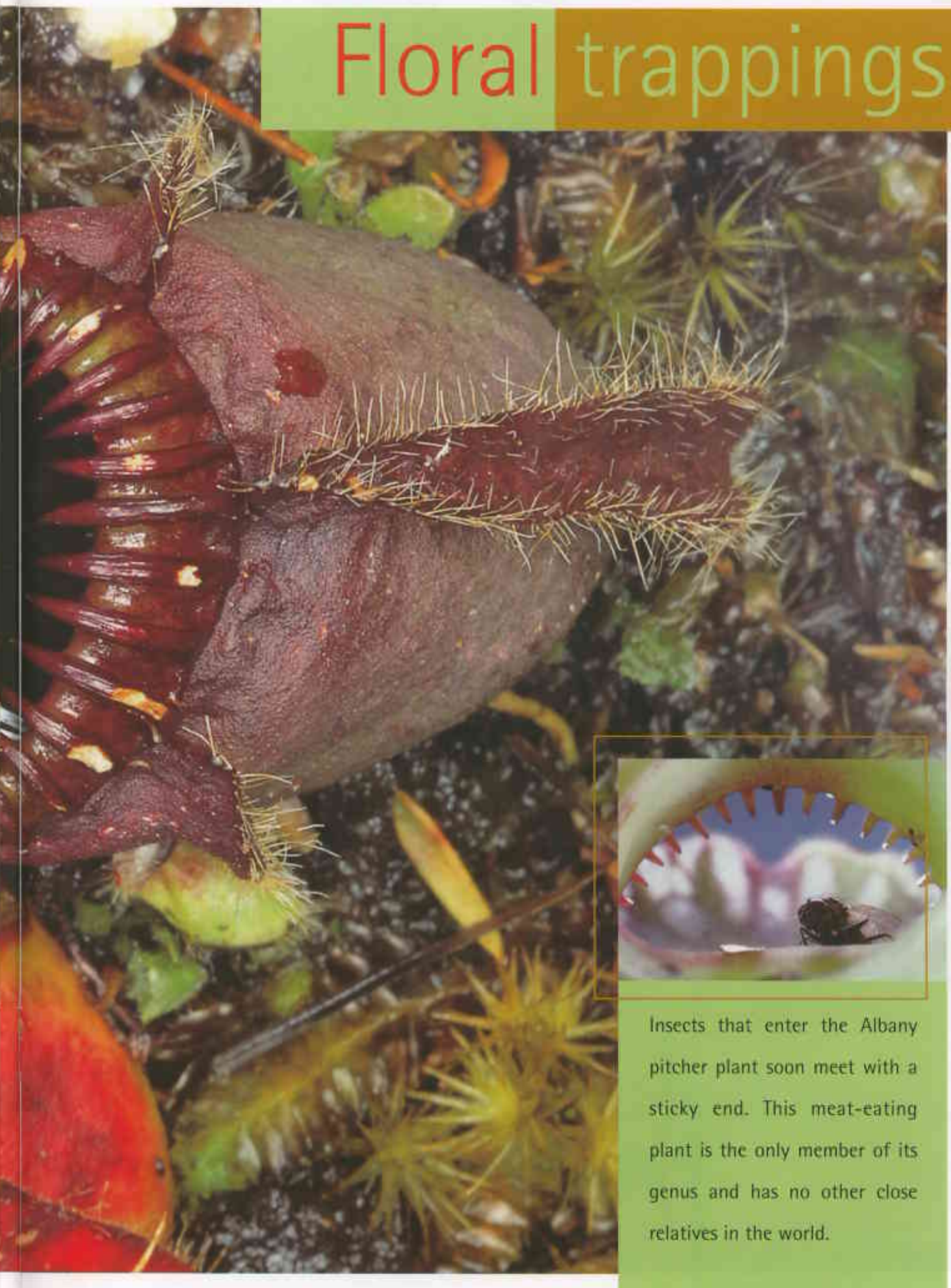
# Floral trappings





Insects that enter the Albany pitcher plant soon meet with a sticky end. This meat-eating plant is the only member of its genus and has no other close relatives in the world.

by Greg Keighery

The Albany or Western Australian pitcher plant (*Cephalotus follicularis*) is one of more than 500 species of flowering plants that attract, catch, trap and digest insect prey. These plants occur in a wide variety of, often-unrelated, flowering plant families throughout the world. Many use sticky hairs (sundews) or suction traps (bladderworts). Others—though this adaptation is less rare—have developed complex, yet passive, traps known as pitchers.

