*Utricularia campbelliana*

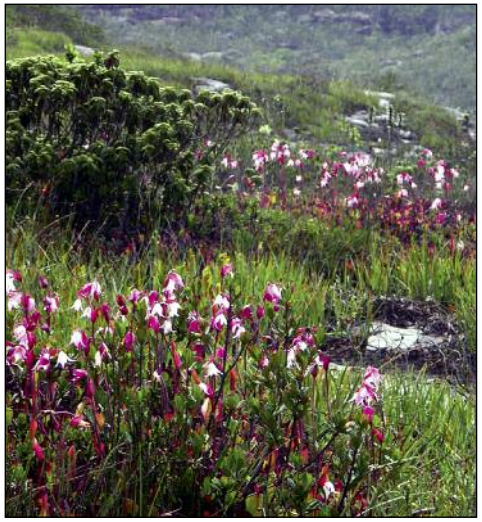
*Drosera roraimae*

*Heliamphora tatei 'Avispa'*

*Nepenthes rajah*

*Heliamphora ionasii*

*Utricularia humboldtii*



*Heliamphora chimantensis*

*Utricularia humboldtii*

ISSN 1033-6966

# VICTORIAN CARNIVOROUS PLANT SOCIETY Inc.

**September 2007** **No. 85**

*Heliamphora pulchella*

# VICTORIAN CARNIVOROUS PLANT SOCIETY Inc.

## Annual Subscriptions

**Australian membership $25.00**
**Overseas membership $25.00**

Payment from overseas must be in Australian dollars.
All cheques or money orders should be made payable to the Victorian Carnivorous Plant Society Inc (VCPS).
Payment by credit card is NOT available at the time of this journal issue.

## Correspondence

Please forward all correspondence regarding subscription, change of address, articles for the journal and back issues to:

**The Secretary VCPS**
**P.O. Box 201**
**SOUTH YARRA 3141.**
**AUSTRALIA**

Journal articles, in MS-Word, ready for publication, may be Emailed to the Editor or Secretary.

## Meetings

Most VCPS meetings are held in the hall at the rear of the Pilgrim Uniting Church on the corner of Bayview Road and Montague Street, Yarraville – Melway map reference 41K7. These meetings are on the fourth Wednesday of the month at 8 PM.

However, some meetings may be at the home of members during a weekend. Details of meeting dates and topics are listed in each journal.

If unsure of the location or date of any meeting, please ring a committee person for details.

The VCPS Annual General Meeting, usually held at Yarraville in June, provides substantial benefits for each and every member able to attend.



VICTORIAN CARNIVOROUS PLANT SOCIETY Inc.

**Issue No. 85** **September 2007**

### Office Bearers: July 2007 – June 2008

| | |
|---|---|
| **President** | Stephen Fretwell |
| **Vice President** | Sean Spence |
| **General/Member Secretary** | Peter Bloem |
| **Minutes Secretary** | Sean Spence |
| **Other Publications** | Gordon Ohlenrott |
| **Journal Editor** | Stephen Fretwell |
| **Assistant Journal Editor** | Sean Spence |
| **Internet Co-ordinator** | Peter Wolf |
| **Treasurer** | Ken Neal |
| **Librarian** | Andrew Gibbons |
| **Seedbank Administrator** | Ron Abernethy |
| **Hardware Co-ordinator** | Andre Cleghorn |
| **Event Co-ordinators** | Peter Anderson, Gordon Ohlenrott |
| **Field Trips Organiser** | Julian Weston |
| **Public Officer** | Alexander Whitehouse |
| **Sales Administrator** | Ron Abernethy |

# Contents

***Brocchinia reducta on the Summit of Jaua Adua.***
Photo: Stewart McPherson



## Seed Bank

We now have a huge collection of NEW fresh CP seed available, and our seed list has become quite extensive.

With over 250 varieties of CP's, we are now providing the list in PDF format on our website, www.vcps.au.com.

The new seed consists of over 200 types of *Sarracenia* species and hybrids, *Darlingtonia* seed obtained from the US and *Drosophyllum*.

Seed was collected from plants late 2006, so be quick, while stocks last. For inquiries or to order seeds, please contact our Seedbank Officer.



