# FLYTRAP NEWS

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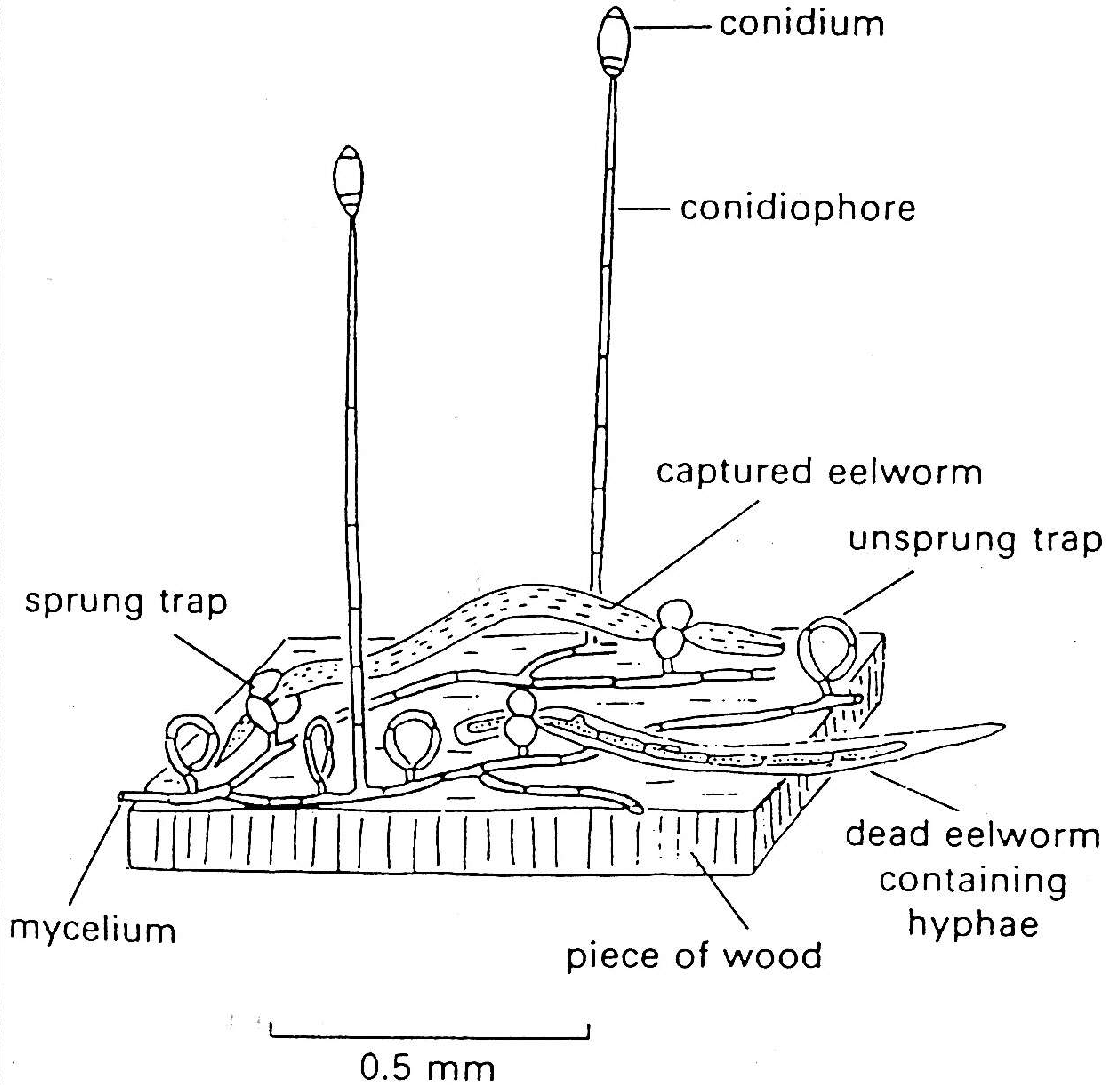


*Dactylella bembicodes.*[1]

## NEWSLETTER OF THE CARNIVOROUS PLANT SOCIETY OF NSW

1993 / 1994 OFFICE BEARERS.

