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Front cover: *Pinguicula laueana* flower. Photo by Joe Mazrimas.

Rear Cover: *Heliamphora minor*, natural habitat, 2400 m. Auyan-tepui. Photo by J. Bogner

The coeditors of CPN would like everyone to pay partieular attention to the following polieies regarding your dues to thc ICPS.

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Views expressed in this publieation are those of the authors, not neeessarily the editorial staff.

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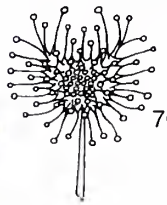
The Savage Garden

"Swelling the Brains of Children"



by
Peter D'Amato
California Carnivores
7020 Trenton-Healdsburg Road
Forestville, CA 95436
(707) 838-1630

No, this is not a piece about some new type of food to feed your plants - or encephalitis.

Instead, let me begin by mentioning that the nursery my friend Marilee and I run has received quite a bit of welcomed media attention since we started the business back in 1989. California Carnivores has been featured twice in the New York Times; in magazines as diverse as Entrepreneur, Sunset, and Alaska Airlines; in other papers such as the San Francisco Chronicle, Salt Lake City Tribune, St. Petersburg Times,, and so on. The nursery has appeared on CNN, the Travel Network, Ed Home's Gardening in America, and numerous other TV shows: Christopher Reeves, the actor, hosted a segment on our nursery for his cable nature program - a show which we have never even seen. One of the funniest articles appeared in Hungary's Reform! Magazine, where, in an article on "What's New From America", California Carnivores was featured along with Madonna and flavored condoms!

With all this publicity, one would expect voluminous mail and phone calls. Most certainly true. But what surprised me the most was the response we received from one article in particular. It appeared a couple of years ago in 3-2-1 Contact, a colorful little science magazine geared to the younger set. We received over *one thousand* letters from that singular piece - and the inquiries just keep on coming.

It practically drove Marilee and I to nervous breakdowns, as almost every one demanded a personal response, a feat we could not afford. Most of the letters were creatively funny, with pop-up flytraps , hundreds of comical illustrations, lots of "burps" and "gulps", inquiries as to parent-eating plants. A couple of parents wrote asking for children-eating plants. A few were downright sad: "My brother poured turpentine on my flytrap. Will it live?", "My mother won't let me have a carnivorous plant, won't you please write her...?", "My mom says we're to pore [sic] to have another mouth to feed."

For a few years Marilee and I did the classroom circuit, hauling our plants to schools around Northern California, giving lectures and demonstrations (plant autopsies were most popular) and helping teachers set up terrariums. School buses came by the the dozens. We finally found it too overwhelming and had to put on the brakes. Nowadays we lend plants to teachers to take to their schools, but the teacher are on their own. We offer discounts to teachers who wish to buy plants for their classrooms. A really sad fact is that most schools these days simply don't fund such projects anymore. Most of the teachers buy the plants with their own personal monies.

To most carnivorous plant growers, the idea of having 50 or 60 hyperactive, often screaming children running around their greenhouse is enough to bring on a stroke. I must admit that we have had no real damage to any of our plants that I can think of. Toddlers have caused the only true damage. I recall the numbness I felt when one

little girl crushed my first flowering *Disa* Orchid - but at least it wasn't a carnivore! Aside from the occasional pebble in a *Nepenthes* pitcher, or a missing magnifying glass, kids, as a rule, show the utmost respect and awe for these plants. To the kids, these plants are utterly cool.

And they are utterly cool because they look so weird and eat things! Since some of the plants almost seem to have faces and appear to "react", kids will sometimes project their own self-consciousness into the plants, and name them like pets. Adults do this too. I have seen children panic-stricken over the ill-health of a beloved carnivore.

All this grossness and strangeness make carnivorous plants an ideal attention-getting tool in the process of helping kids think. As a learning tool, they are surprisingly diversified. When a kid grows or studies carnivorous plants, it offers tidbits of education on subjects like biology, botany, evolution, astronomy, climatology, entomology, and so on. it can also teach responsibility, art, history, design, carpentry, and photography. CP can introduce children to travel, to botanical gardens, to Charles Darwin, to maps, and to politics.

Let's take a quick whirlwind tour through some of the things I have found helpful in using CP as tools in education.

The obvious is most often the only way carnivorous plants are introduced in a classroom. A paragraph or two in a plain, old biology textbook, mentioning that there are indeed plants which catch and eat insects and small animals for food, apparently to supplement the lack of minerals in the soil where they grow. But since CP are in most ways similar to all flowering plants, they can certainly be used to teach plant reproduction, and a flowering venus flytrap will, in most cases, elicit much more interest in children than, say, a tulip. Plant reproduction is certainly a less embarrassing subject matter than animal reproduction! And a study of one can lead to the other.

How exactly does a bee enter a *Sarracenia* flower - and why? What is the importance of cross-pollination? Why do venus flytraps send their flowers so far away from the traps? Are the insects CP eat different than the insects that pollinate the flowers? How about examining the diverse flower structures of differing CP? Why, for instance, are *Pinguicula* flowers long and tubular, with spurs? Why are some plants male, some female, and others bisexual?

Watching a seed pod mature and finally release its seed can excite children tremendously, especially if it is something like a cape sundew, an easy and prolific plant. All the technical jargon describing the parts of a just-germinating seed will be a lot more interesting if that seedling grows up to eat flies.

Evolution Although it may be easy to "imagine" how a *Heliamphora* leave may have "evolved" from a gradual rolling-up of a more typical leaf, is this really the way it happened? CP can offer beautiful illustrations of theories of evolution. Are venus flytrap flowers far away from their traps because their ancestors who caught and ate most of their pollinators died out? A case study of Darwin can lead to a study of evolution itself, from creationism to catastrophism to gradualism - and now it looks like we're going back to catastrophism! Older kids might enjoy Darwin's books, or Velikovsky's Earth in Upheaval, or Sir Fred Hoyles' Evolution from Space as a panorama of theories. All the unanswered questions in theories of evolution can be found in CP.

The Scientific Method As a young adult, I was beautifully introduced to this

philosophy when I read Darwin's Insectivorous Plants, a surprisingly easy-to-comprehend book. Darwin's experiments on *Drosera*, for instance, amply demonstrate the scientific method of experiment and observation.

By exploring how and when carnivorous plants were discovered, a bit of history can be learned. For instance, who were those wealthy Victorians who hired ships and botanists to bring back exotic *Nepenthes* for their newly invented glasshouses? Reading Burbidge's Gardens of the Sun taught me as much about imperialism as it did about collecting *Nepenthes*. Browsing through old Gardeners Chronicles from the 1800s will make our ancestors come alive.

Geography This is an excellent subject to be covered in a study of CP. By mapping out the habitat ranges of various species, kids can sit down with world maps and take a global tour. Would any of us - deprived of our interest in CP - know or care where Mt. Kinabalu, Sulawesi, New Jersey, Cape Town or Queensland existed on a map?

Natural History What do bogs have to do with the Ice Ages? How do they differ from fens and marshes? How did geological changes in America possibly affect the spread of *Sarracenia* ? How did *Nepenthes* spread from Borneo to Madagascar? What is continental drift, and how did it affect the evolution of CP?

Climate *Drosophyllum* grows in a Mediterranean climate. What is a "Mediterranean" climate? Or temperate, sub-tropical, or tropical climates? Do any CP grow in the arctic circle?

Astronomy Growing CP can give young people their first conceptualization of our earth's axis of rotation and revolution around the sun. Kids start paying attention to the changing seasons, the equinoxes, and the length of the daylight period. Why is it winter in the northern hemisphere when it is summer in the southern? Why do some plants go dormant?

Travel We have known several families who have added a side trip to see *Sarracenia* in the wild when visiting places like Disneyworld, or have gone on trips to Michigan, the Cascades, or the New Jersey pine barrens to hunt out CP. Many state and national parks are home to CP. Most major cities have botanical gardens.

Scientific Tools Use a microscope to study CP.

Computers Certainly one of the most popular things on the Internet these days are CP! The CP electronic-mail discussion group has over 500 subscribers from 30 different countries. Where else can a child satisfy her curiosity about *Pinguicula ramosa* by conversing with someone who lives near the wild plants in Japan?

A fun introduction to computer networking can be had by learning how to connect to the Carnivorous Plant Database on the World Wide Web at "http://www.hpl.hp.com/bot/cp_home". This resource has over 600 color pictures of CP along with information about all known types of CP.

(For further information about both these resources contact Rick Walker at his computer address: "walker@opus.hpl.hp.com", or at his mail address inside the front cover of this newsletter.)

Pen-pals Children can communicate with others around the country or around the world who grow these strange plants, sharing information, seeds and plants.

Economics We know of at least one school in the midwest where a class grew, propagated and sold *Drosera capensis*, actually setting up a small business, learning about production, sales, profit & losses, and so on. Their profits were used to set up a CP display for their school.

Politics How are political viewpoints influential in the survival of CP in the wild? What was the Wetland Reclamation Act of the mid-1800s in the U.S.? What are the laws pertaining to trade of CP?

Art and Photography We have had classes visit our nursery not to study the biology of CP, but to draw them and photograph them. Geoff Wong, an award-winning CP grower in Northern California, has built several ingenious mechanical models of CP that have toured children's museums for displays and shows.

Carpentry Help kids build a small greenhouse or display case to house a CP collection.

Biochemistry Order a tissue culture kit from a biological supply company and learn about in-vitro propagation of plants. Or combine this with computers and check out the slide-show tutorial: "CP Tissue Culture in the Home Kitchen" found on the CP WEB page.

Medicine Research the uses of CP as herbal remedies by aboriginal peoples.

Entomology Study insect life associated with CP. What do they eat? What insects eat CP? Kids can culture fruit flies to feed their plants.

I can go on and on, but I must force myself to stop! There are some children in the nursery, and they've brought bugs to feed the plants. Time to swell some brains with education!