FRONT COVER:
*Heliamphora pulchella.*
Photo: Stewart McPherson

BACK COVER:
**Clockwise from top left:**

- *Utricularia campbelliana.*
  Photo: Stewart McPherson
- *Drosera roraimae.*
  Photo: Stewart McPherson
- *H. tatei 'Avispa'.*
  Photo: Stewart McPherson
- *Utricularia humboldtii.*
  Photo: Stewart McPherson
- *Utricularia humboldtii.*
  Photo: Stewart McPherson
- *Heliamphora chimantensis.*
  Photo: Stewart McPherson
- *N. rajah.*
  Photo: Stephen Fretwell
- *Heliamphora ionasii* (Centre).
  Photo: Stewart McPherson


**Journal Design:**
Stephen Fretwell

**Printed by:**
Snap Printing (Box Hill)


# MEETING TOPICS & DATES for 2007

## VICTORIAN CARNIVOROUS PLANT SOCIETY

This year we have scheduled the following discussion topics, and events:

| | | |
|---|---|---|
| **January** | **(20th)** | New Year BBQ at President Stephen Fretwell's House 12pm Sunday, *Darlingtonia*, *Dionaea*. (Contact for details) |
| **February** | **(27th)** | *Sarracenia* species and hybrids, beginners night. |
| **March** | **(26th)** | *Nepenthes and Heliamphora*. |
| **April** | **(23th)** | *Drosera*, video and information night. |
| **May** | **(28rd)** | Growing conditions, pygmy *Drosera* gemmae collection, 'best' and 'worst' plants. |
| **June** | **(25th)** | AGM, plant give-away, any CPs. |
| **July** | **(23th)** | Seed growing and tissue culture, potting demonstration, any CPs. |
| **August** | **(27th)** | Tuberous/Winter growing *Drosera*, show preparation, displays, and companion planting. |
| **September** | **(24th)** | *Cephalotus, Brocchinia, Catopsis* and swap night. |
| **October** | **(22th)** | Field trip to Triffid Park, any CP's. |
| **November** | **(26th)** | *Byblis,* pygmy *Drosera, Drosophyllum, Genlisea, Pinguicula, Roridula, Utricularia*. |
| **December** | **(TBA)** | Annual show at Collectors Corner. |

**Please note: All meetings, other than those where a specific venue is given, will be on the FOURTH WEDNESDAY of the month in the hall of the Pilgrim Uniting Church in Yarraville – corner Bayview Road and Montague Street, Melway Map Reference 41K7.**

***Heliamphora neblinae*** Photos: Stewart McPherson

# Carnivorous Plants of the Guiana Highlands

STEWART MCPHERSON

The Guiana region of southern Venezuela, northern Brazil and Guyana is one of the richest hotspots for carnivorous plants in the world. Over fifty species belonging to six genera (*Brocchinia, Catopsis Drosera, Genlisea, Heliamphora* & *Utricularia*) are found in this small corner of South America and one further genus (Aracamunia) found in the south of Venezuela is also suspected of having carnivorous traits. Around three quarters of all of the known species of carnivorous plants found in the Guiana Highlands occur no where else in the world.

Many reasons can be suggested to explain this remarkably high rate of diversity and endemism. The topography of Guiana Highlands is diverse and dominated by gigantic sandstone plateaus known locally as 'Tepuis' (also spelt 'Tepuyes') that provide a multitude of habitats and ecological niches that have driven species diversification and further evolution. Additionally, increased oreographic rainfall, as a byproduct of the varied topography, has given rise to a greater prevalence of wetland habitats that naturally favour carnivorous plants and so enabled a particularly high density to emerge. Perhaps most significantly, the biogeography of the Tepuis is more akin to that of islands than any other terrestrial mountain range – where as the side slopes of ordinary mountains permit the gradual introgression of plant and animal species between differing altitudinal zones, the abrupt vertical cliffs of the Tepuis physically isolate the summits of the Tepui from the surrounding flatlands. Although seeds, birds and insects may occasionally be transported by the wind between the two habitats, few species are versatile enough to survive the transition and consequently the highland and lowland biomes of Guiana exist and have evolved largely independently from one another. The summits of the 100 or so Tepuis distributed across the Guiana region therefore represent climatically similar yet locally isolated ecological 'islands' that stand above a 'sea' of the tropical rainforest or hot, dry savannah.

The fragmentation of plant and animal populations between the Tepui summits and the lowlands and also on the separate mountain summits has encouraged rapid evolution of wildlife to better suit inherent climatic and ecological differences and consequently, an extremely diverse array of plants and animals has emerged in a relatively small geographic area.

