Three** Sub-Guides (Initial, Freely branched & Rarely branched) allowing identification to a genus **within a** given **Group**.

### **Skeleton Sub-Guides (Skeletons)**

**Three** Skeletons (Initial, Freely branched & Rarely branched) giving **perspective** on which **genera** possess species exhibiting the **characters** of a particular Group.

### **Concordance**

An alphabetical list of the genera to be found within the Guide giving **perspective** on: a) the **number** of **species** within a given genus; b) the approximate geographical **distribution** of that genus; and c) which **Groups** of the Guide contain that genus.

### **Geographical Abbreviations**

Generalized abbreviations for particular areas; two-letter postal-code abbreviations for states and provinces within the United States and Canada.

### **Appendices**

Appendix A: **Quick-Start** Instructions.

Appendix B: **Abbreviated** Overview. Useful to those familiar with the system.

Appendix C: **Glossary**.

Appendix D: **Downloadable** Files (Web version only).

Appendix E: **Corrections** and **Revisions**.

Appendix F: **Downsizing** Recommendations & **Regional** Guides: For those who wish to downsize or use the Guide for a particular geographic area.

Other Appendices in preparation, but not yet ready for distribution, cover highly unique capsules, distinctive asexual brood bodies, and how to look at and find diagnostic features of mosses.

## *Conventions*

### **Genera Included & Nomenclature**

The genera included, and the nomenclature for them, are found in the List of the Mosses of North America North of Mexico (Anderson, Crum & Buck, 1990). Updating the Guide will be necessary on completion of the Bryophyte Flora of North America project.

### **Terminology**

That found in the glossaries of most major floras and, as an **optimum source**, the beautifully illustrated Mosses & Other Bryophytes; an Illustrated Glossary (Malcolm & Malcolm, 2000).

### **Geographical Coverage & Distribution**

North America north of Mexico; distributions are listed in the "full" Sub-Guides and the Concordance. Abbreviations follow the Concordance.

### **Order of use**

This Guide is meant to be used **sequentially** as in other keys. A genus may be found only once in the Guide, if an identifying character is extremely obvious, and it only has one such character. In most cases a given genus will be found in more than one Group based on the number of distinguishing characters it possesses in the "naked-eye", "hand-lens", or "dissecting microscope" categories. If, in the judgment of the authors, the genus can be identified with reasonable certainty without using "compound microscope" characters, then that genus will not be found in the latter Groups requiring such a microscope.

### **Abbreviations**

† (dagger): In part, i.e., not all of the species within a given genus, or the genus containing a species listed, will key to this Group. The other species in this genus will be found again later in the Guide in an appropriate Group.

±: More or less

**Cell ratios** (length to breadth) of medial, laminal leaf cells:

**Freely** branched (mostly pleurocarpous) mosses:

**Long:** >8:1; commonly termed linear or linear-flexuose.

**Intermediate:** 3-8:1; commonly termed elongated, oblong-rhomboidal, fusiform, or elliptical.

**Short:** <3:1; commonly termed isodiametric, quadrate, rounded-quadrate, or rhombic.

**Rarely** branched (mostly acrocarpous) mosses:

**Long:** >5:1; commonly termed linear.

**Intermediate:** 2-5:1; commonly termed elongated, rectangular, hexagonal, or rhomboidal.

**Short:** <2:1; commonly termed isodiametric, quadrate, rounded-quadrate, or sub-quadrate.

Number of **stereid bands** evident in cross-sections of leaf costae:

**2\*** = costa with two stereid bands

**1\*** = costa with one stereid band

**0\*** = costa lacking stereid bands, i.e., ±homogeneous

## Cell surface ornamentation

In the Overview and corresponding sections of the Full Sub-Guides, a distinction is made between "Cells distinctly papillose or prurulose" and "Cells indistinctly ornamented." **Distinct** ornamentation, e.g., papillose, prurulose, mammillose or bulging, is, in our view, ornamentation that is higher and can be seen with reasonable confidence when observing leaves in surface view. **Indistinct** ornamentation, on the other hand, is lower and requires that observations be made on the bends of folded leaves or leaf cross-sections.

## Differences in treatment

There are some differences between the way the Freely branched and Rarely branched mosses are treated. Some of these differences may be removed in future versions; some will not.

- **Species names** are included in the Guide to Initial Groups (the Freely branched taxa ) and the Guide to Freely Branched Mosses when the genus is monotypic, or if the only possible choice at the end of a line is a single species.
- The leaf **cell ratio** definitions (long, intermediate, and short) differ slightly between the Freely branched and Rarely branched Guides.
- In the **Skeleton** Sub-Guide to Freely Branched Mosses, Groups P21 through P28 include all the freely branched moss genera. Those genera **not in brackets** require the criteria in Groups P21-P28 for successful identification. Those genera **in brackets** [--] should have been successfully identified in the preceding Groups. All genera are listed here as a reference to aid in overall perspective on the Freely branched mosses.

**Note:** Comments and suggestions regarding the Freely branched mosses should be directed to Diane Lucas; comments and suggestions regarding the Rarely branched mosses should be directed to Malcolm Sargent.