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ALL CORRESPONDENCE (including articles) TO:
The C.P.S. of N.S.W.
P.O Box 87
Burwood NSW 2134


Meetings are regularly held on the second Friday of the following months February, March, April, (May in lieu of April if the second Friday of April is Good Friday) June (AGM), August, September, October and November
TIME: 7.30 - 10.00pm
VENUE: Woodstock Community Centre, Church St, Burwood.

| Remaining Meeting Dates for 1994 | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | 14th October | |
| | | | 11th November | |
| | | | 11th December | Christmas *Swap Meet.* |

CURRENT MEMBERSHIP RATES

| | |
|---|---|
| Single Membership within Australia | $A15 |
| Family membership within Australia | $A15 |
| Overseas Membership | $A17 |

Please make cheques/money orders payable to the Carnivorous Plant Society of NSW

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**Editors report** Denis Daly

# Swap Meet

The proposed date for the swap meet/picnic to replace the previously advertised Christmas get together is 11th December 1994. Venue Warragamba Dam picnic area. Meet at site between 10.30pm and 11pm. RSVP by 10th October 1994

## Carnivorous Fungi

David Colbourn

### Introduction

Fungi are not able produce their own food by photosynthesis, like most plants including carnivorous plants, since they have no photosynthetic organs, ie chloroplasts. Fungi secrete digestive enzymes, which break-down the organic matter surrounding them into small organic molecules and minerals that are able to be absorbed, through their cell walls and plasma membranes, satisfying their nutritional requirements. Most fungi are saprobes, absorbing food from dead organic matter, some are parasites, absorbing food from the living bodies of other organisms, however, some fungi are predators, actively trapping living organisms which are then used as a supplementary food source.

Predatory fungi are scattered among several division in the fungi kingdom, but are most common within the division Deuteromycota, a division often called Fungi Imperfecti, referring to fungi not known to reproduce sexually. Division Deuteromycota is a large division in the Fungi Kingdom, comprised of approximately 10,000 species. Predatory fungi are particularly prevalent in the class Hyphomycetes, a class of fungi that also contains the genus *Penicillium, Aspergillus, Fusarium and Botrytis.* Predatory fungi produce a sparse but extensive mycelial system in their environment. Along the length of the hyphae, specialised organs of capture are produced from modified branches or branch systems.

A second group of Hyphomycetes also attack micro animals, but no mycelium is produced in the environment. The entire hyphal development occurs inside the body of the animal host. Once the host contents have been broken down and absorbed, the fungus breaks through the cuticle at a number of points and conidiophores and conidia are produced outside the body of the host. This second group is referred to as endoparasitic and exists in soil only as conidia or resting spores.

Animals captured or parasitised include rhizopods (unicellular animals), rotifers and tardigrades (multicellular animals) and nematodes (small worm-like animals).

Predatory fungi produce a sparse but extensive system of hyphae. These hyphae radiate out from captured animals, such as nematodes, producing trapping devices at intervals along their length. Organs of capture take a variety of forms but are usually categorised as adhesive nets or branches, adhesive knobs, similar to *Drosophyllum*, nonconstricting rings, and constricting rings.

### Adhesive Nets and Branches

About 40 species of fungi capture nematodes by means of adhesive nets or adhesive branches. The simplest form of this trapping device is with *Dactylella cionopaga*, consisting of a one to three celled erect branch. Branches in close proximity often combine to produce adhesive hoops. Other species of *Dactylella* form close regular arrangements of branches, which may capture nematodes directly, but are more often captured by lateral branches that join together to form a simple net-like structure, similar to a ladder.

In most predatory Hyphomycetes, however, the trapping device is a more complex three-dimensional net. *Arthrobotrys oligospora* produces an erect lateral branch from the prostrate vegetative hypha, that curves around, similar to tendrils, and fuses back to the hypha. This process is repeated by other hypha to form a tangled network of adhesive hypha. The hypha composing the net are often more robust than the vegetative hyphae, to contain its prey.

The nets are apparently adhesive almost from inception, and short branches that will become primary loops or adhesive networks are capable of capturing nematodes.

