CARNIVOROUS PLANT NEWSLETTER

VOLUME 16, Number 2 JUNE

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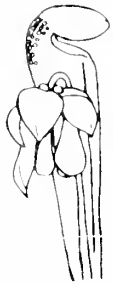
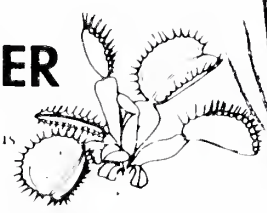


CARNIVOROUS PLANT NEWSLETTER

Official Journal of the International Carnivorous Plant Society



Volume 16, Number 2
June 1987

ON THE COVER: *Sarracenia* x *exornata* cv. 'Moore's Melody', a new cultivar of *Sarracenia*. Article, on page 39, by TL Mellichamp and Rob Gardner. Photo by TL Mellichamp.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to ICPS c/o Fullerton Arboretum, CSUF, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to ICPS. **(See "Notice" on page 57.)**

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 December 1987 issue is October 1, 1987.

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Sarracenia alabamensis

SARRACENIA ALABAMENSIS subsp. *ALABAMENSIS*

Scientific Name: *Sarracenia alabamensis* F.W. Case and R.B. Case, subsp. *alabamensis*. *Rhodora* (1974) 76:653.

Common Names: Alabama canebrake pitcher plant (Case and Case, 1974), canebrake pitcher plant (Lucas & Synge, 1978).

Species Convention Status: Placed on Appendix I in 1983.

Synonyms: *Sarracenia rubra* Walter subsp. *alabamensis* (F.W. Case and R.B. Case) Schnell.

Technical Description: Spring leaves dimorphic or trimorphic (pitchers), clear green to yellow-green, suffused strawberry-red in the upper-third when young, and often strongly maroon-veined only on the basal one-third (inside) of the hood, small, glabrous, 17-50 cm long, recurved; mouth of pitcher 0.7-3 cm wide; summer leaves (pitchers) finely and densely pubescent, 55-72 cm long, not recurved, mouth of pitcher 1.7-6.7 cm wide, soft and thin-textured, often distinctly bright gold-colored or yellowish-green; hoods large, undulate, conspicuously reflexed margins with maroon veins as present in spring leaves; pitcher rim loosely rolled, lacking maroon; juncture of the rim and the lateral wing strongly indented; phyllodia seldom produced or not at all; rhizome densely branched; flowering scapes numerous, 27-57 cm long; sepals 2-3 cm x 1.2-2.0 cm, ovate, maroon-green streaked; petals 2.6-4.2 cm x 1.6-2.3 cm, often erose-denticulate on the margin, maroon of various shades; anthesis from late April to early June; fruit a capsule, 0.6-1.0 cm wide when mature.

Non-technical Description: Leaves of two or three different kinds, there are mainly small and large pitchers. The small pitchers arise in the early spring, they are hairless on the outside and have distinct maroon veins on the upper inside portion of the tube. The summer leaves are covered with dense short hairs, they have a golden tint with maroon veins as in the spring leaves. The pitcher rim is slightly rolled and lacks the maroon venation. The flowers are elevated on unbranched stalks that arise directly from the ground. the flowers point downward (nodding), their petals are maroon, and often have fine, irregular teeth on the ends.

Distribution: Open bogs of Alabama, United States.

Population: Colonies range from small clumps to reportedly a group of 100 plants in a 7 x 15 m area. An estimated 500 plants existed in a total of six known localities in 1976 (Lucas & Synge, 1978).

Trade Relevance: Local newspaper advertisements wanting to buy the plants caused the plundering of one locality in 1975 (Folkerts, 1977; Gibson, 1976). Commercial dealers ship these plants mostly as rhizomes.

Propagation: Horticulturists grow this species successfully from seed and tissue culture is employed for large scale clonal reproduction. Division of crowns and rhizomes has been used, although this is not a preferred method because a large amount of plant material is needed.

Similar Species: As observed by McDaniel (1966) and Kral (1983), the taxonomic status of these Alabama plants is controversial. Some researchers, such as D. Schnell, believe it is a shade variant or semispecies of a highly variable superspecies, *S. rubra*. Case and Case (1974) emphasized, however, that *S. alabamensis* subsp. *alabamensis* differs from all other taxa of *Sarracenia* by producing dimorphic leaves (recurved, short spring pitchers, and longer summer pitchers) and also phyllodia (reduced foliar organs).

"The spring pitchers of *S. alabamensis* ssp. *alabamensis* differ markedly in developing a curved form and in lacking the external dark maroon coloring of the veins, pitcher rim and hoods found in *S. rubra* and *S. jonesii.* The summer pitchers, straight and usually much larger and more tapered than those of *S. rubra* (not *S. jonesii),* differ from those of both taxa in possessing a softer texture, a visibly fine pubescence and a paler yellow-green color. The veins are maroon colored primarily only on the inside of the pitcher tube. The greater expansion of the hood, the stronger reflexion of the hood neck margins, the strongly coiled orifice rim, and overall yellowish-green coloration are also good distinguishing characters (of subsp. *alabamensis)"* (Office of Endangered Species. 1980. U.S. Fish and Wildlife Service).

Other similar species within the genus *Sarracenia* are *S. flava, S. oreophila,* and *S. alata.*

Members of the Asian genus *Nepenthes* are similar because they produce pitchers; although they are easy to distinguish because they form vines and the pitchers are usually suspended and pipe-shaped.

References:

Case, F.W. and R.B. Case. 1974. *Sarracenia alabamensis,* a newly recognized species from central Alabama. *Rhodora* 76: 650-665.

Folkerts, G.W. 1977. Endangered and Threatened Carnivorous plants of North America, pp. 301-313, in France, G.T. and T.S. Elias, eds., *Extinction is Forever.* New York Botanical Garden, Bronx, New York.

McDaniel, S.T. 1966. A Taxonomic Revision of *Sarracenia* (Sarraceniaceae). *Bull. Tall Timbers Research Station* 9:1-36.

Office of Endangered Species. 1980. Status Report-*Sarracenia alabamensis.* U.S. Fish and Wildlife Service, Dept. of the Interior.

References For Additional Illustrations:

Case, F.W. and R. Case. 1976. The *Sarracenia rubra* Complex. *Rhodora* 78(814): 293, 314.

Schnell, Donald E. 1977. Infraspecific Variation In *Sarracenia rubra* Walt. Some Observations. *Castanea* 42: 154, 156, 157, 158, as *S. rubra* subsp. *alabamensis.*

SARRACENIA OREOPHILA

Scientific Name: *Sarracenia oreophila* (Kearny) Wherry, *Bartonia* 15: 7-8 (1933).

Common Names: Pitcher plant, green pitcher plant, trumpets, bugle grass, bog-bugles, dumbwatches, watches, buttercups, Eve's cups, frog bonnets.

Species Protection Status: Placed on Appendix I in 1981 and on U.S. Endangered Species List in 1979.

Scientific Synonyms: *Sarracenia flava* var. *oreophila* Kearny.
Sarracenia catesbaei Mohr *et al.*

Technical Description: Leaves dimorphic; phyllodial leaves falcate to linear 5-18 cm long, 0.50-3.5 cm broad with a thin clasping base, more numerous than the pitchers, persistent, developing before and after the flowers; pitchers green to yellow-green, 20-75 cm high, 6-10 cm wide at the orifice; the orifice subtended by a hood with a blade, suberect, reniform to obovate, apiculate, slightly constricted and strongly revolute at the base, adaxial surface glabrous, internally glandular pubescent, acute to caudate at the apex; internal pitcher veins maroon; rhizome 1-1.5 cm thick; flowers greenish-yellow, pleasant smelling, nodding, 5-merous; scape 45-70 cm long, 3-4 mm thick; petals 4-5.5 cm long, yellow; apical portion 1.4-1.7 cm wide, obovate to elliptic; sepals 3-5 cm long, 2.4-3 cm wide; style disk 5-8.5 cm

Sarracenia oreophila

wide; fruit a 5-valved loculicidal capsule; seeds 1.8-2.0 mm long, irregularly obovoid-pyriform, strongly tuberculate-areolate.

Non-technical Description: There are two types of leaves. One type, the pitchers, are numerous, 20 to 74 cm high by 6 to 10 cm broad, erect, and form a hollow space that traps insects. The other type are smaller basal leaves, between 5-18 cm long and sword-shaped. The pitchers are covered at the top by a hood that is suspended over the opening, the hood is slightly constricted at the place where it is joined to the pitcher. Within the pitcher there are distinct maroon veins. The flowers are greenish-yellow, pleasant smelling, and on a long stalk that projects from the ground. The flower stalks are about as long as the pitchers.

Distribution: South-east United States in Alabama and Georgia.

Population: These plants are restricted to moist mountainous areas, where they are isolated in small populations, and are alarmingly rare. The main threats are habitat destruction and commercial exploitation.

