CARNIVOROUS PLANT NEWSLETTER

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Front Cover: The beautiful open flower of the red-petalled *Drosera cistiflora* in cultivation at Dubbo. Article on page 70. Photo by Robert Gibson.

Back Cover: *Sarracenia* 'Chagall' flower and pitchers. Article on page 68. Photographs by Jay Lechtman.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors.Views expressed in this publication are those of the authors, not the editorial staff.

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Contents

International Carnivorous Plant Society Seed bank

ICPS Seedbank• P.O. Box 71 • Ashland, OR 97520-0003 • USA

Byblis liniflora
Cephalotus follicularis
Drosera aliciae
D. auriculata
D. binata
D. binata—Coromandel, NZ
D. burmannii
D. capensis 'Albino'—white flower
D. capensis—narrow leaf
D. dielsiana
D. filiformis var. *filiformis*
D. filiformis var. *tracyi*
D. glanduligera
D. intermedia—Cuba
D. intermedia—New Jersey, USA
D. intermedia—North Carolina, USA
D. intermedia—Rhode Island, USA
D. intermedia—Venezuela
D. peltata
D. rotundifolia—Alaska, USA
D. rotundifolia—Newfoundland, Canada
D. rotundifolia—Washington, USA
D. stolonifera subsp. *porrecta*
D. tokaiensis
Proboscidea louisianica (noncarnivorous)
Sarracenia flava
S. leucophylla
S. purpurea subsp. *purpurea*
S. purpurea subsp. *venosa*
S. rubra—infraspecific hybrid
S. rubra subsp. *jonesii*—ESA/CITES, USA sales only
S.—various hybrids

PLEASE NOTE the new address for the ICPS Seedbank!

This is a partial list of the seeds available. A complete list is online at the ICPS web site, http://www.carnivorousplants.org/ or by sending a self-addressed, stamped (if USA), envelope to the seed bank address.

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You are encouraged to stock the seed bank with seed produced by cultivated plants. The ICPS poliey on wild seed eollection is on line at the ICPS web site. Cultivation-produced seeds of species protected by the US Endangered Species Act are distributed within the US only, and in accordance with the ICPS's US Fish &Wildlife Service permit TE061005-1.

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New Cultivars

Keywords: cultivar: *Drosera rotundifolia* 'Charles Darwin', *Sarracenia* 'Chagall'.

Sarracenia 'Chagall'

Submitted: 21 March 2005

This plant was originated by Thomas K. Hayes in 1997, and is a selection of *Sarracenia* × *wrigleyana* (i.e. *S. leucophylla* × *psittacina*). On 24 June 2002, I decided it was worth cultivar status and nominated the currently proposed cultivar name for the plant.

Sarracenia × *wrigleyana* is an uncommon, but naturally occurring hybrid found in U.S. Gulf Coast savannahs (I have seen this hybrid or introgressant examples of it with its parent *S. leucophylla*, in Washington and Baldwin counties, Alabama and Okaloosa County, Florida, USA).

Sarracenia 'Chagall' produces a profusion of intensely colored leaves on quickly-forming multiple crowns. Narrow, upright, apple green lower pitchers traced with pale red venation flare into closed, club-like hoods exhibiting extremely large areoles laced with fine red netting (see Back Cover). Areoles on the uppermost portions of the pitcher are brilliant white, softening to pale pink in lower portions of the upper pitcher. The overall coloration of each pitcher is reminiscent of stained glass.

White and green coloration, large, closed hoods and an upright habit predominate in this cultivar, distinguishing it from the only other registered *S.* × *wrigleyana* cultivar, Bob Hanrahan's *Sarracenia* 'Scarlet Belle', as well as from non-named clones of this hybrid.

Sarracenia 'Chagall' must be propagated by vegetative means in order to retain the characteristics of the cultivar.

I have chosen this cultivar name because the pitcher coloration evokes the work of Marc Chagall (1887-1985), the Russian-born French-Jewish painter and stained glass artist.

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Drosera rotundifolia 'Charles Darwin'

Submitted: 23 February 2005

Drosera rotundifolia 'Charles Darwin' is the first cultivar for the species *Drosera rotundifolia*. Although *Drosera rotundifolia* is a popular plant, its cultivation is problematic for many because of its dormancy requirements. It is important to have an easy to grow cultivar for this sundew since it is such a familiar plant to so many of us today, as it has been for eight centuries! After all, we should not forget that this species is the original "Sun-dew," as Darwin called it during his extensive studies of the species. In my selection of a cultivar name I chose to honor Charles Darwin, the icon of evolution theory, because he showed particular fondness towards this species. Much of Darwin's 1875 book, Insectivorous Plants, was devoted to the plant.

I had previously distributed the cultivar under the unregistered name "Evergrow." A number of people felt this name was unsuitable; in March of 2005 I proposed the cultivar name "Charles Darwin" to other growers, who overwhelmingly favored it as being especially fitting. In Darwin's time, the belief that species were immutable was commonly held. Darwin disproved this using evidence based in part from the experiences of professional breeders. Darwin first made use of the breeder's term "artificial selection" in coining the term "natural selection." Similarly, this new cultivar has diverged from the more typical *D. rotundifolia* by means of selective breeding.