A moving nematode can brush against an adhesive trap without being captured, but if the nematode stops briefly and is in contact with an adhesive trap the nematode will be captured. In its struggle to escape, the nematode will contact other adhesive networks and further reduce its mobility. Attachments at several points considerably limits the ability for the nematode to exert escape leverage (1). During the struggle there is considerable movement of the trap and associated hyphae. It has been suggested that such flexibility by the hyphae assists in exhausting the nematode and making its escape more difficult (1).

### Adhesive knobs

There are about 20 species of Hyphomycetes that trap nematodes by means of an adhesive knob. A knob is a morphologically distinct cell which is either sessile (without a supporting stalk eg. sundews) as in *Dactylella phymatopaga*, or more often borne on a two or three celled stalk, as in *Dactylella candida*. A thin layer of adhesive solution covers each knob, but the supporting stalks are not adhesive. Four other species that produce knobs also produce nonconstricting rings as an additional trapping device (1). *Dactylella parvicollis* is exceptional in that the adhesive knobs often continue growth from their apex to form a curved adhesive branch, which may eventually form an adhesive ring. Research studies have shown that the adhesive knobs are capable of producing additional adhesive material upon capture of the prey. After capture, there is a flattened mass of adhesive material at the point of capture, forming a pad-like structure on the prey (1).

Fungi that produced both adhesive knobs and non-constricting rings, the adhesive knobs were considered to be a secondary trapping device. However, it has been observed that the knobs are detachable. When a nematode is captured by a knob and begins to struggle and escape, the adhesive knob will detach itself from the point of attachment to the stalk. The nematode is then free to escape with the knobs firmly attached to its cuticle. The presence of an attached knob or several knobs will not interfere with the mobility of the nematode.

Detachable knobs are an advantage to the predatory fungi, as it can then act as a parasite on the nematode. Nematodes can travel a considerable distance before penetration of the hyphae, through the knob, occurs and subsequent growth incapacitates it. This allows the fungus to be distributed to another location with an immediate food source, and begin producing further trapping devices, to continue the cycle.

The conidia (reproductive spore) of species that produce adhesive nets of knobs often germinate directly from the spore apex and produce a short adhesive structure which allows the spore to attach directly to the cuticle of the nematode. Other species produce adhesive knobs while still attached to the conidiophore, enabling the spore to germinate in an environment that might prevent spore germination.



### Nonconstricting Rings

Only four species of predatory fungi produce nonconstricting rings to capture their prey. The traps consist of an erect, very slender hypha which widens in its upper part and then curves in a circular pathway and fuses with the stalk at the point where it widens. The ring usually consist of three cells with a marked swelling of the ring just above the point of contact with the stalk. Nonconstricting rings may be considered as a passive trap as there is no active components.

Nematodes that enter a ring with a forward motion cause the ring to collapse around the nematode, and apply sufficient force to constrict the nematodes motion and escape. As the rings age, the stalk often shows signs of collapse just below the point of attachment to the ring. When a nematode enters an old trap and begins to struggle the ring may break off at the point of weakness near the stalk apex. The nematode is then free to escape with the ring wedged firmly around its body. This process may be repeated until the nematode is covered by several rings. The detached rings remain viable and become parasitic on the nematode, penetrating and colonising the victim.

All fungi that produce constricting rings also produce adhesive knobs which perform a similar objective. The production of adhesive knobs and nonconstricting rings appears to be dependant upon the surrounding environment (1).

### Constricting Rings

There are twelve species of predatory fungi that capture nematodes by means of constricting rings. Rings are considered as active traps and may vary in size between species, and within species with some varieties being recorded on the basis of trap size. The traps range from 20-31mm in diameter for *Dactylella stenobrocha* up to 50mm (1/20th of a millimetre) for some variants of *Arthrobotrys anchonia.*

The formation of constricting rings is similar to that of nonconstricting rings, with a lateral branch arising from the hyphae and curves around until is joins the stalk to form a `figure 9', where it forms a complete ring. The ring also consists of three cells. The joining of the branch tip to the stalk is accompanied be a small growth, or lateral bud, on the side of the stalk where the branch is to join. The fusing of the growing tip with the lateral bud, thus completing the ring, may be considered one of natures mysteries, although it has been suggested that the tip is guided to the lateral bud by gaseous emissions (1).

