

CARNIVOROUS PLANT NEWSLETTER

VOLUME 9, Number 1

MARCH 1980



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BOTANICAL GARDEN



CARNIVOROUS PLANT NEWSLETTER

Volume 9, Number 1
March, 1980

Cover

"Monster" rosettes od *D. erythrorhiza* from Jurien Bay, just North of Perth, Western Australia. Measured 11 cm in diameter and were between 50 and 60 years old (as determined by sheath counting technique). See text page 10 for more details.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your subscription to CPN:

All correspondence regarding subscriptions, address changes and missing issues should be sent to Mrs. Kathy Fine, c/o The Fullerton Arboretum, Dept. of Biology, California State University, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ARBORETUM.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.
Copy deadline for the June issue is May 1, 1980.

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PUBLISHER: The International Carnivorous Plant Society by The Fullerton Arboretum, California State University, Fullerton, CA 92634. Published quarterly with one volume annually. Printer: Kandid Litho, 129 Agostino Rd., San Gabriel, CA 91776. Circulation: 609 (92 new, 517 renewal). Subscriptions: \$7.00 annually, \$9.00 foreign. Reprints available by volume only.

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FORMAL FORMATION OF THE INTERNATIONAL CARNIVOROUS PLANT SOCIETY

We, the Co-editors, would like to announce that beginning with this issue, we are now officially the International Carnivorous Plant Society and that the Carnivorous Plant Newsletter is the official journal. This step is being taken after much planning and consultation between the Co-editors and the Fullerton Arboretum.

Editor's Corner

As we begin our ninth year, we would like to welcome all of you, old and new alike, to what we hope will be another successful year. This issue will be devoted to the sundews as well as updating the CP Book list and Source List.

Our principal source of material is the subscribers and we encourage you to submit papers for publication. To facilitate our processing them, we would like submitted papers to be typed and double spaced on standard size paper and that any line drawings be done in permanent black ink on white paper.

We would like to keep any slides that we use for any future reprints, but if requested we will return them after publication.

Slides that are to be considered for the covers should have a vertical orientation and a caption which includes any dates and the name of the photographer.

Seed Bank

PATRICK DWYER (St. Michael's Episcopal Church, 49 Killean Park, Albany, NY 12205) writes regarding the seed bank:

Keep the seed donations coming in! Try to get seed donations into the seed bank before the first of the month before each issue of CPN; that is when the seed inventory is sent in. This will insure that the seeds are as fresh as possible. Please make sure that the seeds are fresh, viable, and correctly labeled, as we have no way of checking them.

Thank you again for everyone's help and support.

(Patrick's report and inventory were accompanied by \$500 which will be used to help defray printing costs of CPN. The editors again wish to thank Patrick for the many hours he devotes to the Seed Bank.)

Patrick filled or answered a total of 431 orders and letters in 1979. As of January 30, 1980 he had received 86 orders and letters. He asks that people ordering immediately after CPN comes out should be patient, since he usually receives 50-100+ letters at that time.

To send seed: Please remove seed from the seed capsules and place it in small envelopes (preferably paper so that they dry out enough to prevent mold). Label with the origin and date of collection, including habitat if it is exotic. Fold the envelope over once or twice before taping so that the seeds don't stick to the tape. After the seed is received it will be placed in smaller packets; donors will be informed of how many packets they have donated. A donation of 10-19 packets earns one free seed packet of comparable rarity, with one free for each additional 10 packets.

Do not ask to trade for seed from the bank. Everyone will have to buy all but their

free packets. When you send seed, indicate whether it is for the seed bank, for Patrick's seed project or for a personal trade. The seed bank is separate from his collection. *To order seed:* Please enclose payment. List the seeds desired and an equal number of substitutes in order of preference. If requested, Patrick will add any cultural instructions of which he is aware. Patrick will answer all letters and orders as quickly as possible; if you receive no response within two weeks (U.S.) to a month (outside U.S.) please write again. Each issue of CPN will include an update of the inventory. Cost per packet: 50¢. (Number of packets is listed if less than 15 are available).

SEED BANK INVENTORY

Byblis liniflora, Darlingtonia californica, Dionaea muscipula, Drosera adelae (1), *D. aliciae* (2), *D. aliciae* (pale flower) (7), *D. auriculata*, *D. binata*, *D. burkeana* (4), *D. burmannii* (15), *D. burmannii* (giant form) (1), *D. burmannii* (Taiwan) (1), *D. capensis*, *D. capensis* (narrow), *D. capillaris*, *D. capillaris* (Gulf giant) (2), *D. capillaris* (long leaf), *D. capillaris* (pink flower) (2), *D. capillaris* (white flower) (4), *D. capillaris mix*, *D. erythrorhiza*, *D. filiformis filiformis*, *D. intermedia*, *D. linearis* (14), *D. linearis x rotundifolia* (8), *D. montana* (3), *D. montana* (white flower) (10), *D. natalensis* (6), *D. peltata*, *D. planchonii* (5), *D. rotundifolia*, *D. rotundifolia* (oregon), *D. spathulata*, *D. spath.* (Kansai), *D. spath.* (Kanto) (2), *D. spath.* (round leaf-Japan) (1), *D. spath.* (white flower) (3), *D. sp.* (U.S. rosette mix), *Sarracenia flava*, *S. flava* (Gulf), *S. flava* (Gulf-hvy vein) (9), *S. flava* (Gulf yell/hvy vein mix), *S. leucophylla*, *S. minor*, *S. psittacina* (Gulf) (4), *S. purpurea purpurea*, *S. purpurea venosa*, *S. purpurea venosa* (pink fl) (8), *S. rubra alabamensis* (8), *S. rubra gulfensis* (11), *S. rubra jonesii*, *S. alata* (purple) x *leuco.* (9), *S. alata x rubra F₂* (5), *S. flava x oreo.* (7), *S. leuco. x flava* (mixed with *S. leuco.*), *S. leuco. x minor* (4), *S. leuco. x rubra F₂* (6), *S. purp. x leuco. F₂* (3), *Sarracenia mix* (7), *Ultricularia calcyfida* (6), *U. dichotoma v.uniflora* (1), *U. inflexa*, *U. juncea* (1), *U. laterifolia* (2), *U. racemosa* (1), *U. subulata f. cleistogama* (1)

News and Views

CLIFF BERGER, JR. (Rural Route #6 Box I46, Plymouth, Indiana, 46563). Is interested in contacting people in the Indiana-Michigan area about organizing an affiliate society.

TERRY DAVIS (3538 NW 21st St., Gainesville, Florida 32605). Enjoyed your article on *Heliamphora* — excellent as usual. I have been boning up on mycorrhizal symbiosis as applies to my first love, Bonsai, and on reading your description of the problems you have had with *Heliamphora* seedling, it sounded like this might be it. The root symbiont is obligate in many species and your seedlings behave classically like a fungal-dependent seedling being raised in a sterile situation. Try mixing in some of the soil from the root zone of well-established plants to see what happens. Spores of a symbiont might also be used especially from a particularly efficient species of broad host range.

RICKY DEITCH (R.D. #1, Boiling Springs, PA 17007) has an idea to offer: CPN could print or have printed a series of books, one for each genus. For each plant there could be a full page color picture of the plant with the opposite page having information about the plant. If successful, the books could be combined into one big book showing every carnivorous plant in the world. This would be fantastic for those interested in C.P. I know I would want one and I'm sure many other CPN subscribers would want one also. CPN could make a lot of money so it could continue to be published. I hope this suggestion has helped.

ANTHONY FORD, (320 E. O'Keefe, #4, Palo Alto, California 94303.) I would like to request that you repeat an article contained in a past issue of CPN concerning pronunciation of scientific names. I am getting a little perplexed in discussing plants with other

CP enthusiasts who sometimes throw me off completely with some well-intended, yet blatantly mispronounced, plant name. Plants I frequently find falling victim to bad pronunciation are any plant named after someone, such as *Drosera hamiltoni* (the specific name of which is often pronounced like some strange form of spaghetti) which is generally due to pronouncing the 'i' at the end as a long 'e'. The genus *Drosera* is often commonly fouled up.

Look, fellow CPers! I like to talk plants; however the idea of scientific names for plants and animals was to create a name universally accepted and uniformly pronounced by scientifically-minded people worldwide. Please try to learn to correct way to say the words.