Trade Relevance: Pitcher plants have become extremely desirable ornamental plants. The volume of world trade is unknown but it is thought that trade among private collectors is most detrimental to remaining wild populations. Commercial dealers ship this species mostly as rhizomes.

Propagation: Propagation of the green pitcher plant is difficult. Horticulturists can divide the rhizome successfully. This species has narrow tolerance limits and is difficult to maintain in cultivation.

Similar Species: Identification of most members of the genus *Sarracenia* require considerable expertise. The most similar species are *Sarracenia flava, S. alabamensis* ssp., *S. jonesii, S. alata* and *S. rubra.* Controversy exists over the taxonomy of these taxa because of extreme similarity of appearance and because they may form hybrids. The Asian *Nepenthes* species bear a resemblence to *Sarracenia* spp.; but *Nepenthes* spp. are usually climbing vines with pitchers suspended in mid-air.

References:

Slack, A. 1979. *Carnivorous Plants,* M.I.T. Press, Cambridge, Massachusetts.

Troup, R.R. Jr. and S. McDaniel. 1980. Current Status Report On *Sarracenia oreophila,* Office of Endangered Species, U.S. Fish and Wildlife Service, Dept. of the Interior.

Wherry, E.T. 1933. The Appalachian Relative of *Sarracenia oreophila, Bartonia* 15: 7-8.

SARRACENIA JONESII

(Illustrated on Back Cover)

Scientific Name: *Sarracenia jonesii* Wherry, *Journ. Wash. Acad. Sci.* 19:385 (1929).

Common Name: Upland red pitcher plant, mountain sweet pitcher plant, Jones sweet pitcher plant.

Species Convention Status: Appendix I, listed in 1983.

Scientific Synonyms: *Sarracenia rubra* Walter subsp. *jonesii* (Wherry) Wherry.
Sarracenia rubra Walter forma *jonesii* (Wherry) Bell.

Technical Description: Leaves monomorphic, green; veins purple; hood veins maroon; pitchers glabrous, 21-73 cm high (average 45 cm); petioles 1/4 to 1/3 the length of the pitcher, the mouth of the pitcher 1-4 cm (average 2.84 cm); the tube becoming abruptly expanded in the uppermost portions; often a notch-like fold is formed on the adaxial face of the pitcher, with a corresponding bulge in the abaxial face, 1-4.2 cm wide; lateral wing of the pitcher very narrow; neck of the hood long; hood ascending, held high over the mouth, cordate, its

margins weakly to moderately reflexed, 2.4-6.5 cm long x 2.4-5.4 cm wide; rhizomes only moderately branched; flowers on scapes, few to numerous per plant, 32.5-69.6 cm long; sepals 2.5-3.5 x 1.5-2.0 cm broadly ovate, moderately reflexed, maroon or green-maroon mottled; petals pendant, 3.0-4.5 x 2.0-2.8 cm, often with a distinctly shovel-shaped distal lobe, maroon; anthesis in late April into early June, flowers lasting about seven days in cultivation.

Non-technical Description: Leaves are numerous, primarily of one type. Pitcher-shaped tubular leaves 21 to 73 cm high, with the tubular portions on a short stalk 1/3 to 1/4 the length of the tube. They are green with maroon veins on the inside of the hood. the hood blade is held over the mouth, it is heart-shaped. There is a lateral wing that runs down the side of the pitcher. The flowers are greenish with maroon spots, borne on tall stalks arising from ground level and about as high as the pitchers. The flowering time is early to mid-spring.

Distribution: Localized in the Mountains of North Carolina, and adjacent South Carolina, United States.

Population: Extant populations are located in rapidly developing tourist areas (Folkerts, 1977).

Trade Relevance: Commercial dealers have over-collected in many previously known habitats. The plants are most easily shipped as rhizomes.

Propagation: Pitcher plants are propagated by seed, but other methods are now used to clone them; tissue cultures and rhizome divisions are the most successful.

Similar Species: Members of the *S. rubra* complex are most similar in pitcher size and coloration: *S. alabamensis* supsp. *alabamensis (S. rubra* subsp. *alabamensis), S. alabamensis* subsp. *wherryi (S. rubra* subsp. *wherryi), S. rubra* subsp. *rubra.*

The taxonomy of this complex is controversial because of extreme similarity of appearance and potential hybridization.

Other similar species are *S. oreophila, S. alata,* and *S. flava.*

Sarracenia species may be confused with *Nepenthes* species; however *Nepenthes* originate from Asia and generally form climbing vines with suspended, pipe-shaped pitchers.

References:

Folkerts, G.W. 1977. Endangered and Threatened Carnivorous Plants of North America, pp. 301-313, in France, G.T. and T.S. Elias, eds. *Extinction is Forever.* New York Botanical Garden, Bronx, New York.

Case, F.W. and R.B. Case. 1976. The *Sarracenia rubra* Complex. *Rhodora* 78(814): 270-325. pp. 292, 293.

Office of Endangered Species. 1980. Status Report-*Sarracenia alabamensis.* U.S. Fish and Wildlife Service, Dept. of the Interior.

Schnell, D.E. 1977. Infraspecific Variation in *Sarracenia rubra* Walt.: some observations. *Castanea* 42: 149-170. Pages 154, 158, as *S. rubra* subsp. *jonesii.*

Sarracenia illustrations (pages 31, 34 and 60), courtesy of the Smithsonian Institution and the Department of the Interior. Drawn by Cathy Pasquale under contract to the Smithsonian Institution to accompany manuscript identification sheets being developed for a CITES manual. Materials supplied by R.A. DeFilipps, Smithsonian Institution and Doug O. Fuller, TRAFFIC (USA)-World Wildlife Fund.

T.L. Mellichamp was corresponding editor.

J.A. Mazrimas produced the photographs of the illustrations.

THE FORMATION, PUBLICATION, AND REGISTRATION OF CULTIVARS

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In 1979 CPN (vol. 8, p. 79) was designated the official registration authority for cultivars of carnivorous plants. This was done in response to an increasing need for communication among people interested in growing carnivorous plants (CPN vol. 8, p. 51. June 1979). At that time and subsequently (CPN vol. 9, p. 20. March 1980) the proper procedure for describing and naming cultivars was discussed, and the first cultivar registration came in 1981 *(Drosera filiformis* (California grex) 'California Sunset' - CPN vol. 10, p. 95).

According to the International Code of Nomenclature for Cultivated Plants (1980)[1], the International Carnivorous Plant Society can become a nonstatuatory cultivar registration authority merely by agreement of the parties (the members) concerned. We received no notice of disagreement from anyone, and therefore the ICPS became the registration authority for carnivorous plant cultivars worldwide, and the periodic listing of cultivar registrations will occur in CPN. The statement [that there is no designated registration authority] on page 9 in the new book "Carnivorous Plants of the World," by James and Patricia Pietropaolo, is thus wrong.

The purpose of a registration authority is to see that the rules and recommendations of the Cultivated Code are followed in naming cultivars and hybrids of cultivated plants, and to maintain a listing of these cultivars in an easily accessible source.

To review, the term "**cultivar**" stands for *"cultivated variety"* and represents a highly desirable specimen with recognizably unusual or distinctive features that is propagated under cultivation by man. It may have *originated* in the wild or in someone's collection, either as a chance seedling of a species, or as a seedling of a natural or man-made hybrid. The point is that it is a *selection* of something and continues to exist only in cultivation. The plants are usually propagated vegetatively, by division (for example *Sarracenia),* cuttings *(Drosera* and *Dionaea),* or tissue culture (any cp); but, of course, annuals, like some *Drosera,* may be propagated by seed.

The cultivar name follows the scientific name, or hybrid name (see below), is in English (or whatever your native language is), is capitalized, and is in single quotes ('). The Cultivated Code states: "A cultivar name, when immediately following a botanical or common name, must be distinguished clearly from the latter, either by placing the abbreviation cv. before the cultivar name, or by some typographic device, preferably by enclosing it within single quotation marks."