When stimulated, the cells of the constricting rings expand or swell rapidly with an inward motion. Closure is irreversible, and takes place very quickly, about 1/10th of a second, and is accompanied by a threefold increase in volume (1). Rings can be activated by stimulating the inside of the surface of the ring.

The sudden threefold increase in cell volume results in an equivalent reduction in osmotic pressure. The ring therefore is not always capable of constricting the nematode immediately. Close of the rings occurs in two phases, with the first phase being the immediate expansion around the nematode with little constriction. The second phase occurs as the osmotic potential of the ring cells increase, and the resistance from the nematode is overcome with severe constriction of the victim.

Carnivorous fungi are as amazing as their plant relatives and are just as deadly to their prey. The prey is also captured by similar methods used by the carnivorous plants, with some species of fungi using passive adhesive knobs and branches to immobilise their prey, similar to the function of *Byblis* and *Drosophyllum*, and other fungi use active rings that constrict its prey upon stimulation by the victim, similar to *Dionaea, Aldrovanda, Utricularia* and *Polypompholyx*. However, all carnivorous plants use their traps to supplement nutrient deficiencies in their environment whereas carnivorous fungi use their trapping devices as a distribution method and food source, by parasitising their victims after they have escaped and colonising the immediately available food source.

**Cover drawing**

Fig 94. [1] *Dactylella bembicodes*. Diagrammatic sketch of fungus growing on a piece of damp wood. Seven ring traps are shown, three of them sprung. One nematode, caught near its head, has hyphae inside it. A second, caught head and tail, has not yet been invaded. Two conidiophores are shown, each with a single conidium. (Modified after Couch.)

**References**


1. Barron, G.L.; 1979; <u>Predators and Parasites of Microscopic Animals</u>; Publisher unknown.

2. Slack, A.; 1982; *Carnivorous Plants*; A.H. & A.W. Reed Pty. Ltd., New Zealand


## <u>Carnivorous Plants at Kings Park and Botanic Garden</u>

Robert Gibson

Kings Park and Botanic Garden is the main botanic garden in Perth. It also contains an active scientific research laboratory and is located on the banks of the Swan River within walking distance of the city centre. It has an area of approximately 400 hectares, a large proportion of which is covered by native woodland. It also has a cluster of display glasshouses. These contain carnivorous plants and I had the pleasure of seeing some of them in late March, 1994.

In the native woodland six winter growing *Drosera* species have been recorded. They are *D. macrantha* ssp. *macrantha, D. menziesii* ssp. *penicillaris, D. pallida, D. erythrorhiza* ssp. *erythrorhiza, D. stolonifera* ssp. *porrecta* and *D. glanduligera*. All were dormant at the time of my visit but were listed in "The Bushland Plants of Kings Park, Western Australia.

Road entrance to the display glasshouses is found at the first right hand turn along Fraser Avenue, the main road into the park. Two of the four glasshouses have carnivorous plants. The glasshouses, admission is free, are open every day, from 10am to 4pm, except each Tuesday when they are closed for maintenance.

The main carnivorous plant display is on the western wall of the Pibara glasshouse. It consists of a raised bed approximately 20 meters long by 1 meter wide, at the northern end of which is a small *Stylidium* display. An inclined transparent plastic barrier runs along the length of the brick wall which constrains the bed. The display is divided into sections which are briefly outlined below.

The southern two metres is a fully enclosed section in which one plant each of *Nepenthes khasiana* and *N. alata* var *tracii* grow with *Pinguicular sethos, P x mola* and *P. moranensis* x *P. eherslae*. As with most of the plants in the display they are planted in a peat and sand based mix.



The rest of the carnivorous plants (and *Stylidium*) display is open at the top and consists of an approximately 6 meter long section of *Sarracenia* species -- *S. alata, S. flava, S. leucophylla* (including some very attractive red lidded forms), *S. rubra* ssp *jonesii, S. minor* and numerous hybrids.

The next two meter section contained a flowering pot of *Byblis liniflora* with four flowering plants. Behind them were 3 pots of small *Drosophyllum lusitanicum* plants. Around these were clumps of *Pinguicular* x *sethos, P.* x *kewensis, P.* x *mola* and *P. caudata*.