MICHAEL D. GODDARD (90 So. Yates, Denver, CO. 80219) writes: I have been experimenting with a possible new method of growing C.P. from seed. I used a 50 gal. aquarium with a four bulb fluorescent light (4 foot). The fluorescent tubes were 2-cool white one daylight one warm white placed directly on top of the tank.

I left the light on 24 hrs. a day seven days a week except for a seven hour rest period once a week. On January 27, I received 25 pkgs. of seed that I purchased from the C.P.N. seed bank, all were planted the same day that I received them.

I used a 50-50 vermiculite and sphagnum moss mixture in styrofoam salad cups. I then placed them in the tank on top of 4" of pea gravel with water. The seed was a variety of *Drosera*, *Nepenthes*, *Sarracenia*, *Pinguicula*, and *Byblis*.

The temperature in the terrarium remains a constant 76 degrees F. with the humidity about 90%. Be sure to have a spray bottle of Benemyl solution handy as it will be needed. I used a 50% solution to avoid possible damage to the seed. With this method I was able to get *Byblis* growth

in 9 days *D. anglica* in 12 days *N. chelsonii* x *rafflesiana* in 28 days. I have left the plants in the terrarium since January 27 with the exception of separating some of the more robust plants.

I was able to get 44 *Byblis liniflora*, 12 *D. indica*, 12 *D. peltata* 20 *D. capillaris* and good sets on most of the other plants. I hope that the above data will prove helpful to anybody wishing to grow C.P. from seed.

JEFF HELMER (3620 Shawnee Road, San Diego, CA 92117) has the following thoughts: When I saw the picture of a steam shovel uprooting a field of *Sarracenia* on page 112, Volume 8, it made me wish I could be there to help. It seems to me someone could save endangered plants and do a service to CPN subscribers at the same time by digging them up and sending them to CP growers for the shipping price plus a little to cover his troubles. I for one, would like to enlarge my CP collection for a reduced price and save a threatened plant as well. How about the rest of you?

JEFFREY GOLD (13126 Anza Drive, Saratoga, CA 95070) writes that he would like to contact anyone who might have any carnivorous fungi. He is highly interested in observing them.

RON HUMBLE (3113 Liberty Rd., Greensboro, N.C. 27406). I like to emphasize my agreement with Bob Hanrahan's observation on transplanting terrestrial Utricularias. In the second growing season of growing *U. juncea*, the photosynthetic leaves were smaller and fewer in number than the previous year. The scapes were only a fifth of last years size. In the article in CPN 8.: 47-50, Mr. Hanrahan recommended repotting the plant to renew vigor in growth.

JIM MILLER (2319 Ninth St., Green Bay, Wisconsin 54304). "I have spent much of the last ten years or so exploring the Gulf Coast region for native carnivorous plants. In the course of these travels I have gained a lot of information regarding the habits and

distribution of these plants. In corresponding with CP enthusiasts around the country, I noticed a lot of interest as to the current status and numbers of Gulf Coast populations. In response to this interest and to provide some observations regarding these plants I have issued A REPORT ON THE STATUS OF GULF COAST CARNIVOROUS PLANT POPULATIONS. This report is available for \$3.00 postage paid or two copies for \$5.00. A companion report on northern CP is in the works. For foreign mailing AO rate, please send \$4.00 per copy."

C. SCHON (3660-10 Vista Campana, Oceanside, CA 92054) Over the years, in various publications, I have seen various plans for small home growing chambers. For plants that love humidity, most of these plans either have the growing mix on the bottom of the structure, or the plants potted and suspended somehow above a bottom layer of water. Both of these systems have distinct disadvantages, the most obvious being stagnation and poor control in general of the humidifying substrate. Furthermore, having a water layer can be dangerous if lights and other electrical equipment are used in the environment.

A solution to the problem is to use a layer of some kind of water absorbent material at the bottom, with the plants, (set on a plate or whatever to prevent uncontrolled water absorption), placed on top of the humidifying substrate. In my experience, the best material for this purpose is panamint earth, which is sold on the West Coast in granulated form in pet stores as "kitty litter". It comes in a fine gravel size, and is a light tan in color. Despite its clay-like appearance, it will not break down, even if kept immersed in water for years. Its merits lie in its ability to store and transpire a great deal of water. The corrugated shape of the grains allows for greater surface area than water, thereby increasing the potential for humidification.

This material may be useful in potting drainage-loving species, but it may be of the wrong pH for it appears to be a sedimentary mineral. Most of the material sold contains a

deodorant, which must be removed somehow if it is intended for use as a potting material.

Another advantage of this substrate is that a heating cable, (made for plant bedding), can be strung through the material at a depth of about three inches. The cables sold by Park Seed Co. seem to be best for this system. Any environment with a surface area of eight square feet or more will accommodate one of the many cable lengths. When the material becomes foul or salted, it is far easier to change than water or growing medium. When in use, at least half of the depth of material should be immersed in water for maximum efficiency.

I do not know if this material is sold nationwide, for it is mined in limited quantities in California. Finely broken pieces of crockery would probably make a suitable, (and expensive), substitute, with coarse sand or fine gravel as a poor third choice.

MRS. LILLIAN SEVERIN (22570 San Juan Rd., Cupertino, CA 95014) writes: I recently took a *Nepenthes ventricosa* to an orchid meeting. It had four well developed "traps" present, and I thought the plant might add interest to the plant table. When it was returned to the greenhouse late Friday night, it was placed on a table. The next morning, the "traps" and plants were covered with ants. It remained there until Monday morning, with ants all over it for 2 days.

However, when I came in Monday morning, there wasn't an ant in sight. That was four months ago, and I haven't seen an ant in the 20 x 40 greenhouse since!! Have you ever heard of this?

Up to this time ants had frequently appeared, and I'd killed them with a light sprinkle of chlordane powder.

I would be interesting to see if anyone else had heard of such a "happening".

TOM STORY (1112 Klengal St., Antioch, CA 94509) writes that he had a praying mantis that managed to intercept many of the bugs attracted to his *Nepenthes alata*

plant. However, it eventually fell into a pitcher itself. "As I was growing rather attached to the mantis and had come to think of it as a pet, I felt the same way towards my plant as my grandmother does when her cat eats a bird. But then, like the cat, it couldn't help itself. As it turned out, other mantis' have cohabitated with the plant and they have been smarter".

Tom also warns us that it is a mistake to use Mir-Acid for growing *Utricularia* as mentioned in CPN Vol. 8 (3): 77 (1979) since use of this fertilizer led to the death of his aquatic plants.

JULIE STROMBERG, a graduate student at the University of Wisconsin, Milwaukee, is seriously researching the endangered species, *Drosera linearis*. She is requesting any information anyone is willing to share regarding distribution, ecology, locations, habitat preference, culture requirements, etc. Location information will be kept in strictest confidence. Address: Julie Stromberg, 7033 N. Fairchild Circle, Milwaukee, WI 53217.

SPECIAL NOTICE

CPN readers may be interested in a publication called A HORTICULTURAL GUIDE TO AUSTRALIAN PLANTS. The book is being produced as a series of looseleaf sets of pages to be added to a binder. On one side of each page is an extremely well printed color photo of the species of that page. On the other side is printed information in tabular form of all sorts of good information on the species: botanical, geographical and horticultural. The sets are up to Set 6 as of August, 1979. Only three CP species have been included thus far (*Nepenthes mirabilis*, *Cephalotus follicularis*, and *Drosera prolifera*), but Bill Lavarack promises there will be more in the future. For information on purchase or subscription to the sets, write: A Horticultural Guide to Australian Plants, c/o SGAP, Qld Region, P.O. Box 809, Fortitude Valley, Qld. 4006, Australia.

Short Notes

Cannington Swamp R.I.P. **(Born about the time of the dinosaurs.** **Died 1981)**

by

Allen Lowrie, 6 Glenn Place
Duncraig, 6023, Western Australia

Cannington Swamp is situated about 30 km S.E. of Perth. The land is typical swamp flats and heath on a few rolling hills. In the summer when the swamp is bone dry, the water table is approximately 60 cm under the ground. The nature of the soil is basically white silica sand and leaf mould.

Cannington Swamp has always, in the past 12 years, been for me the most rewarding area for the most number of wild flowers found in one spot. Twenty different types of native orchids are to be found here, not to mention the thousands of different native plants, from Banksias to gums, and, of course, the plants I'm nuts about — CP.

