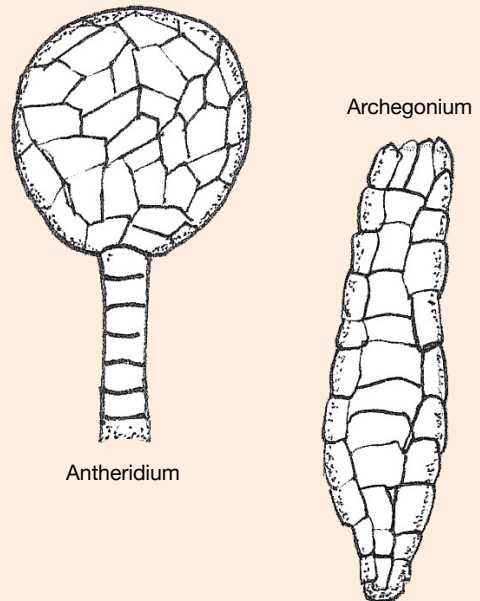


Liverwort reproductive structures – demystifying the jargon

Understanding the terms used to describe liverwort structures and knowing what they look like and where to find them is fundamental to identification. Many bryological terms are equally applicable to mosses, liverworts and hornworts, but in the reproductive organs important differences are apparent. Unlike the mosses, capsule and seta characters are rarely used for identification of liverworts, but associated reproductive structures are important and have their own names. In this article I shall try to demystify some of the terms used in current accounts of the British liverwort flora, including Paton (1999) and Smith (1990). For superb photographs and illustrations I would strongly recommend Malcolm & Malcolm (2006).

Like mosses, liverworts reproduce sexually through the production of male and female sexual organs often associated with specialized leaves (bracts) in what is termed an inflorescence on the green parts of the shoot or thallus (gametophyte). The male inflorescence is known as a perigonium; the female is the perichaetium. The antheridium (male organ) produces sperm cells which fertilize the archegonium (female organ), prompting development of the sporophyte (the capsule, seta and associated structures). The antheridium looks like a small ovoid pouch with a short stalk and is normally

In this edition of Beginner's Corner **Sharon Pilkington** turns her attention to the confusing and difficult subject of liverwort reproductive structures that are often so vital for correct identification.



△ A generalized antheridium and archegonium.
S. Pilkington

found in the axil of a modified leaf (bract). The archegonium is flask-shaped with a long neck and swollen base which contains an egg cell. Between species, the appearance of the individual sexual organs does not differ much.

LEAFY LIVERWORTS

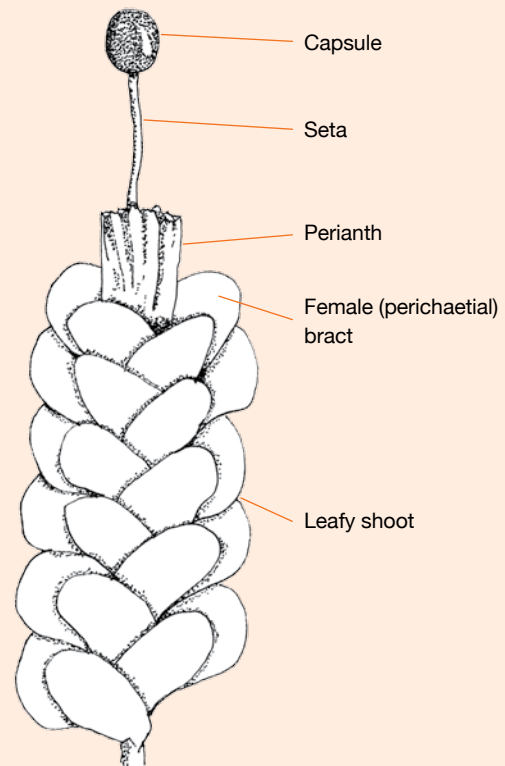
When fertile, most British leafy liverworts develop a perianth, a tube-like structure formed by the fusion of a few leaves that surrounds and protects the developing capsule. Perianths are typically longer-lived and more distinctive than the capsules themselves, which may take up to a year to develop. Size, shape and other characters vary between species and can be important diagnostic features. For example, the characteristic 'star-like' perianths of the Lejeuneaceae are produced by folds in the perianth.