Figure 1: *Drosera rotundifolia* 'Charles Darwin'. Photograph by Chris Hind.

Although *D. rotundifolia* may not be as clearly variable as Darwin's finches, there are certainly different ecotypes to be found. *Drosera rotundifolia* 'Charles Darwin' was created by hybridizing two different parent forms of *D. rotundifolia* naturally found in California which I had originally collected in July, 1997. One parent (from Gasquet, Del Norte Co.; a lowland site) had a weak dormancy requirement, while the other was a larger plant (Willow Lake, N. Plumas CO.; a highland site). I had been cross pollinating these in an attempt to develop a plant more desirable for cultivation; in October 2001 I germinated a plant that exceeded all my expectations.

Cultivate *D. rotundifolia* 'Charles Darwin' as you would the tropical form of *D. anglica* from Hawaii. Like the Hawaiian plant, *D. rotundifolia* 'Charles Darwin' grows continuously under typical indoor terrarium cultivation. Grown outdoors in temperate regions the plant will produce a protective winter bud as normal for *D. rotundifolia*.

Drosera rotundifolia 'Charles Darwin' seed is vigorous and viable, and germinates readily without a cold stratification period. In fact, if the seed is not promptly harvested and dried it often germinates while still in the seed capsule and then rots. While this makes it easy to sow the already germinating seedlings, it complicates the procedure of harvesting seed for storage. Plants flower readily without having to enter a dormancy period first.

Drosera rotundifolia 'Charles Darwin' has proven superior in cultivation to all known natural forms. In many growth trials, growers have remarked that it performs especially well indoors. Cultivation is easy via leaf cuttings. Furthermore, the cultivar's three hallmark traits, seed germination without cold stratification, year-round growth indoors, and ability to flower without having first gone through a dormancy period, are also preserved when the plant is propagated by seed, so the cultivar is available through the ICPS Seed bank. I would like to thank all the many people who helped in the growing trials of this plant and also the many who helped me in deciding upon the great name, *Drosera rotundifolia* 'Charles Darwin'!

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THE STUNNING RED-FLOWERED *DROSERA CISTIFLORA* IN THE WILD AND IN CULTIVATION

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Keywords: cultivation: *Drosera cistiflora.*

Drosera cistiflora is a polymorphic winter-growing, spring-flowering sundew from the southwest Cape of South Africa. The general form is a plant with linear or oblong leaves arranged in a rosette, then scattered alternately up a stem that terminates in a few-flowered cluster of stunning, large flowers. The petals color varies from plant to plant, and may be white, pink, creamy yellow, dark purple or scarlet, often with a dark olive-green to grey centre. Following flowering and seed set the plants retreat to a rootstock that consists of two or three succulent roots by which they wait out the summer drought until they send up new leaves and stems the following autumn or winter (Obermeyer 1980). It is thus a sundew an enthusiast could grow for the flowers as well as for the insect-trapping leaves!

In the wild this species ranges along the coast and adjacent ranges of South Africa from Cape Town east to Port Elizabeth; it occurs to the north to Nieuwoudtville on the edge of the semi-desert of Namaqualand (see Figure 1). The typical form has linear leaves and pale pink to white petalled flowers, however around Cape Town and to the north other variants also occur. Noteworthy variants include the following:

1) Plants with rhombic leaves and many-flowered scapes with white or pink flowers. This variant has been called *Drosera helianthemum* Planch. and *D. cistiflora* var. *multiflora* Eckl. *et* Zeyher (Diels 1906; see Slack 1986: p. 46).
2) Robust pink-petalled plants with oblong leaves that form a large rosette and occur only on the basal third or half of the aerial stem. This variant has been called *Drosera cistiflora* var. *speciosa* (Presl.) Diels.
3) Diminutive plants which may or may not have cauline leaves on the short stem, and bearing flowers that may be white, pink or red. This variant has been called *Drosera zeyheri* (Salter 1940) and red-petalled plants have been described as *D. coccipetala* (Debbert 2002).
4) Plants with linear rosette and stem leaves, and flowers that have stunning dark purple or red petals (see Figure 2) have been called *D. violacea* Willd. Purple-petalled plants of this variant have been called *Drosera rubripetala* (Debbert 1991). It is the red-petalled plants of this variant of *D. cistiflora* that I discuss in the present article.

While visiting South Africa in July 1997 I was taken by Eric Green to see many of these forms in the wild. While it was too early in the season to see many of the plants in flower, I was able to admire more advanced specimens in cultivation in Cape Town. In the wild, *Drosera cistiflora* commonly occurred in well-drained sandy soil and grew apart from all other *Drosera* species, except for *D. trinervia* and *D. alba*. In a few places they grew where water accumulated in the winter. Eric took me to the Ysterfontein Botanical Reserve, near Darling, about 60 km north of Cape Town. This is the best-known place to see the red flowered form of *D. cistiflora*. At the time of my visit the plants had had only recently emerged from dormancy and would need another two months of growth before putting on their stunning floral display. As it was, all that was visible of the plants emerging from the moist clay soil were basal rosettes with few leaves. The vegetation at the site consists of renosterveld: a low herbland or shrubland dominated by fine-leaved members of the daisy family (Manning *et al.* 2002).