Carnivorous plants are particularly prevalent in the Guiana Highlands directly as a result of the unique advantages that the carnivorous adaptation offers – namely an ability to survive where insufficient nutrients prevent other plants from existing. Despite high rainfall, a mild climate and strong tropical sunlight, the complexity of the ecosystem on the Tepui summits is constrained by a chronic lack of nutrients. The Tepuis receive up to 11,000 mm of precipitation annually and this extremely high level of rain results in organic matter washing away before sediment can accumulate and form soils. The result is a landscape dominated by bare rock, typically capable of supporting only small, slow growing plants and a spare population of small animals – and an environment that celebrated Tepui explorer Uwe George aptly described as a 'rain desert'.

**The tepuis – islands above the clouds.**

Plants growing in the rain deserts of the Tepui summits continually face the acute shortage of phosphates and nitrates. Carnivorous plants however, inherently have an alternative source of sustenance and so possess a natural advantage over regular non-carnivorous vegetation in surviving in such conditions of adversity. Paradoxically they are generally most numerous in the most barren and inhospitable of habitats where few other (non-carnivorous) plant species can survive or compete.

Three genera employ the 'pit fall' method of carnivory – *Brocchinia, Catopsis* and *Heliamphora*. These pitcher plants trap insects through essentially the same trapping process – insects and other small animals fall into water containing reservoirs formed from the plants' foliage and are prevented from escaping, drown and die.

*Heliamphora* is the largest genus of Guianese pitcher plants and contains at least fifteen species although several further

***H. ionasii***

***H. tatei* 'Avispa / Aracamuni Form'**

***Heliamphora exappendiculata* on Aropan.**

undescribed taxa await classification. Within the genus, the diversity of species is impressive – the smallest species *H. minor and H. pulchella* typically produce traps that stand 10 – 20 cm in height, whereas the very largest species, *H. glabra, H. ionasii* and *H. tatei* 'Avispa/ Aracamuni variant' produce giant traps often in excess of 30 cm in length. Evolution of *Heliamphora* sp. has apparently occurred in different directions – species such as *H. glabra, H. ionasii* and *H. tatei* have clear adaptations to grow amidst dense vegetation and cloudforest – *H. glabra* and *H. ionasii* produce broad, shade tolerant leaves and uniquely *H. tatei* grows upright on a tall, woody stem that stands up to 2m in height, generally above surrounding undergrowth. Other species such as *H. minor*, *H. nutans* and *H. elongata* have evolved to tolerate extremely exposed conditions on the summits of the tallest, most climatically hostile of the Tepuis – these three species frequently grow in the company of short marsh grasses and *Stegolepis* sp. and so benefit from the shelter that is thereby offered. Most *Heliamphora* sp. are endemic to the summits of just one or two Tepuis however a couple of species also occur in wet, marshy patches of the lowlands of Guiana, of these, *H. heterodoxa* is the most widely distributed.

Two genera of tank bromeliads contain species that have separately evolved similar adaptations to catch insects through fundamentally the same processes as the *Heliamphora*. Tank bromeliads are bromeliads that have evolved watertight leaf rosettes adapted to collecting and storing rain and organic debris as a source of water and nutrients – it would seem that they are naturally predisposed to evolving as carnivorous plants. Three carnivorous species are known from the genera *Brocchinia* and *Catopsis* – each possesses foliage that collectively forms a hollow vessel – however the benefit of the bromeliad adaptation of the pit-fall trap is that its simplicity enables *Brocchinia* and *Catopsis* to be equally adapted to photosynthesis as carnivory – unlike *Heliamphora* that have compromised the efficiency of photosynthesis for their carnivorous adaptation. *Brocchinia* in particular are among the most successful and widely distributed of all plants of the Guiana Highlands and frequently carpet vast areas of the Tepui summits including places where virtually no substrate can accumulate. Both species of carnivorous *Brocchinia* occur in the lowlands of Guiana and also on the summits of the Tepuis. The carnivorous species of *Catopsis* (*C. berteroniana*) is recorded from lowland forests of Guiana although is most prevalent amidst stunted cloud forest of the plateau fore hills – however it is generally absent from the summits of the Tepuis.