Further protection is usually afforded by bracts. Put simply, a bract is a modified leaf protecting the antheridium or archegonium. Perichaetial bracts are found below the perianth and, in certain genera, such as *Jungermannia* and *Solenostoma*, a short fleshy tube called a perigynium may also develop below the female bracts and/or perianth.

Locating male inflorescences can often be the key to determining if a liverwort is dioicous (separate male and female plants) or monoicous, with male and female sexual organs borne on the same plant. Many monoicous leafy liverworts are autoicous, bearing spatially distinct male and female branches on the same plant, but some species are paroicous, where the antheridia are hidden in the axils of male (perigonial) bracts just below the female inflorescence. Unlike mosses, liverworts are rarely synoicous, where archegonia and antheridia are mixed in the same inflorescence. However, closer inspection will always reveal the differences.

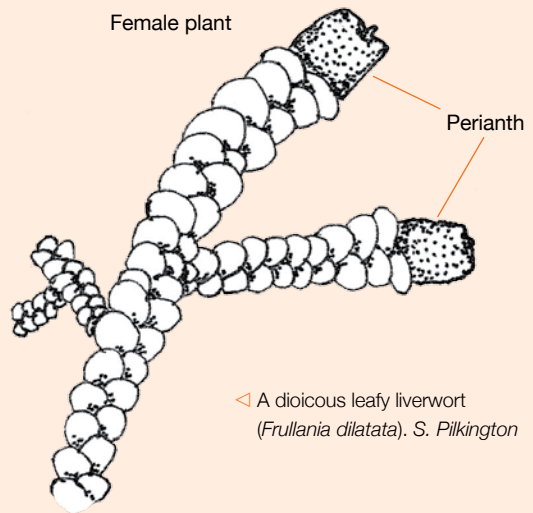
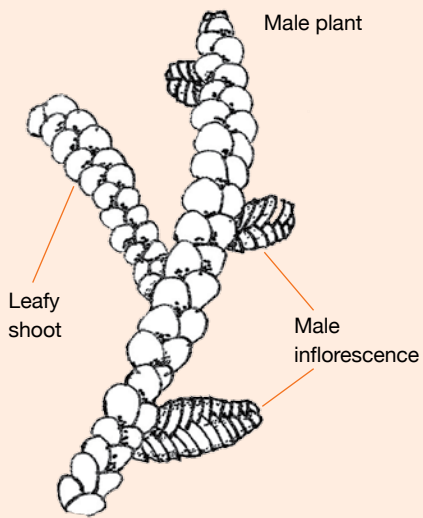
THALLOID LIVERWORTS

It is normally relatively straightforward to tell if a thalloid liverwort has reproductive structures and if it is dioicous or monoicous. However, to avoid