The Growth of Carnivorous Plants on an Acidified Fen Soil

Lubomír Adamec
Institute of Botany of the Academy of Sciences of the Czech Republic, Dukelská 145, CZ-379 82 Trebon, Czech Republic

Most carnivorous plants (CPs) grow on rather acidic soils. For *Dionaea muscipula,* a soil pH range of 3.5-4.9 was found in natural sites (Roberts & Oosting, 1958). *Drosera rotundifolia,* a species with a very wide ecological amplitude, was found growing over a wide pH range of 2.9-6.5 (Adamec, unpubl.). In acidic bog and fen soils (pH 3-4.5), the molar concentration of H^+ in intersticial water is usually the highest of all soluble mineral nutrients ($NH4^+$, $H2PO4^-$, K^+, Ca^{2+}, Mg^{2+}; cf. Roberts & Oosting, 1958). Yet, the effect of soil pH on the growth of CPs has not been studied sufficiently. As shown by Rychnovska-Soudkova (1953, 1954) the effects of pH on *D. rotundifolia* growth greatly interfered with the composition of the mineral nutrient solution.

The basis for this paper was my previous finding that some CPs (*Dionaea, D. capensis* and its cultivars) grow better on a very acidic conifer leaf mould (pH 3.1-3.4) than on a less acid fen soil (pH 4.0-4.4). The aim of this study was to investigate the growth of three CP species on acidified fen soil.

Materials and methods

An acidic fen soil was used as the standard substrate (for details see Adamec et al., 1992). Its dry weight (DW, 105 °C) was 16.9 % of fresh weight (FW). pH of the soil suspension (always 0.5 g of FW of fen soil + 2.5 ml of distilled water) was 4.20 and its electrical conductivity 47-50 $\mu S.cm^{-1}$ at 21 °C. Titration of the fen soil suspension with 0.2 $mol.^{-1}$ HC1 to the pH of 3.30 revealed that such a soil acidification required 22 mmols of HCl.kg-l(FW).

Nine small uniform plants each of these species *(Dionaea muscipula, Drosera capensis cv.* White Flower, and *D. capensis cv.* Giant) were planted together on 10 December 1991, in both control (pH about 4.20) and acidified (pH theoretically 3.30) fen soil with washed sand in plastic pots (8 x 8 x 6 cm). The pots were placed in a heated greenhouse in a white plastic container (1.0 x 0.8 x 0.4 m) among pots with commercially cultivated CPs. Tap water (pH ca. 7.5, 70-80 $\mu S.cm^{-1}$) was added to the container and the water depth kept at about 2 cm. All plants were occasionally sprayed with tap water. The plants were grown in daylight at temperatures between 19-23 °C.

Initial length of the longest root was measured in all plants and initial DW (80 °C) of shoots and roots was estimated in parallel plants. The length of the longest leaf and number of living leaves were measured in all plants, beginning on 10 December 1991 and then at one-month intervals. The growth experiment was finished on 23 April 1992 after 134 days. At that time, the length of the longest root was measured in all plants again. Both shoots and roots of 9 plants of each variant were pooled together, dried and weighed. To show how the different substrates were changing in the course of time, 0.5 g (FW) of fen soil was sampled both from the top soil layer (0-3 mm) and at 30 mm in all pots after 40 days and at the end of the experiment. pH and electrical conductivity were measured in the fen soil suspensions. Electrical conductivity is a measure of the dissolved ion content in a solution.

Results and discussion

Although the initial pH of the acidified fen soil was theoretically 3.30, its actual value was 3.9 by day 40 (Table I). This was the result of probably long-term ion exchange processes in the fen soil. Yet, the pH levels differed by 0.21 to 0.41 between the control and acidified substrates. Both substrates were alkalized at about the same rate by the tap water used during cultivation. However, since the tap water was flowing from the bottom to the top of the soil where it was evaporating, the substrates were alkalized more toward the bottom. Electrical conductivity was markedly higher in the top soil layer than in the middle due to evaporation. Substrate alkalization is usually not desirable for most CPs. It may be mitigated by a higher column of substrate and by adding very soft water.

Of the three CP species, only *D. capensis cv.* White Flower produced markedly higher biomass in the acidified soil than the control plants (Table II). In *D. capensis cv.* Giant, the biomass on the acidified soil was moderately higher, but in *Dionaea* it was markedly lower than the control plants. The growth of *Dionaea* was even negative on the acidified soil when compared with its initial biomass. In all species, acidification of the fen soil affected shoot DW to a greater extent than root DW, both positively or negatively. The longest root length in all species was not significantly affected by soil acidification.

Differences in the final shoot biomass between the variants resulted from irregular growth rates of the leaves during the experiment (Figs. 1-3). In control plants, leaf growth was slow during the first 65 days. In the acidified soil, the leaves of all species were shortened (considerably in White Flower and Giant) in the first 38-65 days and the number of living leaves (except for White Flower) decreased significantly by day 38. However, leaf growth became vigorous after this early period in both cultivars of *D. capensis* on the acidified soil, whereas the growth of the control plants remained slow. Leaf number was significantly higher in the acidified plants of White Flower and Giant at the end of the experiment compared to the control plants. Therefore, after an initial decline of shoot biomass, the cultivars of *D. capensis* growing on the acidified soil were able to overcome the control plants after 134 days, due to a higher growth rate in the second half of the growth experiment. It follows from the data that this difference would increase in favour of the acidified variant over a longer time span. Growth was meagre for both *Dionaea* variants, but there was also some recovery of growth in the acidified variant by the end of the experiment (Fig. 1).

Negative leaf growth in the acidified variants during the first half of the experiment was probably due to the death of leaves which were in contact with the acidified soil. Neither a dangerous pH value nor a strongly increased content of salts occurred in the top soil (Table I). Moreover, the top soil in the acidified variant was greenish due to growth of filamentous protonemata of mosses.

The growth pattern of the CPs in this experiment was also influenced by winter irradiation, especially in *Dionaea,* which formed two types of leaves. The very low pH (3.1-3.4) of the best substrate for growing the three CP species, conifer leaf mould from wet Scotch pine forests, contributes partly to the high quality of this substrate. However, artificial substrate acidification cannot be recommended.

Table I. The mean values of pH and electrical conductivity (G; in $\mu S.cm^{-1}$) in fen soil extracts (0.5 g of wet fen soil + 2.5 ml of distilled water) Samples of the fen soil from the growth experiment were collected from both the top 3 mm of the soil layer and at 30 mm after 40 and 134 days of the experiment.

	Control fen soil				Acidified fen soil			
Date of sampling	Top soil pH	G	30-mm depth pH	G	Top soil pH	G	30-mm depth pH	G
40 days	4.21	82	4.54	63	3.92	85	4.13	67
134 days	4.43	121	4.81	53	4.22	107	4.46	58

Table II. The effect of fen soil acidification on plant growth over 134 days. C, control plants; A, acidified variants. The initial plant dry weight (DW) shown as shoot DW/root DW. 2.SEM are shown where possible.

Species and treatment	Initial plant DW (mg)	Final shoot DW (mg)	Final root DW (mg)	Initial root length (mm)	Final root length (mm)
Dionaea C	5.9/0.35	7.5	0.41	18.2±4.4	17.4±3.1
Dionaea A		5.4	0.44	21.1±3.8	23.6±3.6
White F1. C	1.2/0.23	3.7	0.76	18.8±4.9	33.8±6.2
White F1. A		6.3	1.16	24.0±6.3	40.4±12.3
Giant C	0.80/0.05	2.6	0.91	23.0±6.6	32.3±7.9
Giant A		3.1	0.91	19.3±3.0	32.3±6.4

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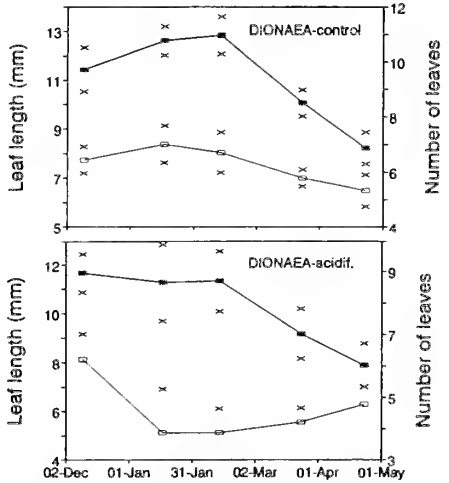

Figure 1. Longest leaf length and number of living leaves in *Dionaea musciputa* in the control and acidified fen soils over 134 days. Left axis, full symbols; right axis, empty symbols. Mean of 9 plants ±2.SEM.

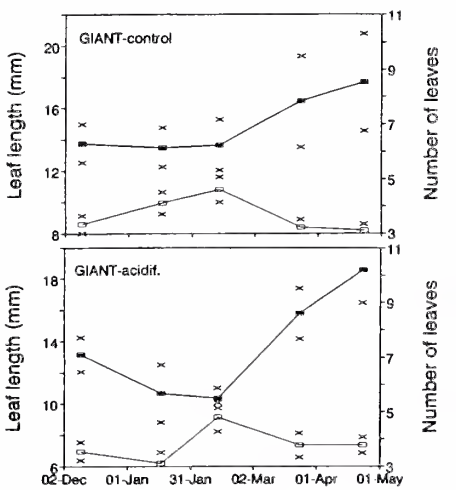

Figure 3. Growth patterns of *D. capensis cv.* Giant during the experiment. For explanation see Fig. 1.