The wildest things to be found, though, are the signs which read, "Don't pick the wild flowers." It seems they don't apply to bulldozers. Half of Cannington Swamp is now a housing and shopping complex. Another two years will see the end of this great flora area.

On my last trip to Cannington Swamp with fellow CP nut Robert Oliver*, last winter, we went exclusively to collect as many different types of CP as we could find.

Byblis gigantea has a very strong hold in Cannington Swamp. *Byblis* grows standing in water in neat clumps, bush-like, approx. 75 cm high. *Drosera gigantea* is everywhere, standing up to 90 cm tall, branches arranged in the shape of a triangle, longer branches on the bottom of the main stem, smaller to the top. The shield-shaped traps occur in three's along the branches. At the end of every branch is a flower spike made up of small white flowers, a truly splendid sight. The tubers of this plant are found about 30

cm under the ground. It took me nearly 30 minutes to dig out the complete plant. I found the easiest way to collect *D. gigantea* was not on the dry ground but in the swamp itself. I found I could work my hand down more easily through the sand and mush underwater to the tuber, then with a little movement around the tuber loosen the plant and ease the plant out the mush. This method took only a few minutes and a lot less sweat.

Drosera nitidula is in abundance along with *D. pulchella*. I also found Steve Rose's find (giant *D. nitidula*) a couple of years ago, which were 5 cm across, beautifully red in colour in a neat compact rosette.

Utricularia menziesii were to be found in clumps up to 10 cm across right in the heart of the swamp on little elevated islands. Many clumps were in flower. Their vivid red blooms against their deep green leaves made a very attractive sight. *U. menziesii*, I believe, has three types of traps: One bladder type at ground level (sitting on the ground), one trap radiating out sideways into the soil, and a different trap below. The trap on the ground level along with the shape of the leaves, gives me the impression of a small *Cephalotus* plant. It's a pity the overall visual effect is so small.

Drosera erythrorhiza covers the ground like a carpet around the base of every *Banksia* tree, mostly back up from the swamp on higher ground. The two *Polypompholyx* species grow right in the water. There must have been millions; I couldn't walk anywhere in

(Please turn to p. 24)

BIOLOGY OF WEST AUSTRALIAN TUBEROUS DROSERA

by K.W. Dixon and J.S. Pate

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Western Australia contains a particularly large proportion of the world's carnivorous plants. Over half of the known ninety species of *Drosera* occur in this part of Australia and a much larger proportion of the tuberous species of the genus is endemic to this region. As a typical example we will describe *D. erythrorhiza*, a conspicuous rosette species of the winter flora of the coastal sandplains of South Western Australia. It is a

member of the subgenus, *Ergaleium* (De Buhr, 1977) and dies down each summer to a dormant subterranean tuber. Each season a new tuber forms into the cavity of the old expended tuber, the successive years of 'skin' or epidermis of the parent tubers building up layers of protective sheathing around the tuber (Fig. 1). By counting these epidermal sheaths it is possible to obtain a minimum estimate of the age of the plant in

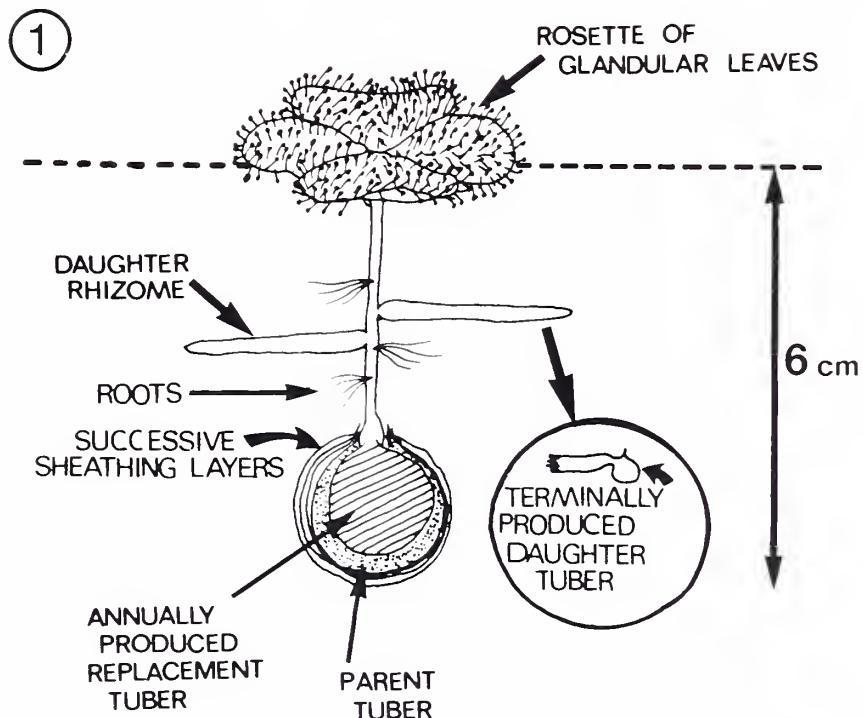


Fig. 1. Peak growth stage of *Drosera erythrorhiza* (x1). Leaf rosette fully expanded and receptive to organism capture and digestion. The underground stem has attached daughter rhizomes which swell terminally to produce daughter tubers (see inset) whilst at greater depth a replacement tuber develops within the tissues of the emptying parent tuber.

years (Dixon and Pate, 1978). Tubers can be sheathed by as many as fifty epidermal layers in plants from certain habitats, but up to twenty layers per plant is a more usual number. The protective sheaths enable the tuber to resist temperatures of 60°C for up to four hours and no doubt enhance its capacity to avoid desiccation in the long hot summers of its native habitat.

D. erythrorhiza will flower only after a summer fire, releasing the small, ornamented seeds (Fig. 2a) in late autumn. Germination is apparently a rare event, occurring in nature only in seeds older than three years. One- and two-year old seeds fail to germinate under a variety of test conditions.

A single plant of *D. erythrorhiza* can produce up to thirteen daughter tubers a season, each tuber forming terminally on a swollen lateral rhizome which develops horizontally from the nodes of the plant's

main stem (Fig. 1). These daughter tubers sprout to produce small plants the following winter, and can produce full-sized leaf rosettes in a matter of three or four seasons of growth (Front Cover). If lateral rhizomes are removed from a plant and stored in pots of moist sand, they will develop small terminal tubers. This indicates that the process of tuber formation can occur on a rhizome without further nutrients or stimuli from the parent.

D. erythrothiza exhibits a circular conformation of its colonies. Each group of plants is up to 2 metres in diameter and contains up to two hundred plants (Pl. A). Rosettes of clones may merge to comprise a continuous lawn of glistening tentacles, which, at the height of the winter, contain a veritable graveyard of insect corpses.

Preliminary studies indicate that in certain habitat situations *D. erythrorhiza* can obtain a significant portion of its annual

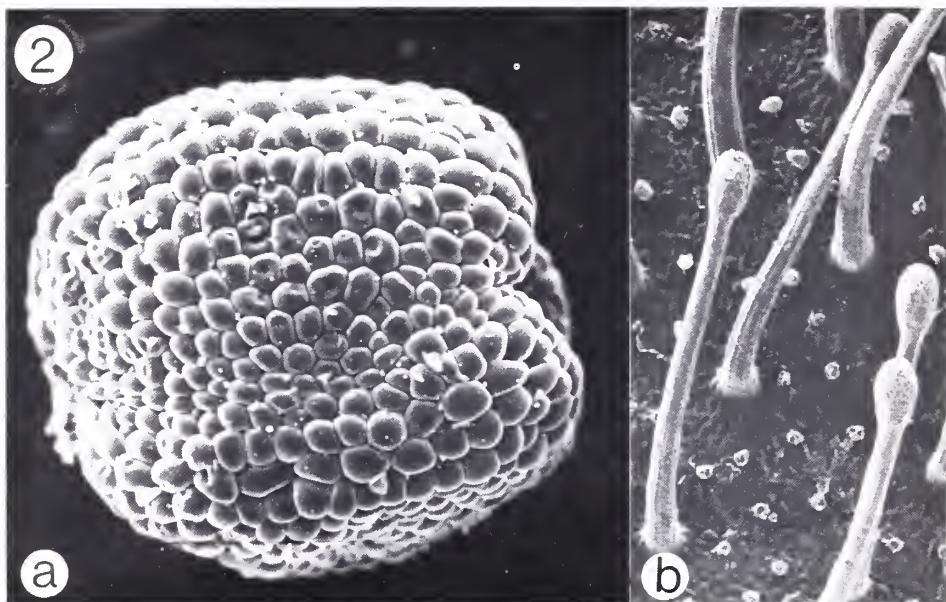


Fig. 2a. Scanning electron micrograph of a seed from *D. erythrothiza* (mag. x200) after application of a thin film of gold-palladium alloy. (Left, above)

Fig. 2b. Scanning electron micrograph of a small area of the leaf rosette of *D. erythrorhiza* (mag. x28). Leaf surface covered with small sessile glands and larger tentacles tipped with swollen glandular heads (mucilage removed). (Right, above)



Pl. A. Densely packed clone of *D. erythrorhiza*.