I have grown the red flowered form of *Drosera cistiflora* since 2001, and in 2004 I was rewarded for the first time with a flower. This form of the species has linear leaves: in the basal rosette they are up to 15 mm long by 2 mm wide and often terminate with an obtuse apex while the cauline leaves are up to 30 mm long by 1.5 mm wide with an acute end. All the leaves have stalked globose retentive glands on the upper surface. The leaf under surface, stem, peduncle and sepals are covered in minute, short-stalked glands. The tallest plant in my collection has produced a stem 110 mm tall; that was the plant that finally flowered for me. A plant of similar

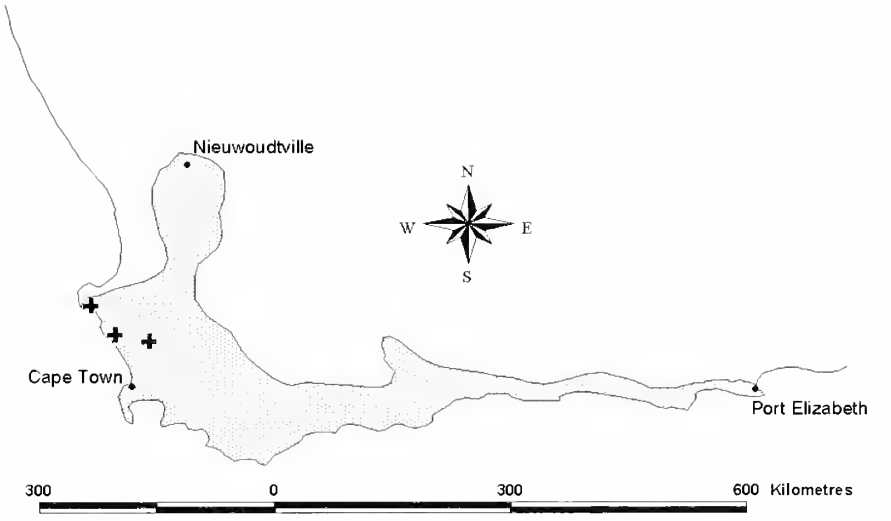

Figure 1: Distribution of *Drosera cistiflora* along the coast and coastal ranges of southern and southwestern South Africa, between Nieuwoudtville and Port Elizabeth. Red-flowered *D. cistiflora* populations are found in the Saldanha—Darling—Hopefield area, indicated on the map by plus signs (+).

dimensions was produced in 2005 and this also yielded flowers.

The flower of this form of *D. cistiflora* is a sight to behold (see Front Cover). The narrowly obovate sepals are up to 11 mm long by 5 mm wide and reflex when the flower is fully open. The petals are obovate with truncate, irregularly dentate margins, and as large as 25 mm long by 17 to 22 mm wide. They are colored a deep scarlet red with an olive-green base. The ovoid ovary is also olive-green and is 4 mm tall by 4 mm in diameter. It is surmounted by three styles that are bifid from the base with ascending free ends. Each style segment is 15 mm long, and is grey-green at the base, translucent in the middle, and red on the apical third. The apical 4 mm of each style segment is multiply-divided into 10 to 20 terete to flabellate style segments. The ovary is surrounded by five erect stamens that have a grey filament 5 mm long, and anthers 1.5 mm long that produce conspicuous orange pollen.

The flower on my *Drosera cistiflora* stayed open for three days and closed each night. Pollen from the anthers was ripe and available early on the first day, and the stigmas appeared to be pollen-receptive at that time too. On the third day, when the outer margins of the petals were beginning to wilt, suggesting the flower's life was coming to an end, I self-pollinated the flower. Over the next few hours the flower began to close for the final time, and the different floral organs retired in a distinctive, orderly sequence. First the styles segments curled inwards until the apices were near vertical, then the petals folded in, to be followed at last by the sepals.

As days turned to weeks, I watched with hope as the ovary enlarged, but since I believed that this species was self-incompatible, due to the amount of resources this species uses to attract pollinators to encourage cross-pollination, I was not optimistic. Five weeks after pollination I harvested the enlarged capsule and obtained approximately 290 black, viable seeds. I was delighted to find that my suspicions of the plant's self-incompatibility were wrong! The seeds were cylindrical to ovoid, up to 0.7 mm long, and had a colliculate surface, i.e. covered in small, rounded protuberances (see Figure 2E).

Drosera cistiflora has specific requirements for cultivation, but once these are met it can be easily grown. From my own experience this species is most difficult to keep alive over the summer, while it is dormant. This appears to be best achieved by growing the plants in large pots (over 20 cm diameter) in a mix that is more sand than peat. The pot is placed in a plastic saucer and given the occasional overhead watering in the summer (when the plant was dormant). The soil is kept moist during the growing season (late winter until late spring). During the growing season, the plants can tolerate a mild frost.

