

TRACKING BIODIVERSITY

MOSSES

TERRY SHISTAR, PH.D.

From the vantage point of the standing human, mosses can all look the same—a carpet of green in a moist, shady place. But get down on your knees and take out a magnifying glass, and you will find that moss comes in various colors (shades of green, mostly) in some unexpected places. Mosses are a fascinating and beautiful part of local ecosystems, filling an important niche, and serving as habitat for literally thousands of microscopic organisms that work in concert with nature. And they are evergreen, providing green cover all winter!

MOSSES ARE BRYOPHYTES

Mosses belong to the phylum Bryophyta, which is often combined with the phyla Marchantiophyta (liverworts) and Anthocerotophyta (hornworts) under the term bryophytes *sensu lato* (s.l.). Bryophytes s.l. are non-vascular plants—they lack specialized tissues to take up and transport water and nutrients—and are therefore small, since cells must acquire water and nutrients directly from the environment and are dependent on diffusion to transport them within the plant. In the narrow sense (*sensu stricto* or s.s.), bryophytes, or mosses, are distinguished from liverworts and hornworts by their form, having multicellular rhizoids (root-like hairs) that anchor them to substrates, and by various characteristics of their reproduction and development.

Some small plants with “moss” in their names are not mosses. Irish moss is a seaweed. Scottish moss is in the carnation family. Reindeer moss and others are lichens. Spanish moss is an air plant related to pineapples. Club mosses are related to ferns.

LIFE CYCLE

As in many other plants, moss reproduction may be asexual (vegetative) or sexual. Vegetative reproduction is very common. A piece that breaks off may land in a suitable habitat and grow there.

In changing habitats, the genetic recombination of sexual reproduction can help the plant adapt. The sexual reproductive cycle of mosses and other bryophytes differs somewhat from reproduction in “higher” plants. The moss plant that we see is a gametophyte (bearing sperm or eggs), which is haploid, having half the chromosome complement of the diploid cell, which contains the chromosomes from both parents. Male gametophytes release sperm into water, which can carry them to female gametophytes. After fertilization, the zygote grows into a sporophyte—a diploid embryo that grows from the female gametophyte. The diploid mother cells within the sporophyte undergo meiosis, producing haploid spores, which disperse and, if they find favorable conditions, germinate



iStockphoto/serdar415

into a thin filament called a protonema, from which buds develop into new moss plants.

ECOLOGY

Mosses contain chlorophyll and use sunlight to produce food, so they require some sunlight. They absorb minerals and water through the surface of the plant. Because of their dependence on water for growth and reproduction, mosses grow most luxuriously in moist environments, with different species preferring different substrates. Mosses are poikilohydric—they have no mechanism to prevent drying out, but can survive periods of desiccation, reviving when favorable conditions return. The moss in the top photo on page 23 is growing in the space between warm season grasses and forbs in a sunny hayfield.

Because mosses do not require soil for nutrients, they are among the first plants to colonize bare ground. In doing so, they help to build soil and prevent erosion. Mosses lack roots to take up nutrients but do have rhizoids that help anchor them to the soil, stone, tree, or other substrate on which they live. Because they do not take up nutrients from the soil, they do not compete for nutrients with their vascular plant neighbors. Because they are small, they do not compete for sunlight.

Who eats moss? Moss has little nutrition to offer, but moose and musk oxen will scrape away snow to get it in the winter. Pikas are small rabbit-like animals living mostly at high elevations, but those living at lower elevations consume large quantities of moss. Small invertebrates make moss their

home as well as a food source. Moss provides shelter, water, food, and insulation. Like moss itself, microscopic invertebrates (such as nematodes, tardigrades, and bdelloid rotifers) require free water for active life, but are all capable of cryptobiosis (a dormant dehydrated state) to tolerate periodic drought. Some of these invertebrates eat moss, while some nematodes and tardigrades prey upon bacteria, insects, and other tiny invertebrates. Fungi and bacteria are decomposers in the moss ecosystem, releasing nutrients for mosses and other primary producers in the food web.

HUMAN VALUE

In addition to their value in building soil and preventing erosion, moss has been used for other human purposes. The absorptive properties of dried moss were once valued as a predecessor to toilet paper and diapers. Currently, dried sphagnum moss is used as packing material for plants and perishable foods. Peat, the partly decayed remains of sphagnum moss, has been used so much as a soil conditioner that the ecosystems it supports are threatened by peat mining. The currently favored substitute for this use is coconut coir.

ENJOY MOSS. GROW MOSS. READ ABOUT MOSS.

The diversity of mosses becomes more apparent up close. The currently known moss flora of North America north of Mexico is comprised of 1,402 species in 333 genera classified in 81 families. Seventeen (5%) of the genera and 273 (19.5%) of the species are endemic to the area. Of these, 36 (2.6%) are considered to be of conservation concern. A major division is between pleurocarpous mosses, which attach to hard surfaces, grow quickly, and creep along the ground, and acrocarpous mosses, which grow in mounds.

Areas that are too shady and damp to grow a healthy grass lawn may be perfect for a moss garden. Mosses like thin, compacted soil of low fertility, as well as rock or logs. When grown in such a location, they require almost no work to maintain. Many kinds of moss do not tolerate heavy traffic, but sheet moss (moss in the genus *Hypnum*) stands up better than most, so it is often used on paths. Mosses make a beautiful groundcover in a shady garden. By providing a variety of substrates (logs, rocks, and soil), a diversity of species may be established. Moss may also be used as a mulch around other plants to hold in moisture and nutrients.

GROWING MOSS

Moss is easy to grow by transplanting a patch from a similar environment. The patch may be broken up into smaller pieces, which will spread to fill in the spaces. To plant, moisten the bottom and press into the new substrate. Pieces may be held in place temporarily with nails or sticks until rhizomorphs grow. Another way of planting moss is to put pieces in a blender with a small amount of water and blend for two minutes. Spread this slurry onto the substrate. Buttermilk is often suggested as an additive to help the slurry stick to rocks or clay pottery. In either case, water frequently until the moss is established.

To learn more about mosses, read *Gathering Moss* by Robin Wall Kimmerer, which explores the biology of mosses in their ecological and human contexts.



Moss in hayfield

Terry Shistar



Moss in hayfield with chigger.

Terry Shistar



Moss with sporophytes.

Terry Shistar