Pl. B. *D. erythrorhiza* can sport variants within newly emerged clones which are for the main lacking stalked glandular hairs. These plants do not have the ability to digest insects.



The many flower bearing stems of *D. macrophylla* are a familiar sight on granitic rocks throughout the S.W. of Western Australia.

requirement for nutrients by digestion of trapped insects. Isotopic labelling studies of mature plants of *Drosera erythrorhiza* show absorption of the heavy isotope (^{15}N) if fed vinegar flies (*Drosophila melanogaster*) labelled with this isotope. The studies show that the *Drosera* utilizes the nitrogen of the flies with 76% efficiency. Assuming that a similar efficiency of nitrogen digestion were to apply to organisms caught by wild populations of *D. erythrorhiza*, it has been estimated from studies of insect catches in nature that carnivory might account for between one-quarter to one-half of the nitrogen acquired by the *Drosera* plants during a season of growth.

Over-supply of insect prey occurs when an excessive number of organisms are captured by *D. erythrorhiza*. More than four *Drosophila melanogaster*/plant/week (ie a supply of insects equivalent to 0.1 mg N/plant/week) results in carcass decay before plant digestion is complete, and in necrotic areas developing on the leaf.

Plant variants occur which lack the mucilage secreting stalked glands (Pl. B) on the leaf rosette. These "glandless" plants fail to catch prey in habitat situations. Laboratory studies using carbon and nitrogen labelled insects also indicate an inability to digest insect carcasses (Dixon, Pate and Bailey, in press).

Although nitrogen provided from insects is important, other nutrients (eg. phosphorus, magnesium, potassium, calcium, zinc, etc) also come from insects. These nutrients, further nutrients absorbed from soil, and carbohydrates formed in photosynthesis are conserved in the aestivating tubers. Certain key nutrients (eg. phosphorus and nitrogen) are mobilized from vegetative parts to developing tubers at the end of the growing season with over 80% efficiency so that a plant can survive a poor season with virtually no additional intake of nutrients. Indeed, in pot culture there is little loss in plant vigour if tubers are grown in nutrient-deficient white sand watered with distilled water. Vigour is, however, reduced in subsequent seasons. In the wild, tubers

accumulate high levels of phosphorus and other nutrients, especially after a season's growth in soil enriched with the ash of a recent fire.

Repeated severe drought can result in complete death of clones, as occurred recently in Western Australia in the dry seasons of 1976 and 1977.

Plants developing from daughter tubers relocate their subsequent replacement tubers at progressively greater depths by production of a vertical stem or dropper which grows through the base of the parent tuber. Eventually, after a depth of 5 - 8 cm is reached, the plant replaces its tubers *in situ*, to give the sheath-enveloped tubers typical of mature plants (Fig. 1).

On the few occasions when we have discovered seedlings we find that these also engage in a depth-seeking system of tuber replacement. However, because of the high temperature and dryness of the upper soil layers and the small amount of nutrient capital in the original seed, there is a high mortality of seedling plants over the first few summers. Mortality is highest when tubers are still relatively high in the soil profile.

Although the studies to date have concentrated on *D. erythrorhiza*, many other members of the subgenus *Ergaleium* show similar strategies, although habitat differences are vast. For example *D. bulbosa* and *D. gigantea* are often completely submerged in water in seasonally swampy areas, whilst *D. stolonifera* and *D. macrantha* are typical of very dry habitats. Many of the tuberous *Droseras* can be grown from seed or daughter propagules and some produce showy flowers in pot culture (eg. *D. bulbosa*, *D. macrophylla* (Pl. C), and *D. stolonifera*. *Drosera zonaria* (Rear Cover), grows well in pot culture, but like *Drosera erythrorhiza*, requires fire before flowering. Our experience with the Western Australian sand plain *Droseras* is that their tubers should be stored dry at 25 - 30°C in pots of sand through summer. Gradual addition of water to pots in early

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Three Australian Sundews

by Warren Stoutamire

(Dept. of Biology, University of Akron, Akron, OH 44325)

Southwestern Australia is a botanically remarkable area where plants assume growth forms not common elsewhere, where they adapt to their specialized habitats in uncommon ways and where they grow in some of the world's most nutritionally incompetent soils. Sundews are restricted to poor soils and the Western Australian soils, sarcastically referred to by some farmers as "silver loam," are ideal in this respect. More than half the *Drosera* species occur in the southwestern corner of the state between Perth and Albany. The *Drosera* soils which I have tested are acidic with a pH range of 4.8-6.2, are very deficient in nitrogen and usually low in organic matter. Such soils also support a rich orchid flora until cleared for agriculture. All *Drosera* habitats are moist in winter and most are totally dry at the surface in summer. Winter frosts are occasional but never last long and summer temperatures are often above 40°C during the several rainless months. Sundews are dormant during this time, as seeds in annual *D. glanduligera*, as buds perched above the hot sand and gravel in the pygmy species, or as deeply buried white, yellow or red tubers in the other perennial species.

Drosera gigantea (Pl. A, P. 14) thrives in some coastal white sand swamps where it forms large colonies of branched yellow-green 20-100 cm tall plants covered with small white flowers in the September - October spring. It also forms large populations in the wet gravelly laterite soils below granite outcrops in the Darling Range just inland from the west coast as well as farther inland in similar shallow soils over granite. *Drosera gigantea* corms are buried deeply in the gravel and sand and are difficult to extract without digging equipment. The seasonally wet outwash areas are botanically rich in other unusual plants such as ephemeral trigger plants and bladderworts, several showy orchids, kangaroo paws, grass

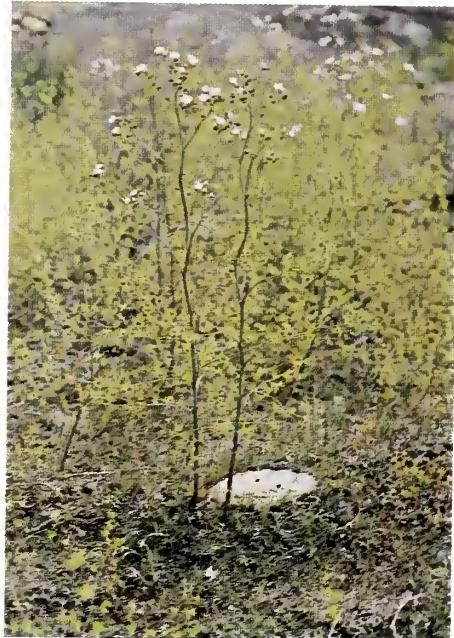
trees and bright-flowered shrubby members of the Myrtaceae and Proteaceae. The vernal pools on the granite have their share of unusual short-lived aquatic plants, including pygmy *Isoetes* species.

Drosera stolonifera is a variable species with several growth forms. Near Perth it grows in the white sand swamps of the coastal plain as luxuriant 4-branched plants, the inflorescence of white flowers emerging from the center of the green cruciform system. Plants seem to flower and seed best after summer brush fires although this may be subjective. They are much more visible after such fires. The Darling range form growing in laterite develops considerable red in the leaves and stems and also flowers profusely after fires.
[* Photo taken (on slide & date)]

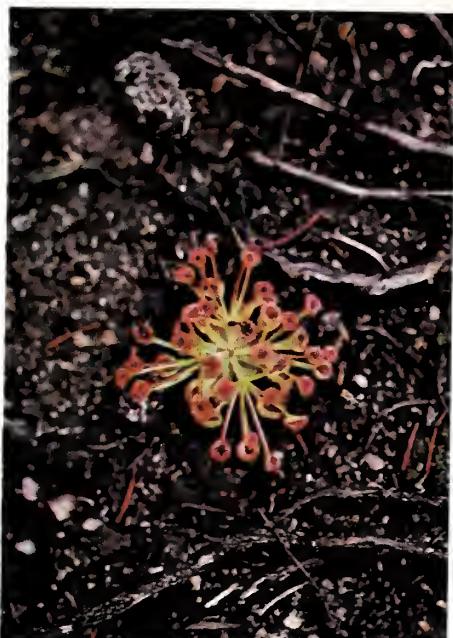
Drosera zonaria grows in sterile white sand where it forms large patches of green, red-edged rosettes. The species flowers so rarely that few botanists have ever seen the event. Leaf rosettes begin to turn brown and begin dormancy early in the spring days, disappearing completely by early summer. While growing it is one of the most colorful but not the largest of the rosette species.

