LIFE CYCLE AND REPRODUCTION OF BRYOPHYTES

Reproduction

Bryophytes reproduce both sexually and vegetatively. Sexual reproduction involves the mixing of the genes of two parents, with the potential to produce new plants that differ, genetically, from each parent. In vegetative reproduction, there is no such mixing and each new plant is derived from just one parent plant.

Sexual reproduction

Sexual reproduction involves the mixing of genes from two different parents to give offspring with a genetic make-up similar to, but different from, each parent. In flowering plants the flowers are essential in the sexual reproductive cycle, with the pollen (the male gametes) from one flower typically being carried to another by some agency, most commonly wind or insects. Once the pollen has been deposited it will fertilize the eggs in the receiving plant.

In contrast to vascular plants, the dominant life form is gametophyte in bryophytes. Sporophyte is found to be dependent on gametophyte. Sexual distribution occurs with spores produced in sporophytes. Therefore, many of the bryophytes can be distributed over large areas. Unlike advanced plants, bryophytes are addictive to water for reproduction. In order for fertilization to occur, the flagella sperm must be transported to the archegonium with water.

In bryophytes the process requires the production of male gametes (sperm), female gametes (eggs) and some means of getting the sperm to the eggs. The gametes are produced on the gametophytes. The sperm are produced within tiny, typically stalked, club-shaped structures called antheridia and you can also see bryophyte sperm referred to as antherozoids. The stalk anchors the antheridium to the gametophyte. Each antheridium produces numerous sperm. The eggs are produced in tiny, typically somewhat flask-like structures called archegonia. Each archegonium holds one egg (in a swollen section called the venter) and the sperm enter through the channel in the narrower, tubular section (or neck). On the side of the venter opposite the neck is the foot which anchors the archegonium to the gametophyte. In the early stages of archegonial development that channel does not exist, the area being filled with cells. At maturity the cells in the centre of the neck disintegrate to create the channel. The channel is filled with mucilage that results from the breaking down of the cells that initially occupied the channel.

Bryophyte antheridia are fairly uniform in structure and the same is true for the archegonia. The antheridia vary in size and shape (from globose to somewhat cylindrical) depending on species, but the diagram above captures the essence of any antheridium - a short, narrow stalk supporting a swollen, sperm-producing organ. Similarly, the archegonia vary in size, and relative lengths of the neck, the venter and the length of the supporting foot - but the diagram above shows the essential features of all archegonia.

A fertilized egg in an archegonium develops into the sporophyte. The sporophyte consists of a spore-containing capsule which, depending on the species, may be stalked or stalkless. Each spore contains a mix of genes from the two parents and on successful germination will give rise to a new gametophyte. he fertilized egg grows by the formation of additional cells. In the great majority of species the embryonic sporophyte elongates and one part becomes a foot that penetrates the gametophyte and anchors the embryonic sporophyte to the gametophyte. The opposite end will develop into the spore-bearing capsule (and also the supporting stalk, or seta, in species in which the mature capsule is stalked). The embryonic sporophyte is often protected by a calyptra, a covering that develops from the wall of the archegonium. The calyptra is therefore a very close covering over the embryonic sporophyte.

Vegetative reproduction

Bryophytes can reproduce vegetatively in a variety of ways. The simplest is fragmentation. A piece that breaks off a gametophyte and then lands in a suitable habitat will grow into a new gametophyte. The breakage may be accidental, such as animal trampling or erosion leading to fragmentation of an existing bryophyte colony. However, many bryophytes have zones of weakness which promote the breakage of parts of the gametophyte, such as whole branches or perhaps just branch tips or even just parts of leaves. Such fragmentation is much more common in the leafy bryophytes than in the thallose ones.

Many bryophytes produce gemmae, but most don't do so in specialised structures. Rather, the gemmae grow off stems, leaves or thallose surfaces and sometimes are visible only under a microscope – in contrast to the gemmae of Marchantia, which are about a half millimetre in diameter and visible to the naked eye.

