

Mosses and liverworts—an introduction

Mosses and liverworts are members of a group of plants which also includes hornworts; species in these three groups are known collectively as “bryophytes”.

The bryophytes have a long story to tell as they were the first plants to colonise land and they have been around for some 450 million years, much, much longer than flowering plants. During this long period species have evolved to cope with different, sometimes extreme conditions, from the highest mountains down to the seashore and from deserts to rivers and lochs and mires. Some are confirmed city-dwellers, some like the snowbeds, but it is in rocky woodlands where they are at their most luxuriant and diverse and in bogs where the bog mosses are often the dominant vegetation. Most bryophytes are small and only a few can compete with larger flowering plants when growing on soil, so the greatest diversity is usually on hard surfaces like rocks and tree trunks where competition is less.

Recognising mosses and liverworts. Once you get used to the small scale, subtle colours and texture, you will begin to realise that bryophytes are very beautiful and that they are everywhere. Mosses and most liverworts look a bit like tiny flowering plants in that they have a recognisable stem with leaves, but hornworts and some liverworts have a ‘strap-shaped’ form called a thallus and look very different. Below are examples of the different forms that mosses and liverworts can take.



1) Thalloid liverworts

Great Scented Liverwort (*Conocephalum conicum*),

A typical thalloid or ‘strap-shaped liverwort, common on soil on streamsides. As the English name suggests, it has a distinctive smell when crushed. In bryophyte terms, this is a large plant, more than a centimetre across the thallus, but some thalloid liverworts can be much smaller.



2) Leafy liverworts

Orkney Notchwort (*Anastrepta orcadensis*).

A leafy liverwort common in heathy places in the hills, especially in the west. This is fairly large for a leafy liverwort and can be 2-3cm tall; some leafy liverworts struggle to reach 1cm in length and are less than 2mm across.

Mosses come in three different growth forms which are usually easy to distinguish; there are the 'cushion formers', technically known as acrocarpous mosses, the 'carpet formers' known as pleurocarpous mosses and the very different bog mosses, the *Sphagnum* species.

3) Acrocarpous mosses

Broom Fork-moss (Dicranum scoparium)

A very common cushion former, growing on both rocks and trees and occasionally in more open places on soil in grassland and quite frequent at Findhorn. Here it is producing fruiting bodies at the end of long stalks



4) Pleurocarpous mosses

Big Shaggy-moss (Rhytidiadelphus triquetrus)

A very common carpet-forming woodland floor species in the east of Scotland and abundant at Findhorn, often called "teddy bear moss" because of its colour and texture. Its comparatively large size means that it can compete with the grasses and herbs in the woodland.



5) Bog mosses

Spiky Bog-moss (Sphagnum squarrosum)

Bog mosses are recognised by the tight bunch of branches at the top of the stem, the capitulum, and the whorls of branches lower down, there are about 40 species in Scotland growing in more or less damp to very wet places. This species is recognised by its squarrose (bent back) leaves giving it a spiky appearance; it occurs in damp hollows under the trees at Culbin.



How do they make a living. Bryophytes are green plants and photosynthesise just like the more familiar flowers and ferns but they have only a fairly basic structure for moving nutrients around the plant. They do not have roots but have simple thread-like structures called rhizoids which help attachment to trees or rocks.



In most species the leaves are just one cell thick and do not have a protective layer or cuticle over the leaf like that in flowering plants; this means that water and nutrients are free to move in and out of the cells and so bryophytes dry out quickly but also rapidly re-absorb water when it is again available and begin to photosynthesise. This means that some bryophytes can thrive in very dry places as long as they get wet every now and again.

6) Leaf section. *A section through a moss leaf showing the single layer of cells; the bulge in the middle is the mid-rib or 'nerve', present in most mosses but never in liverworts.*



Bryophytes reproduce by spores produced in a capsule at the end of a stalk, called a seta. The whole structure is called a sporophyte growing from the gametophyte which is the green, leafy part. The structure of the sporophyte is one of the main differences between mosses and liverworts. Once fertilisation has taken place the seta slowly extends and the capsule forms and matures at the end of the seta, so the whole sporophyte is quite long-lived and may be present for months.

7) Capsules on Nodding Thread-moss (*Pohlia nutans*). *A common moss of peaty soils often abundantly fertile, as here.*



When the capsule and the spores it contains are mature the capsule will dehisce and in most species this dehiscence is controlled by a ring of teeth round the mouth of the capsule. These teeth are called the peristome, which can be very complex and also very beautiful .

8) Capsule, peristome and spores. *The peristome on the right with the tiny spores being released. The capsule here is about 2mm across.*



In liverworts the capsule develops within the female sex organ and when it is mature the seta extends rapidly over a day or so lifting the black, round capsule clear of the plant. The capsule releases the spores by splitting into four flaps and then the whole structure dies, lasting only a few days at most, so very different from the mosses.

8) Sporophytes on Overleaf Pellia (*Pellia epiphylla*) This is a common thalloid liverwort with a very large sporophyte; you can just make out the round, black capsules and some that are already dehisced.

Vegetative reproduction. However, many, and perhaps even most, bryophytes also reproduce vegetatively and some species have never been found with sporophytes. Bryophytes are 'toti-potent' meaning that any part or fragment can grow into a new plant and many species exploit this in various ways. The new plant will, of course, just be a clone of the original.



9) Fragile leaves on Bristly Swan-neck Moss (*Campylopus atrovirens*) A common moss over much of Highland Scotland, and its method of vegetative reproduction is obvious from the photo—leaves at the apex of the stem are fragile and deciduous and are easily blown around in the wind or washed away by the rain and at least some will find a safe site and flourish.



10) Gemmae on Tumid notchwort (*Lophozia ventricosa*). A very common leafy liverwort that produces balls of gemmae at the end of the lobes of the upper leaves, the yellow-green blobs in the photo. Gemmae are just specialised bits of plant tissue that will eventually become detached from the leaf and so potentially form a new plant. Gemmae have many forms and are produced by both liverworts and mosses

How many species. There are about 1000 bryophyte species in Scotland, about 50% of the European total and we have perhaps 4-5% of the global bryophyte flora which is a truly extraordinary figure for such a tiny part of the world and it means that our bryophyte flora is of international importance. The greatest diversity is in the wetter montane areas of the west but even relatively low ground in the Findhorn and Forres area has over 300 species.

How can I tell a moss from a leafy liverwort? Initially this can be puzzling but after a little experience most beginners find that it does not pose a problem - but it is not easy to describe.

- In leafy liverworts the leaves are arranged in two ranks one on each side of the stem so the shoot is at least somewhat flattened. Sometimes there is a line of smaller leaves on the mid-line of the lower side of the stem, the side nearest the substrate.
- The leaves are usually rounded or at least as broad as long, and many species have two, three or four lobes on the leaves and never have a nerve or midrib.
- Moss leaves are almost always in three ranks arranged around the stem with leaves of the same size.
- Most mosses have leaves that taper to a sharp or blunt point and never have lobes but many species do have a nerve or midrib.
- The moss sporophyte, the fruiting body, is relatively long-lived and the capsule with the spores matures at the top of the already extended coloured stalk and spores are released out of the top of the capsule, the release moderated by the peristome (Photo 7).
- In liverworts the sporophyte is very short-lived, the capsule matures within the female inflorescence and then the colourless stalk rapidly extends and the black, round capsule splits into four valves to release the spores (Photo 8).



11) Springy Turf-moss (*Rhytidiadelphus squarrosus*). Should be called "common lawn moss" - if you have a lawn you will have this moss, unless you are a very, very, diligent gardener.