*Drosera* is the only genus of carnivorous plants that exists in the Guiana Highlands that traps prey through the 'fly-paper' method of carnivory. The sticky leaves of most of the Guianese sundews are mobile and actively move once prey is trapped on the droplets of glue that line the plants' leaves. Several species of sundews from the Guiana Highlands are unusual in that they grow erect

***Drosera roraimae***

and form towers of dead leaves or stipules. The most widely distributed species of all is *D. roraimae* which survives in an extremely broad range of terrestrial habitats including typically open, wet, marshy areas to the margins of cloud forests and also wet cliff sides. *D. roraimae* can grow to more than 20cm in height and stand erect without support of any other vegetation. Perhaps this habit is to avoid the trapped prey from being washed away from the plants' leaves as its habitats are often inundated with water. Since the stem of *D. roraimae* forms gradually as the plant grows, it is likely that larger specimens may be several decades old. Although several genera of Guianese *Drosera* are endemic to the summits of specific Tepuis, several are

***Utricularia campbelliana***

**The 'bladder' trap of *Utricularia humboldtii*.**

***Utricularia humboldtii* growing in the rosette of a Bromeliad.**

prevalent in the lowlands and also across the summits of the Tepuis.

*Utricularia* (the bladderworts) are particularly diverse across the Guiana region and over 25 terrestrial and epiphytic species are found on the Tepui summits and in wetland areas in the lowlands of Guiana. Several particularly large and spectacular species are found in Guiana, including *U. humboldtii, U. campbelliana* and *U. quelchii* which produce spectacular, brightly coloured flowers and unusually large traps that are up to 7mm long. The hollow, white 'bladders' from which the plant receives its name, are produced sporadically along the length of the plant's filamentous stem. Each bladder has a small hinged door on its forward side which is fringed with minute trigger hairs. Glands on the interior surface of the bladder remove water and air so that the internal pressure is appreciably lower than that of the exterior. If a microscopic organism touches the trigger hairs, the small trapdoor implodes inwards and through the inward rush, the small victim is swept inside. Once prey is caught, the trapdoor swiftly closes and the imprisoned victim soon perishes. Enzymes released by glands on the interior of the bladder quickly digest the soft remains of the victim's body and resultant dissolved nutrients are absorbed through the walls of the bladder. 48 hours later, the trap is reset and ready to catch again.

The largest and most spectacular of all the Guianese species is *U. humboldtii* which grows exclusively in the water filled leaf axils of large tank bromeliads on the summits and foothills of the Tepuis. It produces large, blue green leaves and flamboyant mauve flowers which grow directly from the bromeliads foliage. It grows predominantly in the water reservoirs of the tank bromeliad *Brocchinia tatei* and also less frequently in those of the carnivorous bromeliads *Brocchinia reducta* and *Brocchinia hechtioides*. Occasionally it also grows terrestrially where the substrate is especially wet.

The closely related genus *Genlisea* (the corkscrew plants) is also well represented in the Guiana Highlands and most of the Guianese species are prevalent in extremely moist conditions at the margins of streams and ponds. Each plant produces two types of leaves, the first type form a compact basal rosette above ground and are usually small, green and tear shaped. The second type of leaves consist of white, hollow, fork shaped structures that extend downwards and grow through the soil. The arms of the forked leaves are twisted spirally much like a corkscrew and along the edge of the twists have open slits. The margin of the slit has an inward protruding lip and inward pointing hairs so microscopic soil organisms can easily enter the subterranean trap but find it extremely difficult to escape.

Charles Darwin examined *Genlisea* in detail in his influential work Insectivorous Plants and noted the plant's apparent ability to trap organisms but remained unsure of precisely how the trapping process functioned. The recent work of Barthlott et al. 1998 provided the answer and conclusively showed that *Genlisea* use various chemical lures to attract primarily microscopic protozoa which are trapped and digested through modifications of the wall of the leaf. That *Genlisea* has evolved specifically to trap protozoa and other microorganisms is perhaps not as surprising as it may initially seem. Micro fauna are indeed abundant in most soil and water environments and provide a potentially bountiful supply of essential nutrients and minerals otherwise deficient in the leached soils. Of the 21 species of *Genlisea* currently known worldwide, seven grow in the Guiana Highlands, including one of the largest species of all, *G. guianensis* which produces traps up to 15 cm long and certainly traps small soil organisms as well as protozoan life.

Stewart McPherson's new book Lost Worlds examines the wild ecology and remarkable diversity of the Guiana Highlands including *Brocchinia*, *Catopsis*, *Drosera*, *Genlisea*, *Heliamphora* and *Utricularia*. Stewart is selling copies personally through his online company www.redfernnaturalhistory.com to raise money for the Meadowview Biological Station – with the goal of donating 5 to 10 acres of Sarracenia habitat for permanent protection – please see www.redfernnaturalhistory.com/conservation.htm.