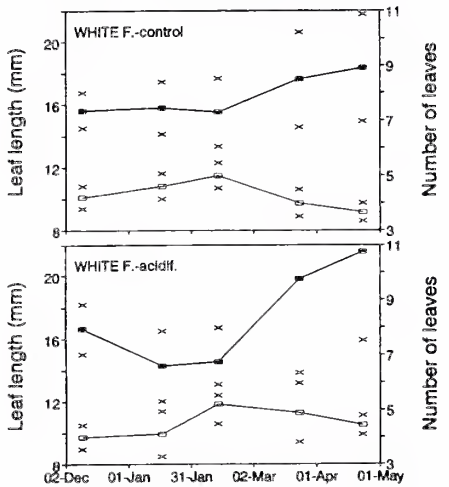

Figure 2. Growth patterns of *D. capensis cv.* White Flower during the experiment. For explanation see Fig. 1.

Thoughts, Reflections, and Upper *Nepenthes ampullaria* Pitcher

by
David Wong
c/o #25 Duxton Hill
Singapore 0208

In 1994, I decided to move my family over to Singaporeand have finally decided to share some of my thoughts. I will stick to the topic, namely that of our beloved CPs.

Approximately four years ago, a group of us CP'erphiles decided to publish a biannual CP club newsletter serving the Pacific Northwest. I was the editor, Tom Kahl, the Northwest US representative, Randy Lamb the Yukon representative, Kevin Snively the treasurer, Bob Cattermole the events co-ordinator, Don Graham, secretary, Doug Fung, Education liaison, and Lorne Dennison, B.C. representative. Ambitious as it was, we had a lot of fun and camaraderie over our common interest. We had a lot of fascinating material in our newsletter, written by many people and we managed to further the knowledge of CPs through the local media and by locating new members. It is with sincere regret that a lot of correspon-

dence, ideas and articles have not gone further than the third issue of the PNWCP newsletter, and to this day remains unpublished. Unfortunately, something happened during the autumn of 1993.

In August of 1993, the PNWCP club had a meeting at my house in Vancouver, B.C., of which approximately 20 diehards participated...from Oregon, Washington, British Columbia, and Yukon. During this meeting, we formed the basis of a local plant exchange of which a purpose was to enlighten the general public, and to spread rare specimens into competent collections for the cause of conservation. We had wanted to do a planting in the Bloedel Conservatory in Vancouver. We even made arrangements with the various authorities and the like. Many plants came from private collections and institutions. There were many beautiful donations, including specimens such as *N. stenophylla, N. macfarlanii, N. sanguinea, Heliamphora, Sarracenia* species and *Cephalotus*. I remember everyone being very proud of all the generosity coupled with the interesting discussions.

Figure 1. Photo of Dr. C. L. Wong with upper pitcher on a *N. ampullaria* vine.

Later in the week I received a telephone call from a young, polite, but impatient collector. This individual, in his early twenties, had casually contacted a number of us over the past year and had always appeared rather anxious wanting to acquire everything, especially if it were "rare". He made contact with some of us a week after our August meeting. He was engrossed by the number of rare Nepenthes at that meeting and wanted to see them.

Figure 2. Closeup of upper pitcher of *N. ampullaria*.

To make a long story short, in early September of 1993, Lorne Dennison had his greenhouse broken into. All of his rare Nepenthes were taken. Including a robust, but beautiful *N. burbidgeae*, the only one of its kind in the Northwest, and possibly the only one in Canada. I have known Lorne for a long time. As young enthusiasts, Lorne and I contacted each other through the ICPS and had thought we were the only two locals who enjoyed this neat hobby. Lorne had acquired most of his specimens long before all the CITES entanglement and difficulties. He had his *N. burbidgeae* "baby" for over 15 years.

Also removed from Lorne's collection were all his highland Nepenthes and rare orchids. I know Lorne as a very generous and friendly individual. The thief really crushed

Lorne. The saddest thing was that many of his plants were being prepared for divisions in the following spring, some earmarked for the public conservatory in Vancouver. Many people had been patiently waiting for their cuttings / divisions of one of Lorne's plants.

The Royal Canadian Mounted Police did an investigation and collected some evidence from Lorne's greenhouse.

A few weeks later, the same thing happened to me. The thief broke into my greenhouse, and stole all of my highland Nepenthes plants, numerous lowland species, and some of my best specimens of, *Darlingtonia, Heliamphora* and *Sarracenia*. This time he was seen. It occurred at 3:10 am, and was seen by my neighbours. He worked with an accomplice. Together the two came in through my rear yard, and filled up a black garbage bag with my plants. The thief then ran across my rear deck to the front yard. Unknown to the thief, all of this was caught by another neighbour's security camera. Recognizing him, we've given his name and copies of the videotape to the police. Fortunately for the young (early twenties) 5'9" + tall, long dirty blonde hair thief, I have not yet laid charges.

I was later informed that the fingerprints on my side yard gate matched the ones found on several other greenhouse break-ins. The perpetrator, who is a recent member of the ICPS, is reading this now. I hope he realizes what he has done. Because of his greed, many of us have made ridiculous security measures and trust no one. "Open houses" were put on hold, new faces were and perhaps are still greeted with caution, and the worst thing was that the "official" PNWCP club newsletter is no longer published as I was too upset to continue on. The thief had learned from earlier newsletters the telephone numbers and addresses of individuals and targeted specific collections described in the newsletters.

I apologize to all those who had wanted more information and a subscription to the PNWCP newsletter. I have been extremely bitter and perhaps my reflections here still indicate it. However, now that I have moved to Singapore, I can finally pen my thoughts down and have finally gotten this matter off my chest.

Being of several generations North American, I am really uncomfortable with the weather in Singapore. I think I am gradually adjusting to it though! It is really hot and humid. But these are the conditions the lowland Nepenthes thrive under. So it is with delight that I would like to report my observations to all of you. Hopefully, it will bring some new insights and give Nepenthes growers a better understanding and give their adopted plants a better fighting chance for survival.

I have briefly chatted with some of you on the "CP-Net", so some of you may already know that I have been regularly trekking through the jungles of Indonesia and Malaysia. I've bumped into some real nice people down here; in particular, Dr. Wee Kiat Tan, Dr. Hugh T. W. Tan and Dr. Chong Lum Wong (no relation), all of whom are professors at the various universities here. The best thing is that they also love *Nepenthes*! We explore various nature reserves and mountains on a regular basis, sometimes with students and other nature lovers.

Over the past number of months, with my wife's permission (of course!), I disappear into the jungles and look for variations of rafflesiana, ampullaria, albomarginata, sanguinea and others. What is really interesting is the diversity of plants and animals here in Malaysia! Someone told me that one square mile of jungle here contains more different species than of the whole of North America.

I do not know if this is true, but seeing all the weird and wonderful plants, birds, fish, reptiles and bugs (excluding leeches) really delight you! As much as I would love to share my experiences with all of you, I will start with them one at a time and continually share my observations in future CPNs. I'll also jump onto the "CPNet", and do some daily entries into it during my treks.

After being informed that upper pitchers on *Nepenthes ampullaria* have never been observed before (i.e. recorded), Dr. C. L. Wong made an effort to find one. After observing thousands (tens of thousands?) of *N. ampullaria* plants, Dr. Wong finally

located a single upper ampullaria pitcher on a solitary plant in Singapore. This poor specimen was only about one foot tall and had been regularly cut over and over again by the maintenance people who looked after the area which was under some overhead power lines. A cutting was made of this plant and is now under care in the university greenhouse. Periodically, new upper pitchers have appeared on this specimen and the plant has been in cultivation for close to a year.

Pitcher plants are quite plentiful in this region (Malaysia, Singapore, Indonesia) but one has to know where to look. Once you locate them, they are so plentiful one tries with great effort not to step all over them. Not only are the pitchers beautifully painted individually with their own charming personalities, the leaves, seed pods and backdrop of adjacent vegetation really makes one just utterly charmed by this genus.

N. ampullaria grow to tremendous heights, it is not uncommon to see vines climbing up to more than a couple hundred feet tall, and if it were a male it would be an old clone with hundreds of vines climbing up. Females would also climb these heights, but have many generations of litter at their feet. Given a choice, *N. ampullaria*, along with other species would prefer the sunny side of an embankment. So walking along transversally on a sloped trail, more plants at least ten times more plants, are found on the high side of the trail, namely that side that has more sunlight. Plants are also readily located on disturbed soil. Ferns and *Nepenthes* are one of the quickest colonizing plants. But all plants grow fast in the tropics. So a disturbed site is usually less then half a year old. And perhaps due to the lack of other competitors, one tends to find more young plantlets (6 inch to 12 inch tall plants), and therefore more variations, than on more established sites.

The local substratum is a mix of rough sharp yellowish white coloured sand with lots of organic debris (leaves, twigs, dead insects) mixed into it. I would say this rough sharp sand comprises nearly 75% of the medium. The pH is just slightly off of neutral towards the acidic side. However, for all intents, the pH is neutral. Compare this with live sphagnum moss which is a little more acidic. Water drains through this medium, but not as quickly as one would expect. The rains here are fast and hard. It feels like someone turned on the taps full over your head for a few minutes, and even sometimes hours at a time. However, it inevitably stops and you are shortly greeted with the unforgiving tropical sun and hot humid air. I have also seen numerous *N. ampullaria* plants growing in and under streams and ponds.

The pitchered specimens are found in both bright and shaded locales. I believe the plant prefers sunnier locations, as there are always many more young plants in sunnier sites. At the same time, plants found in shaded locations are off of branch-like terrestrial creepers. If you trace the plant, you would invariably locate nearby, long robust vines of the same plant climbing up trees to the sunlight. These upper vines may supply photosynthetic foods to its basal offshoot. Frequently, the aerial vines would have clusters of rosetted pitchers climbing up each of the many vines. But the largest and most spectacular pitchers are those located at the plant's base, usually hidden beneath forest debris and filled with many hefty meals of ants. Keep this in mind when growing *N. ampullaria* in temperate climates. I had always grown my ampullaria in the shade in a sphagnum/Styrofoam mix while I was in Vancouver. Although the plant grew, it was slothfully slow, giving me only a few leaves at a time. So give your young plants lots of light (but be careful not to burn them).

