Ancient Tiri Part 5: The Bryophytes II – Liverworts and Hornworts.

The term "*Bryophytes*" is gradually being dropped by botanists, and the term "*Embryophytes*" is now preferred.
Living embryophytes include hornworts, liverworts mosses and a variety of other primitive plants as well as modern seed plants.
The Embryophyta are informally called *land plants* because they live primarily in terrestrial habitats, while the related green algae are primarily aquatic. All are complex multicellular eukaryotes (Remember what they are? See Part 1) with specialized reproductive organs. The name derives from their way of nurturing the young embryo sporophyte during the early stages of its multicellular development within the tissues of the parent gametophyte.

In *The Bryophytes* of *Ancient Tiri Part 4*, we saw how the mosses colonised the barren dry land using their ability to grow wherever any damp sheltered places were to be found. They did this by hugging the ground where a "boundary-layer" of humid air resides, and also by blitzing the environment with millions of tough drought-resistant spores – a few of which would almost certainly land and grow in the few favourable spots available. Their ability to allow their bodies to "shut up shop" and shrivel during short dry spells, only to rehydrate again and resume life when rain returned was also a life saving talent.

Features of the Liverworts and Hornworts: ("wort" is pronounced "w**e**rt")

The liverworts and hornworts were able to use these same survival skills to colonise the dry land alongside the mosses. Despite being non-vascular (lacking an internal water tube system to carry water around their bodies), their drought resistant spores allowed them to grow into new plants and exploit a shady nook for a few weeks – long enough to complete their brief life cycles, before dry conditions returned.
Its hardly surprising that the bryophytes as a group never managed to grow taller than a few centimetres off the ground.

What *is* astonishing is that they live on *dry land* and *still posess swimming sperms* needing at least a thin "film" of water to move in for reproduction.

Liverworts and hornworts have similar dominant gametophytes as mosses, also green and photosynthetic, and similar sporophytes which grow "parasitically" (= dependent for life) on the gametophyte.

As you walk along the Ridge Track in the Summer heat, you can see these dead liverworts, hornworts and mosses looking very forlorn. But all is not lost! There are thousands of microscopic spores blowing in the dust, just waiting for the autumn rains to restart the whole cycle!

Liverworts can be either *leafy* (they look a bit like mosses)….

John Sibley

Or *thallose* - flat, and prostrate (seaweed like).

John Sibley

Generally speaking, *moss leaves* are arranged *spirally around the stem* whereas *leafy liverwort leaves* are arranged *as 2 flat rows on either side like the picture above left*.

Hornworts are always thallose.

John Sibley

In this photo liverworts (larger) are growing together with hornworts (smaller, lower centre)

John Sibley

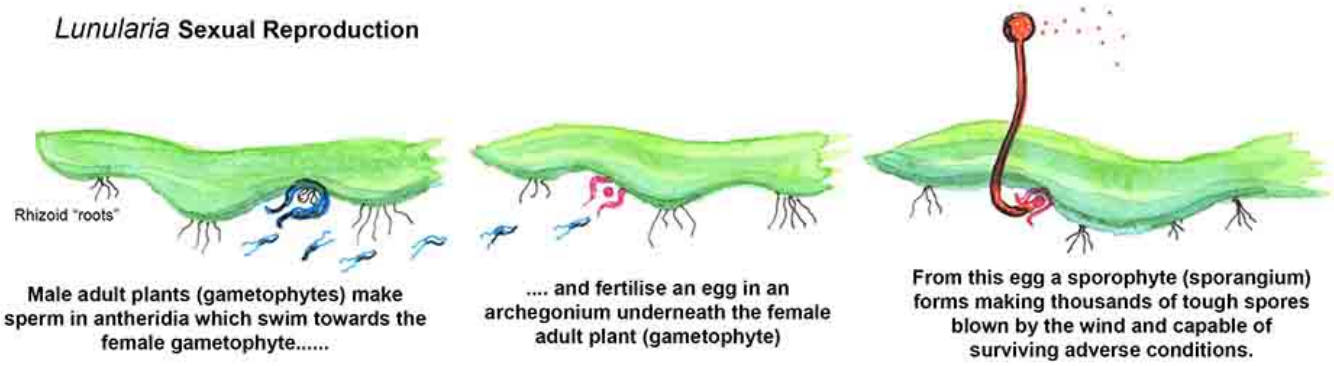
Good places to see liverworts are on the cabbage tree trunks up the Wattle Track (where you might be excused for thinking they are mosses!) Also on the path margins and gulleys along the Ridge Track and in the ditches where the Wharf Road crosses the Wattle Track.