The last 6 metre (approximately) section of the carnivorous plant display was raised slightly and featured *Drosera* and *Dionaea*. The species planted were *Drosera binata* var. *multifida, D. aliciae, D. burkeana, D. communis, D. binata* var. *dichotoma, D. pygmaea* "WA form", *D capillaris, D. spatulata* and *D. capensis* "narrow leaf form". The later formed an attractive backdrop to the mass planting of *Dionaea muscipula*. The northmost 4 meters (approximately) consisted of the *Stylidium* display.

Five *Nepenthes* were on display in the Fern House. These were two *N. alata* plants, with green pitchers, two *N. maxima* plants, one of which was in flower at the time of my visit, and a large *N.* x *kosobe*. These were all planted in the substrate of the floor of the glass house and trained up wire.

Most plants were labelled in which the Latin name and geographic origin were given. Some of the larger signs contained the family and common names as well. A general sign was in place above the main display which outlined what carnivorous plants are, the main types which occur and how they work. Signs were also in place providing details of trapping techniques and species distribution for *Sarracenia, Drosera, Dionaea* and *Nepenthes*. An information leaflet was freely available at the entrance of the glasshouse complex. This outlined plants of interest, including some of the carnivorous plants, which were within the display glasshouses and surrounding gardens, and was updated each month.

Overall, King's Park and Botanic Garden has a good range of carnivorous plants on display and is well worth a visit when you are in Perth.

**Acknowledgment:** I would like to thank . K. Keys, assistant Horticultural Adviser at Kings Park and Botanic Gardens, for reviewing this article.

## <u>Australian Curator of Port Moresby Botanic Gardens</u>

Colin Clayton

Justin Tkatchenko, formally of Melbourne, Australia has been appointed to the position of Curator of the Botanical Gardens at Port Moresby in Papua New Guinea.

Justin left his former post of Manager of a large carnivorous plant and orchid nursery to take on the challenge of restoring these once famous gardens to their former glory and make them once again a designation stop for tourists and botanists alike.

One of Justin's more challenging and interesting assignments is to secure new plant material for these gardens. Helicopters, boats, permits and armed soldiers are all supplied by the Government to make his job easier.

Naturally, Nepenthes are high on his list of priorities, as these plants with their bizarre pitchers are regarded with "awe" by camera-toting tourists.

Justin has set about identifying and relocating many of the indigenous Nepenthes species from the bush into the Gardens. many of these plants are impossible for even the most avid collector to locate in their native habitat, as they are either on closed tribal land, or only accessible by helicopter. Already Justin has discovered and named several orchids new to science, so we can only hope Nepenthes are not too far behind.

So if you travels take you to P.N.G., put the Botanical Gardens at the University at Waigani, Port Moresby, on your "must see" list and make yourself known to Justin. He'll make you most welcome.

## *Drosera glanduligera* Robert Gibson

*Drosera glanduligera* is a winter-growing, spring-flowering annual sundew found throughout the southern Australian mainland (Lowrie, 1989) and north east Tasmania. It is an attractive species which has so far proved difficult to grow in cultivation.

I have observed this species in western Victoria and the Esperance region of Western Australia. I have yet to see it in New South Wales where it has been collected along the western slopes and on the south and central coasts. In the later it has been recorded in western Sydney. It is an adaptable species which grows in a range of habitats including disturbed roadside margins, tracks in woodland, the mossy margins of granite outcrops, creek beds, lake edges and in low undisturbed "heathland".

The seed germinates in autumn and ultimately produces a golden green to red rosette to 4cm diameter. The deeply cupped leaves are broadly obovate-spathulate, to 7mm wide by 5mm long, on a straight petiole to 13mm long. One to five glandular scapes are produced from late July to October, grow to 9cm tall and have up to 15 flowers. The scapes, pedicels, bracteoles and bracts are glandular. The flowers, to 1cm diameter, have distinctive and attractive metallic orange petals. These are only open in warm, sunny conditions and are pendulous in fruit. Almost every flower is pollinated and yields abundant dark brown spherical to pyriform seed to 0.3mm diameter. It is not uncommon to find flowering plants in dry conditions with almost completely dead rosettes. Ray Nash (1983) has reported finding non-flowering plants in spring, in South Australia which have survived summer as a dormant tuber, growing to maturity the following year. This significant detail has not been reported elsewhere and more details would be most welcome.