***Brocchinia reducta***

***Catopsis berteroniana***

**Bibliography**

**Barthlott W., Porembski S., Fischer E. and Gemmel B., 1998, "First Protozoa-trapping Plant Found." Nature 392 (April): 447**

**Darwin, C. 1875, Insectivorous Plants. London, England: John Murray Press**

# *Nepenthes* in the (tame) wild

**The Mesilau Nature Centre.**

Photos: David Bond:

**The bridge that you cross to reach the *N. rajah* paradise.**

**David with *N. rajah*.**

**DAVID BOND**

Most of you I am sure read through the last few journals and drooled over the articles by Justin Thong on visiting Borneo and finding amazing *Nepenthes*.

Being a friend of Justin's I have heard many times of his wonderful adventures and also dreamed of one day going and seeing the plants myself. His beautiful photos always got me thinking about how hard it would actually be to find the plants though.

So whilst we were on a big overseas holiday to Egypt in February 2007, by flying Malaysian Airlines we were able to get very cheap stopovers in Kota Kinabalu and Kuching.

Firstly let me say that Mt. Kinabalu was amazing. The scenery alone was fantastic. The best plants we saw were at the Mesilau entrance to the park. This less visited area is a little difficult to get to as no organised tours include this as a day trip. In order to get there you need to hire a car and drive for 1-2 hours. The drive travels along great roads that are very scenic and well worth the extra effort as it costs a bit less than a taxi and the time is your own. The guided tour of the *Nepenthes* walk, viewing *N. rajah, N. burbidgeae, N. tentaculata* and slipper orchids was amazing! This trail is only open to those with a guide and was being repaired while I was there. The walk is steep in places but very accessible. Viewing a large area (100m x 50m) covered in metre high *N. rajah* plants with pitchers over 30cm is wonderful! Strangely, not all plants had pitchers and not all leaves had developed large pitchers. This area, that is located on the side of a hill is prone to landslides and these are evident as you wander the trail.

Justin provided a lot of great information (that I used) on the sites in Kinabalu and here I will explain how to find the plants in Kuching.

We saw three main sites with *Nepenthes* while we were staying in Kuching:

## 1. BAKO NATIONAL PARK.

This most amazing place should be a must for all plant and nature lovers visiting this part of the world. Travelling about an hour out of Kuching, the day trip was about $80 Aus including lunch, transport and guide. You travel the last 30 minutes by a 'stretched tinnie'. This was exciting as you head off down the river to the sea and then bounce across the waves at the entrance to the South China Sea. The water wasn't very deep, (it was low tide) so when we were about 300 metres from the Park Headquarters the guide said, "Shoes Off!". We then had to climb over the side of the boat and walk the rest of the way to shore. As no roads lead into the National Park it is a lot more isolated than many others. First we saw Silver-tailed monkeys running along the beach, then a green viper on a branch (very poisonous), and wild boars around the little restaurant.

The trail we chose was a relatively easy one compared to others you can travel, but by no means disappointing. A large network of walkways over mangrove swamps lead to the trails. A ten minute walk into the swamps we found Proboscus Monkeys (Big Noses) in the tree tops and there, on the cliffs above the seashore was *Nepenthes albomarginata*. They were growing over the tea trees and other stunted plant growth. The pitchers were very colourful (bright

***N. burbidgeae***

**A Slipper Orchid; *Paphiopedilum hookerae* that can be found growing near *N. rajah*.**

***N. ampullaria* found at Bako NP.**

green) and the margin of white was like a collar below the peristome. Each pitcher was about 8 cm tall.

The rest of the family didn't follow the guide Lee and myself, as their interest in plants was just that I was happy. It was a hard walk up as the humidity is quite extreme for one out of condition and not used to climbing. The trail was very good but akin to climbing stairs for 20 minutes in the heat. The reward at the top of the hill was worth it. First was another *N. albo-marginata* but this time the pitcher was quite red and a little smaller. Then in a very flat, rocky area similar to some of the walks in the Grampians (Victoria), we found some quite big, 15-20cm plants of *N. rafflesiana*. With upper and lower pitchers these plants were very striking. There were also a few *N. gracilis* plants near the trail but most didn't have many pitchers.