How to interpret what you *see* when you look at liverworts and hornworts.

Just like the mosses, both have a *dominant gametophyte* phase (sexual – creating *diversity*) and an *inconspicuous sporophyte* phase (to clone *vast numbers*) in their life cycles.

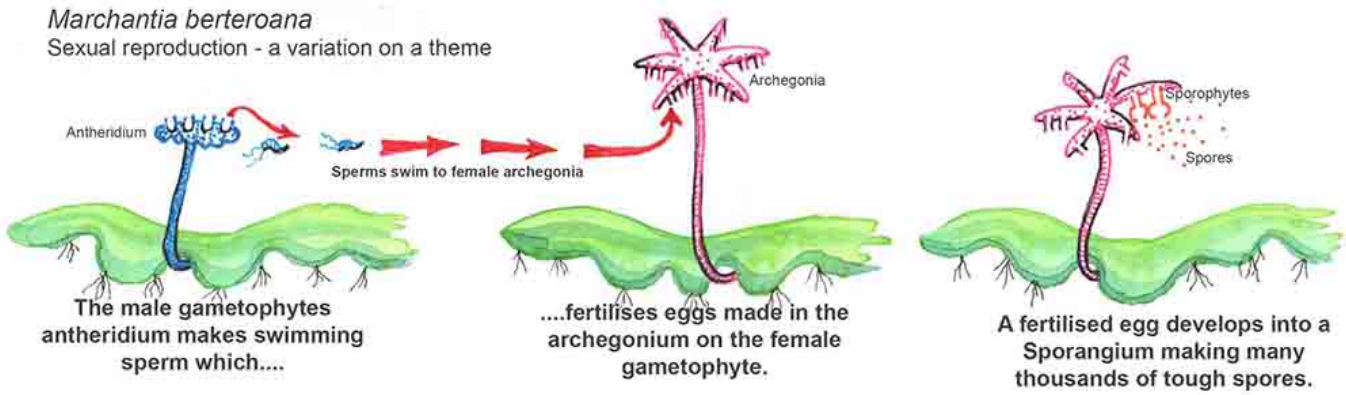
The ground hugging thalloid (flat) forms of liverworts are easy enough to identify as you walk Tiri's tracks, but they often have odd projections sticking up which are to do with reproduction. In the illustrations below I have coloured the sex organs in pink and blue (no prizes for guessing which are boys and girls!), and the spore bearing organs (sporophytes) in orange.

Lunularia is a genus of liverwort found in abundance on the Wharf Road and Wattle Track. It forms dense patches in ditches and gulleys, and has the appearance of a patch of shiny green liver! (hence the name – it was once thought to cure liver problems too!) Many liverworts reproduce *asexually* much of the time using "*gemma cups*" containing little packets of loose cells which get splashed about when it rains (see photo opposite). These clones are capable of growing into new liverwort plants – a bit like taking a cutting. The name *Lunularia* comes from the half-moon shaped gemmae this plant is known for. *Lunularia* and the other thalloid liverworts reproduce sexually too.



These club shaped sporophytes are fairly typical of what you might see on Tiri, but there are other “variations on the theme” too! For example *Marchantia* is another common liverwort that you often find in damp ditches and even on the road surface itself on the Ridge Track. They have odd star or button shaped projections sticking up which can make them look like Lilliputian versions of tiny palm trees growing beneath your feet!

These curious little plants have evolved in such a way as to raise their sex organs high above their bodies – presumably to maximise the chances of rainwater forming a pathway from male to female sex organs to help fertilisation.