New growth breaks the soil surface in midwinter: June and July for growers in the southern

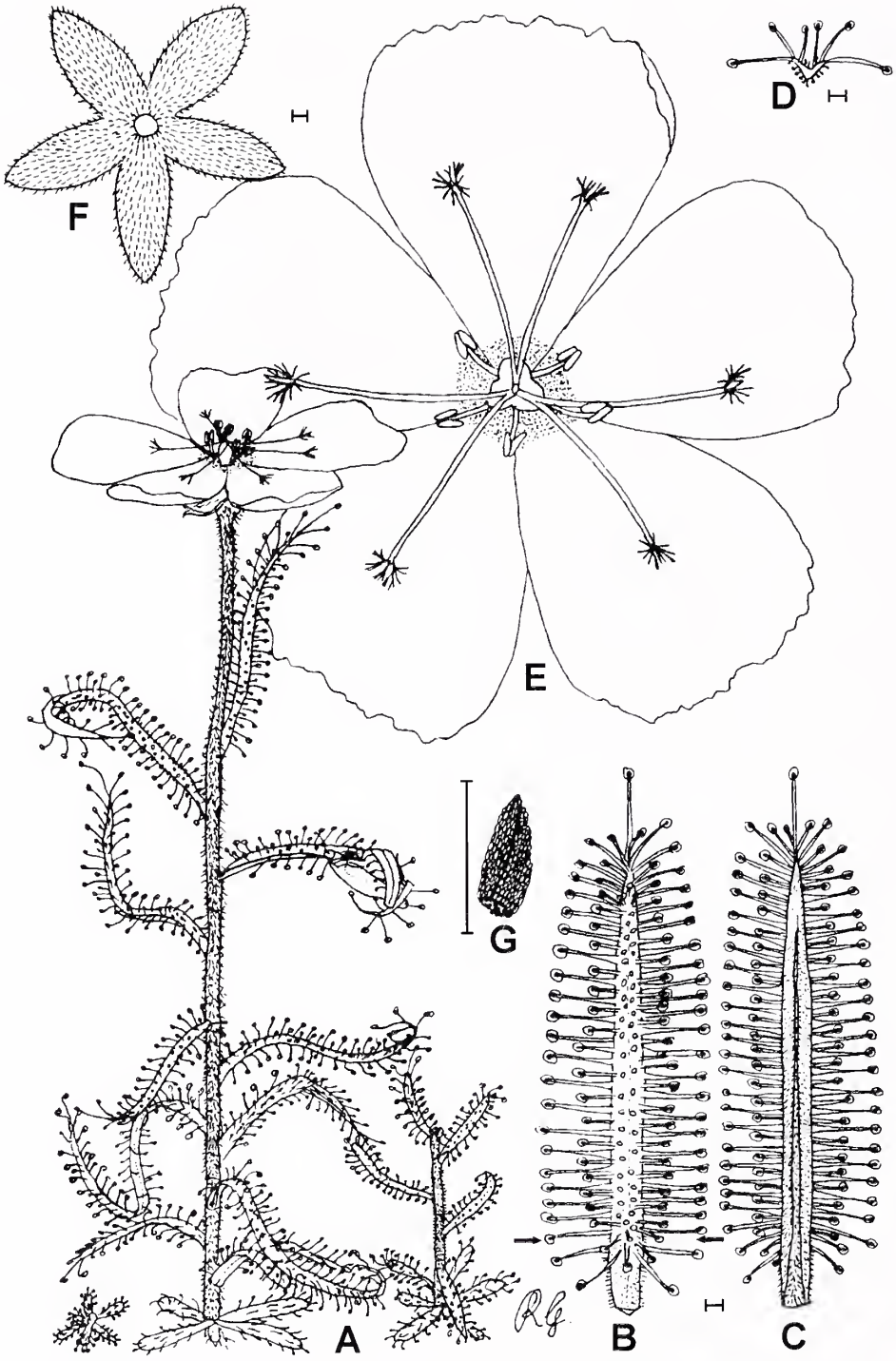

Figure 2: The red-flowered form of *Drosera cistiflora*. A: Habit of the plant; B: leaf upper surface; C: leaf lower surface; D: triangular cross-section of the leaf; E: open flower from above; F: calyx; E: mature seed. Sketch by R. Gibson, 2004. The scale bar represents 1 mm in all cases.

hemisphere (December and January for those in the northern hemisphere[1]). It is easy to become despondent that the *Drosera cistiflora* pot is still showing no sign of life whilst most tuberous *Drosera* are already in active and conspicuous growth. Do not give up, for it appears that this species resumes growth in response to environmental conditions rather than because of a strong internal clock. At first the plant forms a basal rosette, and by early August (February) the plants should form a stem. The cauline leaves are highly mobile and will wrap neatly around larger prey. By late August (February) the lucky grower will detect a spherical flower bud or two in the centre of the apical growing point. The flower buds grow rapidly in September (March) and flowers commonly open in the middle to later parts of that month. Each flower opens in the vertical position, and lasts for three days (see Figure 3). Following anthesis the plant begins to die down to the roots, and this process is commonly completed by November. Ripe seed, if present, is ready to harvest in late October (April).