Lee told me that the area had not had much rain over the past season so the bigger plants were a little harder to find. Also in the bush, Lee pointed out a *N. ampullaria* with pitchers as big as your fist. The stems were very interesting as they looked like hard sticks with the pitchers just stuck on around it. The soil here was a lot richer and was on the side of a hill under big trees.

Later near the top of the hill where a boardwalk takes you to a pergola with seats to rest I saw some small *Drosera spatulata*. These small sundews were about 2cm in diameter and were growing next to a muddy puddle.

## 2. NEPENTHES AND ORCHID NURSERY.

About an hour out of town on a drive to the Orang-utan Centre called Semmigoh, we stopped off at a great *Nepenthes* Nursery. All the plants are grown on and sold from tissue

**A 3ft plant of *N. bicalcarata* being grown in a ceramic pot.**

culture. (Not to purchase here though) The plants are in a beautiful man made garden area. Trails with bridges, ponds and waterfalls lead you to huge clumps of *Nepenthes* in pots, planted in groups, growing along a frame and in hanging baskets. Probably over 200 plants were here and although out of season offered a lot to the visitor with a camera. The highlight was a 3 metre tall *N. bicalcarata* plant which was flowering, that had 10 cm pitchers.

## 3. MATANG ANIMAL CENTRE.

This is a tourist spot about 45 minutes out of Kuching. While we went to see Orang-utans one of the highlights included seeing *Nepenthes ampullaria* next to the enclosure. These plants were very green and in a fair bit of shade. They were signposted and right next to the trail. They were growing in and through the leaf litter from the large trees above them. I also had half an hour to explore a trail called 'The Pitcher trail' near the park entrance. Walking by the campground and river, the trail is an easy walk into the forest. They say that 5 species of *Nepenthes* grow here but I only saw *Nepenthes ampullaria*. But then I only walked in for about 10 minutes. The plants had lovely clumps of pitchers right on the trail and were the size of your fist. Here they were colourful with green and red flecks. I am sure there would have been more to see, 'Off the trail', if I had time. This is a place anyone can get to see the plants growing in the wild easily.

The tours offered are cheap, but so is a taxi and driver for the day. These will get you to places to see the plants or to areas you could explore if you have more time. Make sure the driver knows a little English as this helps you explain times/places etc. a lot more easily. Accommodation in Kuching caters for all budgets and good hotels are very cheap.

If you are thinking about a holiday that includes CP's why not take the challenge and see what you can find in these places and share it with the other members.

**Orang-utans from the Matang Animal Centre.**

# Greenhouse Inspiration:

## How to build a fully equipped greenhouse for less than $2500 – Part 2

**DAVID BANKS**

We repeated this method again for the second half of the roof in order to allow dad time to get ready for his plane flight home. To overcome the short cut roof beams we decided to replace the under length beam with a spare length of timber and then cut off the excess after butting it up against, and attaching it to the first beam. With that done dad was able to get ready and we headed off to the airport with an hour or so to spare. Whew!

After getting back from the airport I was able to quickly finish off the remaining rafters without any incident giving me the next day to move onto the end frames and finish the frame.

To find an accurate measurement for the top plate of the front door frame I simply lifted a length of timber to the level of the doorframe uprights and used a pencil to mark where it overlapped the rafters of the front "A" frame. After cutting it I slid it into place and drilled and nailed it. From there I secured the door uprights to the door top plate, this meant I could now add the noggins either side of the door to finish the front frame. **(See photo 5, opposite).**

For the frame at the back of the greenhouse, I wanted to duplicate the front door frame arrangement so I would have a convenient spot for another door in the future if I wanted to attach a nepenthes hot house on the end. I copied the front by measuring the door frame uprights and cut timbers to match. I attached these to the bottom plate of the end frame, leaving enough room for a screen door, and secured them to the wall brace being used to keep the

**The finished product – my now operational greenhouse, up and running.**

Photos: Dave Banks

walls from spreading under the weight of the roof. The top plate was done in the same manner as the front door to ensure a good fit especially as it provides strength for the ends of the frame. Again, noggins were measured to fit the spaces between the uprights for added strength, and support for laserlite sheeting. I then removed the cross brace.

So now I had finished with the basic wooden frame, but even though it locks itself in, the structure is still susceptible to cross winds, so some sort of bracing is required. In one of my many trips to Bunnings I remembered seeing a roll of galvanized steel in various widths and thicknesses made specifically for cross bracing, so it was back to Bunnings! I chose a 25m roll of 8mm thickness and 10mm wide as there was a massive increase in price between that roll and the 1mm thick roll.