In any population of *N. ampullaria* plants, upper pitchers are extremely rare. Chances are that they are probably there but you'would have to have a sharp eye and have the patience of "Job". Dr. Wong has located all the plants with upper pitchers. The number of separate specimens Dr. Wong has located to date is four. Considering the number of plants observed (many thousands), plants with upper pitchers are definitely uncommon. Plants that have upper pitchers are unique, such that neighbouring plants in the same soil conditions do not have the upper pitchers. I postulate the upper pitcher phenomenon to be a genetic factor, triggered by stress factors - namely, bright sunshine and / or repeated pruning (e.g. the lone plant found in Singapore exposed to

lawnmowers). To support this observation, I remember one site near Mersing, Malaysia. Great excitement was generated when Dr. Wong found a sparse colony of *N. ampullaria* with upper pitchers on them. But upon closer observation, we traced all the stems back to one single plant that had crept and crawled amongst its not so well endowed siblings. The plants are usually only of average height - four to seven feet tall, and are located on exposed sites.

Another factor that contributes to the difficulty of seeing plants with upper pitchers is due to the fact that the pitchers are so tiny! The largest upper pitcher we've seen to date is only 3/4 of an inch tall, the majority being a little better than half an inch in size. Whereas basal lower pitchers on the same plant may have pitchers reaching three inches. Emptying out the contents of the upper pitcher, we have found nothing- no fluids, no trapped animals. Perhaps the natural fluids and water from the rain evaporate too quickly for any results. As a conclusion, I believe the upper pitchers are just genetic throwbacks of this particular species, serving no real effective purpose.

While in Canada, my greatest joy with *Nepenthes* was to see them grow and flourish in my and other friends' greenhouses Now my greatest joy is to walk the forests and see them growing naturally in their native habitats. Everytime I see the plants, it is like seeing them for the first time ... rapid heartbeat and loss of breath! To make my trips more fun, I have been cataloguing the many different variations I have seen of *N. ampullaria* (and *N. rafflesiana*, but that is another story). So far I have located some real gems - all green with ruby peristomes, all bronze, all green, a near all-crimson red form and everything in between.

As a footnote, one of the four ampullaria plants that has upper pitchers is close to being destroyed, literally inches away. Roadwork crews in updating and widening roadways clear off all plants in adjacent embankments during the course of their activities.

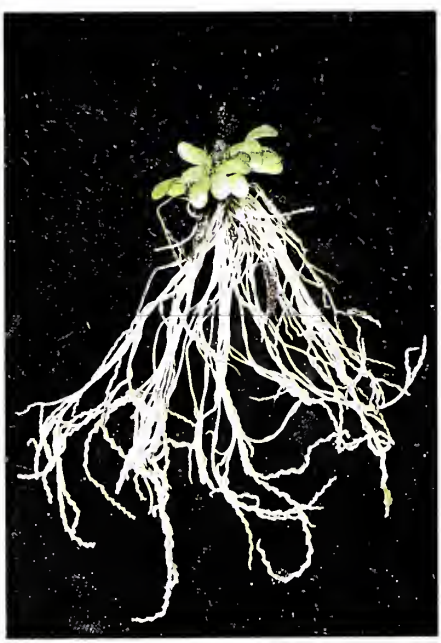

Figure 1. *Genlisea hispidula* were used to investigate capture of prey in comparable conditions. Their favourite menu must be different.

Figure 2. *Genlisea pygmaea* were used to investigate capture of prey in comparable conditions. Their favourite menu must be different.

Several ecophysiological observations in *Genlisea*

by
Miloslav Studnicka, Botanic Gardens, 460 01 Liberec,
Czech Republic

Thanks to successful cultivation of *Genlisea* species, it is possible to complement field research with important details. This can be helpful particularly in acquiring better knowledge of life functions. Six species (*G. filiformis, G. hispidula, G. pygmaea, G. repens, G. roraimensis and G. violacea*) are cultivated in the Bot. Gardens Liberec (CR).

According to occasional field observations,*Genlisea* species often grow in water. Nevertheless, one must question if they are true aquatic plants or if they are in some sense semiterrestrial. We can look for stomata which are considered special aerial organs. Stomata are mostly absent in submerged plants but there are several exceptions having rudimentary stomata.

Lloyd (1942) writes: "All the species are small plants which inhabit swampy places and apparently live mostly submersed in shallow water; only the inflorescence, as in *Utricularia*, projecting above the surface. This is to be inferred from the absence of stomata .....". In contradiction to this opinion, Elsa Fromm-Trinta (1979) published photographs of distinct stomata in *G. filiformis, G. pygmaea, G. repens and G. violacea*. She writes: "Stomata are only in the dorsal epidermis of *G. repens and G. pygmaea.*" I have also studied *G. repens and G. pygmae and G. hispidula and G. roraimensis*. I have also found stomata, but I have been surprised by observing the stomata only in the lower (abaxial) surface of leaves. According to Czech authorities (e. g. Dostál 1954, etc.), the "dorsal" near the upper surface of a leaf. The term "dorsal" is evidently used in different meaning in botany!

It is better to say that stomata occur in the abaxial surface of leaves. That is however an arrangement which is normal in many purely terrestrial plants. I have found both open and closed stomata in various specimens of *Genlisea*. I believe,therefore that stomata are working and are not rudimentary. *Genlisea* species are semiterrestrial plants, green leaves of which are aerial organs. They can survive also below water for long periods, but I have never observed morphological adaptations to that condition. Many semiterrestrial Utricularias (*U. graminifolia, U. prehensilis* etc.) make short aerial terrestrial leaves and very long ribbon-shaped aquatic leaves. These plants, related to *Genlisea*, are probably more adapted to aquatic life in comparison with *Genlisea*.

The investigation of traps in cultivated specimens is of interest, I have compared two most different species, namely *G. hispidula* and *G. pygmaea*. You find only one type of trap in *G. hispidula*, but in *G. pygmaea* there are two evidently different types of traps. The traps of the first type are very long, with very small vesicles, narrow necks and with long arms. They are in a vertical position. The traps of the second type are short, but the vesicles are three times larger and the necks are three times wider than in the first type. The arms are also very short, with fewer windings. These traps are more or less horizontal.

Analysis of contents in the traps has been surprising. The traps of *G. hispidula* have been quite empty, but the traps of *G. pygmaea*, cultivated in the same soil and in the same conditions, have been full of prey. In the vesicles I have seen remains of two species of Nemathelmintes, Arthropoda, and also single-cell algae (Baccillariophyzae and Desmidiales). In necks, I have frequently observed living Nematodes. Comparing

the two studied species, we can draw two conclusions:
1. There is specialisation of different prey in the species, because only one of them has consumed prey from the uniform culture system..

2. Prey is not wholly necessary because all specimens of *G. hispidula* (without any prey in traps) have been in good form and frequently flowered.

A further step of my research has been connected with the published hypothesis about active capture of prey in *Genlisea* (Meyers-Rice 1994). I have performed a simply experiment, using intact specimens of *G. pygmaea*. The plant was removed from soil and traps of the one were submerged into water with very finely dispersed particles of a red pigment. After 20 minutes . . . several traps of both small and large types were cut and observed microscopically. I have never observed any red grains or soil particles in the traps.I could not confirm Meyers-Rice's hypothesis this way. I believe that the traps are passive. The soil particles in traps, mentioned in literature (Juniper, Robins and Joel 1989), could be pushed to the vesicles by captured animals or in consequence of artificial compressions during transport of the plants from the wild.

The fact that glands in the vesicles in *Genlisea* are different from the active traps in *Utricularia* also speaks against the hypothesis; especially the group of two-armed glands, which should be responsible for the pumping of water in *Utricularia*, is absent in *Genlisea*. Because the glands in the vesicles of *Genlisea* are very similar to the glands known in *Pinguicula*, the speed of absorption is probably comparable.

I can also comment on the description of growth in the traps of *Genlisea*, published by Lloyd (1942). How do the traps penetrate into soil? According to Lloyd, in the begin the *Genlisea* trap grows like a root. The meristem is also in the apex of the tubular organ, which is covered by mucilage produced by numerous very small glands. Most interesting is the last part of development, when arms start to grow. According to Lloyd, there is rotation of the growing arms. I have found two near-by traps with arms screwed one into another. It seems to be a demonstration, that the arms penetrate into soil like an auger into wood.

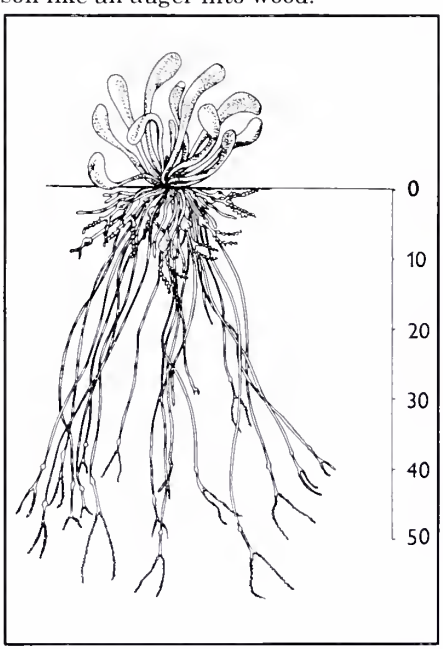

Figure 3. *Genlisea pygmaea* on a scale in millimetres. Two different types of traps in one plant. (Drawing by R. Novotná.)

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Noteworthy *Sarracenia* Collections II

Phil Sheridan
Dept. of Biology
Virginia Commonwealth University
Richmond, VA 23220

Bill Scholl
11420 Winterpock Rd.
Chesterfield, VA 23832

Abstract

Two new green mutant *Sarracenia* species are reported for the southeastern United States, *S. leucophylla* Raf. and *S. minor* Walt. with both producing yellow flowers. A dominant/recessive relationship is suggested for wild-type reds (dominant) and mutant greens (recessive). Reports of putative orange-leaved or flowered intermediates between reds and greens are discussed and we suggest that these represent novel mutations instead of backcrosses.