Plants can be propagated readily. Each plant will commonly produce additional plantlets from the roots, and thus will slowly form a clonal group. New plantlets can also be produced from leaf cuttings, especially when taken early in the growing season. Seed germinates well, especially when fresh, and it too is best sown in autumn or early winter so that seedlings have reached a reasonable size by the time they approach dormancy, and thus have the best chance of surviving their first summer. Plantlets produced by the above methods are particularly susceptible to both desiccation and excessive moisture during the summer dormant period. For best results start them off in large pots and expect some losses. From my experience it appears best to repot this species as actively growing plants early in the growing season. This enables the plants to be watched in the new environment to gauge how suitable it is for them, and also allows the plants to settle in, and develop new thickened roots at an optimum depth in time for the next growing season. The best way to share this stunning form of this species with friends is to send propagules as fresh leaves or young leaf cuttings; these are easy to post and the resulting vigorous plants have a great chance of getting established in time to survive their first dormant season.

In conclusion, it is great to report success in growing the red-flowered *D. cistiflora* and flowering it at last! It was interesting to find that this form forms viable seed when self-pollinated. Both in growth and especially in flower, this spectacular sundew will appeal to most people, especially to carnivorous plant growers accustomed to growing plants only for their carnivorous leaves.

Acknowledgements: I wish to thank Richard Sullivan for kindly providing the *Drosera cistiflora* plants that flowered for me in 2004 and 2005. I am indebted to Eric Green and his family for their hospitality and field assistance when in South Africa in 1997. I also wish to thank the staff and directors of herbaria in South Africa and Western Europe for granting me study access to their collections.

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[1]Of course, I grow my plants in the southern hemisphere, where June-July is midwinter. To aid readers in the northern hemisphere, I include their seasonal information in parentheses.)

Observations of a Two-Headed Flytrap

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Keywords: Observations: *Dionaea muscipula* – physiology: abnormalities.

In the summer of 2003 I observed that one of my *Dionaea muscipula* plants was producing a petiole with two traps. The plant was about five years old when it produced the anomaly, and I had never before seen it make such a leaf. Fifteen other petioles that the plant produced that year were normal. While this abnormality is occasionally reported in the literature and by hobbyists, it is a relatively rare event, so I took the opportunity to make some observations on the development and function of the traps.

I grew this plant in a circular terrarium approximately 44.5 cm (17.5 inches) in diameter, filled approximately 12 cm deep (5 inches) with live, long-fiber sphagnum moss. The plant was watered with both purified water (tissue cell culture-grade, 18.0 megohm/cm) and rain water. The pH of the compost was regularly tested with a laboratory grade pH meter and varied from 4.5-6.0. The plant was never fertilized, but it was hand fed insects (but not excessively) and also caught an occasional fly. The plant produces traps that are green with only a slight blush of pink color, even in strong sunlight. The temperature rarely exceeds 38°C (100°F) in the summer. Nighttime winter temperatures may drop to -10°C (14°F) but rarely lower. The compost does freeze solid during the winter. Humidity remains above 80% during summer months.

In June I first noticed that one of the immature petioles contained dual traps. The traps developed at about the same rate as other traps on this plant and on adjacent plants of similar age. When the traps reached maturity they opened exhibiting two nearly separate traps. Figures

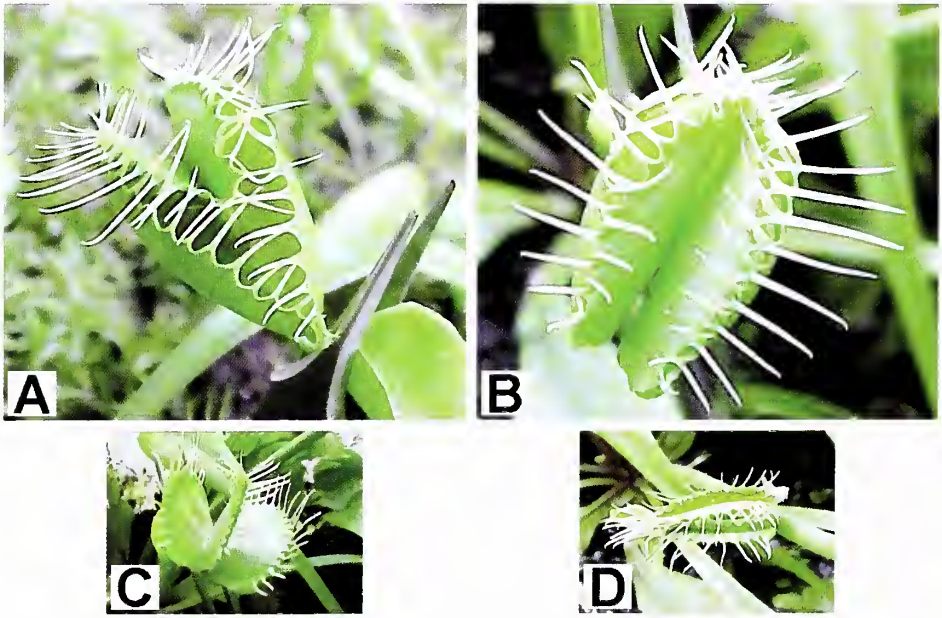

Figure 1: (A) Closed trap after artificial stimulation of trigger hairs on outer half of left trap, viewed from petiole. (B) Closed traps after artificial stimulation of trigger hairs on outer half of left trap. This view shows the fused trap base at the top of the picture. (C) Dual open traps viewed from the distal end of the traps. (D) Closed traps three days after a live fly was introduced into the left trap. The traps have developed the characteristic narrowing of closed appended surfaces.