In addition to the cultivar name of a selection, you may be dealing with a hybrid (either man-made or natural) between two, or more, species. If it is a natural hybrid, found in the wild, it should have a "**hybrid name**" in Latin according to the Code. For example, the hybrid between *Sarracenia flava* and *S. purpurea* has been given the hybrid name *Sarracenia* x *catesbaei.* The "X" (times sign) indicates that it is a hybrid. Hybrids that have not been given hybrid names may be referred to by their **hybrid formula,** such as *Sarracenia flava* x *S. oreophila,* in which the two parents are mentioned (in alphabetical order). Now, since these

latter two species could never hybridize in the wild (since they don't grow together), their hybrid should not receive a latinized hybrid name in cultivation. Instead, and this is very important, the hybrid combination should receive a **collective epithet,** or **collective name.** A collective name is the single designation -word or phrase of not more than three words in a modern language -that covers all the progeny of a particular hybrid combination. That collective name applies to the progeny no matter how often such a cross is made, or who makes it. The collective name is usually given after the genus name and is placed in parentheses (). The cultivar selection would follow. The collective name thus becomes a kind of "common name" given to a group of seedlings (a grex) resulting from crossing two or more parents. The parents may be species, or hybrids themselves. For example, the name *Drosera filiformis* (California grex) 'California Sunset' shows all of these elements, though you would have to read the published description to determine the details: a cross between *D. filiformis filiformis* and *D. filiformis tracyi* resulted in a group of hybrid seedlings [a grex] called "California;" a single specimen was selected and named 'California Sunset' as a cultivar. The purpose of the collective name is to identify a hybrid cross and to be able to trace back to the parents; the purpose of the cultivar name is to identify a specific selection and identify it in cultivation. The collective name could refer to many more individuals than a cultivar name. You would name the cross first (collective name) and then a cultivar (selection). This procedure has worked well for many years among orchid hybridizers, who have to keep up with thousands of crossed and selections a year. Rhododendron breeders, on the other hand, do not name crosses (no collective names), only selections (cultivars). In actual usage, the collective name may be very useful to identify the ever increasing number of CP hybrids; while the cultivar name may become more important as specific selections are made. The Cultivated Code recommends that both names be used when formally writing about hybrids and cultivars.

The cultivar is called a "selection" because it was chosen from among a group for its distinctive features, and is one of the "best" for some reason. The old saying "select the best and discard the rest" may be applied to many plants grown from seed in cultivation. While you may not literally discard all of your *Sarracenia* seedlings, certainly only the most outstanding specimens should be given cultivar names after a rigorous evaluation procedure. These cultivars then may become the plants that will be propagated *en masse* (normally by tissue culture) and be released for sale to the hobbyist grower or even the general public in some cases. Pitcher plants sold now to the public in the U.S. are generally wild-collected plants.

The value of having a cultivar is that you will know exactly what you are getting because it will be an exact duplicate, or clone, of the original selected specimen. And of course, it will cost more than just any old seedling. One may also select better-than-average seedlings from among a batch and offer those for sale under a collective name, but that is still not the same as offering named cultivars of outstanding selections. It is becoming more likely that tissue-culture will be the method for mass-producing CP. A single piece of a unique specimen would be very expensive if you had to wait and just divide the plant every year as it grows.

In order to accomplish valid publication of collective and cultivar names, you must:

1. publish the name so that it becomes distributed to the public (like in CPN)
2. publish it in a dated publication (not an undated nursery catalog, for example)
3. give a description of the plant.
4. it is recommended that you try to indicate how it differs from related cultivars, and that a color illustration be provided.

5. oddly enough, the Cultivated Code states that publication is NOT valid if it is against the expressed wish of the originator of the plant, or if the cultivar does not really exist.

The Cultivated Code recommends the following guidelines for the guidance of registration authorities [realize that cultivar names and collective names may be *published* in any suitable publication; **registration** is a separate process]:

New names submitted for registration should be accompanied by the following particulars:

1. name and address of the originator or introducer
2. name of the describer or namer, if the cultivar has been previously described, together with full reference to the date and place of publication. [A cultivar may have been named and described in the past, and just now be registered by someone else.]
3. the parentage, when known
4. details of observations or tests for distinctness, including date and place of testing.
5. a description, if not previously provided.

James T. Robinson (Box 1625, Connecticut College Arboretum, New London, CT 06320) is official registrar for CPN and information should be sent to him.

[1] A copy of the Cultivated Code is available from The American Horticultural Society, Mt. Vernon, Virginia 22121, USA. Inquire as to price.

NEW CULTIVARS OF *SARRACENIA*

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and

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We are presenting here a five cultivars of species and hybrids from various sources (as indicated) that we have been observing and evaluating seriously for at least two full years. One should not select cultivars haphazardly; they must prove themselves to be outstanding plants and the evaluator must consider the criteria carefully. Our evaluation criteria consisted of a consideration of:

Plant habit: good growth form with the leaves stiffly erect, not affected by wind or rain;

Plant size: was it compact; could it be grown under lights or in a small terrarium.

Leaf coloration: was there distinctive venation, good colors, interesting contrasts, a fall color change, etc.

Winter form: did the leaves retain color and substance better than average under cold but non-freezing winter dormancy.

Propagation: was the plant a vigorous grower, easy to divide.

Leaf production: was it constant, or seasonal.

Flowers: were they attractive, were they fragrant.

(Cont'd.)

These were the main criteria; of course, not every specimen rated highest in all categories, but they had to be above average in some important characteristics.

The new selections that we are describing and registering here are, to our knowledge, the first *Sarracenia* cultivars designated in the United States. Our aim is to have them propagated commercially and make them available inexpensively to collectors in the near future. Please do not inquire about them now unless you are willing to pay a great deal of money for a division!

Photographs and herbarium specimens of these cultivars have been deposited in the herbarium of the University of North Carolina at Charlotte (UNCC). All cultivars have been grown and tested at one or (in almost all cases) both authors' institutions. These particular hybrids are known to occur in the wild, and have already been named (See Bell 1952, Pietropaolo 1986, and Schnell 1976 for more information on the hybrid names). Photographs of each cultivar are presented here also, though the colors may not necessarily have reproduced true to life. (Photographs on opposite page and cover).

1. ***Sarracenia* x *catesbaei* 'Sun Warrior'**

A selection of the well-known hybrid between *S. flava* and *S. purpurea*. It originated as a seedling from open-pollinated parents (presumably of wild North Carolina specimens) at the North Carolina Botanical Garden (NCBG) before 1983. The plant has made several leads and has retained its compact size while producing new leaves 6-7" high throughout the season. They do not last well into the winter, however. The pitchers have richly colored red tubes and the hood is distinctly red-veined. The throat is especially dark red. The flowers have not been seen.

2. ***Sarracenia* x *catesbaei* 'Carolina Cooler'**

A selection originating from the same batch of open-pollinated seeds as 'Sun Warrior.' It is growing well, maintaining its small habit, and producing 5-6" leaves throughout the season. They, too, do not last well into winter. The pitcher color is much less suffused with red. The tube, and especially the hood, have varying tones of green and yellow-green underlying the distinctive red veins, giving a refreshing appearance.

3. ***Sarracenia minor* 'Dark Ladies'**

This plant was selected from among seedlings grown at the North Carolina Botanical Garden from wild-collected seed. The seeds came from Brunswick County, North Carolina. The pitchers are 6-8" high and are typical in shape for the species, though they are a bit more slender. The aereolae are very distinctive. The most unusual aspect is the very dark red coloration of the hood, inside and outside. New pitchers are formed throughout the growing season, but they do not hold up well into the winter.

4. ***Sarracenia* x *swanlana* 'Friar Tuck'**

This delightful little cultivar originated as a seedling from a batch of wild-collected seed (Brunswick Co., N.C.) taken from a plant identified as straight *S. minor*. Obviously cross-pollination had occurred with *S. purpurea*. The seedlings were grown at the NCBG. The leaves are about 5" high, richly colored red outside above, with dark veins on the unusually smooth-margined hoods (such hybrids have hoods that are distinctly more wavy, after the *S. purpurea* parent). The hoods are also a little flatter in side view than usual, with an upturned tip. There are subtle shades of color in the hoods, making this cultivar attractive and distinctive. The leaves look good all season, and do not turn brown completely in winter.

5. ***Sarracenia* x *exornata* 'Moore's Melody'**

This large, robust plant was collected in the wild in southeastern Mississippi in 1985 by Mr. J.C. Moore, Sr. of Mobile, Alabama and sent to Larry Mellichamp at UNCC. We have named the cultivar after the musically talented collector who has been very instrumental in discovering unusual pitcher plants in the Mobile area. The plant appears to be a hybrid between *S. alata* and *S. purpurea venosa* (undoubtedly the "Louis Burk" pink-flowered

Top Left: ***Sarracenia* x *catesbaeii* cv. 'Sun Warrior.'**

Top Right: ***Sarracenia* x *catesbaei* cv. 'Carolina Cooler'**

***Sarracenia minor* cv. 'Dark Ladies'**

***Sarracenia x swaniana* cv. 'Friar Tuck'**

Photos by TL Mellichamp

Citation of cultivar names: TL Mellichamp
Rob Gardner

form), both of which grow in the vicinity but do not hybridize commonly. Stout, firm-textured pitchers about 6-9" high are produced throughout the growing season. They taper gradually from bottom to top to produce a broad cone with very wide slightly wavy-margined erect hoods. As the pitchers grow and mature they show various colors. The colors are intricate and subtle, yet rich and interesting with predominately maroons and oranges as a background for dark red veins. There are no aereolae (or light windows) evident as there would be if *S. leucophylla* were involved in the hybrid. The flower is also very large and attractive, somewhat orange-pink in color. We have already used this cultivar in cross-pollination with other attractive specimens.

The most important feature of this hybrid is the fact that the pitchers remain fully intact and colorful throughout the winter in an unheated greenhouse where temperatures occasionally go just below freezing. Since most Sarracenias die down in winter, we believe this is an exciting characteristic to use in breeding plants that look good year around. So far the plant appears vigorous, and it looks like it is going to become even larger.