Introduction

Since our previous article on noteworthy collections appeared (Sheridan and Scholl, 1993a) additional *Sarracenia* variants have been discovered which warrant publication. Our goal was, and remains, to continue field work to find and report new, unusual or interesting pitcher plants. We invite other workers to join us in this effort and publish their noteworthy collections. Many times we have heard of interesting collections from remote geographic areas or of new varieties which have not been backed up with a written record, map of location or, ultimately, a herbarium specimen.

Materials and Methods

Field searches were conducted by Bill Scholl and Jim Bockowski in southwestern Georgia and northern Florida for pitcher plant bogs and reptile habitats. Surveys were conducted along interstates, state highways and dirt roads. Suitable habitats for investigation were determined by floristic, hydrologic and topographic composition as well as reports from other workers.

Results

Two new *Sarracenia* variants were found:

S. leucophylla Raf. (green)

A single non-flowering specimen was discovered during August of 1993 in Baldwin County, Alabama by Bill Scholl and two separate plants were found in the same area by John Hummer and Carl Mazur in July of 1994. The identity of the Scholl specimen was confirmed as a green mutant in 1994 when the plant produced a yellow flower (Fig. 1). Self pollination of the flower resulted in all-green seedlings.

Seedlings of this noteworthy specimen are available from the second author. Inquire as to availability and prices.

S. minor Walt. (green)

Discovered by Jim Bockowski in the company of Bill Scholl in a burned long-leaf pine hillside seepage bog in southwestern Georgia in August of 1993 (Fig. 2). This clone has been rather anemic in its growth and the largest leaves are only 12cm. Flowers, leaves and growth point are pure green/yellow in full.

Discussion

We propose the following terminology regarding color varieties:

1. Green
2. Yellow-flowered
3. Red

Green is used in place of the term "anthocyanin-free" to refer to mutants without red pigmentation in leaves, flowers or growth point. Normally red-flowered species which have mutants that are yellow-flowered do not fall under the nomenclature of "green". For now they will simply be called "yellow-flowered mutants". "Red" will refer to plants that normally contain any red or purplish pigment in either leaves, flowers or growth point (e.g *S.flava* with red only at the growth point would fall under the designation "red"). Geneticists would refer to this phenotype as the wild-type. We acknowledge, however, that the differently pigmented phenotypes may deserve a more detailed genetic nomenclature in the future.

Although the term that has been used in the past, "anthocyanin-free", may be correct we use "green" for two reasons. First, additional biochemical work is necessary to determine whether "anthocyanin-free" is indeed accurate. Although paper chromatography work (McDaniel, 1966; Schnell, 1978) suggests that anthocyanin is the red pigment which is normally lacking in these mutants, an objective analysis should not rule more obscure possibilities such as betalins, phlobaphenes or red carotenoids. (Harborne, 1973; Robinson, 1980). Second, "green" is more concise than "anthocyanin-free".

Case (pers. comm. 1995) reports the discovery of a single green *S. leucophylla* with yellow flowers near Chatom, Alabama in 1962 while Bednar (in press) reports the discovery of green *S. minor*. Bednar (in press) also mentions *S. psittacina* variants which are pink or orange flowered as well as individuals with green leaves but red to maroon flowers. The second author has observed similar plants in western Florida. Don Schnell (pers. comm. 1994, 1995) also reports intermediate flower and leaf colors in *S. purpurea* in Michigan bogs where *S. purpurea* ssp. *purpurea* f. *heterophylla* grows as well as in North Carolina where *S. rubra* ssp. *jonesii* and its green mutant coexist . Case (1956) reported orange-red leaved plants of *S. purpurea* in Michigan and speculated (1972) that several genes were involved producing the orange phenotype in backcrosses between wild-type reds and greens.

Sheridan and Scholl (1993b) did not detect intermediates in Nova Scotia nor did Robinson (1981) in Connecticut. An alternate hypothesis to the blending of phenotypes (partial dominance) being responsible for orange and pink colored plants is Robinson's

suggestion that mutated genes are responsible for intermediate colors. Orange and pink flowered mutants are known to occur in other plants as a result of lesions in the anthocyanin metabolic pathway (Martin and Gerats, 1993). Thus several independent mutants may occur in the same bog and give the illusion of being hybrids between reds and greens. Some bogs may have several different mutants (green mutants, orange-flowered and yellow-flowered plants) while others have none because of random chance, genetic drift in small populations or other factors.

Sheridan (1994) determined that a dominant/recessive relationship exists in controlled crosses between reds and greens, not partial dominance as earlier workers suspected. In other words only red is expressed in leaves, flowers and growth point of the F_1 generation (offspring of crosses between reds and greens) not an intermediate color such as pink or orange. Seed collected from the original *S. rubra* ssp. *gulfensis* green growing in the wild which were raised to maturity resulted in a mix of red and green plants. The green plants were probably the result of self pollination and the reds were probably naturally outcrossed with wild-type plants as indicated by the dominant red flower color in these F_1 specimens (Fig. 3). Note that the flower is the red color typical of wild-type plants, not an intermediate color, suggesting a dominant/recessive relationship between reds and greens. Self pollination of these flowers resulted in red and green seedlings suggesting a dominant/recessive relationship. Anthocyanin is known to be controlled by a set of dominant genes and homozygous recessives (green plants) lack enzyme activity (Mulder-Krieger & Verpoorte, 1994) which would tend to support the conclusion that a dominant/recessive relationship exists in crosses between red and green pitcher plants. A manuscript with a more detailed explanation of these results and supporting data be reported in a future paper.

The dominant/recessive interaction of reds and greens is in contrast to and should not be confused with the presumed normal genetic behavior of blending (incomplete or partial dominance) of phenotypes observed in wild crosses in *Sarracenia* (e.g. the cross between *S. flava* and *S. purpurea* has intermediate colored flowers). Green mutants produce only red flowers in the F_1 generation when crossed with wild-type reds. A possible explanation is that these mutants, in addition to lacking red pigment, also are missing yellow pigments or controlling factors which are responsible for the blending seen in crosses in the field between red and yellow flowered species.

In summary, the following phenotypes have now been found or are reported in *Sarracenia* which may represent novel mutants, not hybrids.

1. Orange-leaved plants.

2. Orange-flowered plants.

3. Green-leaved plants with red flowers.
   (normally have red leaves)

4. Green leaves, flowers and growth point.
   Nomenclature: "green" (traditionally anthocyanin-free)

5. Red-leaved plants with yellow flowers.
   (normally red-flowered)
   Nomenclature: Yellow flowered mutant

Acknowledgements

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Figure 1. Flower and leaves produced in spring and fall 1994 of the *S. leucophylla* (green) mutant. Photos by Bill Scholl.

Figure 2. *S. minor* (green) in burned long leaf pine seepage wetland in southwestern Georgia, June 1994. Photo by Bill Scholl.

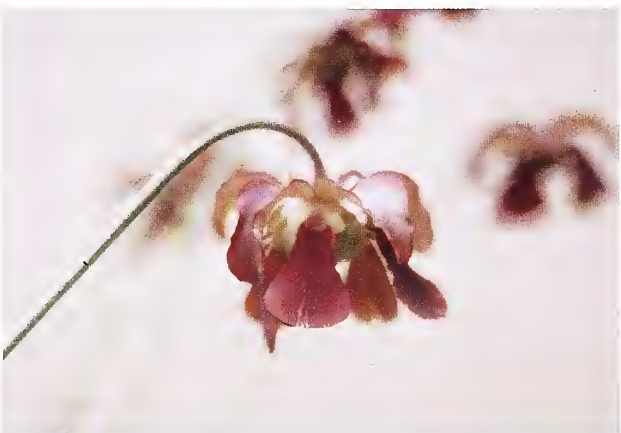

Figure 3. *S. rubra* ssp. *gulfensis* F_1 heterozygote. Red petals are deposited at FTG, #1469. Photo by Phil Sheridan.

Rediscovery of a Very "Rare" *Utricularia* in Brazil

by
Fernando Rivadavia,
Rua Inacio Pedroso 230, C.E.P.,
05612-050, Sao Paulo, S.P. Brazil

On my third trip to Cuiabá (Mato Grosso state, western Brazil) in February '94 to

visit my friend Marcos Cardoso. Twenty-nine species of CPs were seen during the week we spent exploring the nearby Chapada dos Guimarães (see CPN 21:3), plus areas south of Cuiabá, in the northern Pantanal Basin. Of these 29 species, 5 were *Drosera*, 3 were *Genlisea*, and the remaining 21 were *Utrics*. Most of the *Utricularias* were terrestrial (14 species), others aquatic (6 species), and one rheophytic.

The terrestrial species we found were *U.amethystina*, *U.costata*, *U.hispida*, *U.lloydii*, *U.nana*, *U.nigrescens*, *U.pusilla*, *U.simulans*, *U.subulata*, *U.tenuissima*, *U.trichophylla*, *U.tricolor* (?), *U.triloba*, and an unidentified *U.*sp.(apparently in the same section of the genus as U.subulata). While *U.lloydii*, *U.nigrescens*, *U.simulans*, *U.tenuissima*, and this *U.* sp.seem to grow strictly as annuals, *U.amethystina*, *U.pusilla*, *U.subulata*, and *U.triloba* are apparently optional, growing as annuals in sites that dry up in winter and as perennials at sites that remain humid all year long (or at least regenerating new plants constantly from seeds). *U.costata* might belong to this annual/perennial category, but we are not sure yet since we have only found it at one site next to a stream where it flowers all year long. *U.trichophylla*, *U.nana*, and *U.hispida* grow as perennials in marshy seepages often among tall grasses, the first two also growing on streamsides. *U.trichophylla* always grows in soil below water with only the peduncles above the surface. It's long, feather-shaped leaves are very pretty.