1A-C show how the two outermost halves to the traps were normally formed. The two innermost halves were separated at the distal end (trap apex), but fused at the proximal end (trap base). All four trap faces appeared to have trigger-hairs, although I was unable to determine how many.

Exciting trigger hairs on any of the four trap faces caused closure of both traps simultaneously (Figures 1A-B). When no prey was present both traps opened within 36 hours of closure (Figure 1C). A living fly was introduced into one trap, which resulted in closure of both traps. Within 36 hours both traps showed the narrowing phase (Figure 1D) described by Darwin (1875). In the distal portion, the trap surfaces closed as if they were two distinct traps. However, in the proximal portion, the outermost trap surfaces functioned as if there was only a single trap. Both traps remained closed until digestion had occurred and then both traps reopened. There was no evidence of self-digestion (i.e. blackening of the trap faces) or seepage of fluid from the empty trap, but the trap with prey did show some self-digestion. This was surprising in that the introduced prey was not particularly large and the trap sealed completely around it.

I will observe the plant for the occurrence of similar unusual traps, but I believe that this was a one time phenomenon and unlikely to be repeated.

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Looking Back: CPN 25 years ago

Bill Barnett wrote about an experience he had at a nursery in San Francisco where he worked: "One day I was stunned when I arrived at work to find a vase of cut *Sarracenia leucophylla* pitchers among the carnations and gladioli. The wholesaler received the pitchers from South Carolina. The pitchers drew quite a lot of attention from the public but were not big sellers.... I mean how many people would have the nerve to present a boquet[sic] of carnivorous plants to their sweethearts?" This is the earliest reference that I (BR) have found of *Sarracenia* being offered to the public as cut leaves. Can you find anything earlier?

A Bog at Walden Pond: Serendipitous Botanical History

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Keywords: history: Massachusetts (USA), Henry David Thoreau.

The American writer Henry David Thoreau (1817-1862) is best known for his famous work, "Walden Pond" (Thoreau, 1854), an account of his two idyllic years spent living in the wilds of Massachusetts. While Thoreau's works and his association with Walden Pond are well known to most people who attended high school or college in the USA, they are probably at most distant memories for those who are many years out of college. Even though I was fortunate to be born and raised in Massachusetts, I never visited the historic Walden Pond site until I was sufficiently inspired by the carnivorous plants and orchids reported to be found thereabouts.

That inspiration came from a paper called "Biogeochemistry of Thoreau's Bog, Concord, Massachusetts" (Hemond, 1980) and a site notation in a book called "Bogs of the Northeast" (Johnson, 1985). The authors of these works described the history of "Thoreau's Bog" and the many botanical wonders found there. The recent date of the research indicated that perhaps this bog might still be extant. Hence, on a rare trip home in 1995, I decided to follow-up on this information with a trip to Walden Pond in search of this bog.

I realize now that my first visit to the area was what could be described in the Thoreauvian tradition as "sauntering" (Smith, 1997). I simply wanted to see just what the Walden Pond area might have to offer. Orchids such as *Cypripedium acaule* and *Goodyera pubescens* were especially abundant, but few carnivorous plants were seen and the quality of their habitat appeared to be quite marginal. Although at the time I thought that I had found Thoreau's Bog (also known as Gowing Swamp), I now know better. Why? Because after much additional research I have realized that Thoreau's Bog never was at Walden Pond! I am not unhappy about the misguided energy I spent looking for a bog near Walden Pond—surely my wanderings provided a good chuckle for the dearly departed transcendentalists buried on Author's Ridge at Sleepy Hollow Cemetery.

Indeed, my serendipitous journey would be especially fitting as it was noted by one local historian that part of Thoreau's legacy was "the joy of the search" (Brooks, 1975), and another author described Thoreau's walks as "his mode of discovery" (Paul, 1958). Searches of his journals are not conclusive about his knowledge of this boggy area in the mid-1800s, but he did comment on "good cranberries" there, and later said "I had no idea that there was so much going on" in Heavenly Meadow[1] (Broderick, *et al.,* 1981-2002).

Heavenly Meadow is a site near Walden Pond, and indeed, there is "much going on" there. Let us take a trip through just a few examples of Thoreau's appreciation of wetlands and their denizens. For as noted by another grand bog man (James A. Larson) who used Thoreau as a benchmark for dedication and perseverance, "Studies of the life of northern swamps and bogs in sufficient detail to result in knowledge of scientific significance required the fanatical dedication of a Thoreau" (Larsen, 1982).

"No other plant, methinks, that we have is so remarkable and singular." This was Thoreau's comment on the "sidesaddle-flower" (*Sarracenia purpurea*) in Volume III of his journals (Broderick *et al.*, 1981-2002; Torrey & Allen, 1906). Indeed, even today the discovery of this plant in the wild often evokes the same response from even well traveled botanists! Thoreau noted pitcher plants at Conant's Grove near Fairhaven Bay and in Gowing Swamp. Eaton's Flora (1974) lists it as "rather common", although it is probably found at only two or three sites in Concord today.