References cited:

Bell, C.R. 1952. Natural Hybrids of the genus *Sarracenia*. Journal of the Mitchell Society 68:55-80. [A classic]

Pietropaolo, James and Patricia. 1986. Carnivorous Plants of the World. Timber Press, Portland, Oregon. 206 pages. [brand new attractive book]

Schnell, D.E. 1976. Carnivorous Plants of the United States and Canada. Blair, Winston-Salem, N.C. 125 pages. [best manual on native CP]

Note: The US Fish and Wildlife (USFW) -Office of Scientific Authority is *considering* listing all *Sarracenia* species on Appendix II of CITES.

SARRACENIA UNDER ARC LAMPS

by John De Franco, 220 Lynnwood Lane, Brookfield, WI 53005

Living in Wisconsin, where outdoor culture of most CP is impossible, I've encountered difficulties growing the taller species of *Sarracenia* indoors under artificial light. However, it is possible to achieve excellent results when adequate light and humidity are confined to a properly sized growing area.

I felt confident when I received one *S. leucophylla*, one *S. leucophylla x S. oreophila*, two *S. flavas*, one *S. purpurea x S. minor*, and one *S. alata*. Knowing they required plenty of humidity, I purchased three, twenty-gallon, long aquariums (12"x12"x30"). One of the tanks I used in the traditional manor (lying flat with a glass cover). The other two I modified by standing them on end and hinging the glass to make a door. On the bottom from the inside, I siliconed in a twelve by eight inch piece of plexiglass to form a waterproof box at the base of the tanks for the growing medium. These tanks proved vital to me in providing the proper humidity levels so necessary for the plants we enjoy.

To provide light, I constructed three somewhat pyramid-shaped hoods to house the fixtures. For the conventional tank I installed three, two-foot, twenty-watt fluorescent bulbs. The modified tanks were supplied with three, eight-inch, twenty-two watt circular fluorescent bulbs. On all the hoods small electric fans were installed to dissipate heat produced by the lights and ballasts.

As would be expected, the conventional tank containing some decumbent sarracenias, pinguiculas and droseras not mentioned previously, did quite well; however, not so with the modified tanks. The *S. leucophylla* produced distorted pitchers with over-sized wings, under-developed lids and no venation. While one *S. flava* died, the *S. leucophylla x S. oreophila* produced nothing but phyllodia. The *S. purpurea x S. rubra* did nothing for six months. The *S. minor* and *S. alata* grew tiny spikes from the rhizome. Where nice healthy growing plants were once, now was a disaster.

Not wishing to see my favorite type of CP meet a slow and agonizing demise, I sought other alteratives in artificial light sources. Because of the problems that exist with incandescent sources such as heat, low efficiency and spectrum problems, I sought information on arc lamps. There are a variety of arc type lamps and ballasts using different substances as their source of emission, each one having its own spectral peaks. Since mercury emits a stronger range of bluer light, I felt it would be best suited for supplying the proper bands required for plant growth.

I replaced the fluorescent bulbs with a one hundred seventy-five watt deluxe, white, mercury arc lamp. By remoting the ballasts, the heat was easily dissipated with the electric fan. This lamp produces about seven times the luminary output of a two-foot, twenty-watt fluorescent bulb. Because the light is emitted from a peanut-size envelope located within the protective bulb, rather than spread out over fourteen feet of bulb, it is easier to confine with a reflector constricting it to the growing area.

The plants responded immediately. I won't expound on the joys of seeing a very mature rhizome produce textbook pitchers, however, a noteworthy remark should be made about the coloration. All the plants, regardless of species, seemed to take on the same hue, a very maroonish color. I later grew a cobra lily under a mercury arc lamp and it took on the same color as the *S. purpurea x S. rubra* and *S. leucophylla.* This was also apparent in the conventional tank being supplied with fluorescent light.

As the *S. leucophylla* and *S. flava* grew, it became evident they weren't going to fit in the twenty-gallon long tank, the height being only about two feet. I found that a fifty-gallon aquarium could accommodate a growing height of about three feet. Instead of a glass door, I used one quarter inch mar-resistant lexan for safety reasons. A simple wood strip with a short piece of surgical tubing looped on either end acted like a big rubber band and replaced the hinge.

Because of the additional height (and the suffering I put my plants through), I felt I would need more light, despite the greater output of the mercury lamp. I chose the one hundred seventy-five watt metal halide arc lamp for two reasons. While the mercury arc lamp stands alone in its nice peak in the bluer bands, the metal halide has a spectral distribution confined mainly in the redder bands. Also the metal halide arc lamp is 60% more efficient than the mercury lamp, making it slightly more efficient than fluorescent sources. A special hood was designed to accommodate the lamp in a vertical position since metal halide lamps cannot operate efficiently in a horizontal position. The ballasts were remoted with good heavy-gauge wire. A fan was installed at the top and the lamp fitted with a reflector.

This unit provided more than adequate lighting. Not only were the plants more stout, with wide flaring pitchers, but all the secondary tones began to emerge. Where only maroon was, now were yellows, coppers and bright reds. I later planted a variety of decumbent species including *S. purpurea,* venus fly traps, and some droseras and pinguiculas. Providing there was room above to allow the light to pass through, even the venus fly traps produced deep red traps at over three feet from the light source. I later acquired a variety of almost all the genuses of CP and have found little difficulty in maintaining them in a healthy state, providing dormancy and proper photoperiod requirements are met.

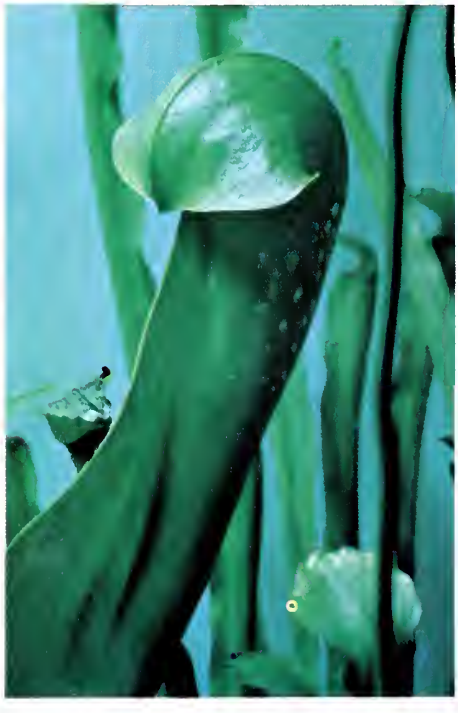
By using these methods of maintaining proper humidity and adequate light in a sufficiently sized container, it is possible to bring your favorite sarracenias indoors. Even the tallest of sarracenias can be expected to grow, multiply and flower in these self-contained growth chambers in an area where they can be constantly viewed and admired. (Photos on next page.)

S. oreophila under metal halide at thirty inches from light source.

Fifty-gallon aquarium with one hundred seventy-five watt metal halide lamp.

Photos by J. De Franco

S. purpurea purpurea under mercury arc at twenty inches from light source.



S. "Okefenokee" *minor x psittacina* under mercury arc at eight inches from light source.

I am in awe. Aghast might be a better word. This is a day I never expected to come, and I played it for all it was worth. (Article on next page)

Bettinna, I believe, is filliping one of the insidious gnats into an early demise.

The area just past the site. The Lithe River in all its resplendent glory. Photos by J. Zielinski

THE QUEST FOR (and pilgrimage to) *S. OREOPHILA*

by James Edward Zielinski (2630 Valleybrook Dr., Huntsville, AL 35811)

From the moment I heard of the seldom-seen pitcher plant, *Sarracenia oreophila,* I was determined to locate it, never dreaming the quest would take four years. As with most naturalists who have no idea of what they are doing, I took the direct approach of scavenging the underbrush between Fort Payne, Alabama and the Desoto Falls, dragging my hapless friends behind me. At first, it did not occur to me to undertake any heavy research, and my ramblings took me through terrain that rivalled the jungle canopies for verdure and the ensnaring tendrils of animated vegetation. Though the labours yielded nothing, I can at least reminisce and laugh hideously at the memories of my compatriates being swept away by the torrential waters of the Little River.

One day, however, a stroke of fortune befell me. At an old friend's house, in the midst of sampling a homemade liqueur called, if memory serves, "Plum Bounce," and prior to setting aside its remainder so that memory would continue to serve, I chanced to mention the plant to my friend's wife, who was originally from the Fort Payne area. Not only was she familiar with the plant, which in itself was cause for alarm, she had a friend who could probably reveal its precise location. Needless to say, I plum bounced from the recliner and began mapping out strategy for the imminent safari. First, I contacted my contact (that is, after all, what they are for), a self-made naturalist of the area; a lover of wildflowers and gardening. Following this, I assembled the massive band of explorers, which consisted, after all was said and done, of two. My sole partner in this endeavor, Bettinna Student, shares many of the same loves as I do, with the possible exception of me. Indeed, we had travelled to this area together before, and therefore, a portion of the remaining narrative is co-authored.