Despite the large range and short life cycle, *D. glanduligera* is a remarkably uniform species. The only variation I have seen was a small population near Esperance which had pale orange flowers.

*Drosera burmanni* may be easily mistaken for *D. glanduligera* in eastern New South Wales and adjacent south east Queensland where their ranges overlap. Both are rosetted species of similar size and leaf shape. However *D. burmanni* is a summer growing annual to short lived perennial, with distinctly wedge shaped leaves and a glabrous scape, to 25cm tall, with white petalled flowers.

To date I have had no success in growing *D. glanduligera*. The seed is reported to remain viable for 1 - 2 years (Nash, 1983) and I suspect that it may need exposure to moderately high temperatures in summer to stimulate germination the following autumn. In cultivation this may be achieved by sowing the seeds in summer on the surface of the pot in which they are to grow. This is then covered with a sheet of glass or thick plastic and taken to an exposed place for a few days in summer. Following this the pot is stored in a sheltered dry place until March or April when it is placed on a saucer of water. I look forward to hearing if anyone has success in germinating this species by this, or any other method.



***Drosera Glanduligera*** Robert Gibson.

In conclusion, *Drosera glanduligera* is an attractive, winter-growing native rosetted sundew. It is a stunning plant to see in the wild, especially when in flower and will be a worthwhile plant to grow in cultivation when its cultural requirements are known.

**References**


Lowrie, A. 1989. Carnivorous Plants of Australia: Volume 2. University of Western Australia Press, pp 202.

Nash, R. 1983. "South Australian Carnivorous Plants: Drosera glanduligera". Bulletin of the Australian Carnivorous Plant Society Inc., Vol 2(3), p. 10-12.


## *Drosophyllum lusitanicum* cultivation

Denis Daly

I germinated the Drosophyllum lusitancium seed by soaking it in water for a period then sowing it as shown in the table below:-

| Seed No. | Soaked | Taken out of water and Sown | Germinated | Notes |
|---|---|---|---|---|
| 1 | 31 - 12 - 93 | 31 - 1 - 94 | 8 - 2 - 94 | Flowered mid March but not set seed. Two 50mm side shoots eminating from a 75mm horrizontal branch at 28 - 8 - 94 |
| 2 | 31 - 12 - 93 | 31 - 1 - 94 | 18 - 2 - 94 | 75mm high at 28 - 8 - 94 |
| 3 | 31 - 12 - 93 | 31 - 1 - 94 | 10 - 3 - 94 | 130mm high at 28 - 8 - 94 |
| 4 | 31 - 12 - 93 | 31 - 1 - 94 | Not germinated by 28 - 8 -94 | Considered a Failure |

The seeds were sown in a 50% peat 50% coarse sand mix in terracotta pots left standing in trays of water for about 2 months after germination receiving up to 4 hours direct sun per day.

The plants are on the floor of my glass house sheltered from rain but not the glass house sprinklers which, in the winter, are only turned on about once a week for 2 or 3 minutes. During the 1994 winter the three *Drosophyllum lusitancium* plants, on the floor, while in bright light receive less than 2 hours direct sun in mid winter but are thriving.

## Glossary of terms

| | |
|---|---|
| Abaxial | The side of the organ facing away from the plant axis. e.g. underside of leaf. Compare adaxial. |
| Aberrant | Diverging from normal type |
| Abortion | Failure to develope or incomplete development |
| Acuminate | Tapering to a long, drawn tip. Compare acute. |
| Acute | Tapering to a point but not drawn out. Compare acuminate. |
| Adaxial | The side of an organ facing toward the axis (eg stem) of a plant. eg upper side of leaf. Compare abaxial. |
| Adherance | Sticking or fusing to something. |
| Adjunct | Something subordinate or accompanying. |
| Adnate | Fused to an organ of a different kind. Compare connate. |
| Adventitious | Arising in the irregular or abnormal position. eg roots arising from a stem. |
| Ala ventralis | Wing or keel of picture plants. |
| Albumin | A protein. eg egg white |