[1]Due to the sensitive nature of this site, its name has been changed to the fictional "Heavenly Meadow" to minimize any possible undesirable intrusions.

Sundews (*Drosera intermedia* and *D. rotundifolia*) are noted in at least two of Thoreau's journals, where he refers to the former as *D. longifolia* or the "spatulate sundew" (Gleason, 1975). Eaton (1974) lists both *D. intermedia* and *D. rotundifolia* as being "common", but has no mention of any other species from this area. Certainly Thoreau's travels to Canada and as far west as Minnesota were sufficient that he might have also seen *D. anglica* and *D. linearis* just as he had seen *D. filiformis* (perhaps on Cape Cod) (Thorndike, 1987).

Bladderworts (*Utricularia*) are noted in several journal entries. Eleven species have been reported in this area (Eaton, 1974), and Thoreau noted several of these in his travels to Flint Pond, Fairhaven Bay/Pond, Sudbury Meadows, and Heavenly Meadow (Torrey & Allen, 1906). I have seen only one species which appeared to be *Utricularia macrorhiza* at Walden Pond, but certainly others could be expected wherever habitat persists. Currently there is research in progress using Thoreau's data on flowering dates of *U. macrorhiza* and other species to see how global warming has apparently increased initial and peak flowering times at Walden Pond (Miller-Rushing & Primack, 2004).

Several orchids were noted by Thoreau in the Walden Pond area, and as noted earlier, at least two—*Cypripedium* and *Goodyera*—are still abundant. I have seen *Calopogon tuberosus* in Heavenly Meadow and certainly *Pogonia ophioglossoides* or *Arethusa bulbosa* could also persist there despite the description of these orchids as "may linger somewhere" or simply "?" in Thoreau's journal entries (Torrey & Allen, 1906). *Platanthera blephariglottis* would not be a surprise given the presence in the area of its frequent companions *Sphagnum*, *Sarracenia*, and *Drosera*.

The cranberries (*Vaccinium macrocarpon* and *V. oxycoccos*) noted earlier by Thoreau (Torrey & Allen, 1906), Eaton (1974), and others have certainly persisted with the modest sphagnum mat found here. The *Vaccinium macrocarpon* probably contributed greatly to the Heavenly Meadow Cranberry Sauce that was served at a Thoreau Society Symposium in 1962 honoring the 100 year anniversary of Thoreau's death (Maynard, 2004). The possibility of finding podgrass (*Scheuchzeria palustris*) or Labrador tea (*Ledum groenlandicum*) here must be considered by anyone fortunate enough to penetrate this wilderness. The former was found to be abundant in Gowing Swamp by Thoreau in 1855 (Torrey & Allen, 1906) and later was seen by Eaton in Harrington's Swamp in the 1950s (Eaton, 1974). Unfortunately, only five sites have been documented for this species in Massachusetts since 1978 (Anon., 1998). *Ledum* was said to be once found in a single location in Concord that has now been destroyed (Eaton, 1974).

Several other boggy or aquatic species of note from the Concord area such as *Menyanthes trifoliata*, *Eriophorum* spp., *Carex* spp., *Lycopodiella inundata*, *Kalmia polifolia*, and *Chamaedaphne calyculata* were initially listed in Thoreau's fourteen journals. Additional information on these species or others of interest can be found in Eaton (1974), Gleason (1975), and Angelo (2001).

Obviously my discovery of Heavenly Meadow and my subsequent research has been a curious trip through botanical history, sauntering through the countryside, and connecting generations of botanical travelers to Thoreau, and also to those of us who have followed his voluminous works.

Herbert Gleason (cited in my list of references), was Thoreau's photographic bibliographer, and he met John Muir in California in the 1900s (Beckman, 1975). However, Muir did not "meet" Thoreau until he visited his gravesite in 1893 (Maynard, 2004). Gleason and I have much in common as we have both traveled extensively in the footsteps of Muir from the Sierras of California to Alaska, and also as we both have journeyed transcontinentally in our effort to catch up with the great saunterer—Henry David Thoreau.

Acknowledgments: I would like to thank the following individuals for their insightful contributions to the completion of this paper: Ray Angelo, Harvard University Herbarium; Ed Schofield, Tower Hill Botanic Garden; Richard Primack, Boston University; Marsha Salett, Massachusetts Audubon Society, Broadmoor Wildlife Sanctuary; W. Barksdale Maynard, John Hopkins University and University of Delaware.

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Propagating *Dionaea* by Tissue Culture Using Flower Stalks

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Keywords: cultivation: tissue culture, *Dionaea.*

Introduction

It was inevitable. As a novice carnivorous plant enthusiast in 2002, I had been scouring the internet educating myself about carnivorous plants and how to grow them, and I encountered numerous references to tissue culture as a means of propagating plants. The advantages of tissue culture are the ability to rapidly propagate plants, and for cloning cultivars or endangered plants which can not be propagated efficiently by any other method.