All 'meat-eating' plants grow in soils with low organic content and trap insects to supplement an inadequate supply of nitrogen. All of these plants have leaves containing chlorophyll (the green pigment that plants use to convert sunlight, water and carbon dioxide into food and oxygen) and are capable of photosynthesis. Hence, they can grow and thrive when provided with an adequate nitrogen supply, without needing animal prey.

## Family history

Pitchers have developed in three unrelated groups of flowering plants: the American pitcher plants (Sarraceniaceae), the tropical pitcher plants (Nepenthaceae) and the Western Australian pitcher plant (Cephalotaceae). Despite this, the pitchers of each group look remarkably similar, since they all operate in essentially the same manner.

The Albany pitcher plant is not at all closely related to other pitcher plants. It is related to the stonecrops (Crassulaceae) and more distantly to the hydrangeas (Saxifragaceae). However, it is distinctly different from both of these groups and is therefore placed in its own family, the Cephalotaceae.

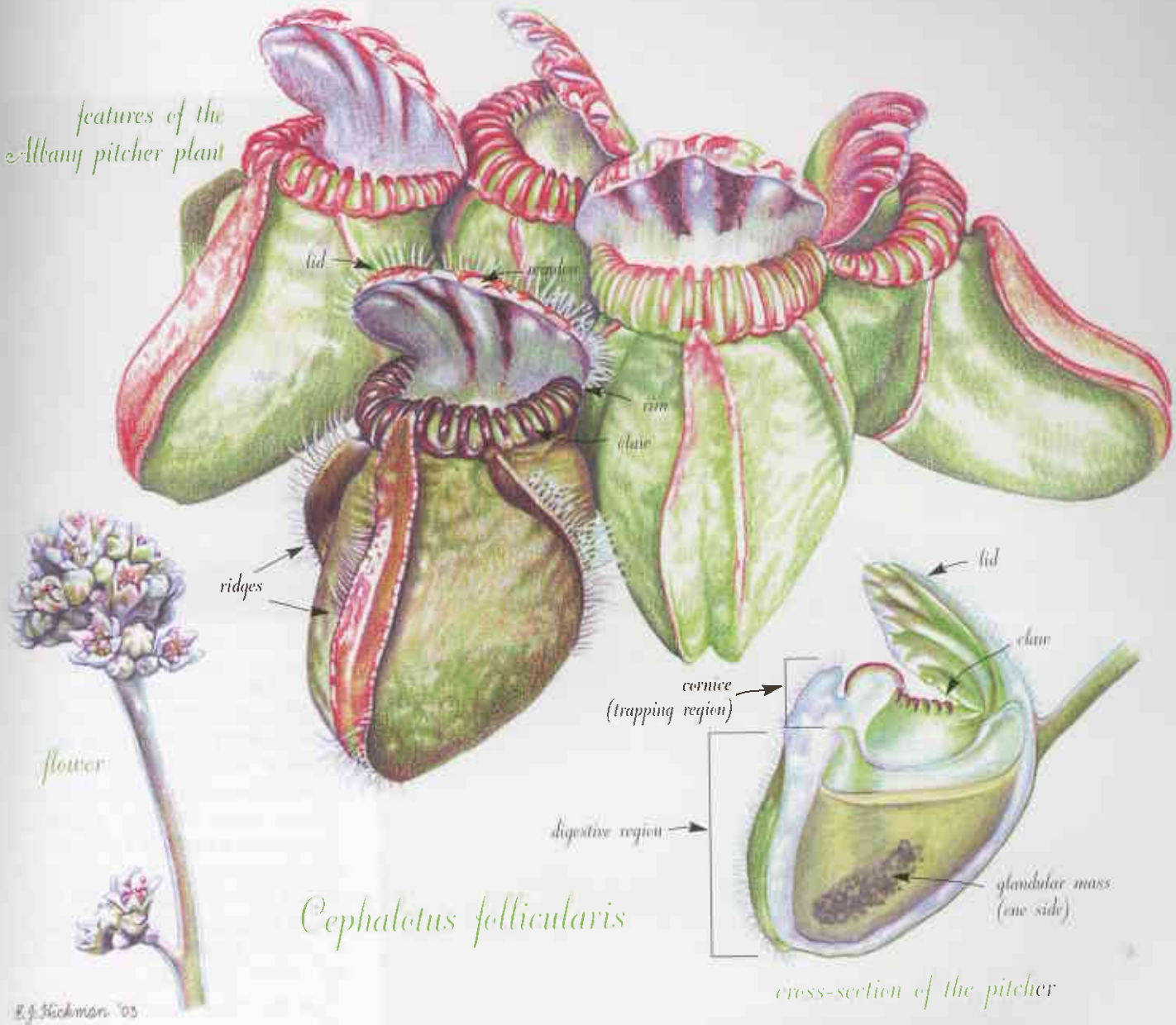
The south-west of Western Australia is world renowned for the diversity of its flowering plants, but this diversity is largely at the species (and to a lesser extent the genus) level. Our flora is closely related to that of eastern Australia and there are only a few small families confined to our State (see box on page 54).

