Study about Bryophytes, Characteristics, Classification and Bryophyte Life Cycle

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Abstract : Bryophytes include the mosses, liverworts, and hornworts. Bryophytes are the simplest of plants (excluding the algae, which are not considered plants by most botanists) and and bryology is the study of bryophytes. While there are marked differences between these three groups of organisms, they are related closely enough to warrant a single term that includes all three. So a moss is a bryophyte, a liverwort is a bryophyte and a hornwort is a bryophyte. Bryophytes are small, seldom exceeding 6-8 in (15-20 cm) in height, and usually much smaller. They are attached to the substrate (ground, rock, or bark) by rhizoids, which are one or a few-celled, root-like threads that serve only for anchoring and are not capable of absorbing water and nutrients from the substrate. Brypohytes lack vascular tissue (the specialized cells grouped together to pipe water and nutrients to various parts of the body), or in the rare cases when this tissue is present, it is not well differentiated. The leaves of bryophytes are technically not true leaves, because in most species they lack vascular tissue. However, they are functionally equivalent to leaves, containing chlorophylls a and b for photosynthesis. Leaves are usually one-cell thick, except for the midrib, which may be up to 15 cells thick. Bryophytes satisfy their nutritional requirements by absorbing minerals from dust, rainfall, and water running over their surface.

Bryophytes can be found in wet environments all around the world. Because they have no vascular tissue, they aren't able to take water from the soil and transport it to higher tissue. Bryophytes need wet and often well shaded environments which deliver a lot of rain water for them to soak up. Bryophytes are therefore common on the forest floor and tree stems in rain forests, wetland ecosystems and at high altitudes. They also find their way into urban life by establishing on places such as bricks and in the cracks of paved surfaces.

Bryophyte Characteristics : The following characteristics are exhibited by bryophytes:

- Bryophytes are non-vascular land plants. Although they do exhibit specialized structures for water transportation, they are devoid of vascular tissue.
- Bryophytes grow primarily in damp environments but can be found growing in diverse habitats ranging from deserts, the artic, and high elevations. Since bryophytes do not depend on root structures for nutrient uptake like vascular plants, they are able to survive in environments that vascular plants cannot (e.g., on the surface of rocks).
- All bryophytes have a dominant gametophyte stage in their life cycle. During this stage, the plant is haploid and the sex organs that produce the gametes are developed. Bryophytes are unique compared to many other plant species in that they remain in this stage for long periods.
- The sporophytes (the diploid form of the plant) of bryophytes are unbranched, producing a single spore-producing capsule (sporangium). Moreover, the sporophytes are dependent on the gametophyte for nutrition and develops within the female sex organ (archegonia).

The Bryophyta may be classified as follows:

Division	**:**	**Bryophyta**
Class 1.	:	Hepaticopsida (Hepaticae)
Class 2.	:	Anthocerotopsida (Anthocerotae)
Class 3.	:	Bryopsida (Musci)

Mosses

mossMosses are flowerless plants that grow in clumps. They don't have roots. Instead they have thin root-like growths called rhizoids that help anchor them. Because they don't have roots and stems to transport water, mosses dry out very quickly, so they are usually found in moist habitats. The only place they don't grow is in salt water.

Moss plants are usually very small. They have leaf-like structures or phyllids that are usually only a single cell layer thick. The phyllids spiral around a stem-like structure called the caulid. Mosses reproduce in an unusual way.

There is a first generation moss, the gametophyte. The gametophyte produces a sperm and an egg. They come together and grow into the next generation, the sporophyte. The sporophyte usually grows on a stalk or seta. The sporophyte has no chlorophyl and lives on a gametophyte. The sporophyte dries out and releases spores that grow into a new generation of gametophytes.

Liverworts

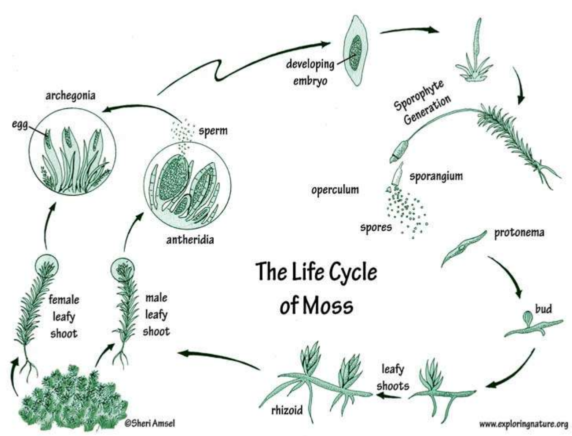
liverwortLiverworts get their name from their shape. In medieval times, people thought that the shape of a plant would tell you the part of the body it could help cure. Some liverworts look like the liver! Like moss, liverworts grow in moist habitats. They also don't have leaves, stems, or roots. Like moss, they use rhizoids to anchor themselves to the ground, rocks or trees.