SPECIAL NOTICE

In the June , 1979 issue of CPN on page 45 (CPN 8:45), there appeared a notice by a Mr. Steve Hawkins offering a booklet of CP line drawings for 50 cents. One of the co-editors (DES) has received a letter from an individual who sent for the booklet (50 cents enclosed) in August, 1979, and has not heard anything. A followup letter went unanswered, and co-editor Don Schnell also sent a letter to Mr. Hawkins with again no reply. We are warning others not to send for this booklet until the matter is resolved. In the meantime, we would like to hear from others who sent for the booklet and have or have not received it.



D. gigantea Plate A.
Photo by Warren Stoutamire



D. stolonifera Plate B.
Photo by Warren Stoutamire



D. regia Plate C.
Photo by Jim Miller



D. regia Plate D.
Photo by Jim Miller

DROSERA REGIA

by Bob Ziemer, P.O. Box 4562, Arcata, CA 95521.

When I first received my plant of *Drosera regia* from a friend, it was a small specimen and I grew the plant in a 4-inch pot under grow-lux bulbs in my house. During the first summer, it grew reasonably well but put out only a maximum of 3-inch leaves. Last fall a large amount of salt (probably 10 grams) fell from a skunk skin I was curing into the pot of *D. regia*. By the time I observed this disaster, the plant had completely wilted and the leaves turned black. I leached the plant and sphagnum for 3 days in fresh water. Within two weeks, there was a new leaf emerging but it only was 1-inch long. Later, the plant went dormant and the leaves were only $\frac{1}{4}$ -inch long with no tentacles. I did not realize that these plants had a dormant phase but it lasted from November to February. In mid-February, larger tentacled leaves began to appear. I then transferred the plant to a 10-inch plastic pot filled with live sphagnum moss. The plant is now growing and routinely putting out 16 inch (40 cm long) leaves.

I have been spraying and watering the pot about every 2 weeks with 1/10 strength Hoaglands solution (a complete fertilizer) and occasionally spraying the leaves with fish emulsion. About $\frac{1}{6}$ of the leaf surface of each leaf is covered with spiders, mosquitoes, and flies which have been trapped naturally.

The plant is growing in an unshaded greenhouse which is surrounded by redwood trees and at this time of year (May) receives about 3 hours of direct sunlight. However, many of our days are overcast and the light intensity is often low. Lighting is supplemented with Vita-gro fluorescent lamps on a 12-hour photoperiod. The greenhouse heater is set to go on at 45°F (7°C) and the vent fans go on at 85°F (29°C). Thus the plant receives cool nights and warm days. The night temperature at this time of year will be about 50°F (10°C). Apparently, *D. regia* enjoys these conditions because it grows vigorous and healthy.

(Plates C & D).

Pinguiculas gotta swim, Sarracenias gotta fly.

by D.C. Speirs

(Box 6830, Stn D, Calgary, Alberta, Canada, T2P 2E7)

In the netherworld of taxonomy, the botanist and zoologist seldom cross each other's path. Their Latin nomenclatural systems are independent and a commonly shared name is not particularly upsetting. Thus it is that *Byblis* is a crustacean and *Cephalotus* is a mammal. *Darlingtonia* is not only the cobra plant but also a reptile. And how appropriate that *Dionaea* is both a fly and a fly-trap! With reference to the title, *Pinguicula* must swim because it is a mollusc, and *Sarracenia* flaps its wings because that is what butterflies do.

One of the more interesting nomenclatural cross-connections is that of *Aldrovanda*. There is no animal with that exact name, as far as I can determine, but there are three runners-up in the close-but-not-quite category. *Aldrovandia* is a fish, *Aldrovandiella* is a fly, and *Aldrovandum* is a mollusc. What really makes this interesting is the fact that the original name for the plant was *Aldrovandia*, but the name was misspelled and the error perpetuated by Linnaeus; thus the incorrect version is the one that now stands.

DROSERA LINEARIS

by Donald Schnell

Drosera linearis Goldie, apparently never very common in the past, is a rapidly declining species. Generally, its range is eastern boreal in the United States and Canada, extending into Maine, Michigan and as far west as Saskatchewan (Blue Jay 36: 74-75, 1978). The species was recently rediscovered as a small colony in Crystal Bog, Aroostook County, Maine (Rhodora 81: 145, 1979), and recently additional colonies in the same, large bog have been found (George Newman, personal correspondence). The species was once easily found as far south as Oakland County, Michigan, but has decreased markedly in that area.

Drosera linearis appears less able to compete with other plants than most other carnivorous plants and grows best and often very prolifically in so-called marl bogs or fens (marl fen is probably the preferred wetland term). The latter are wetland areas with a base of sand (usually) covered by a mixture of grass-sedge peat and marl (calcium carbonate). The marl-peat mixture is in small, soft granules and imparts a rather greasy texture to the soil. The fen usually has 1-3 cm of water overlying the marl where *D. linearis* can grow. There are usually widely spaced plants of grasses and sedges leaving many open areas which the linear-leaved sundew is able to colonize. *Sarracenia purpurea* ssp. *purpurea* can also grow in similar habitat where it responds with the so-called "ripicola" growth habit (Castanea 44:47-59, 1979). A typical soil analysis done by me on marl-peat from a good *D. linearis* bog still extant in northern Michigan shows a pH of 8.0, Calcium 9000 ppm, Carbonate positive, Manganese 7.5 ppm and Aluminum 100 ppm. (partial results or more interesting findings listed). There is the usual low N and P, but Potassium was 200 ppm. Other Droseras of the region (*D. rotundifolia* and *D. anglica*) and most Utricularias do not grow well in such soils. (*U. cornuta* is a common exception.)

Frequently, the marl fen is surrounded by and contains island-like hummocks of sphagnum which in many instances has been known to overgrow the bog and eventually impart an acid reaction to it, whereupon it becomes a raised bog of low mineral content. The sphagnum surrounding the fen and in the hummocks supports a rich growth of the other two species of *Drosera*, and additional Utricularias. Many times in a few remaining good locations, one can see an edge gradation around and on the hummocks with *D. linearis* growing in the marl around the hummock, hybrid plants of *D. linearis* x *rotundifolia* (sometimes thought of as "sterile x *anglica*") in the moss of the base of the hummock, and the other two *Drosera* species in the sphagnum at the top.

Even though the reaction of the marl in analysis is basic (see above), the water in the fen is frequently near neutral (pH 7.0) or even slightly acidic (pH 6.8 e.g.), the latter probably reflecting acidification of spring waters percolating through surrounding sphagnum mats before the water spreads out over the open fen. As alluded to previously, *D. linearis* can grow in continuously damp marl soil and in water to a depth of about 1-3 cm; flooding of the fen in very wet weather can produce considerable loss of *D. linearis* plants if the flooding is prolonged. Occasionally, one sees a few individuals growing up on sphagnum and other moss mats, but these plants appear depauperate.

Flowering occurs in mid-summer (mid-July to mid-August) and the shiny, black 0.5-1.0 mm seeds fill large capsules by September. The species will self if not open pollinated, so there is usually abundant seed in a good flowering year.

CULTIVATION — This is difficult outside the species native climate. The plant is acutely attuned to northern photo-period and temperature cycles and aberrant responses to cultivation are common in

areas further south such as North Carolina. Here, the plants tend to go in and out of winter bud stage several times during the spring and summer, and they grow much smaller. However, if one pays careful attention to providing maximum light vs. preventing excessive heating of the growing container, and providing evenly cool dormancy conditions during winter, the plant can successfully be grown to flowering. The seed germinates abundantly *after stratification* (autumn maturing seed), and stores well under dry refrigeration, so propagation to seedlings is easily accomplished. I have found that native (or artificially mixed) marl soil gives the best long-term results. The plants are in plastic pots with drainage holes (these covered with paper toweling to keep soil in while letting water pass) and the pots placed in saucers which are kept filled. Others grow the plants in Sphagnum or other mosses, but my experience has been that while such a system may maintain the plants for one or two years, they are eventually lost. In a northern Michigan marl fen, I have seen the plants growing profusely in cracks of fallen logs lying in the water of the fen!