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|---|---|
| Amalgamated | Combined, unite. |
| Amphibious | Able to grow on land or in water. |
| Anastomoses | Cross connection of veins (plural). |
| Annual | A plant living for one year of season. |
| Annular | Ring shaped. |
| Anomalous | Irregular, abnormal. |
| Anroecium | The male part of the flower, comprising of stamens and any staminal accessories. |
| Anterior | Nearer to the front. |
| Anther | Pollen-bearing part of stamen. |
| Anticlinal | Arch-like fold. |
| Apetalous | Without petals. |
| Apical | At the apex or tip. |
| Apiculate | With a short, broad point at the apex. |
| Appressed | Closely pressed to an organ but not fused to it. |
| Areolae | White or clear "windows" in pitcher plant pitchers. |
| Asexual | Reproduction other than seed eg leaf cuttings |
| Attenuate | Gradually narrowing. |
| Axial | Regarding the axis. |
| Axis | The main line (often imaginary) of a structure around which its parts are centred. eg stem of plant or midrib of leaf. |
| Basal | Of or at the base. |
| Basifixed | Attached by the base. |
| Biconvex | Convex on both sides. |
| Bidentate | Having two teeth. |
| Bifacial | Having two faces. |
| Bifid | Deeply split at one end into two parts. |
| Bilocular | Having two cavities or compartments, two-celled. |
| Bisexual | Having fertile male & female organs in the one flower. |
| Blade | The expanded part of the leaf. |
| Boss | Small protrudence (usually round) |
| Calibre | Internal dimension of a tube. |
| Callosity | Thickened, hardened part of organ-forming a small lump. |
| Calyx | Is the outermost part of a typical flower consisting of the sepals. |
| Campanulate | Bell shaped |
| Capillary | Extremely slender, usually a tube or vein. |
| Carpel | A unit of the female part of the flower consisting of an ovary, a stigma, and usually also a style. |
| Cauline | Attached to the stem. |
| Cell | A locule or compartment |
| Chasmogamous | Flowers which open and are fertilized. Compare Cleistogamous. |
| Ciliate | Fringed with fine hairs (cilia). |
| Cirrhus (Cirrus) | Slender, fillamentary process or appendage. |
| Cleistogamous | Bisexual flowers which never open and are self fertilized. Compare Chasmogamous. |
| Comminute | Reduce to small particles. |
| Commissure | Joining, seam. |
| Compound leaf | A leaf divided to the mid rib into small leaflets. |
| Concave | A surface which is curved inwards. Compare Convex. |
| Concavo-Convex | Concave on one side and convex on the other |
| Concurrent | Occurring together |
| Congenital | Dating from birth. |
| Connate | Fused to one or more organs of the same kind. Compare Adnate. |
| Conspecific | Belong to the same species. |
| Contiguous | Touching, adjoining. |
| Convex | A surface which is curved outwards. Compare Concave. |
| Cordate | Heart shaped in outline, broad part at the base. |
| Coriaceous | Of a leathery texture. |

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|---|---|
| Corm | A short, erect, swollen underground stem surrounded by a dry leaf bases and lasting for 1 year only, each year's corm arising from the last. Compare tuber. |
| Cornucopia | Legendary horn of plenty. |
| Cornucopian | Overflowing abundant. |
| Corolla | A second whorl of organs of a typical flower consisting of the petals. |
| Corona | A ring shaped crown-like body. |
| Corymb | A raceme in which all flowers lie on the same level giving a more-or-less flat-topped inflorescence. See drawings. |
| Corymbose | Having flowers arranged in Corymb. |
| Cotyledon | The first leave or leaves of a plant present in the seed in embryo form. |
| Crenate | Said of a margin having low regular rounded lobes. |
| Crisped | Said of a margin which is very markedly and irregularly undulate-curled - see drawings. |
| Cuniate | Wedge-shaped having a broad more-or-less flat apex and tapering towards the base. |
| Cuticle | Continuous protective layer of impervious material secreted by cells of epidermis (skin). |
| Cylindrical | Having the shape of a cylinder. |
| Cyme | A branched inflorescence which keeps branching. See drawings. |
| Cymose | Having flowers arranged in a cyme. |
| Cytology | Branch of biology concerned with the structure, physiology and reproduction of cells. Adjective Cytological. |
| Cytoplasm | Contents of a cell other than the nucleus. |