The rafters still needed to be strengthened with a cross piece to form the classic "A" frame but that would require quite a bit more timber and add to the overall weight of the roof so I decided to use the roll of cross bracing for this job too. This meant much less measuring and cutting, far less time and mucking around and I would be able to get my plants in a better growing environment much sooner. As I had not thought about this when buying my first roll I had to make another trip to Bunnings to buy a second roll of 15m length.

To save material and money I only attached the cross bracing to the middle four of the six uprights on either wall and did the same for the rafters each side of the roof. So including the cross bracing that spans between the opposite facing rafters and across the end frame the whole frame has become rock solid and it would now take a nuclear blast to bring it down. **(See photo 6).**

The next step was to wrap the frame in a layer of plastic film and follow it with the shade cloth. **(See photo 7)** I won't bore you with the details of the ensuing, almost never ending, tussle between myself, the wind and the plastic along with the various and colourful phrases that issued forth from my mouth during my many unsuccessful attempts to get the plastic attached before a new gust took hold. Suffice it to say that necessity is the mother of all invention and I overcame my adversity surprisingly neatly and without any major rips or tears to my plastic cover. The shade cloth was a much easier affair as I had discovered the method of rolling the cloth over a length of wood thus the unattended side was weighted down preventing the wind from taking hold.

**Photo 5: Creating the door frame.**

**Photo 6: The finished frame.**

**Photo 7: The greenhouse now covered with plastic and shadecloth.**

**Photo 8: Greenhouse front entrance.**

**Photo 9: Evaporative cooler and humidifier.**

Next: I placed the evap cooler to the right side of the door **(See photo 8),** on the outside of the greenhouse as water and electricity don't mix well.

Plug the power cord of the cooler into the thermostatic switch that in turn is plugged into the power supply. For the humidifier I fitted the float valve to the bucket, and attached a length of retic hose between the float valve and the garden tap. Next I sat the humidifier in the middle of the bucket, plugged it into the timer, and then turned on the tap and adjusted the float to ensure the water level was correct. The bucket with its contents sits just under the outlet of the cooler. This allows the cooler to circulate humidified air when the temps inside the greenhouse rise to the level set on the thermostat. I've set the thermostat to turn the cooler on at 25 degrees during summer **(See photo 9)**.

I placed my second hand bathtub bog in front of the evap cooler and humidifier, by making a frame to support the bath tub and placed a bed of sand under the tub to support its weight. The bath tips slightly towards the drain plug to allow water to drain freely into a hole in the ground to ensure that no worms can find their way into the bottom of the bog. Worms will eat the peat and turn it into soil that is toxic for CP's.

For the shelving, which I placed at about waist height for ease of inspecting the plants, I measured and cut timbers for support legs along the walk way and I attached a beam across these legs. I attached beams along the wall uprights to support the back of the shelving. The shelving runs both sides of the greenhouse minus the spot for the bathtub bog. For the slats of my shelving I pulled apart old pallets, cut the slats to length, placed them along the beams using a few pallet slat off cuts as spacers and screwed them in place.

Next, by cutting into the retic line for the float valve I attached a "T" piece to run a second leg for the retic with a solenoid valve controlled by a retic timer. The retic is suspended over the shelving, just above head height, each line has a set of four misting sprays at equal intervals, plus a single drip line to top up the evap cooler. I also made a "switchboard" by making a wooden frame to house a typical house hold power board so I could plug in the humidifier and its timer, the evap cooler via its thermostatic switch and the retic timer. I covered the switchboard with greenhouse plastic for waterproofing.

So the essential steps are; visit at least one working greenhouse to see what they've done, make a shopping list, make a drawing and use it to calculate all your lengths of timber, plastic and shade cloth. Precut your timbers and source your other materials trying to obtain second hand if you can to save costs, that way the extra can go on plants!

Erect the greenhouse frame, ensuring it is straight and square, and then cover it with the plastic sheeting. Once the frame is up and covered you can make to measure all your shelving, and retic that way everything fits well.

Once you have placed your plants inside you will need to monitor the conditions for a time until you've tweaked the retic and adjusted the cooler to achieve the correct conditions. I would also suggest you do check the greenhouse at least once a day to ensure the cooler is working correctly and there are no dry spots where the retic misses valued plants, especially during summer when problems can quickly lead to plant losses.