Hornworts

There are about 100 species of hornworts in the world. They are found in tropical forests and along streamsides. They are usually small and greenish-blue. They are long and narrow and have sporophytes at their tips. The sporophyte is where the spores are made. When the spores mature, the stalk splits open and releases the spores.

Bryophyte Life Cycle

The bryophyte lifecycle consists of alternating generations between the haploid gametophyte and the diploid sporophyte. During the gametophyte stage, haploid gametes (male and female) are formed in the specialized sex organs: the antheridia (male) and archegonia (female). The gametes consist of flagellated sperm, which swim via water or are transported by insect species. The two haploid gametes (sperm and egg) fuse, a diploid zygote is formed. As described above, the zygote of bryophytes grows inside the archegonia and will eventually become a diploid sporophyte. Mature sporophytes remain attached to the gametophyte and



generate haploid spores via meiosis inside the sporangium. These spores are dispersed, and under favorable environmental conditions become new gametophytes. The lifecycle is shown below.
As do all plants, bryophytes alternate a game tophytic generation with a sporophytic one (a sporic meiosis, a life cycle in which meiosis gives rise to spores, not gametes). Each of the haploid (1 n) spores is capable of developing into a multicellular, haploid individual, the gametophyte. The first structure formed from spores in most mosses and many liverworts is a filamentous, algal-like, green protonema (plural,protonemata). In some mosses the protonemata are long lived with rhizoids and aerial filaments and they often form dense green mats in suitable sites. Cells in the protonema, probably stimulated by red light and kinetin, give rise to shoots, which enlarge and become the mature gametophytes. In the bryophytes, these are the dominant, independent (photosynthetic) plants.

The gametophytes initiate gametangia on special branches or at the tip of the main shoot. In these structures the gametes— eggs and sperms—are produced during the sexual portion of the cycle. The female gametangium—called an archegonium—and the male antheridium may be produced on the same plant or on different plants. In both kinds of gametangia, a protective layer of non-reproductive tissue—a sterile layer—surrounds the inner reproductive cells. (A sterile layer is absent in algal gametangia and is considered an upward evolutionary step towards the protective seed coats of flowering plants.) Mature sperm, released from the tip of the antheridia when dew or rainwater is present on the surface of the plants, swim to the archegonia and down the necks to reach the eggs. One fuses with the single egg in each archegonium—the process of fertilization—thus combining the sperm and egg nuclear and cytoplasmic material. The resulting cell, a zygote, has a diploid (2 n) chromosome number and is the beginning of the sporophytic generation. This reproduction is termed oogamy—a large, nonmotile egg is fertilized in the archegonium by a small, motile sperm that swims to the egg. In the bryophytes, an external film of water on the surface of the plant is the passageway for the biflagellate sperm; in more advanced plants, sperm move internally within special structures (pollen tubes) to reach the eggs.

After fertilization, the zygote remains in the archegonium and divides by mitosis repeatedly to form a multicellular, diploid embryo, the young sporophyte. Sugars and other materials are translocated from gametophyte to the developing sporophyte through placental tissue, a type of nutrition called matrotrophy. (No plasmodesmata connect the gametophyte and sporophyte; movement of material is along the cell wall, that is, it is apoplastic movement). The sterile jacket cells also divide and in mosses form a tight cap, the calyptra, over the tip of the developing sporophyte. The mature sporophyte in both liverworts and mosses consists of a foot, seta, and capsule. The moss capsule has modifications to assist in spore release: a cap, the operculum, covers the opening, and peristome teeth form a ring around the mouth of the capsule. Sterile cells, elaters, within the capsule are hygroscopic and as they alternately absorb water and dry out, they twist and turn pushing the spores upward and outward.

The hornwort sporophyte that develops from the zygote is an erect, long, green cylinder with an absorbing foot embedded in the gametophyte thallus. The sporophyte is photosynthetic and has stomata so it doesn't depend entirely upon the gametophyte for sustenance. Spores are produced in the cylinder around a central columella of sterile tissue and are released as the mature tip of the sporophyte dries out and twists in the air. At the base of the foot, a zone of meristematic tissue continues to divide and the sporophyte is thus continuously renewed from the base.

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