

1913-12

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The Ohio Naturalist. v14 n2 (December, 1913), 211-214

<http://hdl.handle.net/1811/1797>

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THE CLASSIFICATION OF PLANTS, XI.*

JOHN H. SCHAFFNER.

The various groups of Bryophyta are apparently closely related and it is sometimes difficult to tell what characters are of phyletic importance. There are no fundamental peculiarities or structures which will divide the group into two or three main divisions without considerable overlapping of equally important structures of another type. Thus one is compelled in certain cases to delimit classes and orders on trivial or rather unimportant structures. Nevertheless, the complexity of the group as a whole demands that it should be divided into a number of classes.

The homologies of the various organs are quite evident among themselves and also when compared with the plants immediately above; yet we often find a very illogical terminology and a set of names applied to the various structures which makes comparison with other phyla impossible until special explanations have been made. If we apply a morphological terminology to the mosses and liverworts similar to that used in other groups no difficulty of presentation is experienced. Such an attempt has worked well for the writer in dealing with large numbers of students in general botany.

The synopsis of the Bryophyta given below segregates the main groups and attempts to arrange them in phyletic series.

SYNOPSIS OF THE CLASSES OF BRYOPHYTA.

- A. Archegonia not sunken in the plant body; sporophyte without definite intercallary growth between the foot and sporangium.
- I. Gametophyte thalloid or with stem and scales, the scales always without a midrib; sporophyte without a stalk or differentiated into foot, stalk and sporangium mostly with elaters, never with a columella, opening irregularly or by a lid, or mostly by four valves. *HEPATICA*E. Liverworts.
 - II. Gametophyte with stem and scales, the scales mostly with a midrib; sporophyte usually with a solid stem; sporangium mostly opening by a lid (operculum) or if opening by slits or valves, not with elaters; columella present in the sporangium, complete or occasionally incomplete; archegonium usually developing as a calyptra after fertilization.

* Contributed from the Botanical Laboratory of Ohio State University, No. 78.

1. Sporophyte borne on a pseudopodium developed by the gametophyte; columella not extending through the spore cavity; sporangium without air cavities; without or with a calyptra.
 - a. Gray-green bog-mosses with two kinds of cells in the gametophyte; sporangium opening by a lid; archegonium breaking irregularly at the tip. SPHAGNEÆ, Bog-mosses.
Sphagnales, Sphagnaceæ, Sphagnum.
 - b. Dark green rock mosses, not with two kinds of cells; sporangium opening by four or more vertical slits; archegonium developing a calyptra. ANDREÆÆ, Granite Mosses,
Andreæales, Andreæaceæ, Andreæa.
 2. Sporophyte not borne on a pseudopodium, usually with a prominent stalk or seta; columella usually extending thru the spore cavity; sporangium with an air cavity, usually with stomata; archegonium developing a calyptra.
MUSCI, True Mosses.
- B. Archegonia having their venters imbedded in the thallus; gametophyte thalloid, without typical scales; its cells usually with only one or two chloroplasts; sporophyte with intercallary growth between the foot and the sporangium; sporangium with a central columella, opening by two valves, sometimes with stomata.
ANTHOCEROTEÆ, Hornworts, **Antocerotales**, Anthocerotaceæ, Notothylas, Anthoceros, Dendroceros.

SYNOPSIS OF THE HEPATICÆ.

- I. Gametophyte a thalloid, dorsiventral frond composed of several distinct tissue layers; mostly with air passages; sporophyte spherical or with a foot and short stalk; sporangium rarely opening by 4-8 valves.
 1. Sporophyte spherical, without foot or stalk, remaining enclosed in the venter of the archegonium; no sterile cells in the sporangium. Ricciaceæ, Riccia,
Ricciolepis, etc.
 2. Sporophyte differentiated into foot, stalk and sporangium, breaking thru the venter of the archegonium at maturity; sporangium with spores and sterile cells which mostly develop as elaters.
Marchantiaceæ, Targionia, Grimaldia, Conocephalus
Lunularia, Marchantia, etc.