During the year your greenhouses requirements will change, like the amount of watering, the temps that the cooler cuts in and some plants may need to be placed in different areas of the structure. Also during the cooler months you will need to remove the shade cloth as the light intensity drops and the lack of light may affect some plants. If you have North American pitcher plants and other CP's that require a cold dormancy you may need to open the front door to allow the air inside to drop enough to allow your CP to experience cold enough temps for their rest.

Since starting to write this article the greenhouse has been up and running for a spring, summer and the start of winter. The plants did really well during summer, and the cooler managed to reduce the heat though it was difficult to adjust the drip line to keep the water reservoir in the evap cooler at a constant level. The evap reservoir would either overflow or dry out by the end of the day so I've been thinking about attaching a float device to regulate automatically. I am also considering buying the second evap unit this winter (to get it for $60 and not $90!) and installing it for next summer to see if it makes any difference.

**Simple to build, solid wooden benches.**

In an effort to obtain the optimum rate for watering, I gradually reduced the watering times which sadly led to the loss of two more of my cobras. I found for a certain duration on my retic timer the hot water in the hose didn't have enough time to flush though to allow cool water to reach the greenhouse so the cobra roots were not receiving cool water to keep them happy. The other factor was a heavy infestation of thrip that I found particularly stubborn and hard to get rid of as any insecticide would tend to be washed off before it had a chance to be absorbed into the plant. I found the best time to spray was at night when the retic was not active.

**A peat bog created out a bath tub.**

I found the benefit with overhead watering is the plants roots are regularly being flushed with fresh water and so I didn't need to purchase an RO unit. As the plants are not on the tray system salts don't get a chance to build up to toxic levels and the plants seem to enjoy this setup. The plants that particularly seem to thrive in this environment are the *Heliamphora* and the *Cephalotus* that have both grown beyond my wildest expectations. Even the cobras enjoyed this until I reduced the watering duration too low to cool their roots.

I had purchased some *Sarracenia* from Triffid Park and potted them up late summer, being very careful to disturb the roots as little as possible. With a 100% success rate I am pleased to say the greenhouse has been a great way to provide the optimum conditions my plants need. However a few weeks after potting them up in their typical medium I noticed that some of the new pitchers were dying from the rhizome up and I began to worry that I might lose them to root rot. But with diligent attention, removing any pitchers I saw that exhibited signs of rot and removing the soil away from the affected areas around the rhizome the plants were able to heal themselves and fully recover. I am certain that if these plants had been on the tray system I would have lost them and maybe a few more. I am sure it had a lot to do with the constant flow of fresh air and water to the roots, and possibly a little to do with the chlorine, that enabled the plants to not only survive such a late repotting but to thrive in their new home.

I've noticed that the plants are not able to catch any where near as many flying insects as they did when they were growing out on the deck due to the enclosed nature of the greenhouse but some of them have supplemented that with the ants which have moved in. Plus there are plenty of slaters that love to hide under the pots that I take great delight in feeding to my pitcher plants along with the odd slug and snails.

I hope this story has been helpful and entertaining, and good luck with your new greenhouse project. I'm sure once it's up and running you will never look back and who knows, you will probably be making plans for extensions or the addition of a hot house for that new Nepenthes collection before you've had a chance to fill your new benches. I can hear all the wives complaining now.





## NEWS

Congratulations to Sean Spence for winning the Triffid Park Award for a gift voucher to the value of $25 to be spent at Triffid Park, at the annual show on 1st and 2nd December 2007 for his *Nepenthes glabrata*. This award is given to the most outstanding plant of our choice that has not won any other award at the show.

We had a fantastic Open Day at Triffid Park on the 28th October 2007. Everyone found some wonderful plants to buy and all the children were given a free Sarracenia psittiata to take home. We are really looking forward to next years Open Day at our new nursery in Somerville.

However we are still waiting for our plans to be passed through council. But in the mean time we have had a very busy spring selling carnivorous plants both in Australia and overseas. This is great to get carnivorous plants out into the world for more people to enjoy and learn about these fascinating plants.

Triffid Park will be closed for the Christmas period from Friday 21st December and will re-open on Monday 7th January 2008. No sales or inspections will be available during this time. Also no emails will be answered, but you are welcome to send them for a reply on our return to business.

Jason, Donna, Colin and Tina wish all our C.P. friends a very Merry Christmas and a happy and safe New Year.