U3A Port Fairy

Science…naturally!

Carnivorous plants

John Miller: 15 September 2020

This is the 25th in a series of guides for U3A members around Port Fairy and district to help us get out and about safely during COVID-19 restrictions. The aim of the guides is to provide enjoyable outdoor activities that can be undertaken either by yourself or others (in accordance with Government directives).

This guide introduces you to the secret lives of carnivorous plants and explores some of the fascinating adaptations that allow them to survive and flourish in some tough places throughout the world.

Examples will be drawn from various places around the world but will highlight those that can be found in western Victoria.

What is a carnivorous plant?

A carnivorous plant is one that eats animals. Mostly they trap and eat insects, most of which we can see with our naked eye, although some of them also eat protozoans – single-celled microorganisms in the Kingdom Protista – which we can only see under a microscope.

Contrary to myth, Charles Griffith and John Wyndam, there are no known carnivorous plants with teeth; none of them wander around killing people after meteor showers; and apparently very few of them devour human flesh.

Apparently……

Why do they eat insects?

Carnivorous plants typically live in nutrient poor areas such as bogs, seasonally waterlogged heathlands and swampy areas, as epiphytes in rainforests, and in the nutrient poor sandy soils typical throughout western Victoria. They also thrive in the native grasslands on basalt soils further inland from Port Fairy.

Carnivorous plants are mostly green, due primarily to chloroplasts in their leaf cells. Chloroplasts use the energy of the sun to convert carbon dioxide and water into energy for the plant. So, in our sunny land they have plenty of energy but, because they live in nutrient poor environments, they need another way of getting the nutrients into their systems – this is where the insects come into it.

Insects have a high content of mono- and polyunsaturated fatty acids; they are rich in trace elements such as copper, iron, magnesium, manganese, phosphorus, selenium and zinc, as well as vitamins like riboflavin, pantothenic acid, biotin, and folic acid in some cases. Yum! Maybe we should all be eating insects.

Why don't they eat their pollinators?

Carnivorous plants eat insects (mainly) but they also need insects to pollinate their flowers. So, the plant has a problem to solve – how to attract insects so it can eat them while at the same time attracting insects to pollinate the flowers without being eaten.

The various carnivorous plants have solved this problem via three basic mechanisms:

- Spatial separation – their flowers are high above ground to attract flying pollinators while their traps are close to the ground to attract crawling insects
- Temporal separation – their flowers bloom and attract pollinators first, then they develop their traps to attract prey
- Different attractants – their flowers rely on pollen or nectar that attracts pollinators while their traps rely on a certain scent or colour pattern to attract prey.

Sometimes mistakes are made, and the plant eats a pollinator insect by mistake, but it was probably an insect that couldn't distinguish between nectar and digestive juices, so it had to go anyway. Darwinian selection in action!

How do they trap their prey?

Carnivorous plants have four principal means of trapping insects:

Snap traps: Leaves open and snap closed around unsuspecting prey.

The Venus Flytrap *Dionaea muscipula*, which occurs naturally in just a small area of sub-tropical coastal bogs of the eastern USA, is the best-known example of the snap trap carnivores. The toothed traps are modified leaves. A crawling insect or spider enters the trap and disturbs some small hairs which results in the trap snapping shut. Small prey, which is a waste of energy for the plant to digest, can escape through the teeth but if the prey is large enough it will be caught and then digested. After 5-12 days the trap will reopen but it can only do this a couple of times before the leaf must be replaced.

Pitfall traps: A pitcher-shaped leaf entices insects which then fall into the tube and are trapped in the digestive goo at the bottom of the pitcher.

Species within the genera *Sarracenia* (trumpet pitchers) and *Nepenthes* (tropical pitcher plants) are the best-known of the carnivorous plants that use the pitfall trap method.

Similar to the Venus Flytrap, the pitcher traps are modified leaves. Insects are attracted to the scent of the leaves and fall into the trap – downward pointing slippery hairs inside the pitcher stop the insect from escaping. The exhausted insect eventually falls into the digestive liquid in the base of the pitcher.

All species are tropical occurring throughout Asia and the Americas. Three species of *Nepenthes* occur in northern Queensland, but *Sarracenia* is confined to USA and Canada and *Heliamphora* is confined to South America.


Sarracenia sp.


Nepenthes sp


Heliamphora sp.

Flypaper traps: Leaves secrete a sticky substance to capture small insects.