PRESERVATION, AND WHERE TO SEE *D. LINEARIS* —

While the chief threat to the species seems to be natural environmental change and local specific environmental damage wrought by development, cumulative massive harvesting of plants is obviously to be discouraged since many colonies are quite small. I have mentioned one particularly fine area with probably the best remaining colonies of *D. linearis* in northern Michigan, but will not disclose or further characterize geographically this unprotected area for obvious reasons. Another excellent area that is protected but open to observation is the Petrel Point Preserve owned by the Federation of Ontario Naturalists. This preserve is located on the western shore of the famous Bruce Peninsula in Ontario, the peninsula extending into Lake Huron. There is a boardwalk

from which observations and photographs can be made without disturbing the delicate ecosystem of the fen. Also, the preserve is closely monitored to prevent vandalism which of course is punishable by law. The Petrel Point fens have some of the best *Drosera* stands on the Bruce Peninsula, including some interesting hybrids and back-crosses with particularly large leaves. (Note: Soil analyses were done with the Hellige 697-18 comprehensive soil testing kit, and water pH's were determined in the field with a portable electronic pH meter.)

ADDENDUM

Since completion of the text of this note, a paper has appeared (Michigan Botanist 18: 137-142, 1979) describing in part rediscovered and additional locations of *D. linearis* in the Red Lake Peatland of northern Minnesota.



Drosera linearis in flower. Northern Michigan, July, 1979. Photo by author.



Drosera linearis habitat in northern Michigan. This is a portion of a large marly fen.

Photo by
Don Schnell



Closeup of above plants.

Photo by
Don Schnell

A new *Drosera* record for New England

By Dr. George Newman
(22 Carriage Lane, Bedford, N.H. 03102)

In August, 1978 my family and I visited the northwest portion of Newfoundland. This is a very interesting area with extensive limestone barrens lining the seashore in many areas. The whole peninsula has an arctic to boreal climate with many plants at sea level which are usually found in higher mountains or much further north in Labrador and Greenland. The barrens are covered with *Rhododendron lapponicum*, *Tofieldia pusilla* and *Salix vestita*. *Pinguicula vulgaris* is extremely abundant, being found in small crevices in open, almost dry-appearing areas. These plants tend to be slightly dwarfed, while those found growing in slightly more sheltered areas are much larger. These areas are often subject to high winds and late spring snowstorms. At Port au Choix there are many small ponds scattered throughout the barrens. Surrounding many of these there are shallow zones of water, containing sedges and grasses which are usually found in alkaline soils. Scattered among these there are large colonies of *Drosera anglica*. In some places they are common enough to color the water red. *Drosera* was always in shallow, rather mucky water growing with moss species, but almost never in sphagnum. The drier areas at the edge contained large number of *Drosera rotundifolia* and *Sarracenia purpurea*. *Drosera linearis* was located earlier in the century in the same area; however, I was not able to find it. I have transplanted several clumps of *Drosera anglica* to my bog garden in New Hampshire; it has done well in a mixture of sand and sphagnum peat, with a small amount of limestone added.

Last year, Sally Rooney rediscovered *Drosera linearis* at Crystal Bog in Southern Aroostook County, Maine (see CPN 8: 68, 1979), growing in an alkaline open area. This July, Sally Rooney, Candy McKellar and Les Eastman found another larger stand about one mile distant, growing in shallow

water, often at the edge of moose runs. Les Eastman found a *Drosera* new to New England growing in the same place. This proved to be *Drosera anglica*! This August I visited the larger station with Les and we found many plants of *Drosera linearis*. Scattered throughout an open area of shallow water there were many small clumps of *Drosera anglica*. In slightly dryer areas there were large numbers of *Drosera rotundifolia*, *Drosera intermedia* and *Sarracenia purpurea*. Adjacent areas contained *Utricularia intermedia* and *Utricularia cornuta*. The *D. anglica* was growing in shallow, rather mucky water, occasionally in sphagnum. Most of the surrounding plants were acid lovers as the usual calcifiles were absent. The *Droseras* were identified by leaf shape, position of the stipules and morphology of the seeds. Fortunately the bog is owned by The Nature Conservancy.



D. intermedia with captured craneflies.
Photo by B. Hanrahan.

Publication of New CP Cultivars

by James T. Robinson

(Box 1625, Connecticut College Arboretum, New London, CT 06320)

Please send the following information when submitting CP cultivars for publication:

1. Cultivar name — include the genus and species from which you selected the cultivar. The cultivar name must be in accordance with the Cultivated Plant Code*:
 - a. The cultivar name should be markedly different from the Latin botanical name. English words are usually used.
Each word of the name should begin with a capital letter.
 - c. The name should be enclosed within single quotation marks.
 - d. The name should consist of one or two words, but not more than three words.
 - e. Avoid using the same cultivar name for selections from different species of CP.
 - f. An example: *Fraxinus americana* 'Autumn Purple', an ash cultivar with outstanding fall color.
2. Description — describe what character or characteristics distinguish this individual from typical individuals of the same species. I urge you to propagate

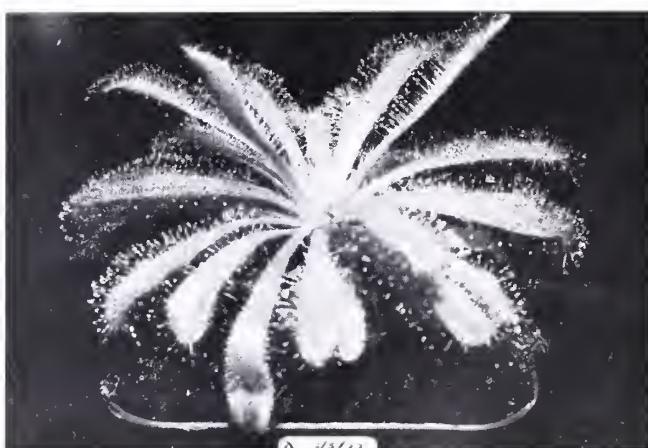
your new cultivar asexually to preserve its unique genetic composition. If possible, distribute plant material to botanical gardens or file a voucher specimen at a major herbarium.

3. Color photograph — optional, but helpful.
4. Your name and address — if someone else discovered the plant, include his name and address.
5. Miscellaneous information — anything else about the cultivar such as origin or location; i.e., found in wild, found in cultivation; year of discovery, location of an herbarium specimen, or botanical garden where cultivar can be seen.
6. Send the above information to me at the address given. I will maintain a file of all material and periodically publish a list of new cultivars in CPN. Publication will include a summary description of each and the name of its author. Upon publication your cultivar will be legitimate.

* *International Code of Nomenclature of Cultivated Plants — 1969* (available from The American Horticultural Society, 701 N. Saint Asaph St., Alexandria, Virginia 22314; price about \$3.00).

D. capensis
x
D. spathulata
Artificial
hybrid

Photo by
David Taylor



Review of Recent Literature

Franck, DH. 1976. The morphological interpretation of epiaescidiate leaves. *Bot. Rev.* 42:345-388.

A thorough review of the various theories of ontogeny of ascidiate leaves in the families Nepenthaceae, Sarraceniaceae, Cephalotaceae and Lentibulariaceae. It is concluded that best evidence indicates that the tubular leaves are derivatives of peltate structure with the upper (adaxial) surface cupped into various tube structures of the families during development, hence *epiaescidiate*. This general concept is applied to each family with additional specifics; e.g. Nepenthaceae wherein the broad laminar part of the leaf is a modified and lengthened leaf base, the tendril is the petiole and the pitcher is the rolled lamina. The phyllodeal theory is rejected; this, the flat leaf structures of some Sarracenias (*S. flava*, *S. oreophila*) are probably not phyllodea, but unexpanded or ensiform leaves. The nature of the traps in *Utricularia* is somewhat variable; some species are clearly modified whole leaves, in others they appear to be modified leaf lobes, and in many it is unclear. Likewise, the aerial leaf-like photosynthetic structures are in some instances modified stems, in others stolons, and in some leaves. DES

Haber E. 1979. *Utricularia geminiscapa* at Mer Bleue and ranger extensions in eastern Canada. *Can. Field Naturalist* 93: 391-398.