The plants we believe to be *U.tricolor* were found at a streamside shaded by forest. It could be *U.amethystina*, but we are not sure yet since it has never flowered. The typical forms of *U.amethystina* in central and eastern Brazil have purple, lilac, violet, or bluish flowers with a vertical yellow or orange-yellow streak on the base of the lower lip. We have found two varieties of *U.amethystina* (which I believe should both be separate species from *U.amethystina*) at the Chap.dos Guimarães.

There is a white-flowered variety (with the usual yellow blotch), which grows in grassy seepages, with the leaves and peduncles usually concentrated around the slightly elevated and drier mounds formed by tufts of grasses. The flowers are very tiny and always single atop very delicate peduncles. It has been found growing as an annual in sandy soil, where they are even smaller and more delicate as a whole. I often see this variety in eastern Brazil growing near the common forms of *U.amethystina*, where both are easily distinguishable from each other.

The other variety of *U.amethystina* at the Chap.dos Guimarães grows only as an annual. Its leaves are usually covered by mucilage on the upper surface (like *U.pubescens*) and form small rosettes. What is most surprising is that the flowers are golden-yellow! There are various flowers per scape and these are found alternately along the peduncle, born by long pedicels. In cultivation, this variety lost the mucilage and the leaves spread out over the soil like most *Utricularias* do, no longer restricted to rosettes. Though conditions were kept humid in cultivation, all leaves had disappeared by the end of the dry season.

U.neottioides can be considered both terrestrial and aquatic, depending on how you look at it. Technically, it is rheophytic, which means it grows fixed to rocks submerged by water (Taylor 1989). It is commonly found growing in cold, mountain streams here in Brazil.

The aquatic *Utricularias* were found in marshes, small ponds, and roadside ditches. I saw the beautiful *U.cucullata* for the second time in the wild. Though it is widespread in South America (Taylor 1989), it is very hard to find. There was a single light-purple-lilac flower among a small group of free-floating stolons, located in a small puddle amid grasses at a marshy seepage. I had seen plants with beautiful deep-violet flowers and a friend of mine claims to have seen red-flowered plants (both in Goiás

state). *U.breviscapa*, *U.foliosa*, *U.hydrocarpa*, and *U.gibba*, were found south of Cuiabá and the latter two also in the city itself.

The last aquatic *Utricularia* was uncovered by a stroke of enormous luck and came as a tremendous surprise. It was one of those finds which are even more exciting than discovering a new species. A case of inverse proportion, with it is importance being as gigantic as the species was microscopic. Every night in Cuiabá, after a shower and dinner, Marcos and I would organize the day's catch of CPs and the herbarium we had made. On one of those nights, I was cleaning some aquatic *D.communis* (plants with long stems growing partly or totally submerged) we had collected at a grassy seepage at the Chap.dos Guimarães, preparing them for herbarium. As I delicately removed the mesh of algae covering the sundews with the help of tweezers (while holding a flashlight low on batteries with my teeth and trying to keep it pointed towards my hands), I came across a hair-thin string bearing minute reddish bladders. At first I thought it was a stray, leafless stolon, maybe of *U.subulata*. More of these strings appeared and I got a little suspicious, but what was flashing through my mind was utterly impossible, too much to wish for! All of a sudden I froze in awe with my mouth forming a big "O" as my tweezers came up with one of these strands bearing a minute peduncle!

I ran to get Marcos' photocopies from Taylor's monograph and in total ecstasy flipped nervously through the pages. I soon found what I wanted and confirmed that I was actually holding *U.biovularioides*!! I had rediscovered the smallest of all the *Utricularia* in the world! I was in a frenzy of excitement. According to Taylor, this species has only been found TWICE IN HISTORY! One of these collections was from somewhere in the vast Brazilian Amazon (1913) and the other from the Chapada dos Veadeiros in northern Goiás state (1940). At that moment I was feeling like I was that person who discovered live Coelacanth off the coast of Africa in 1938 (a fish though to have been extinct for 60 million years)!

Before I returned to S.Paulo, we went back to collect more *U.biovularioides* for herbarium and to preserve in alcohol. Surely enough, we found the aquatic *D.communis* to be surrounded by creamy-white dots, which we now knew were the flowers of *U.biovularioides*, though we had not even noticed their presence previously! This *Utricularia* is probably not that rare at all, but is extremely unlikely to be seen and collected since it's one of the world's smallest flowering plants, probably the smallest in weight. Now that I know what it looks like in situ (which is usually a whole lot different than seeing drawings in books) and the type of habitat it can be found in, I will hopefully start discovering more *U.biovularioides* on my CP hunts around Brazil. Though if they are not in flower, I will continue tramping on the invisible stolons, as I have probably done a few times in the past.

In April/May '95 I returned to the Chap.dos Guimarães and Chap.dos Veadeiros. Marcos and I went to the *U.biovularioides* site at the Chap.dos Guimarães and found them to be still in flower, though we unfortunately found no new sites for this species. At the Chap.dos Veadeiros I had better luck than on my previous trip in early '93 and uncovered four sites where this species grew thanks to the experience of having already seen them in the wild once.

Like at the Chap.dos Guimarães, the *U.biovularioides* at these four sites were always mixed with green, stringy algae from which they were hard to separate. At two sites they grew in pools of slow-flowing water. One of these was almost a puddle by a stream and the other was a series of holes in a grassy bog packed with these *Utricularias* near the edges (mixed with aquatic *D.communis* up to 22cm in length!!).

Figure 1. *Utricularia biovularioides* at Chapada dos Veradeiros, Brazil. Note the minute red traps. Photo by Fernando Rivadavia. See article this issue.

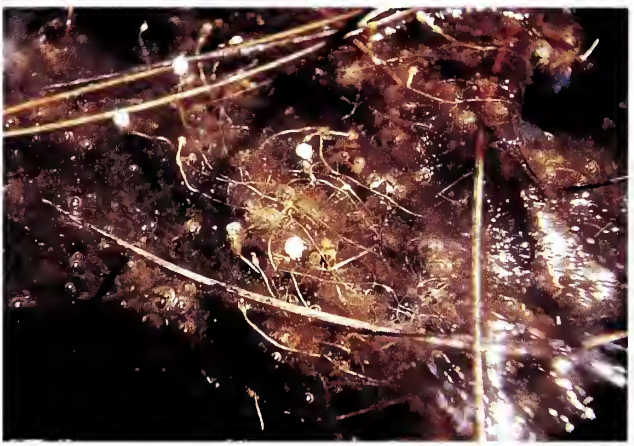

Figure 2. *Utricularia biovularioides* in flower at the Chapada dos Veradeiros, Brazil. Photo by Fernando Rivadavia.

At another site they were crowding the sides of a small rivulet cutting a grassy seepage. The other site was a seepage where they grew among large, semi-aquatic *Drosera hirtella*. Curiously, I only found the *Utricularias* that night while cleaning the Drosera for herbarium, like when I first discovered them. All of these sites seemed to be the type that are wet all year round, which indicates that *U. biovularioides* might be a perennial and not an annual, as Taylor suggested.

Reference:

Taylor, Peter. 1989. The Genus Utricularia - A Taxonomic Monograph. Kew Bulletin Additional Series XIV, Royal Botanic Gardens, Kew.

Figure 1. *Drosera sessilifolia* in seepage at the Chapada dos Veradeiros, Brazil. Photo by Fernando Rivadavia.

Drosera sessilifolia

by
Fernando Rivadavia,
Rua Inacio Pedroso 230,
C.E.P.,
05612-050, Sao Paulo,
S.P. Brazil

One of the prettiest native Brazilian sundews is *D. sessilifolia*, a species similar and also closely related to *D. burmanni*, with which it forms Sec-

tion Thelocalyx (Diels 1906). Both species have yellowish leaves, but those of *D. burmanni* are wedge-shaped, almost triangular while *D. sessilifolia* has rounder lamina. In the wild, rosettes tend to become reddish with age, as occurs with *D. burmanni,* though in cultivation they seem to maintain more of this coloration than the latter. The tiny flowers have pink lilac or light-lilac petals (while those of *D. burmanni* are white) and the sepals are often covered with short, stiff, red hairs. Both species have 5 styles segmented at the tip, differing from all other *Drosera* in the American continent, most of which have 3 styles bipartite at the base (Diels 1906). Only *D. meristocaulis* from the Neblina Peak (border between Brazil and Venezuela) has three unbranched styles, being the sole member of section Meristocaulis (Degreef 1990).

The French botanist Auguste de Saint-Hilaire discovered *D. sessilifolia* in Brazil, early in the nineteenth century in western Minas Gerais state, near the São Francisco River and described it in 1824. A *D. dentata* was described by Bentham in 1842 from Guyana, but later synonimized to *D. sessilifolia* by Diels (Diels 1906). I have found wild *D. sessilifolia* at the Chapada dos Guimarães National Park (southern Mato Grosso state), Chapada dos Veadeiros National Park (northern Goiás state, bordering the new state of Tocantins which covers the top half of the old Goiás), and twice in the floodplain of the Paraguay River (once in Mato Grosso and once in Mato Grosso do Sul), a region called the Pantanal.

At the Pantanal *D. sessilifolia* was found in barely humid sandy soil while at the Chap.dos Guimarães and Chap.dos Veadeiros the plants grow in seasonal seepages where a thin film of water infested with stringy algae covers the sandy soil, making it almost look like the rosettes are floating on the water. Seeds germinate below the algae and have to push their way to the surface of the water and are often seen still submerged. At the edges of these seepage sites, *D. sessilifolia* can be seen growing in drier sandy or gravelly soil. At the Pantanal both sites were at around 150 meters of altitude and at the Chap.dos Veadeiros *D. sessilifolia* grew up to approximately 1200 meters.