Arriving in the Sand Mountain area late in the day from our home in Huntsville, we at once proceeded post-haste to the Little River Canyon State Park and, as dusk approached, set up our camp, which consisted of two sleeping bags and a colony of mildew held together by strands of pup tent. It was to be a real back-to-nature trip. After two seconds of famine, we decided it was our nature to eat all our meals at the local restaurants, most of which were closed. First, however, we decided to consult our benevolent guide, whose name, for the sake of her privacy, we will not divulge. It was a doomed attempt. (Incidentally, if anyone wishes to visit the hamlet of Mentone, we would discourage the use of payphones in the area, as there are none. Luckily, the wildlife preserve was more civilized than the towns surrounding it, and it afforded the opportunity we needed. We were, sad to relate, unable to reach her, and decided to try again the following day.) For the moment, we would content ourselves with the perusal of the nearby villages. In addition to their being within a dry county, the area as a whole seemed extremely languid, with the most exciting phenomenon being the impending opening of the local Food World at midnight. Within moments, we were quite hypnoid, and spent the remainder of the evening committing sloth.

The following morning, we enjoyed some of the natural beauty of the state park, and finally reached our guide, acquiring the directions to her hidden domicile. Her home is nestled in the mountain range, and we spent much of the early part of the day looking about her lavish garden of wildflowers and the most herbaceous grounds and woodlands which surrounded the area. The prickly pear was in full bloom; the flowers of the mountain laurel were beginning to fade. We discoursed extensively on the flora of the region, including *S. oreophila* and its declining colonies and, eventually, the dear lady took us to the beginning of the trail. As we parted company, heeding her admonition not to reveal the plants' whereabouts, the heart of the expedition began.

Following her instructions to the letter, we proceeded parallel to the river and upstream. The area was laden with intriguing boulder and rock formations. As we meandered in

wayward fashion, I espied the pale green hoods first. In the fervor of the moment, we broke into jubilant hosannas and a spontaneous rendition of the "Hallelujah Chorus." Then we dashed to the edge of this sanctuary and fell into uncontrollable paroxysms of mirth and general hysteria.

One could trundle for miles in this stretch of wilderness, never venturing near any of the remaining sites of *S. oreophila,* and yet this particular site, a mile or so trek from the origin of the path, was scarcely 30 feet from the trail itself. In a seeming attempt to corroborate this theory, several hikers, and a few bikers, chanced to pass by during our stay there, but none appeared aware of the plants' presence. Evidently, the site had only recently been visited, for upon one of the larger plants, the only one that flowered, there hung a silver tag stating the date inspected and the number of plants in the area. There was also some disturbance of the soil. The plants were growing in a clearly-defined pattern of lateral progression, with only a very few scrub plants interspersed amongst them. One could almost envision the hand of Nature clearing this secluded area within which the pitchers were ensconced, so clearly were the dimensions marked. On the whole, however, the site and its contiguous regions were a morass of flora, and eventually, the brush could overtake the *Sarracenia.* In addition to the *S. oreophila,* there was an abundance of mosses, including sphagnum, and a variety of ferns. All of the foliage were plushly green, growing out of a sandy-peaty soil which was fairly dry and rocky. The area, roughly 500 square feet, is approximately 5 feet from the river, which is 11-15 feet wide at that point. This close proximity results in a humidity level that is extremely comfortable, if you happen to be a trout. Obviously, the site is prone to flooding and perhaps this accounts for the differentiation of the species therein. The area looked healthy, but astonishingly small. A rough count of the leaves totalled about 65, which, when compared to stands of *S. purpurea, leucophylla,* or *alata* we have seen in the gulf coast area, was very meager by any means. Our confidante had indicated that there were two other nearby locations of the plants, one further up the river and the third on the Sand Mountain plateau but, pressed for time, we tendered all our care to the scrutinizing of this one.

We spent some time enjoying the pitchers; investigating their contents; taking photographs. However, we had no foreknowledge of the possibility of writing an article for CPN, and the pictures, rather than candid shots of the plants, were merely a means by which we could commemorate the journey. The pitchers were robust and a good size, ranging from a diminutive 4-6 inches to approximately 2 feet in height. The hoods were a somewhat paler hue of green than the remainder of the plant, and many of them were infused with a reddish tone. The mouth area and the interior were flushed with a white tinge as well. The lone flower, already opening, was a pale yellow. We noted at the area a preponderance of gnats which, in fact, appeared to be the pitchers' primary food source as they hovered about in multitudinous herds and considerably satiated the trumpets' entomophagous cravings. A foolish attempt to observe their capture resulted in their mounting a formidable battalion and a resultant blitzkrieging of our formerly beautiful physiognomies. Having observed all we could, and having eaten our quota of gnatmeat, we ran and plunged headlong into the Little River.

Eventually, the time came to take our leave. Wary, lest we should fall victim to another ambush, we surveyed the area once more before hying ourselves to a neighboring cafe and toasting the event with iced tea. It had been an exhilarating experience, to say the least. However, it troubles one to think that this and only a shade more are all that exist of an entire species. The locations in central Alabama, I have been informed, have vanished, and rumors of the plant's existence in a montane area near Huntsville, at least of this writing, are just that. Indeed, the areas that do exist are, to their detriment, being encroached by more woody plants. Worst of all, we had been earlier informed by a park ranger of a very large stand of plants which is nowhere to be found. From the perusal of various publications, it appears the plants were "harvested" by an unscrupulous plant company. At any rate, they are gone now, and it is our hope that the remaining few will be nurtured and cared for, in order that they may attain the once-prevalent numbers they knew. My cohort and I, even now, are planning further and more in-depth studies of the plant in the very near future.

Steve Clemesha with *S. alata* (red throat) x *flava* (red tube, green lid), a clone he bred.

S. oreophila x *minor*. This plant is slightly and evenly pubescent - a characteristic it has inherited from *S. oreophila*. Photos by S. Clemesha.

S. alata x *psittacina* x *catesbaei*. Even though two grandparents of this plant produced red flowers, this clone has clear yellowish-white flowers, without a trace of pink.

SARRACENIA — THE HAIRY ONES

by Steve Clemesha

Hair or pubescence on *Sarracenia* is a rather controversial subject. There is not agreement on which species produce it naturally and which ones are hybrid descendants. Hair on them is often difficult to see and some plants with me produce hair late in the growing season, but are hairless early in it. To further complicate matters, some plants with me were entirely hairless in the summer of 1985-86 but this season (1986-87) they are showing pubescence.

I suspect growing conditions and, especially, full sun influence production of pubescence. My plants grow outdoors with no protection at all for the whole year. They receive full-sun most of the day. Summers are warm, but temperatures above 30°C are uncommon, and winters are cold enough to cause *Sarracenia* to go dormant, but mild enough to allow me to grow *Nepenthes* with no protection but shade cloth.

Pubescence, or hair, on *Sarracenia* differs. In some it is very dense, while in others it is sparse. Hair on some is very short and fine so is difficult to see, while in others it is more coarse, longer and easily seen. In most cases it is difficult to see, except in full sun. It is easily overlooked, and I have had some plants up to 18 years and was unaware they were pubescent till I looked for it last season. The only plants I consider pubescent are those I can see it on without any magnification. My eyes are quite good, and I do not wear glasses. I do not know what purpose, if any, the pubescence serves. Possibly it makes the pitcher outsides less slippery so insects can walk on them more easily or reduces transpiration in hot weather. In all cases, except where stated, observations have been made on my own plants.

The underside of the "umbrella" of the flower of some pubescent species also is pubescent, but some of my hairless *S. leucophylla* plants also have this characteristic. *Sarracenia* all have hairs and bristles on the pitcher insides so possibly its presence outside is only a minor adaptation.

PUBESCENCE ON *SARRACENIA* SPECIES

S. purpurea ssp. purpurea. I have plants of this from Ohio, Michigan and Algonquin in Canada. I also have fma. *heterophylla* from an unknown locality. In the spring of this and last year all plants were hairless but later in the season last year all were finely pubescent, though much less densely than in ssp. *venosa*. I suspect my local climatic conditions caused this pubescence. It does show that this subspecies has the potential to produce hair, especially as all my plants produced it.

S. purpurea ssp. venosa. All my plants of this are pubescent year-round. Ssp. *venosa* lacks the smooth, shiny appearance and feel of ssp. *purpurea*.

S. flava. A clone of the heavily-veined form that I received in June, 1985, was not fully established in southern hemisphere seasons last season and made its best pitchers in mid-summer. They were finely and densely pubescent in the upper part. Whether it will remain as pubescent when it is fully established and produces its best pitchers in spring, remains to be seen. This spring it flowered, and still in late spring has made no good pitchers—probably because it still is not fully adapted to our reverse seasons. So far it is the most pubescent form of *S. flava* I have seen. A clone of the typical red-throated form showed no sign of pubescence on any of my plants the entire 1985-86 growing season, but this year fine pubescence is present near the tops of the large spring pitchers.