In addition to reporting this station located east of Ottawa for the first time, the author also discusses the differentiation of the species from *U. vulgaris* and important ecological considerations. Many of the bogs in the region are craters remaining from bombing range practice in WWII! A detailed description of the species in all phases is also given.

Harms, VL. 1978. The native carnivorous plants of Saskatchewan. *Blue Jay* 36: 71-81.

Keys, brief descriptions, herbarium citations and excellent line drawings along with dot-location maps are features of this good article on the CP of the province which include *Sarracenia purpurea*, *Drosera rotundifolia*, *D. anglica*, *D. linearis*, *Utricularia cornuta*, *U. intermedia*, *U. vulgaris*, *U. minor*, *Pinguicula vulgaris* and *P. villosa*.

Johnson, PH. 1979. Venus' Flytrap. *Gardening* 1: 34-39.

A good popular article on the plant, written mainly from a conservation angle. There is one text error: Seeds of *Dionaea* do NOT require stratification prior to germination since the seed matures in late spring to early summer. The article also features nine full color photos by Donald Schnell, Jerome Wexler and David Thomas.

Schnell, DE. 1979. *Sarracenia rubra* Walter ssp. *gulfensis*: A new subspecies. *Castanea* 44: 217-223.

The fifth subspecies of *S. rubra* recognized by the author is herein formally described. Two B&W photos. (Reprints: DE Schnell, Rt. 4, Box 275B, Stateville, NC 28677, USA).

Slack, Adrian. CARNIVOROUS PLANTS 1979 Ebury Press, London, England W1V 2BP.

This 240 page book is illustrated with sixteen color photographs and many in B&W which were artistically taken by Jane Gate. The author describes all the world genera of CP and explains in detail each of the trapping mechanisms and the ecological niche they occupy in the

world. Many drawings made by the author accompany the explanations and descriptions especially in the chapter that deals with *Nepenthes*. The last section in the book deals with the cultivation of the plants in fine detail for everyone wishing to grow these plants. The two appendices deal with the raising and naming of *Sarracenia* hybrids and the listing of *Nepenthes* horticultural hybrids. The book ends with a list of suppliers of plants and, materials and a glossary of botanical terms used in the text. This book is an ideal text for anyone who is either starting or already growing CP for their enjoyment.

Wheeler, GA and PH Glaser. 1979. Notable vascular plants of the Red Lake Peatland, northern Minnesota. Michigan Botanist 18: 137-142.

Among the carnivorous species discussed, are *Drosera anglica* supported for the first time by a voucher in the state, and *D. linearis* (photo) as a rediscovery in Minnesota. Other companion CP spp. mentioned only are *Utricularia cornuta*, *U. intermedia*, *U. minor*, *Drosera intermedia*.

(Ed. note — The CPN co-editors wish to gratefully acknowledge the assistance of D.C. Speirs of Calgary, Alberta, Canada, in keeping us informed of Canadian publications on carnivorous plants. He has been sending us bibliographic citations or copies of papers and articles, many of which would have been missed in our screening. We appreciate his efforts in helping to keep this section of CPN as complete as possible.)

Drosera peltata
var *gracilis*

Photo by
J.A. Mazrimas



(continued from p. 12)

autumn (Southern Hemisphere) will promote early rosette growth and, in certain species, flower production.

Although natural flowering of *D. erythrorhiza* is usually stimulated by a habitat bushfire over summer or early autumn, removal of tubers from soil and storage in closed paper bags for a week or so, followed by replanting, can result in up to 20% of the tubers producing inflorescences. Burning plant litter on the soil surface of pot grown plants will also induce flowering, but the addition of cold ash to non-stimulated tubers has no effect. Studies have yet to confirm the nature of the stimulus caused by fire. High concentrations of ethylene gas in soil during and after fires may well be a key factor in initiating floral primordia (Smith, 1977).

Not all tuberous *Droseras* are amenable to cultivation. *D. gigantea*, a branched erect species up to 1½ metres tall, inhabits swampy ground and its large tubers (up to 2 cm in diameter) are often buried up to 70 cm deep, usually at the base of a layer of silt or sand overlapping a clay pan. These conditions would be difficult to simulate in culture.

The reader is referred to the articles listed below for further information on the biology of Australian tuberous *Droseras*.

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- Smith, A.M. (1977). Microbial interactions and healthy plant growth. *Journal of Society for Growing Australian Plants* (Picnic Point, New South Wales). 9: 209-212.



A bug (*Cryptopeltis* sp.) cohabiting and gaining nutrients from the captured prey of *D. gigantea*. Photo by Dixon and Pate.

the swamp without trampling them under foot.

Drosera stolonifera — what a sight! A bush fire had been through this part of the swamp the year before. Every *D. stolonifera* was in bloom. From each rosette at ground level four to five branches grew, with a rosette of traps every four to five cm along the stem, up to a height of 30 cm. Each branch was topped with a spike of white flowers — the flowers' perfume was out of this world! *Drosera zonaria* I found on the higher ground up from the swamp. Pure white silica sand with no leaf mould is where these plants love to grow. They don't carpet the ground like *D. erythrorhiza*, but confine themselves to small groups here and there in numbers up to 20. The fan-shaped leaves are green with the margins of the leaves a vivid red. The fan-shaped leaves are arranged in a perfectly balanced circle.

Drosera menziesii with their pink flowers up to 4 cm across on totally red coloured plants

grew almost weed-like.

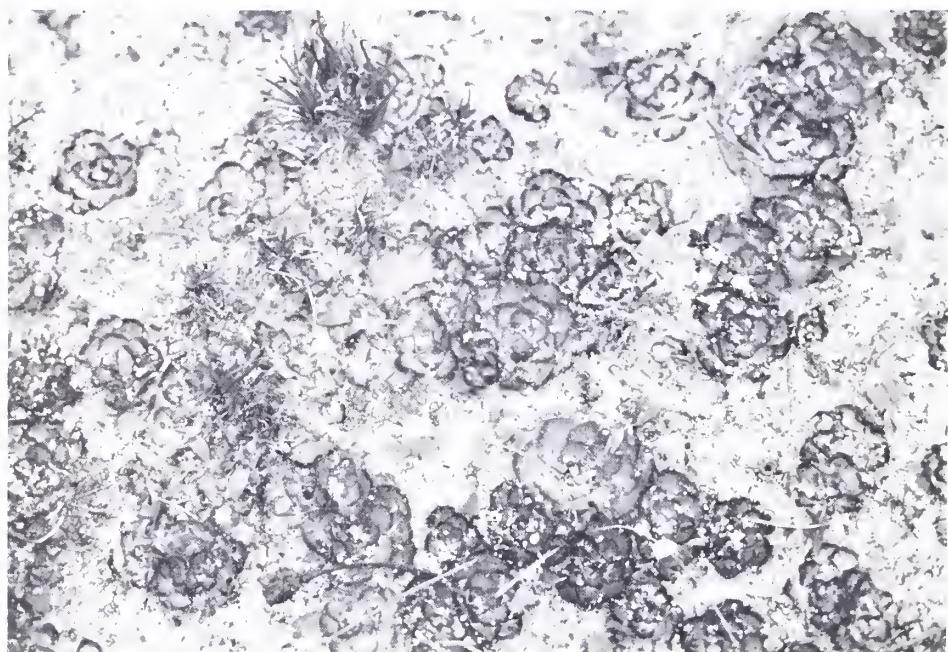
Drosera stricticaulis with its upright appearance and shield-shaped traps, topped with pink blooms, were scattered here and there throughout the swamp.

Drosera macrantha and *pallida*, the big climbers up to 1 m long, curled their way up through every shrub. With the sun shining behind them, they look magnificent.

Drosera glanduligera was in abundance. Truly a beautiful *Drosera* with its *D. burmanii* type leaves and its vivid metallic orange flowers. It's a pity this plant is an annual.

Robert Oliver and myself collected quite a few CP on this trip, and I'm happy to say most of these CP are scattered across Australia and the USA in CP growers' collections, where they will be propagated. It is hoped that these species will be saved.

* Robert Oliver will be living in California from May '79 for approximately two years. Maybe some CPNers will want to make contact. Robert will send me his address when he is settled.