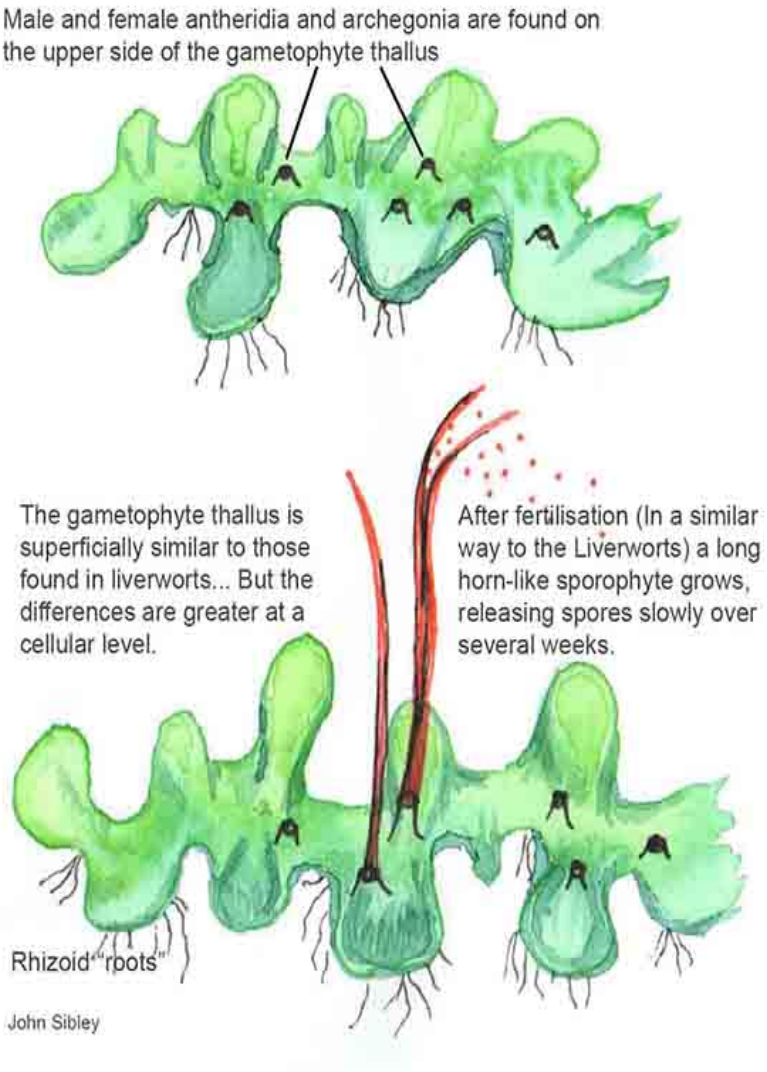


Some more spore capsules found on liverworts growing on and around cabbage tree trunks on the Wattle track near the lower bird bath.

The leafy liverwort on the left is called *Porella* and when it rains it rehydrates dramatically, hoisting its body out from the tree trunk horizontally to catch as much light as possible! After a time in dry “suspended animation” it has a lot of living to catch up on!

HORNWORTS

Another Gametophyte dominant Bryophyte



Hornwort reproduction is similar to that of liverworts. The resulting Sporophyte is quite different though.
These are hornwort sporophytes in the photo below.
The capsules are long and skinny, and they fray at the top turning brown as the spores are released. At a distance you might mistake it for a forest of chives growing on the sides of ditches on the Totara and Ridge Tracks!

A visitor may ask you what evidence exists to suggest that the Bryophytes evolved from algae and then developed into the land plants we know today.

The fossil evidence for *early* Bryophytes is largely lacking as they do not fossilise well. So the picture is by no means clear or complete. Todays Bryophytes can be traced back to 500-350Ma. However there are tantalising links and clues regarding their origins 700-500Ma.

1. *Protonemas:* The *filamentous algae-like* "plantlets" that emerge from the spores of Mosses and Liverworts. These grow into the gametophyte plant.
2. *DNA Evidence:* Liverworts appear to be a *living link to the transition* from *marine algae to land plants*. Biologists have analyzed the *DNA genome sequence* of the common liverwort (Marchantia polymorpha) to identify *genes* and *gene families* that were deemed crucial to plant evolution and have been conserved over millions of years and across plant lineages.
3. *Internal cell structures:* Hornworts have a *single large chloroplast* inside each cell, like the *Algae*.

So between 700Ma and 500Ma the first bryophyte-like plants tentatively colonised the land, and where the plant food was, the animals soon followed. In the next episode of *Ancient Tiri* we will be looking at the primitive animals that emerged from the seas to exploit the land alongside the Bryophytes.