S. flava red-tube, green-lid. I have had a clone of this at least 12 years, producing 2 crops of pitchers each year. The main one is in spring, a few poorer leaves follow, then soon

after Christmas a set of smaller pitchers follows. Last season the spring pitchers were hairless, but the summer ones were slightly pubescent in the upper part. This season the spring pitchers are pubescent, though less so than the summer pitchers last year. A recently received clone of this colour form is pubescent this spring also.

I have heard of a clone of the typical red throat form that is in cultivation in South Africa that is pubescence. It was raised from seed sent from U.S.A. and was the only pubescence plant in the batch of about 30 plants.

A hybrid I made between the above mentioned red-tube, green-lid form and a hairless, heavily-veined plant is pubescent like the former parent.

S. leucophylla. My only pubescent clone is the one referred to by Thomas Alt of Germany in C.P.N. *14*, June 1985, p. 50. It is closely and densely pubescent, much more so than on *S. purpurea* ssp. *venosa* and the hair is easier to see than on that sub-species. It can easily be seen at least a meter away and it is persistent and still visible on dead pitchers in winter. A few hairs are present also on flower buds and sepals and the underside of the floral "umbrella" is the most pubescent I have seen. The pitchers are slender but slightly shorter than those of my other plants of this species. The flowers of this remarkable clone differ from those of my other *S. leucophylla.* The sepals are greener and the petals more the colour of a *S. leucophylla* hybrid such as *S.* x *Areolata.* I pressed the petals and sent them to Don Schnell. He thought, and I agree, that the plant has some of the pubescent form of *S. alata* in its breeding. He considers the latter could be descended from hybrids involving *S. purpurea* ssp. *venosa* 'Louis Burk'. I have noticed that in hybrids between pubescent plants and hairless *S. leucophylla* that the seedlings often have more pubescence than the pubescence parent.

S. alata. The two best examples of this that I have are two, three-year-old seedlings. The seed they were raised from was mixed and also contained *S. alata* hairless form and *S. Areolata* x self or *S. alata.* Some of these are hairless, and some pubescence. Three of the plants have flowered. Though *S. leucophylla* colouring and spotting was evident in the pitchers, all flowers were the colour of *S. alata.* Whether the plants that show no *S. leucophylla* influence really are full-blooded *alata* I have no way of knowing, but two of them are very densely pubescent, especially in the lower parts which are silvery white from over a meter away. The other pubescent clones of *S. alata* and *S.* x *Areolata* in the batch vary in the amount of pubescence they have. Two plants of *S. alata* pubescent form I imported produce pubescence on some pitchers, but not others. All the pitchers are rough to touch, unlke the hairless forms which are very smooth.

S. rubra ssp. rubra. I was sent a plant of a pubescent form of this species in the spring of 1985. Its pitchers are finely and densely pubescent throughout the growing season. My only other clone of this ssp. was hairless in spring but was pubescent in mid-summer, though much less so than the other clone. Hybrids between two other clones and hairless species are pubescent indicating that the *S. rubra* parents were pubescent.

S. rubra ssp. jonesii. In spring, all my plants of this were hairless but by mid-summer all the larger plants of all clones, including the yellow albine form, were lightly pubescent. The plants are from two different localities.

S. rubra ssp. gulfensis. What I have stated about ssp. *jonesii* is true of this sub-species also, but the pubescence on ssp. *gulfensis* is finer and harder to see than on ssp. *jonesii.* With me, ssp. *gulfensis* is the least pubescent of the *S. rubra* sub-species.

S. rubra ssp. wherryi. I have plants of this from 3 different known localities and others from unknown localities. All are finely and densely pubescent throughout the growing season.

S. rubra ssp. alabamensis. Both my clones of this are finely and densely pubescent throughout the growing season like ssp. *wherryi.*

S. oreophila. Both my clones of this are from extreme N.E. Alabama and not from near Birmingham where it once grew near plants of *S. rubra* ssp. *alamamensis.* Both my *S. oreophila* clones have pubescence on most pitchers, especially the lower parts. When present

it is fairly dense and persists till the pitcher dies. Being fairly dense and less fine than on the *S. rubra* ssp. it is easier to see. A minority of pitchers lack hair and I can find no trace of it on the curved, flat leaves.

To date I can find no trace of any pubescence on any of my plants of *S. minor* or *S. psittacina.* I have both species from 4 widely-separated localities. Hybrids from *S. psittacina* in my collection have little or no trace of pubescence except for the cross with *S. purpurea* ssp. *venosa.* There are a few gland-like dots that might be hairs on the cross with *S. rubra* ssp. *rubra.*

Species Pubescence. My plants of *S. purpurea* ssp. *purpurea* are from at least 3 widely-separated localities and all have pubescence. *S. oreophila* and *S. rubra* ssp. *alabamensis* like *S. purpurea* ssp. *purpurea* grow in habitats where no other species of the genus grow. For this reason I do not believe that pubescence on them is the result of their being descended from hybrids with other species. All my plants of *S. rubra* are pubescent and I believe this to be a pubescent species. My *S. flava* that have pubescence look pure but it is possible that a trace of *S. rubra* or *S. purpurea* is in their distant past. On the other hand, *S. oreophila* is pubescent and there seems to be no reason why its closest relative should not be in some plants.

Disagreement has been expressed concerning the origin of the pubescent *S. leucophylla.* One thought was it is a true form, another that it is descended from *S. purpurea* ssp. *venosa* 'Louis Burk' hybrids. I thought it was descended from *S. rubra* ssp. *wherryi* hybrids and I still think it may have some of that in it. Its flowers show a link to *S. alata,* as Don Schnell pointed out. In view of its petal colour, this would seem beyond reasonable disagreement.

The other point of disagreement concerns the pubescent form of *S. alata.* This seems to be more numerous than pubescent *S. leucophylla,* which would support the claim made by some that it is a true genetic form. Against this is the claim that it is descended from hybrids with *S. purpurea* ssp. *venosa* 'Louis Burk'. Because of my own breeding with these plants and the ones I have received, I think if this *alata* is a hybrid descendant then it is descended from hybrids with *S. rubra* ssp. *wherryi.* The presence of *S. leucophylla* in hybrid breeding seems to increase pubescence. I have some hybrids between *S. alata, S. leucophylla* and *S. rubra* ssp. *wherryi* that were sent to me from Alabama, and they are almost as pubescent as the pubescent form of *S. leucophylla.* It would be possible to breed *S. alata* and *leucophylla* hybrids with this plant, and in one or two generations some pubescent plants like these species should result.

PUBESCENCE IN HYBRIDS

As I have had some of my plants 18 years, or near it, I have bred them without realizing they are pubescent. There have been some intersting results. I can find no trace of pubescence on seedlings in their first year, but it often shows up the second year after seedlings stop producing juvenile pitchers.

Because plants appear to show no influence of another species, one often concludes they are pure and not a hybrid descendant. I have some *(S. rubra* ssp. *rubra* x *S. leucophylla)* x *S. leucophylla* and the same cross involving *S. rubra* ssp. *gulfensis.* The plants differ from *S. leucophylla* only slightly in the hood shape. I would not be sure they were not pure if I had not bred them myself. In both cases, *S. leucophylla* was the pollen parent both times.

In yellow-flowered plants, a trace of pink in the petals is a sure sign a plant is descended from a red-flowered species. The colour can persist for several generations, but it also can be dropped entirely any time from the second generation, providing yellow-flower genes are in both parents. I have 3 examples of this. One is a hybrid between a field-collected *S.* x *Catesbaei,* and the other parent is *S. alata* x *S. psittacina.* Both these parents have pink-red flowers, but one plant of the hybrid has clear yellow flowers with no trace of pink. The pitchers show influence of *S. psittacina* and *S. purpurea.* The second example is a hybrid between the same *S.* x *Catesbaei* and *S. alata* = *S.* x *Illustrata.* I have two plants of the cross.

(Continued next page)

Both have short, wide-mouthed pitchers that show the influence of *S. purpurea*. One plant has pink petals, while the others are pure yellow. Two *S. alata*-like seedlings with some *S. leucophylla* spotting have clear yellow flowers.

S. purpurea ssp. purpurea Hybrids. My only mature hybrid from this is a cross with *S. psittacina*. It is completely hairless. My plants of the yellow form of *S. rubra* ssp. *jonesii* x fma. *heterophylla* are pubescent in summer, a bit more so than their parents. My other ssp. *purpurea* hybrids are seedlings in their second year, but already some are showing pubescence that is about as dense as that on ssp. *venosa* hybrids. The ones showing it so far are crosses with *S. flava* 'typica', *flava* red-tube, green-lid and *flava* heavy veins. The first two are pubescent plants mentioned earlier, while the last is hairless so far. My largest *S. flava* x *S. purpurea* ssp. *purpurea* is a cross with the all-green *S. flava*. So far, all seedlings like the *flava* parent are hairless. Less than one plant in 10 of my ssp. *purpurea* x *S. alata* and x *S. leucophylla* are pubescent, but these that are have as much pubescence as ssp. *venosa* crosses. The *alata* and *leucophylla* parents are hairless. A cross between the two sub-species of *S. purpurea* looks so far as if it will be as pubescent as ssp. *venosa*.