The Albany pitcher plant was described by the great French botanist Labillardiere, in his publication on the botany of the voyage when he accompanied the D'Entrecasteaux expedition to Australia in 1791 to 1793. This voyage took six years because of the French Revolution and war with England and he did not return to France until in 1796. The expedition that Labillardiere accompanied only landed at Esperance, so it was believed that pitcher plants grew at Cape Le Grand (see pages 32–37). However, after numerous searches, three publications and 173 years had elapsed, it was finally determined that the species had been described from a collection made at Albany in 1803 by Leschenault de la Tour, a botanist on Baudin's expedition.

*Previous page*
**Main** This close up of a mature Albany pitcher plant (*Cephalotus follicularis*) pitcher shows its shiny digestive fluid.
*Photo – Marie Lochman*
**Inset** A fly enticed by the odour of decaying insects within a pitcher is poised just above the slippery trapping region.
*Photo – Babs and Bert Wells/CALM*

**Above** An Albany pitcher plant with normal leaves at rear and pitchers in the foreground.
*Photo – Greg Keighery*

**Left** Albany pitcher plant showing mature open pitchers and a developing, still-closed pitcher on the soil surface.
*Photo – Jiri Lochman*




Because of its unusual habits, the Albany pitcher plant is one of the most closely studied of all our native plants. More than 30 scientific papers have been published on aspects of its morphology (the form and structure), physiology (the parts and their function) and its botanical relationships. Despite this, many aspects of this unique Western Australian plant are still poorly known in the community at large.

## Habit and structure

Pitcher plants are perennial herbs with a short, fleshy rootstock bearing rosettes of leaves. There are two types of leaves on the one plant. The foliage (or normal) leaves are green, oval in shape and between 10 to 15 centimetres in length. In cultivated specimens, these leaves are produced in autumn and winter and the pitchers—which are modified leaves—are produced in winter and spring. In the wild, however, growth occurs between late October and March. Plants vary from having a single pitcher to more than 200 pitchers and unmodified leaves. Some plants that have been monitored are known to have lived for at least 12 years. Most pitchers are produced in summer, when insect activity is at its peak. Pitchers die throughout the year and are replaced annually, but may live for more than two years. They do not, however, increase in size once open.

At full size, the pitchers measure three to five centimetres long and about two to three centimetres wide (unlike other pitchers, the leaf stalk is not at the base) and are shaped like a loose purse or slipper. Since the pitchers lie on the surface, they are supported by three thickened ridges, to ensure sufficient rigidity. Pitchers in full sun are a deep red colour and are smaller than those in shade. The mouth of the pitcher has a thickened rim bearing approximately 24 stiff 'claws' that project inwards and downwards. This opening is surmounted by a lid, which lowers evaporation of the contents of the pitcher and prevents rain from diluting the contents. The lid has a series of transparent 'windows' (lines of tissue devoid of chlorophyll). Numerous nectaries, which secrete a sugary solution, are found between and below the claws, on the outside of the pitcher and inside the lid.

## Attracting and digesting

Inside the pitcher, when it is cut in half lengthwise, two distinct zones can be seen: the trapping region (cornice) and the digestive region. The cornice is a thick collar of spongy tissue forming an internal ridge. A covering of downward-pointing hairs gives it a slippery, glistening surface. Below the cornice is a brief transitional zone, before the start of the digestive region.