Life Cycle

Bryophytes have life cycles with alternation of generations. In each cycle, a haploid gametophyte, each of whose cells contains a fixed number of unpaired chromosomes, alternates with a diploid sporophyte, whose cell contain two sets of paired chromosomes. Gametophytes produce haploid sperm and eggs which fuse to form diploid zygotes that grow into sporophytes. Sporophytes produce haploid spores by meiosis, that grow into gametophytes. Bryophytes are gametophyte dominant, meaning that the more prominent, longer-lived plant is the haploid gametophyte. The diploid sporophytes appear only occasionally and remain attached to and nutritionally dependent on the gametophyte. In bryophytes, the sporophytes are always unbranched and produce a single sporangium.

Liverworts, mosses and hornworts spend most of their lives as gametophytes. Gametangia (gamete-producing organs), archegonia and antheridia, are produced on the gametophytes, sometimes at the tips of shoots, in the axils of leaves or hidden under thalli. Some bryophytes, such as the liverwort Marchantia, create elaborate structures to bear the gametangia that are called gametangiophores. Sperm are flagellated and must swim from the antheridia that produce them to archegonia which may be on a different plant. Arthropods can assist in transfer of sperm.

Fertilized eggs become zygotes, which develop into sporophyte embryos inside the archegonia. Mature sporophytes remain attached to the gametophyte. They consist of a stalk called a seta and a single sporangium or capsule. Inside the sporangium, haploid spores are produced by meiosis. These are dispersed, most commonly by wind, and if they land in a suitable environment can develop into a new gametophyte. Thus bryophytes disperse by a combination of swimming sperm and spores, in a manner similar to lycophytes, ferns and other cryptogams.

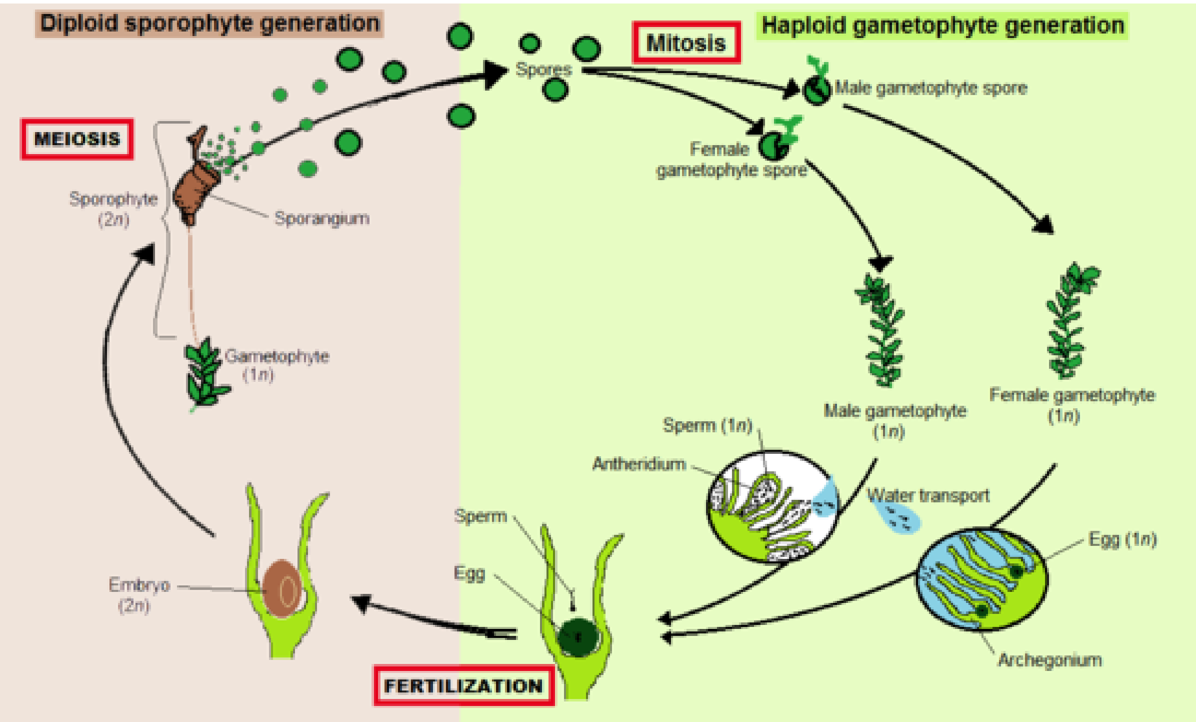

Figure1. The life cycle of a dioicous bryophytes

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