The first live *D. sessilifolia* I ever saw were brought to me by a friend in mid '91 from southwestern Goiás. Unfortunately none of these lasted very long nor did any seeds germinate. The same happened later on with plants and seeds I brought from the Pantanal, Chap.dos Guimarães, and Chap.dos Veadeiros. I kept getting increasingly frustrated at not being able to cultivate this fascinating CP until one day I discovered it was already established in my collection! *D. sessilifolia* was growing in various pots and I'd been thinking those small plants were hybrids made by local insects between *D. burmanni* and some other *Drosera* (like *D. dielsiana*) which had resulted in *D. burmanni*-like plants with pink lilac flowers and orangish leaves! They must have germinated among CPs I brought back either from the Emas National Park in southwestern Goiás (where I did not find *D. sessilifolia*, since I went there in the dry season, but am sure they do grow there) or from the Chap.dos Guimarães.

It took me quite a few frustrated trips before I actually saw wild *D. sessilifolia*. I only found out it was an annual in mid '92 when I returned to the Chap.dos Guimarães especially to see this species. Imagine my disbelief as I walked over the parched, dry soil where hundreds were claimed to have been growing luxoriously only a few months earlier! The only proof of their previous existence was a single, dead plant. A few days after this maddening surprise, I was over 300km southwest from the Chap.dos Guimarães, somewhere in the middle of the vast Pantanal floodplain. It was the farthest spot from cilvilization I have ever been to and that is where I was finally rewarded with the sight of my first wild *D. sessilifolia*! Yet sadly, the dry season was already taking its toll and there were only a few plants still alive.

As a result of it's annual cycle, *D. sessilifolia* is native to regions where the wet and dry seasons are very distinct. This is probably why it has not been found in southern

and most of southeastern Brazil. Other than my collections from Mato Grosso, Mato Grosso do Sul, and Goiás, plus the TYPE collection from Minas Gerais, I know through herbarium specimens studied at the University of São Paulo that *D. sessilifolia* also grows in the Brazilian states of Acre, Tocantins, Pará, Maranhão, Piauí, Ceará, Paraiba, Pernambuco, and Bahia. More field work should fill in a few gaps and add a few more states to this list, not to mention a few more countries. Other than Brazil, *D. sessilifolia* has only been collected in Venezuela and Guyana, though I am almost sure it will (in the future) be discovered in Paraguay, eastern Bolivia, and northern Argentina, which share the Pantanal floodplain with Brazil. *D. sessilifolia* is likely to be native to other countries like Surinam, French Guiana, Colombia, Peru, and also Bolivia.

In northeastern Brazil the dry season is very harsh and *D. sessilifolia* can be found right up to the coast. The largest specimens I have ever seen (4.5cm in diameter) were collected at the Cajú Island, off the coast of Maranhão, where they probably grow on the edges of fresh-water pools which form amid the sand dunes during the wet season. I have also seen a specimen with a flower scape 52cm in height! In northern Brazil this sundew probably occurs on mountain tops and in pockets of cerrado (Brazilian savanna) amidst the extensive rainforests which cover that region. Surely, *D. sessilifolia*, like other CPs, also invades and colonizes deforested areas in these northern reaches of Brazil.

In '94, Ivan Snyder from Los Angeles was able to hybridize *D. burmanni* with *D. sessilifolia* (which he grew from seeds I sent him from the Chap.dos Guimarães) and we decided to call the cross "*D. x thelocalyxiana*." I had imagined this cross was possible, but had not been able to get both species flowering at the same time. For the few who have seen *D. sessilifolia* in cultivation, the reaction is always the same: "Are you sure that is not *D. burmanni*?" For a while I agreed with Ivan that even though they are geographically very isolated, maybe *D. sessilifolia* should be reduced to a subspecies of *D. burmanni* due to the extreme similarity between the two. Yet after studying *D. sessilifolia* at the Chap.dos Guimarães and Chap.dos Veadeiros again April/May '95 and remembering the wild *D. burmanni* I saw at Litchfield plus Kakadu National Parks in Australia's Northern Territory in mid '93), I believe these truly are separate species.

If we could get *D. sessilifolia* to grow in cultivation as beautifully as it does in the wild, this difference would be obvious. The problem is that in cultivation, Ivan and I have only been able to grow small and depauperate *D. sessilifolia*. I am just not sure if, in the wild, *D. burmanni*'s rosettes are always flat like the ones I saw or if they may also be semi-erect like those of wild *D. sessilifolia*.

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3.) Saint-Hilaire, A. 1824. Droseraceae in Histoire des Plantes les plus Remarquables du Brésil et du Paraguay.

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Map -- Known locations of *Drosera sessilifolia* in South America. Prepared by Fernando Rivadavia. See article this issue.

SPECIAL NOTICE

To our great embarrassment, it has been brought to our attention that we slipped up and neglected to acknowledge our new logo that now appears at the top of page two of each issue. This logo was thoughtfully created for us by Paul M. Milauskas who also does some cartoons for us. The updated logo has been appearing since March, 1994 (Vol. 23, no. 1), and is also used on the cover of the CPN binders. Thanks, Paul.

The 1996 List Of CP Books

Not available through CPN. Order directly from publisher, your local bookshop or C.P. Nursery.

1. A Guide to the Carnivorous Plants of the World. 1992. Gordon Cheers. Angus & Robertson, Pymble, NSW, Australia. (ISBN 1-85238-124-8)

2. Animals & Plants that Trap by Phillip Goldstein. Holiday, 1974; (ISBN 0-82340-241-x)

3. Carnivorous Plants by Gordon Cheers. Globe Press. Melbourne. (ISBN 0-9591937-0-7)

4. Carnivorous Plants by Francis E. Lloyd. Peter Smith, Magnolia, MA 01930; USA. 1942 ed. (ISBN 0-486-23321-9)

5. Carnivorous Plants by Randall Schwartz. Avon Books, 1975; 959 Eighth Ave.; New York, NY 10019; USA. (ISBN 0-275-51580-X)

6.Carnivorous Plants by Adrian Slack. MIT Press, 1979; 28 CarletonSt.; Cambridge, MA 02142; USA. 1984 paper (ISBN 0—262-69089-6)

7. Carnivorous Plants by John F. Waters. Franklin Watt, Inc.,1974; 845 Third Ave.; New York, NY 10022; USA. (ISBN 0-53102-700-7)

8. Carnivorous Plants by Nancy Nielson. Franklin Watts, NY . 1992 (ISBN 0-531-20056-6)

9. Carnivorous Plants by Cynthia Overbeck. Lerner Publications, 1982 241 First Ave.; Minneapolis, MN 55401; USA. (ISBN 0-8225-9535-4)

10. Carnivorous Plants by Paul Temple. 1988. A Wisley Handbook. Royal Horticultural Society, London. (ISBN 0-304-30045-6)

11. Carnivorous Plants-Care and Cultivation. 1990. Marcel Lecoufle. Blandford (Villiers House, 41/47 Strand, London WC2N 5JE). US Dist., Sterling Publishing Co. Inc., 387 Park Ave. South, New York, NY 10016-8810. English version. (ISBN 0-7137-2185-5).

12. Carnivorous Plants of Australia. Vol. 1& 2 by Allen Lowrie. West Australia Univ. Press, 1986; Nedlands, WA 60009; AUSTRALIA. (ISBN 0-85564-254-8)

13. Carnivorous Plants of California by J.HawkeyeRondeau,PhD. 1991. $15.95 +postage from author (37 Sunnyslope Avenue, SanJose CA95127;USA. Tel. 408/929-6529.) No ISBN.

14. Carnivorous Plants of the World by J. & P. Pietropaolo. Timber,1986. Peter Pauls Nurseries; Canandaigua, NY 14424; USA. $30.30. (ISBN 0-88192-066-5)

15. Common Marsh, Underwater & Floating Leaved Plants of the United States & Canada by Neil Hotchkiss. 1972. Dover Pub. N.Y. (ISBN 0-486-22810-x)

16. CP of the US & Canada by D. E. Schnell. John F. Blair, Publisher,1976. 1406 Plaza Dr., SW; Winston-Salem, NC 27103. 1976 ed. (ISBN 0-910244-90-1)

17. Cultivating Carnivorous Plants by Allen Swenson. Doubleday & Co., 1977; Garden City, NY 11535; USA. (ISBN 0-385-11148-7)

18. Droseracea and Nepenthaceae in Flora of Australia. Vol 8. Australian Gov. Print. Serv., Canberra, Australia 1982. (ISBN 0-644-02017-2)

19. Insect-eating Plants by Patricia Kite. Millbrook Press, Brookfield, Conn., 1995 (ISBN 1-562-94562-9)

20. Insect-EatingPlants by L.&G.Poole,T.Y.Crowell,1963;666FifthAve.;New York, NY 10016; USA. No ISBN.

21. Insect-Eating Plants and How to Grow Them by Adrian Slack. 1986. (ISBN 0-295-96637-8).

22. Insectivorous Plants by Charles Darwin. AMS Press, 1893; 56 E. 13th St. New York, NY 10003; USA; 1972. (ISBN 0-404-08412-5)

23. Killer Plants by Mycol Doyle. Lowell House, LA 1993. (ISBN 1-565-65056-5)

24. *Nepenthes* of Mt. Kinabalu (in English) by S. Kurata. Sabah National Park. no ISBN.