## Insectivorous plants of the world

| Family and genus | Number of species | Geographical distribution |
|---|---|---|
| **Droseraceae** | | |
| *Drosera* (sundews) | approx. 90 | cosmopolitan |
| *Dionea* (Venus fly trap) | 1 | North America |
| *Drosophyllum* | 1 | Portugal |
| *Aldrovanda* | 1 | Europe, SE Asia, Australia |
| **Roridulaceae** | | |
| *Roridula* | 2 | South Africa |
| **Byblidaceae** | | |
| *Byblis* | 5 | Australia |
| **Sarraceniaceae** (American pitcher plants) | | |
| *Sarracenia* | 10 | North America |
| *Heliamphora* | 6 | South America |
| *Darlingtonia* | 1 | North America |
| **Nepenthaceae** (pitcher plants) | | |
| *Nepenthes* | 40 – 70 | Madagascar, SE Asia to Queensland |
| **Cephalotaceae** | | |
| *Cephalotus* | 1 | south-western Australia |
| **Lentibulariaceae** | | |
| *Pinguicula* (butterworts) | 46 | northern hemisphere |
| *Utricularia* (bladderworts) | 200 | cosmopolitan |
| *Genlisea* | 15 | Africa, South America |

The digestive region is smooth, purplish in colour and contains two types of digestive glands. Large spherical glands are distributed around the inside of the pitcher, above the glandular mass, where small digestive glands are grouped on a purplish, kidney-shaped, glandular mass on each side of the pitcher. Below this gland is the fluid in which the prey drowns and is digested.

Insects are attracted to the pitchers by odour from the nectaries and decaying prey, the coloured markings on the rim and lid, and the light coming through the 'windows' on the lid. Crawling insects, such as ants, attempting to reach the nectaries inside the pitcher slip on the surface of the cornice and fall into the liquid. Flying insects are able to reach the nectaries

**Above left** Madagascar pitcher plant (*Nepenthes madagascariensis*), in the family Nepenthaceae.
*Photo – Jiri Lochman*

**Above** Sundew (*Drosera indica*) in the family Droseraceae with a dragonfly caught fast.
*Photo – Dennis Sarson/Lochman Transparencies*

**Far left** Family Lenitubulariaceae. Bladderwort (*Utricularia fulva*).
*Photo – Jiri Lochman*

**Left** Northern byblis (*Byblis liniflora*).
*Photo – Marie Lochman*

**Right** Albany pitcher plant (*Cephalotus follicularis*) in the family Cephalotaceae. *Photo – Jiri Lochman*

(or the fluid), but, when they attempt to escape by flying through the 'windows', they hit the lid and eventually fall into the liquid, where they drown and are digested.

## Weird wetland

The water within the pitchers is secreted by the plant and is almost as pure as distilled water upon opening. This mini wetland ecosystem (such wetlands are also found in tree hollows and other pitcher plants) supports its own unique fauna—in only 20 millilitres of water! This ecosystem was studied by Sally Clarke (from the University of Western Australia Zoology Department) in 1985. Sally found more than 166 species of plants and animals within the pitchers, including various species of bacteria, fungi, algae, protozoa (flagellates, ciliates, amoeba and microflagellates), nematodes, roundworms, rotifers, arthropods (micro-crustacea, midge and fly larvae), water bears and water mites. The life forms within this ecosystem largely arrive via air currents, and are sustained by consuming the bacteria that aid the decomposition of the prey.

The much larger tropical and American pitchers—containing nine to 30 millilitres of fluid—host a series of mosquito, midge and fly larvae (up to 38 species in American pitchers), which predate on other inhabitants. Some of these species are only found as larvae in these pitchers. Sally thought that the small size of our pitchers precluded large predatory species. However, David Yeates of the Western Australian Department of Agriculture has since shown that the larvae of a small flightless fly (*Badsis ambulans*) may specialise in consuming decaying insect remains in our pitcher plant. Interestingly, the adult female fly is flightless and looks like a meat ant, the most common insect prey of the pitcher. So there is probably more to learn about this weird wetland.