This strategy is used by the largest group of carnivorous plants and includes the genus *Drosera* (Sundews)

There are around 200 species of *Drosera* world-wide of which 14 occur and are native to Victoria. Scented Sundew *D. aberrans,* Scarlet Sundew *D. glanduligera* and Tall Sundew *D. auriculata,* amongst others, occur extensively in western Victoria and are a conspicuous component of our woodlands and grasslands.


Scented Sundew


Scarlet Sundew


Tall Sundew

Bladder traps: A bladder sucks the meal inside the plant where it is trapped.

The use of bladder traps is confined to the Genus *Utricularia,* which has a world-wide distribution and contains the greatest number of species (around 233) of any of the carnivorous plants. All of the species grow in wet places, mainly in bogs or wet mossy banks although some are free floating in still, open water.

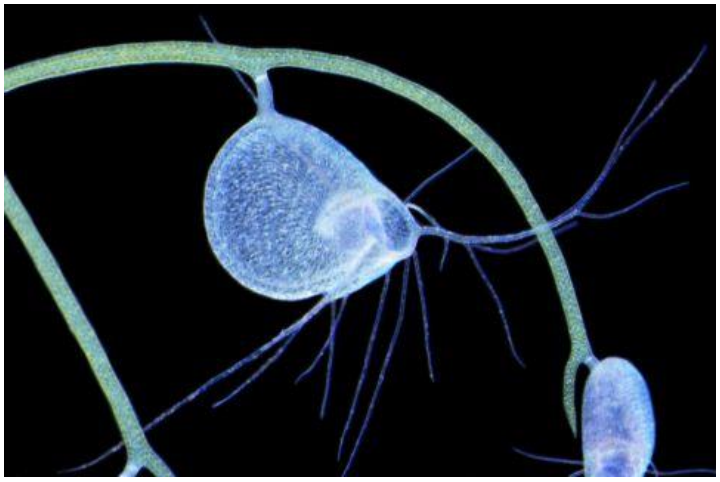
The very attractive and dainty little plants, collectively referred to as Bladderworts, are also often known by the slightly more poetic common name “Fairies Aprons” due to the arrangement of the flower petals.

However, it is not immediately obvious that this group of carnivorous plants is in fact carnivorous - their secret is hidden in their roots.

Fairies Aprons growing on a wet mossy rock in the Grampians

The roots of the Fairies Aprons have tiny, but visible to the naked eye, specialised bladders which open very rapidly when small hairs on the bladder are stimulated by passing water bugs. The rapid opening of the bladder causes the nearby water, and the bug, to be sucked into the bladder, after which a tiny trap door closes to ensnare the bug.

Bladders on the roots of Fairies Aprons



The trigger hairs and set trapdoor on a single bladder

Twelve species of Bladderworts occur in Victoria 10 of which can be found in western Victoria. The Grampians is a great place to see them on wet mossy rocks during spring.

It acts like one but it isn't one

There are a few other plants in our woodlands and grasslands that could be confused with carnivorous plants – not because they look like the carnivorous plants but because of the way they use insects.

Trigger Plants, *Stylidium* species, have an elaborate pollination mechanism which at first glance could be confused with predatory behaviour.

The “trigger” of the Trigger Plant is in fact a structure that supports both the pollen-bearing anther of the flower and also the stigma which receives the pollen for the fertilisation of the seeds.

When a flying insect visits the flower and inserts its proboscis (like a feeding straw) in search of nectar, the trigger rapidly fires and hits the insect on the back. It does not kill the insect, but it gives it a good dusting of pollen which is then transported to the next flower where the process is repeated. In this way, pollen is transported from flower to flower and plant to plant. So, far from eating the insect, the plant is using the inset to fertilise its seeds.

Trigger Plant with triggers set and waiting

Trigger Plant in the bush

In a similar fashion, some of the Greenhood orchids use insects for pollination, particularly the greenhoods that have the labellum (tongue) hanging down.

The insect lands on the tongue which immediately flips upwards tossing the insect into the hood of the flower. The presumably slightly dazed insect wanders around inside the flower both delivering pollen from a previous flower visit and also collecting more pollen for the next trampoline ride before it finds its way out unharmed by the experience.

Tall Greenhood with tongue set

Not carnivores, but still exploiting insects for their survival.

As always, there are many more plants and other good stuff to discover as you wander around. If you find a plant or animal you want to know more about, email me a photo and a short description and I will endeavour to work it out for you - **jmiller3350@gmail.com**

Please feel free to share this with anyone else who might enjoy the information.