II. Gametophyte a frond with stem and scales, or if flat and thalloid not composed of several distinct tissue layers, never with air passages; sporophyte consisting of foot, stalk and sporangium, nearly always opening by 4 valves. **Jungermanniales.**

1. Archegonia not terminating the growth of the axis on which they are borne; perigonium not consisting of distinct scales but of a continuous sheath; frond without scales or with imperfectly developed scales. Metzgeriaceæ. Metzgeria, Pallavicinia, Pellia, Fossombronia, etc.
2. Archegonia terminating the growth of the axis; perigonium consisting of scales or occasionally wanting; frond nearly always with 2 or 3 rows of scales. Jungermanniaceæ. Nardia, Lophozia, Kantia, Porella, Frullania, etc.

SYNOPSIS OF THE ORDERS AND MAIN FAMILY GROUPS OF MUSCI.

At present, only a partial segregation of the families of Hypnales and Bryales is attempted.

- A. Sporangium without a columella, the sporogenous and vegetative cells commingled; spores very large; archegonium not forming a calyptra but finally rupturing irregularly. **Archidiales**, Archidiaceæ. Archidium.
- B. Sporangium with a definite central columella.
 - I. Archegonia situated on top of short, special lateral branches; peristome when present usually double, developed in the amphithecium from thickened parts of the cell walls; teeth transversely barred, the outer set usually 16, alternating with the inner; frond usually of creeping habit. **Hypnales.**
 Eropodiaceæ, Eustichiaceæ, Entodontaceæ, Fabroniaceæ, Hedwegiaceæ, Fontinalaceæ, Climaciaceæ, Cryphæaceæ, Leucodontaceæ, Prionodontaceæ, Cryptopodaceæ, Echinodiaceæ, Ptychomniaceæ, Spiridentaceæ, Lepyrodontaceæ, Pleurophascaceæ, Neckeraceæ, Lembophyllaceæ, Pilotrichaceæ, Hookeriaceæ, Ephemeropteraceæ, Hypopterygiaceæ, Helicophyllaceæ, Rhacopilaceæ, Leskeaceæ, Hypnaceæ, Leucomiaceæ, Brachytheciaceæ, Sematophyllaceæ, Rhenmatodontaceæ, Hypnodendraceæ.

II. Archegonia situated at the tip of the main stem or of ordinary branches; frond usually of erect habit.

1. Peristome single or double or sometimes absent, developed in the amphithecium from thickened parts of the cell walls; teeth always transversely barred.

Bryales.

a. Peristome single, seldom wanting.

Dicranaceæ, Leucobryaceæ, Fissidentaceæ, Calymperaceæ, Pottiaceæ, Grimmiaceæ.

b. Peristome double at least in its inception, rarely wanting, the endostome thin and membranous.

(a.) Teeth of the endostome alternating with those of the exostome.

Orthotrichaceæ, Mitteniaceæ, Drepanophyllaceæ, Schistostegaceæ, Calomniaceæ, Rhizogoniaceæ, Bartramiaceæ, Timmiaceæ, Catosciaceæ, Aulacomniaceæ, Meeseaceæ, Mniaceæ, Leptostomaceæ, Bryaceæ.

(b.) Teeth of the endostome, when present, opposite those of the exostome, either free or united with the outer set.

Funeriacæ, Disceliaceæ, Oedipodiaceæ, Voitiaceæ, Splachnaceæ.

2. Peristome single or double, developed from two tissue layers of the sporangium; teeth consisting of entire cells, not transversely barred, or if developed from thickened parts of cell walls then the sporangium decidedly dorsiventral and zygomorphic.

Polytrichales.

a. Peristome of 4-6 teeth; sporangium actinomorphic. Geogiaceæ. Georgia.

b. Peristome with numerous teeth; sporangium actinomorphic or zygomorphic.

(a.) Sporangium strongly zygomorphic and dorsiventral. Buxbaumiaceæ.

Buxbaumia, Webera, Dawsonia.

(b.) Sporangium actinomorphic, usually prismatic. Polytrichaceæ. Catharina, Atrichum, Polytrichum, etc.