25. Pitcher Plants by Carol Lerner. William Morrow & Co.; New York. (ISBN 0-688-01717-7)

26. Pitcher Plants of Peninsular Malaysia & Singapore by Roger G. Shivas. (ISBN 9-971-954-16-8)

27.Plants of Prey by Densey Clyne. Allen & Unwin Pty Ltd, Sydney, Australia. 1992 (ISBN 1-86373-132-6)

28. Plants of Prey in Australia by Rica Erickson. Univ. of W. A. Press, 1986. (ISBN 0-85564-099-5)

29. Plants That Eat Animals by Linna Bentley. McGraw-Hill Bk Co.,N.Y. 1968 (ISBN 68-26856)

30. Plants That Eat Animals by J. H. Prince. Lodestar Bks. NY 10016; USA; 1979 ed. (ISBN 0-840-76599-1)

31. Plants That Eat Insects. by Anabel Dean. Learner Pub., Minneapolis, 1977. (ISBN 0-8225-0299-2)

32. Secrets of the Venus' Fly Trap by Jerome Wexler. Dodd, Mead & Co., NY. 1981 (ISBN 0-396-07941-5)

33. Sundew Stranglers: plants that eat insects by Jerome Wexler. Dutton Children Books,NY. 1995 (ISBN 0-525-45208-7)

34. The Carnivorous Plants by B. E. Juniper, R. J. Robins and D. M. Joel. Academic Press. (ISBN 0-12-392170-8)

35. The Genus *Utricularia* a taxonomic monograph, KEW Bulletin, Series XIV, Royal Botanical Gardens. $68.00. (ISBN 0-11-250046-3)

Farewell Co-Editor...
...Hello Ordinary Member!

by
Don Schnell

At the turn of the new year 1996 a few months ago, I thought I would check to see what volume we were starting for 1996 CPN. Volume 25. Volume 25! The number 25 -- 25 years, that is --suddenly weighed in on me and I guess feelings and thoughts accumulating over time aggregated into the realization that 25 years is a good round number. Time to pass the baton. Just time for a change, not only for me, but for that one part of the co-editorship team. I will retire as co-editor at the conclusion of this volume 25. I will, of course continue my very avid interest in and activities with CP, but I will have the pleasure of being an ordinary member of ICPS, enjoying CPN, and perhaps submitting the occasional contribution for editorial consideration.

Things were a lot different 25 years ago. There were no PC's, no net, just typewriters. Joe and I had been writing each other and many others as well, and we realized that we were often saying the same thing over and over again to different people. The idea of some sort of newsletter as a central collection point was born. People often ragged us later about such a fine bulletin existing without an organization behind it, kind of the cart before the horse, but we were frankly tired of typing the same thing over and over so many times--It was that simple!

Joe has been a fine and steadfast co-editor over those 25 years; we have become fast friends and it always amazed me how we were able to work out many questions and problems so agreeably. The times were bitter-sweet, many problems, but many rewards and accomplishments, much fine information exchanged, 25 years of a superb accumulative encyclopedic archive of great information and some history. I wonder if anyone else will ever look at it all together.

The first six volumes were printed by a xerographic offset method crude by today's standards but very useful then, and we could afford to do it for a very nominal subscription fee. We thought in terms of a four-pager. The very first issue was 15 pages (!) of pica-type 8 1/2 x 11 inch paper. My long suffering secretary at work volunteered (honestly!) to type all the master copies and Ritchie Bell had the printing done through the UNC print shop which mainly handled schedules, class handouts and exams. It worked, and we even tried some crude black and white photos.

When Leo came aboard as third co-editor, he was instrumental in converting us to the slick-papered magazine format we now use, first with nice black and white photos only, and then color! That was a super milestone. Leo handled all the assembly, printing, subscriber records, money and mailing--Quite a load! When the strain began to tell in too much time consumed, Steve Baker came in and has successfully "made the trains run on time". Using his Mac, he now actually composes each page of CPN as it will look and the printer uses these to print the issues, and Steve handles the mailing.

In betwixt, Larry Mellichamp was with us all too briefly, acting as our botanical conscience, keeping us accurate in those respects, and writing a nice set of columns imparting botany in a very enjoyable way to non-botanically inclined readers. He did a great job.

After finally organizing a society -- ICPS -- some years back, we tried to hold an election but nobody came. We really needed officers to go with the organization and co-editors could only act as de facto officers for so long. Finally, two years ago we held another election, and it took!

As members of ICPS, we have an energetic set of officers with many plans, and they deserve our cooperation. As they say in politics, once you have elected officials, work with them--You can always vote the rascals out next election! I say this in jest, of course, but there are many problems for our officers to solve and we really should work with them.

Overall, the thoughts of the 25 years leave a warm feeling. There were naturally down times, times when we thought the whole thing would fold, that the direction was wrong, but it all worked out and CPN is finer than ever. Articles are now listed in the Index of American Botanical Literature pubilished with each issue of the prestigious Bulletin of the Turrey Botanical Club. Professional botanical scientists are among those who write for us, and recently for the first time using CPN as a vehicle for official publication of new taxa by ICBN rules. Some may think CPN has lost its simplicity, but we have always had a policy of selecting material from what was sent in--Sometimes it was more technical because that was what we got; sometimes the material from which to select was less technical. You members have to support CPN by writing for it. Alas, in all those years, in spite of the ubiquitous term papers to which every high school or higher graduate has been exposed, I do not think I ever got the concept of "typed or wordprocessed double space" across. Private co-editorial aside!

It has been fun. I learned a lot; working with Joe particularly and so consistently all these years has been great, and I hope I helped a little. Now move over in the gallery--You've got another ordinary member coming in!

News & Views

Mário Paniago, Rua 1124 Quadra 225 Lote 11, Casa 2 Setor Marista, Goiania-Goiás CEP 74 175-080 Brazil

My name is Mário Paniago and I want to exchange letters about CP with anyone around the world. I'm also looking for a strain of the plant *Dionaea muscipula* which tolerates high temperatures between 20-35 degrees C. Please write to the above address.

Attention!Attention!Attention!

3rd Annual Southeastern CP Workshop

Hosted this year by Ron Gardner and the NC Botanical Garden in Chapel Hill. Oct. 4, 5, 6 are the dates this year and we are LIMITED to 75. So please register early to be apart of this years workshop.

We hope to have a social Friday night and talks, auctions, and business meeting on Saturday. This will leave Sunday for a field trip to The Green Swamp. If their is enough interest. If you are interested in speaking at this workshop please let Rob Gardner know ASAP. If you need more information on this workshop or the field trip please Phone at 919-962-0522 or write Ron Gardner at the following address:

NCBG
CB#3375
Totten Center
UNC-CH
Chapel Hill NC 27599-3375

Literature review

Zimmer, Carl. "The Processing Plant" in Discover Magazine, Sept. Vol 16,#9, 1995.

A complicated eco-system exists inside the pitchers of *Sarracenia purpurea* . In the watery liquid there exists insect larvae that can take apart the corpses of other insects. This digestion ultimately benefits the plant itself because of faster breakdown of the insect bodies into dissolved nutrients that are taken up by the plant.

Zamudio, S. and R. Z. Ortega. 1994. Una nueva especie de *Pinguicula* (Lentibulariaceae) de los estados de Queretaro e Hidalgo, Mexico. Acta Botanica Mexicana 28:57-62.

En espanol

Pinguicula moctezumae is found in wet growth sites in the Rio Moctezuma canyon in the Mexican states of Queretaro and Hidalgo. The species belongs to the section Orcheosanthus, subsection Violiformis, with closest resemblance to *P. gypsicola*. It differs from the latter in that the leaves are somewhat longer and more strap-like, and in growing in sub-acquatic locations. The article is accompanied by good line drawings. (Ed. Note Miloslav Studnicka of the Botanicka zahrada Liberec in the Czech Republic who brought this new species and description to my attention and who also grows it, feels that in spite of its elongate leaves, it may be more ciosely related to *P. colimensis* by reason of the shape of the winter rosette and certain floral characters.)

Attention All CPer's World Wide

First ICPS International CP Convention

ICPS is proud to announce our first International CP Convention to be held at Atlanta Botanical Gardens in Atlanta, GA ,USA from May 16-23 (Friday to Friday) in 1997. There will be seminar/talk/presentation/workshop to go on for the first few days than field trips will take place . One field trip to Gulf Coast (Panhandle of Florida) and still in the work are a Mountain bog trip and NC Coastal Plain trip. But first we need some help from the CP Family. Please submit for presentation your papers, talks or demos that could be given at the first of the convention. More detail to come later. Please submit your presentations, ideas, wants, and concerns for review to the following address:

ICPS International CP Convention 1997
Rt. 1, Box 540-19AB
Conover, NC 28613, USA

Deadline for submitting June 1, 1996

Fourth Annual Eastern Carnivorous Plant Convention

Our annual meeting will be held at Botanique Nursery near Charlottesville, Virginia June 28 - 29, 1996. Botanique is located in the Virginia hills, at the foot of the Blue Ridge Mountains and the atmosphere is wild, rural and country. Plenty of tent sites are available and we should have enough water for hygiene, drinking, etc. Because Botanique is normally not open to the public, this could be a unique opportunity to visit and see how we approach the challenge of growing. We are a small nursery, but the variety and density of plants is worth seeing. Wildlife is plentiful but would doubtless be hiding.

The nearest motels are outside of Charlottesville, on or near Route 29 and about 20-30 minutes drive. This distance may or may not be comfortable for some folks to drive. A closer motel exists, but does not take reservations! Campers may be asked to park their cars a short hike away, about 1/4 mile, after unloading. There are only a few parking spaces near the camping area and house. The walk is a short one, surronded by trees. While a turnout of over 45 people is not expected, we would have to limit attendance to 50 or so. The facilities and parking are of limited capacity. Registration fee is $25.00 by June 1, 1996. Registrations after this date will be accepted but are non-refundable and $30.00. Meals are included for Friday and Saturday evening with a late morning meal on Saturday. T-shirts will be available at the meeting.

Registrations should be addressed to:

Perry Malouf
5308 Carlton Street
Bethesda, MD 20816

Please make checks payable to Perry Malouf.

Talks are scheduled for Saturday evening and we solicit speakers to contact the registrar for available time slots. Bring your plants for swap or display. We look forward to seeing you there.