## Format & Availability

The files for this Guide have been created in Microsoft's **Word X** for Mac. The page margins are generally 0.7" throughout, and the font is Times 11 except for headings and other unique situations. The files are continuously **monitored** for viruses, worms and etc. by Norton AntiVirus using the latest virus definitions.

A **HTML** version may be found at: <http://www.life.uiuc.edu/moss-guide/>. Downloadable files in both msWord and **PDF** formats are available at the website. The msWord and PDF files are also available from the authors via **e.mail**, or, if all else fails, on a CD.

When printing the msWord files from PC's or different operating systems, the page margins or page breaks may be slightly **misaligned** and require correction. The PDF versions of the files do not normally have these alignment problems, or other Macintosh versus Windows incompatibilities.

## Warnings

**Immature**, sterile or small, and ratty specimens often cannot be identified with certainty.

While many genera can be identified **in the field** with relative certainty, some can only be identified if sporophytes are present, and others cannot be identified with certainty in the field under any circumstances.

**Substrate** specificity varies with conditions, e.g., with ideal conditions (often high humidity and moisture levels) taxa that might normally grow on soil may also be found on rocks or bark.

The characters used assume a “normal” level of **hydration**. Plants wet from a recent rain may look very different! For example, *Hedwigia ciliata* goes from being rigid and dull gray with tightly appressed leaves when dry, to soft and green with squarrose leaves when wet. Plants removed from their substrate may quickly alter their appearance. For example, leaves of *Atrichum* species will quickly fold up to the stem when the plants are removed from the soil.

The characters used assume a “typical” **size**. Plants growing under unusually adverse conditions, usually too dry, can be smaller than “typical”. Plants growing under unusually beneficial conditions, usually ideal moisture and humidity, can be larger than “typical”.

**Color** can vary for a variety of reasons. Most mosses darken in color as they mature and age. Many mosses growing under lower light intensities will be green (shade form), whereas they will be reddish or purplish (sun form) from various pigments when growing under higher light intensities.

“**Plants vary!**” Lewis C. Anderson

## Sources

The **major** sources of information for this Guide are: a) the Key to Moss Genera of North America North of Mexico (Vitt & Buck, 1992); b) the floras for eastern North America (Crum & Anderson, 1981), the Pacific Northwest (Lawton, 1971), and North America (Grout, 1931-1940); and c) the volume on the Pottiaceae by Zander (1993). **Other** sources occasionally providing highly relevant information included: a) the floras for Britain and Ireland (Smith, 1978), Japan (Noguchi, 1987-1994), Mexico (Sharp, Crum & Eckel 1994), and the West Indies (Buck, 1998); b) the increasing number of contributions to the Bryophyte Flora of North America on the Internet; and c) original articles in various bryological journals.

There has been a long **history** of efforts to make bryophyte identification easier for the non-specialist, and the works of Dunham (1916), Grout (1947), Bodenbergh (1954), and Conard & Redfearn (1979) are good examples representing those efforts for North America. While the present Guide has benefited enormously from some ideas and concepts from these earlier works, the target audience is slightly different. This Guide is not meant for the absolute novice, but for the **intermediate level naturalist** or bryologist having difficulties with specialist keys.

## *Disclaimers*

This Guide is:

- a work “**in progress**”, i.e., very much like **open-source** software, and in need of improvement and revision. We continue to discover ways to improve it as we work with actual collections, and constructive comments and criticisms would be greatly **appreciated**. The authors are by no means experts on the moss flora of North America, and the preparation of this Guide has been, among other things, a learning experience meant to make the authors more familiar with the flora. Revisions and corrections will be **posted** in Appendix E at the Guide website at appropriate intervals.
- going to be "**out of date**" within the near future as the "Bryophyte Flora of North America" (BFNA) is completed. Our intention is to revise the Guide to make it agree with the BFNA as soon as the latter is completed.
- meant for users with **access** to a hand-lens, a dissecting microscope, and, preferably, a compound microscope. It assumes that the user already has a basic understanding of the morphology and life cycle of mosses, and the terminology used to describe those items.
- meant to be **used with**, and as an **aid to**, floras presently available, whether they cover major areas of North America, specific regions, or individual states, i.e., it is not a "stand-alone" product. The floras have invaluable information including:
  - a) full morphological descriptions of the mosses;
  - b) habitat and substrate preferences;
  - c) geographic ranges; and
  - d) most importantly – illustrations.
- totally **artificial** in that no effort is made to group phylogenetically related taxa.

## *Acknowledgements*

The continuing stimulation, encouragement and advice on all things bryological from Barbara Andreas, Barbara Crandall-Stotler, Bill Buck, Bill McKnight, Dale Vitt, Janice Glime, Nancy Slack, Norton Miller, and Ray Stotler, among others, is most sincerely appreciated. Nancy Slack, in particular, has made noteworthy suggestions.

We are especially indebted to the Department of Plant Biology at the University of Illinois for generous financial support regarding design of the website, to E. Barbara Meyer for her expertise in designing the web version, and to Bill N. McKnight for extensive, detailed editorial suggestions.

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End.