Drosera zonaria in habitat - Ongerup, W. Australia on Sept. 18, 1972.
Photo by W. Stoutamire.

THE 1980 LIST OF CP BOOKS

Not available through CPN. Order direct from publisher or your local bookshop.

* = books intended primarily for children.

1. Insectivorous Plants, Charles Darwin, AMS Press, 1893, 56 E. 13th St., N.Y., N.Y. 10003, \$27.50.
2. Plants that Eat Insects: A Look At Carn. Plts.*: Anabel Dean, Lerner Publications, 1977, 241 First Avenue, Minneapolis, MN 55401. \$3.95.
3. Plants of Prey in Australia, Rica Erickson, Univ. of W.A., Press 1968; World Insectivorous Plants, P.O. Box 303, Grant, FL 32949, Cloth, \$12.00 ppd.
4. Animals & Plants that Trap*: Phillip Goldstein, Holiday 1974, Holiday House, Inc., 18 E. 53rd St., N.Y., NY 10022. \$5.95.
5. Nepenthes of Mt. Kinabalu (in Eng.), Kurata, S., Sabah Nat'l. Park, World Insectivorous Plants, Box 283, Grant, FL 32949.
6. Carnivorous Plants, F.E. Lloyd, Dover Pub., Inc., 180 Varick St., N.Y., NY 10014, Soft cover (1976), \$4.50.
7. The World of Carnivorous Plants, J. and P. Pietropaolo, R.J. Stoneridge, 1974, Peter Paul Nurseries, \$6.30.
8. Insect-Eating Plants*, L. and G. Poole, T.Y. Crowell, 1963, 666 Fifth Avenue, N.Y., NY 10003, \$4.50.
9. Plants that Eat Animals*, J.H. Prince, Nelson 1978, Thomas Nelson, 407 Ave. S, Nashville, TN 37203, \$7.95.
10. CP of the U.S. and Canada, D. E. Schnell, John F. Blair, Publisher 1976, 1406 Plaza Dr., SW, Winston-Salem, NC 27103. \$19.95 + Shipping.
11. Carnivorous Plants, Randall Schwartz, Avon Books (soft cover) 1975, 959 Eighth Ave., N.Y., NY 10019, \$1.25.
12. Carnivorous Plants, Adrian Slack, MIT Press, 1979, 28 Carleton St., Cambridge, MA 02142, \$19.95.
13. Cultivating Carnivorous Plants, Allen Swenson, Doubleday & Co., 1977, Garden City, NY 11535, \$7.95.
14. Carnivorous Plants*, John F. Waters, Franklin Watts, Inc., 1974, 845 Third Avenue, N.Y., NY 10022. \$4.90.

SPECIAL NOTICE

Mike Goddard (90 S. Yates, Denver, CO., 80219 tel. 303/922-0452) and Paul Hieple (tel. 303-238-4808) are starting a CP club in the Denver area. Interested persons can write or call for more details.

COMING IN JUNE

-*S. flava* variants
a color reference

-CP growing the
Unique Way—
report from
Downunder

-Beginner's
Corner—
Cephalotus

CP SOURCES

Name and Address	Cat.	Price	Stock
Carolina Exotic Gardens P.O. Box 1492 Greenville, N.C. 27834	75¢		<i>Dionaea, Drosera, Sarracenia, Darlingtonia, Pinguicula Utricularia, live Sphagnum</i>
Country Hills Greenhouse Rt. 1 Corning, OH 43730	\$1.50 refundable with order		<i>Nepenthes</i>
Exotic and Bizarre Plt. Nursery Wandena Rd. Bullsbrook East; West Australia 6084	\$1.00		<i>Cephalotus, native Drosera, Nepenthes and C.P. seed.</i>
Marcel Lecoufle 5, Rue de Paris 94470 Boisse St. Leger FRANCE	inquire		<i>Cephalotus, Darlingtonia Drosera, Dionaea, Ping- guicula, Nepenthes, Sarra- cenia.</i>
Carnivorous Gardens P.O. Box 331 Hamilton, N.Y. 13346	\$1.00		<i>Cephalotus, Dionaea, Drosera, Ping., Nep., Sarracenia, Utric. & Byblis liniflora</i>
Peter Pauls Nurseries Canandaigua, NY 14424	25¢		<i>Sarracenia, Dionaea, Drosera, Utric., Darlin., Nep. seed, Ping., live Sphagnum.</i>
Plant Shop's Botanical Garden 18007 Topham St. Reseda, CA 91335	\$1.00 refundable with order		<i>Drosera, Byblis l., Ping., Sarr., Nepenthes, Cephalotus Dionaea, Utricularia.</i>
Whispering Pines Nursery P.O. Box 119 Bastrop, TX 78602	free		Various CP
World Insectivorous Plants P.O. Box 303 Grant, Florida 32949	50¢		<i>Cephalotus, Dionala, Drosera, Drosophyllum Nepenthes, Sarracenia, Aldrovanda, Pinguicula, Byblis l., Utric., Heliamphora.</i>

The co-editors and CPN do not endorse any of the above vendors. This is only being provided as a service to our subscribers. Information correct at time of receipt. Please contact them for further information. Not responsible for omissions. Inquiries for inclusion in future lists should include a catalog/price list of CP available, cost of catalog and address. Send information to J.A. Mazrimas; 329 Helen Way, Livermore, CA 94550.



WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please circle the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:

Arboretum, Want Ads
California State University
Fullerton, CA 92634

Cliff Berger, Jr., Rural Route #6, Box 146, Plymouth, Indiana 46563
(WB) *Larix laricina* -4 or 5 seedlings, any *Utricularia*, *Sarr. purpurea* ssp. *purpurea* f. *heterophylla*, any *Sarr. purpurea* hybrid (possibility of growing southern forms in the north through hybrids with this hardy form), *Sarr.. rubra* ssp. *jonesii*, *Sarr. flava*, any bog plants associated with carnivorous plants.

William Clemens, 7410 Lime St., #E, La Mesa, CA 92041 (WTB) *Byblis gigantea* (seed only), *Cephalotus follicularis*, *Drosera regia* (seed or plants), *D. petiolaris* (seed or plants), *D. schizandra* (seed or plants) *D. trinervia* (seed or plants), *D. villosa* (seed or plants), *Pinguicula caudaia* (seed or plants), *Heliamphora* (any species, plant, seed, or cutting), *Pinguicula grandiflora* (seed or plants), *P. lusitanica* (seed or plants), *P. primuliflora* (seed or

plants), *P. ionantha* (seed or plants), *Drosera burmanii* var. *dietrichiana* (seed or plants), *D. glanduligera* (seed or plants), *D. montana* var. *robusta* (seed or plants), *D. whittakeri* (seed or plants). (TS) *Sarracenia purpurea* pur. (seedlings), *Drosera burkeana*, *D. brevifolia*, *D. rotundifolia*, *D. binata* (asstd cultivars), *Darlingtonia californica*, other species CP too few to mention.

Jim Emrich, 423 Morrison, Fremont, Ohio 43420 (WB) cuttings and/or plants of any *Nepenthes* species, any species of *Cephalotus*, live sphagnum moss, giant rhizomes *Dionaea muscipula*, *Colchicine*.

Anthony B. Ford, 320 E. O'Keefe, #4, Palo Alto, CA 94303 (WB) *Drosera arcturi*, any Australian rosetted sundew EXCEPT *D. hamiltoni*, *Heliamphora heterodoxa*, *H. nutans*, *H. minor*, *Drosera linearis*. (WTS) 6 good sized *Dionaea*, leaf cuttings of *Drosera capensis*, *D. binata* (typical), *D. adelae*, *D. anglica*.

Reinhard Matthes, Auf der Toterloh 3, D-4790 Paderborn, W. Germany (WB) seed, plant or cutting, *Drosera regia*, *D. schizandra*, *D. cistiflora*, *D. stolonifera*, *D. macrophylla*, *Heliamphora* (any species), *Nepenthes rajah*, *Sarracenia x Excellens*.

SPECIAL NOTICE

An international flower show will be held in Montreal, Canada from 17 May to September 1, 1980. It will feature many indoor and outdoor exhibits. For further information please contact: Les Floralies Internationales de Montreal, Bureau du Commissaire general, 360, rue Saint-Jacques, Montreal (Quebec) Canada H2Y 1P5.



D. zonaria, showing the concentric arrangement of rosette leaves.

Photos by K.W. Dixon and J.S. Pate