S. purpurea ssp. venosa hybrids. All my plants of these were bred from Carolina plants. I doubt if the result of breeding from Gulf Coast plants would be much different. All my ssp. *venosa* hybrids are pubescent to about the same degree, regardless of the other parent. Pubescence on individual pitchers varies a bit throughout the season making comparison of plants difficult.

S. flava hybrids. In CPN 12(3):67, Fig. 2, a photograph of *S. flava* red-tube, green-lid x a hairless *S. alata* red-throat is shown. All plants of that cross are lightly pubescent. The hair is more scattered than on the *S. flava* parent, but is less fine and easier to see. I have crossed the same *S. flava* with a hairless dark clone of *S. leucophylla*. The resulting hybrid is identical to the *S.* x *Mooreana* in CPN 13(2):42, Fig. 2. My clone produces attractive pitchers throughout the growing season, unlike my other *S.* x *Moorena*-a field collected plant of the red-throat form. It is attractive only in spring. The pitchers of the plant I bred are all pubescent and much more so than on its one pubescent parent. The hybrids I have made between *S. flava* (various forms) and *S. oreophila* all have some pubescence. The cross between the red-tube, green-lid form and *S. oreophila* is only 3 cm. high and already pubescent.

S. oreophila hybrids. The cross of this species and *S. minor* is an extraordinary one. The pitchers are tall and stout and the hood is a bit small to cover the pitcher mouth. It is evenly, though not densely pubescent and the pubescence is fairly easy to see. Pubescence in *S. oreophila* x *S. alata* is dense and easily seen, and, as in *S. oreophila*, mainly in the lower part of the pitcher. The same is true of *S. oreophila* x *S. leucophylla*. The pubescence is greatest on hybrids with the very pale *S. leucophylla* that has yellow flowers. Don Schnell said, and I agree with him, that this unusual clone he found is probably an *S. alata* hybrid descendant.

S. rubra hybrids. I have found when the various sub-species of *S. rubra* are crossed with other species the resulting seedlings usually are pubescent, except in the case of ssp. *gulfensis* which in the case of my plants is the least pubescent of the *S. rubra* sub-species. It is likely that more pubescent clones of it exist which would give a different result.

My only mature *S. rubra* ssp. *alabamensis* hybrid is a cross with *S. leucophylla*. It is finely and densely pubescent, more so than on the ssp. *wherryi* parent. A minority so far are only slightly pubescent. This cross is also very like *S. leucophylla*. The only significant difference is in the hood and upper pitcher colouring. It is patterned as in *S. leucophylla*, but the colour is duller as is common in *S. leucophylla* hybrids. It is not as dull as in the hybrid *S. Areolata*. These seedlings are not full size yet and I expect a back cross to *leucophylla* would be very similar to a pure one and a selfing of the seedlings could result in some seedlings being more pubescent still. *S. rubra* ssp. *wherryi* x *S. alata* also are fully pubescent but it is less easily seen than in the *S. leucophylla* hybrid. These *alata* hybrids look much more like *S. rubra* ssp. *wherryi* than they do *S. alata*. Those bred from the red throat form of *S. alata* look rather like *S. rubra* ssp. *wherryi* with a red underside to the lid.

Complex Hybrids and Back Crosses. Most of my hybrids in this group have *S. purpurea* ssp. *venosa* in them. The degree to which they are pubescent varies according to the amount of ssp. *venosa* that is in them.

I have three-year-old seedlings of *S. mitchelliana* x *S. leucophylla* and *S. exornata* x *S. alata.* Less than one quarter of these show any pubescence at all, and in those that do it is very fine and hard to see. The *S. leucophylla* cross is an exception to what I have noticed about *S. leucophylla* in a cross increasing the pubescence in the seedlings. It is likely that selfing my slightly pubescent back crosses will result in some plants that are more pubescent. If that is so, pubescent forms looking like *S. alata* and *S. leucophylla* could be bred both in cultivation and in the field. The *S. purpurea* used in my breeding is a Carolina one, and it is possible, though unlikely, that the results when breeding from Gulf Coast forms would be different.

I have a field-collected plant of a hybrid of mixed parentage form. It is one of the most pubescent plants in my collection. I think it is likely that it is a selfing of the hybrid and that it would be one of the most pubescent seedlings in its batch. This plant is not as pubescent as my best *S. alata* and *S. leucophylla,* but it is not far behind. I think it will be easy to breed pubescent plants like the last 2 species from this plant, and I will try it. As the plant is a field-collected one, the same thing could happen in the wild.

Although many Sarracenia species and hybrids have some pubescence, the degree varies greatly, and in only two is it conspicuous, these being the pubescent forms of *S. alata* and *S. leucophylla.* It is possible and likely that these are descended from hybrids involving *S. rubra* ssp. *wherryi, S. alata* and *S. leucophylla.* It, also, is possible that *S. purpurea* ssp. *venosa* hybrids have been the ultimate source of pubescence. I do not think pubescence on *S. rubra* ssp. is the result of hybridization. That is true also of the very fine pubescence found on some plants of *S. flava.* There can be no doubt that pubescence on *S. oreophila* and *S. purpurea* ssp. *purpurea* is not the result of their being hybrid descendants.

In hybridization (except where only one parent is pubescent and that minimal inheritance of pubescence seems dominant) often seedlings are more pubescent than their parents. In hybridization beyond the first generation pubescence is gradually lost if breeding is away from pubescent parents. If it is desired to maintain or increase it then, selfing, selection or back crossing is necessary.

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THE PATH TO PLANT CARNIVORY

by Dr. B.E. Juniper, Botany School, University of Oxford, Oxford, England

Summarized by J.A. Mazrimas

There is a considerable amount of interest in the pages of CPN on the subject of CP evolution. In a recent exchange of correspondence with Dr. Juniper, he sent me a rough draft of a chapter he authored for a forthcoming biology textbook. I would like to share some of his ideas with our readers hoping that it might stimulate further ideas on the subject.

A discussion of the evolution of any CP is purely speculative, simply because there isn't any scientific evidence of plant material still in existence from the ancient ages. Most carnivorous plants are herbs which are too soft-bodied to survive the activity of microorganisms in the soil for scientists to locate and study. There are even plants existing today that have most, but not all the "necessary" carnivorous mechanisms, so that they are either into or out of the carnivorous habit.

Some assumptions we can make on their evolution is that being flowering plants, the carnivorous habit had to begin sometime after the Upper Cretaceous period at the end of the Mesozoic era about 100 million years ago.

If one looks at a typical representation of an evolutionary tree (as one appears in CPN 7:18 (1978), there are six independently developed places where CP are found at widely separated places in the natural order of things:

ORDER	GENERA
1) SARRACENALES	N & S American Pitcher plants
2) NEPENTHALES	*Nepenthes, Drosera, Dionaea, Drosophyllum Aldrovanda*
3) VIOLALES	*Triphyophyllum*
4) SAXIFRAGALES	*Byblis, Cephalotus*
5) SCROPHULARIALES	*Pinguicula, Utricularia, Biovulria Polypompholyx, Genlisea, Martynia*
6) BROMELIALES	*Brocchinia, Catopsis*

As one looks at the list above, the plant order Scrophulariales have asymetric flowers and are regarded relatively more advanced than other groups having radial or symmetrical flowers which tend to cluster together in an evolutionary sense. The trapping mechanisms, however, do not fall so easily into such typical categories. No matter how we analyze this chart, the CP fall into a polyphyletic scheme and it's not easy to come up with viable relationships to one another.

Most of the carnivorous plants we know today exhibit 7 features in order to be successful in their habitat:

1. Attract
2. Trap
3. Retain
4. Kill
5. Digest
6. Absorb
7. Use

It is Dr. Juniper's opinion that it is not necessary to assume that any one of these individual features has a common origin in evolution. In fact, many of these features occur uniquely or occasionally grouped in plants living today that do not rely on carnivory. For example:

Flowers attract.
Root caps secrete mucilage.
Flowers temporarily trap pollinators.
Germinating seeds secrete digestive enzymes.
Plant leaves absorb surface nutrients.

In CP, several features develop in a certain limited area of the plant, and these features are expressed there to an EXTREME EXTENT.

Since there are no intermediates in the fossil record of carnivores, we are forced to speculate on the path to plant carnivory by looking at analogous structures from non-carnivorous plants. This report will concentrate on the *Nepenthes* trap and the *Dionaea* trigger hair.