## Distribution and habitat

Pitcher plants are found in and around moist acid peaty swamps, usually those with an ample and regular supply of fresh water. They are frequently found perched on the rootstock of the tea tree (*Homalospermum firmum*) that characteristically grows in these swamps, or they may grow directly on the soil surface.

In the wild, pitcher plants grow between Cape Riche, along the swampy coastal plain south of the karri forest to the Scott Plains and West Bay near Augusta, with an isolated population near Yallingup on the Leeuwin-Naturaliste ridge. There are old, but still unconfirmed, reports of pitcher plants in the Locke Estate Nature Reserve (near Vasse, west of Busselton), at the base of the Whicher Range and near Capel on the Swan Coastal Plain. However, detailed searches have not been able to confirm any of these reports.

Unfortunately, pitcher plants are apparently retreating from the western portions of their range. Recent searches have not relocated the populations from the Scott Plains, West Bay and the Leeuwin-Naturaliste ridge. We do not know if this is due to drought or the result of clearing interfering with the natural hydrology or due to changed fire patterns, including a lack of fire. Pitcher plants can resprout from their

## Western Australia's own plant families

There are six other families of plants that are confined to Western Australia, but, unlike the pitcher plant, these are almost unknown outside the scientific community. Most are relatively small and contain only one or a few species.

### Eremosynaceae

The solitary species in this family, *Eremosyne pectinata*, is a small annual herb that occurs abundantly after summer fires on sandy soils between Margaret River and Mount Manypeaks. It was once considered a possible relative of the pitcher plant, as they were both previously placed in the Saxifragaceae (a largely northern hemisphere family). *Eremosyne* is still considered a close relative of this family and is the only relative present in Western Australia.

### Emblingiaceae

The only member of this family, the slipper flower (*Emblingia calceoliflora*) is a prostrate perennial short-lived soft-wooded shrub that is also abundant after fires on limestone soils from Eneabba to North West Cape. Flowers are borne singly in the upper leaves and are pale yellow (south of Kalbarri) or pale orange (Shark Bay northwards). This plant, with its unusual slipper-shaped flowers is considered to be related to the Leschenaultia family (Goodeniaceae).

There are also a series of families that have been recently segregated from the jointed sedges (Restionaceae) on the basis of anatomy, chemistry, pollen morphology and fruit type. These are the **Anarthriaceae** (which contains seven species in *Anarthria*, largely from wetlands ranging from Perth to Cape Arid), **Ecdeiocoleaceae** (two species in two genera, *Ecdeiocolea* and *Georgeantha*, from sandplains north of Perth), **Hopkinsiaceae** (two species in *Hopkinsia* from sandplains between Eneabba and Lake King) and **Lyginiaceae** (three species in *Lyginia*, from sandy soils from Kalbarri to Cape Arid).

**From top right** Albany pitcher plant (*Cephalotus follicularis*).
*Photo – Babs and Bert Wells/CALM*
*Emblingia*. (Emblingiaceae), *Eremosyne*. (Eremosynaceae), *Eedeiocolea monostachya* (Ecdeiocoleae), *Georgeantha* (Ecdeiocoleaceae)
*Photos – Greg Keighery*


root base after fire, but are killed by hot summer and autumn fires that burn out the rootstocks or peat soils. They appear to flower and seed after less severe fires and regenerate from seed after sporadic hot summer fires. It is likely that a combination of all these factors is responsible for the decline of this unique species.

Pitcher plants produce a slender, leafless, inflorescence stalk, 40 to 80 centimetres tall, which bear numerous small, sweetly-scented, white flowers. These lack petals, but have six prominent sepals instead. Flowering occurs from January to March, when the swamps are at their driest. Held well above the traps, the flowers are pollinated by a variety of flying insects including small flies, bees and wasps. Flowering appears to be enhanced by fire and the inflorescences are also more visible after fire.

## Cultivation

Because of its unusual, carnivorous habits the Albany pitcher plant is widely grown in specialist collections—usually in pots in peat—throughout the world. Plants are readily grown from leaf cuttings or seeds. When grown in full sun, the pitchers develop a deep red colour that is very attractive, or are mottled reddish-green in partial shade.

Unfortunately, pitcher plants are still illegally dug up from the wild, despite being easily cultivated. This activity usually results in the death of any mature plants that are removed.

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