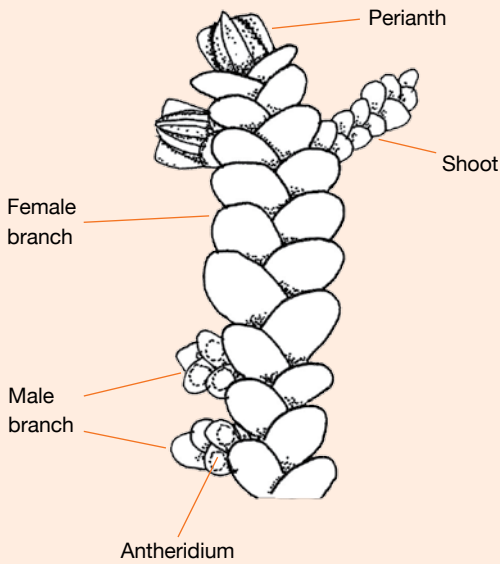


△ Perianth and other structures (*Scapania*). S. Pilkington

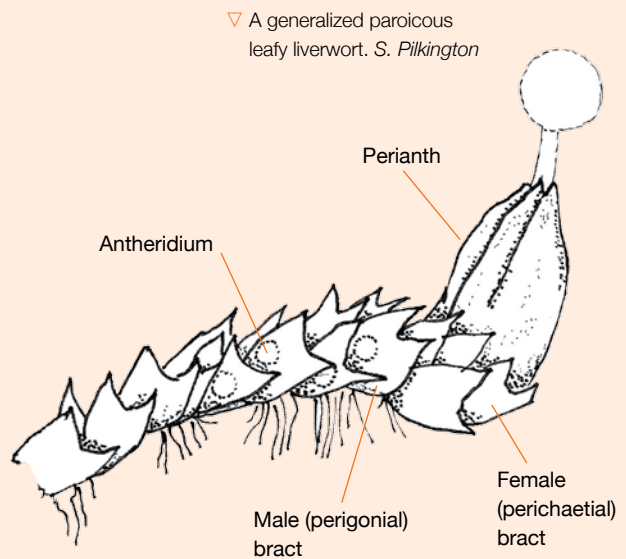
self-fertilization, antheridia and archegonia mature at different times in some monoicous species, and thus individual plants may appear to be dioicous at certain times of year. With the exception of the large thalloid liverworts in the Marchantiaceae family, antheridia and archegonia are usually immersed in the thallus. After fertilization, the capsule starts to develop and is protected by an involucre, a tube serving the same function as the perianth in leafy liverworts. Characters such as the presence of teeth at the mouth of the involucre are sometimes used in identification. When mature, the capsule is usually raised by the seta above the thallus, although in ephemeral genera, e.g. *Riccia*, the capsules may remain totally immersed in the thallus until spores are released through disintegration of thallus tissue.



◁ A dioicous leafy liverwort (*Frullania dilatata*). S. Pilkington



◁ A generalized autoicous leafy liverwort (Lejeuneaceae). S. Pilkington



▽ A generalized paroicous leafy liverwort. S. Pilkington

In *Pellia epiphylla* (a monoicous liverwort), the archegonia (and ultimately the capsules) are borne towards the apex of a main thallus, with many antheridia immersed in small warts/papillae on the midrib behind. The shape of the sexual organs is similar to those of the leafy liverworts.

When mature, some antheridia are brightly coloured, as in the case of certain species of *Fossombronia*, which are orange.

Liverworts in the Marchantiaceae – such as *Marchantia polymorpha*, *Conocephalum conicum* and *Preissia quadrata* – have specialized sexual branches on the thallus called receptacles. Rather confusingly, the developing sporophyte is protected not by an involucre, but by a pseudoperianth, though its function is the same. Some authors

also refer to perianths in thalloid liverworts so the structural distinction can seem unclear.

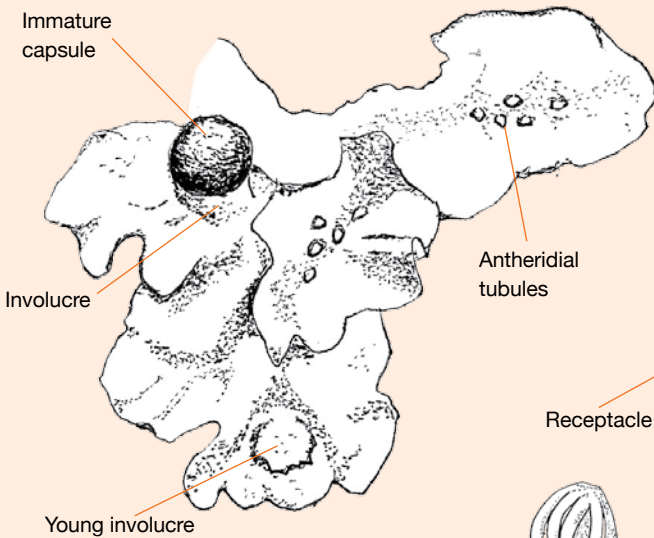
Many thalloid liverworts also reproduce asexually via gemmae – the most familiar example is probably *Lunularia cruciata*, named for the crescent-like gemma cups it always bears in abundance.

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▽ A thalloid liverwort, *Marchantia polymorpha*, with receptacles and gemma cups. S. Pilkington

△ A thalloid liverwort, *Pellia epiphylla*, demonstrating monoicous characters. S. Pilkington