THE *NEPENTHES* PITCHER

There are many examples of flowers of non-carnivorous genera that trap insects even though true carnivorous plants never use the floral structure for this purpose. The tropical flowering plant, *Dischidia,* has a modified leaf in which ants may temporarily live. Other examples are the ornamental Croton and *Ficus bengalensis* whose leaf tips form small pockets or pitchers with no obvious purpose. Wild plants can undergo large modifications or adaptations in a few generations with examples of doubling flowers, fasciated stems, fused fruits or multiple meristems. These modifications may be due to selector genes that undergo duplications and mutations in large segments and become part of the inheritance package in subsequent generations.

The waxy surface within the pitcher and just below the nectar-secreting glands under the peristome lip is a wax-secreting epidermal surface which appears to have no exact parallel in any other known plant. Insects find it difficult to adhere to these waxy scales because the scale pulls away very easily when a claw of an insect attempts to take hold. When the waxy scales are removed with chloroform solvent, insects can once again escape by climbing out of the pitchers. This crystalline wax is secreted only by cells in this area during pitcher development and presents an effective barrier to insect escape. Once it is used up by flaking off the walls, the wax is not replaced so that old pitchers often are seen to allow insects to escape.

Epicuticular waxes in plants are usually present for water retention, sunlight protection, dew condensation or frost damage protection. It may protect the plant from plant pathogens and insect predation. In general, we do not see plant surface wax in more primitive plants as a device to impede the movement or adhesion of harmful insects. However, there are two species of fern that do have a powdery wax that seems to be there as a mechanism to impede insects attacking the sori (the propagation mechanism) of one *Ceropteris triangularis* and the petiole and rhachis of *Phlebodium aureum.*

Other examples of the general defensive role of wax on the pedicel, especially of the type that is crumbly, soft and non-adhesive, exists in other angiosperms. The Dahlia, Narcissus, Blood-Lily and Amaryllis are some examples of this. *Sarracenia* and *Dionaea* also have waxy-coated pedicels but *Drosera* has a glandular-flowering stem and this is an example of how nature 'plays the cards'. It is not difficult to see how this wax has become adapted to a specific restraining role in *Nepenthes* and *Brocchinia reducta.*

THE *DIONAEA* TRIGGER HAIR

One view to explain the purpose of leaf hairs or glands of various sorts which may impede or kill insects is that they are purely defensive structures. They do not exist because of selection towards carnivory but remain in *Roridula* where the tentacles on the leaves trap insects but there are no absorbing glands to make use of the nutrients. This plant may be obtaining its nutrients indirectly. Older leaves fall to the soil with their prey which are slowly broken down into nitrogenous nutrients by soil microorganisms and later absorbed by the roots of the plant.

PLANT CARNIVORY *(Continued)*

The well-known, roek garden herb- Catchfly-belonging to over 400 species of the Silene genus secrete an adhesive fluid from their glands which trap insects. Several species of the Nightshade genus *Solanium* have glandular hairs which rupture into releasing a sticky substance when aphids attack the plant and glues these insects to the leaf. This may prevent virus diseases from spreading from plant to plant. The leaf surfaces of the tobacco plant *Nicotiana tobacum* trap insects in a similar manner. The pubescent calyx, with stalked glands on the upper part of *Plumbago capensis* often catch aphids.

A gland bearing leaf, then, can be readily transformed as a teratoma into a pitcher. Plants that bear trichomes, which usually are branched hairs or bristles on the leaf surface, are capable of absorbing simple nutrients. Charles Darwin tested many plants and found that 2 species of the *Saxifraga,* which is distantly related to *Drosera,* could absorb organic matter from raw meat and solutions of nitrate and ammonia. Another non-carnivorous example is the Bromeliad family where trichomes in the tank eells absorb at least 2 amino acids from a solution in contact with the leaf. Absorption of nutrients is not a problem in the evolutionary sense.

GLANDS

Examples of secretory and absorptive glands in the plant world are not restricted to carnivorous plants. In the fern, Isoetes, there are organs which secrete a mucilaginous layer of fluid containing protein in the basal regions of the microphylla, and this organ's function once had an extracellular lytic activity analogous to the glands from CP. In *Cephalotus,* there is evidence of an ancestral stomatal pore that developed into a simple absorptive gland. The epidermal glandular cells of *Nepenthes* may also have a stomatal origin. When glands developed over evolutionary time, various functions also showed up a specialization for mucilage or enzyme secretion. *Drosera* is an exception in that the tentacle retained both functions of capture and digestion. In the leaf base, there are sessile glands probably involved in the transport of the digestive fluid. They may have been derived from ancestral stomata which is a very tentative idea, but may be the basis for the digestive glands of all the carnivorous species.

The evolution of what appeared first in *Sarracenia, Nepenthes* and *Dionaea* is the question of nectar-secreting glands or enzyme-secreting types. *Darlingtonia* is an example of a primitive carnivore where there are nectar glands, but no glands in the digestive zone that appear to secrete enzymes. Perhaps, this dichotomy in function is the present day example of an intermediate stage in the development of a highly adapted CP species.

Nectar glands secrete dilute fluids based on the exudation of phloem contents and need to become more concentrated to be an enzyme secretion gland. However, a contrary example was pointed out by Dr. Juniper when he observed that nectar-secreting glands in the rim of the pitcher of *Sephlotus* only appear in the mature pitcher and not in juvenile pitchers. Both plants function successfully in capturing and digesting prey.

Drosophyllum is a single example of how its glands may have evolved over a period of time from being first a simple lure, than a trapping glue, a drowning mechanism, an enzyme medium and finally a hygrometer to absorb moisture from the air. Are there any CP specimens living today which can suggest a possible evolutionary sequence? Most biologists concur that there are 4 CP which may be closely related: *Drosophyllum, Drosera, Dionaea,* and *Aldrovanda.*

We can speculate that the primitive carnivore looked something like a modern *Pinguicula. Drosophyllum* diverged early from this primitive beginning because of pressure to develop glands capable of maintaining its water balance during dry spells on the Iberian coast. Then *Drosera* diversified over the entire earth developing a tentacle that is both nastie and tropic in function. Also, this led to a more economical use of enzymes and mucilage required to trap and digest prey. The gland head went to the prey, and not the prey going to wasteful and copious amounts of mucilagenous fluid.

In the beginning, a CP plant could have started out glandless and we see a modern example of this trait today in a mutant *Drosera erythrorhiza* as shown in CPN 9(1):11 1980. Although this plant totally lacked stalked glands, it had lost the ability to absorb nutrients but did have sessile glands in the leaf base.

Dionaea development perhaps came about by fusion of the tentacles of the leaf margin, however, a study of the leaf venation pattern suggests tentacles were lost and that each lobe developed by expansion of a *Drosera* leaf. In the intermediate stage, this pre-*Dionaea* leaf must have retained 3 or 4 tentacles on each lobe which today are called sensory hairs. There is a striking physiological resemblance between the stalked glands of *Drosophyllym,* the tentacles of *Drosera,* the trigger hairs of *Dionaea* and the bristles of *Aldrovanda.* There is a structure termed the endodermoid cell layer which is present in the stalked gland, tentacle and trigger hair of their respective species. This structure is indicative of a secretory ancestry. If *Drosera erythrorhiza* can grow sometimes without tentacles, it can grow with some of its tentacles modified to form cilia around the edge of the *Dionaea* leaf!

There are no intermediate species that can lead us to the possible origin of *Aldrovanda* but it is known that *Dionaea* frequently is found submerged in flooded areas a part of the year. It's interesting that even under several inches of water it is capable of trapping prey.

In conclusion, none of the features of carnivorous plants are exclusive but actually shown to be partly inherited during polyphyletic evolution. A few of these features are ancient with analogues found even in the fern family. The spectrum of all the features in one plant undoubtedly evolved because of the "relentless grind of pest pressure."

After completing Dr. Juniper's report, it occurred to me that there may be a living example of an intermediate plant which has characteristics between *Dionaea* and *Drosera rotundifolia.* This plant was recently described in 1985 as *Drosera falconeri* Kondo & Tsang and is a member of the petiolaris group. The plant resembles *Dionaea* in having small scaly bulbs encased in the petiole bases, the petioles are oblanceolate and the leaves are arranged in basal rosettes. The roots are blackish-brown and the leaf blades are circular and rather flat with the surface covered with glandular trichomes, but the rim having longer tentacles encircling it. The trap is reddish-orange in color and when the new leaf first emerges, it is folded along a midrib closely resembling a newly growing leaf of *Dionaea.* I have not observed if a mature leaf blade folds in half when an insect is trapped, but that would be an interesting simularity to *Dionaea.* The plant was discovered in 1980 by Doug Falconer and sent to Peter Tsang who reported this discovery in the pages of CPN 9(2):46 1980.

NOTICE

Effective June 1, 1987, ICPS Business Manager Joanne Klingensmith has resigned her duties with the society. As of this printing, a replacement has not been named. In the interim, please address all correspondence pertaining to dues, address changes, back or missing issues and other matters of a non-editorial nature to: ICPS, Fullerton Arboretum, CSUF, Fullerton, CA 92634. Please do not call the Arboretum. Thank you.

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