This intrigued me because I was spending a lot of money increasing my modest collection, and I wondered if it would be possible to propagate carnivorous plants this way. Planting seed, making divisions or leaf pullings (a very common way to propagate *Dionaea*) worked, but was slow. I discovered the "Kitchen Culture Kit" website (http://www.kitchenculturekit.com), and decided to try it on my carnivorous plants. My first cultures were *Dionaea* 'Dentate Traps' and *Dionaea* 'Red Dragon' cultivars. Both cultures were successful, with over 25 plantlets of each type being produced from only a single leaf trap cutting from each plant in only a matter of months! Despite the perception that tissue culture is somewhat difficult, and requires an expensive lab environment and equipment, it can actually be done at home with simple equipment for relatively little money (see Figure 1). The "Kitchen Culture Kit" costs less than $100 (US), and includes media, hormones, baby food jar caps, measuring spoons, droppers, pH test papers and instructions with a Material Safety Data Sheet CD.

Figure 1: Tissue culture tools and supplies.

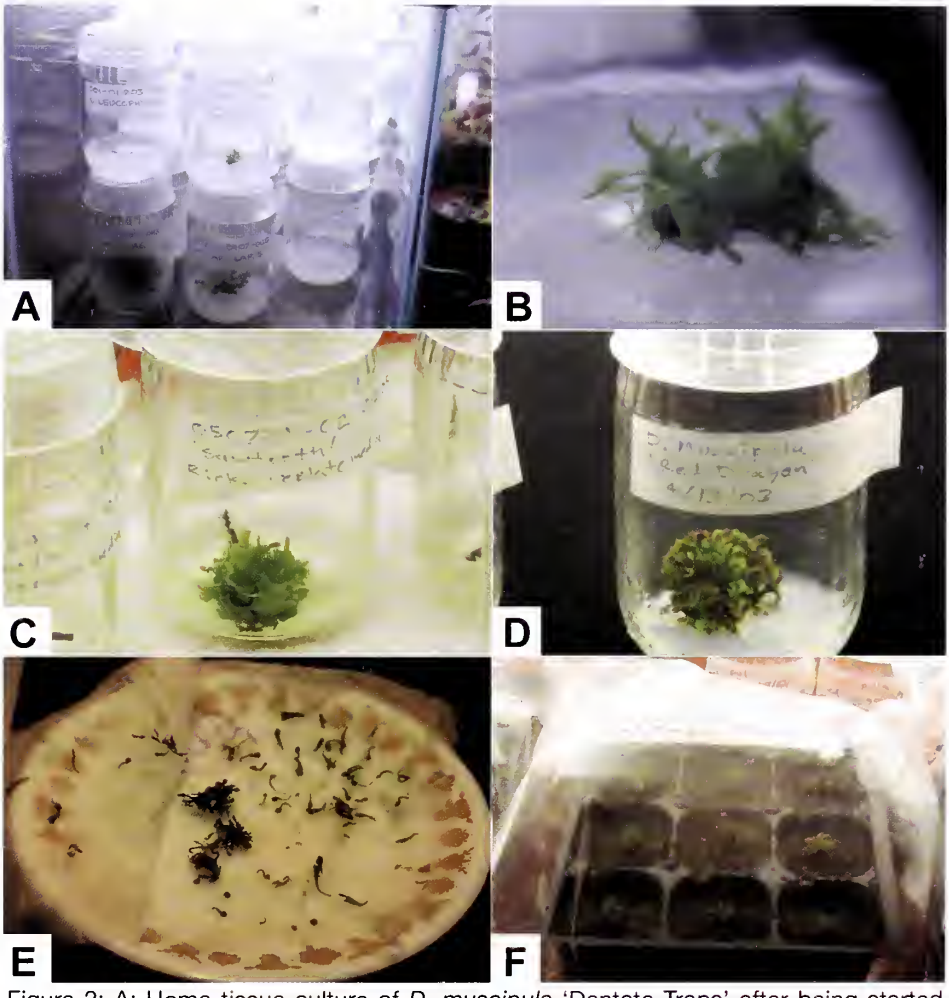

Figure 2: A: Home tissue culture of *D. muscipula* 'Dentate Traps' after being started three months from a single leaf trap. B)Close view of growth at three months. C)*Dionaea* 'Sawtooth' culture at approximately two months. D)*Dionaea* 'Red Dragon' at five months, just before transplanting. E)Look at all the *Dionaea* 'Red Dragon' plantlets! Each clump contains approximately 30 plantlets with leaves and roots. F)*Dionaea* 'Red Dragon' hardening off.

In tissue culture terminology, plant tissue material taken from a plant is called an "explant." Around a dozen or more plantlets can be produced from a single explant. The resulting plantlets can either be transplanted or sub cultured to produce more plantlets, which over the course of a year could conceivably multiply into the thousands.

Every summer, growers cut off and discard emerging *Dionaea* flower stalks in order to conserve the plants' energy. I decided to try using the flower stalks as explant material for tissue culture. I did not know if it would work, because to my knowledge, no one has documented propagating *Dionaea* by tissue culture using flower stalk cutting material. However, I have confirmed that it can and does indeed work (see Figure 2)!

I have found that when using *Dionaea* flower stalks as explant material, you can use any part of the flower stalk—from the base, all the way to the top of the inflorescence. The portion at the top (where the flowers are) can be used, however, sterilizing this complicated structure sufficiently is difficult and is likely to be unsuccessful in many cases. The age of the inflorescence

Figure 3: A simple cleanbox or transfer hood.

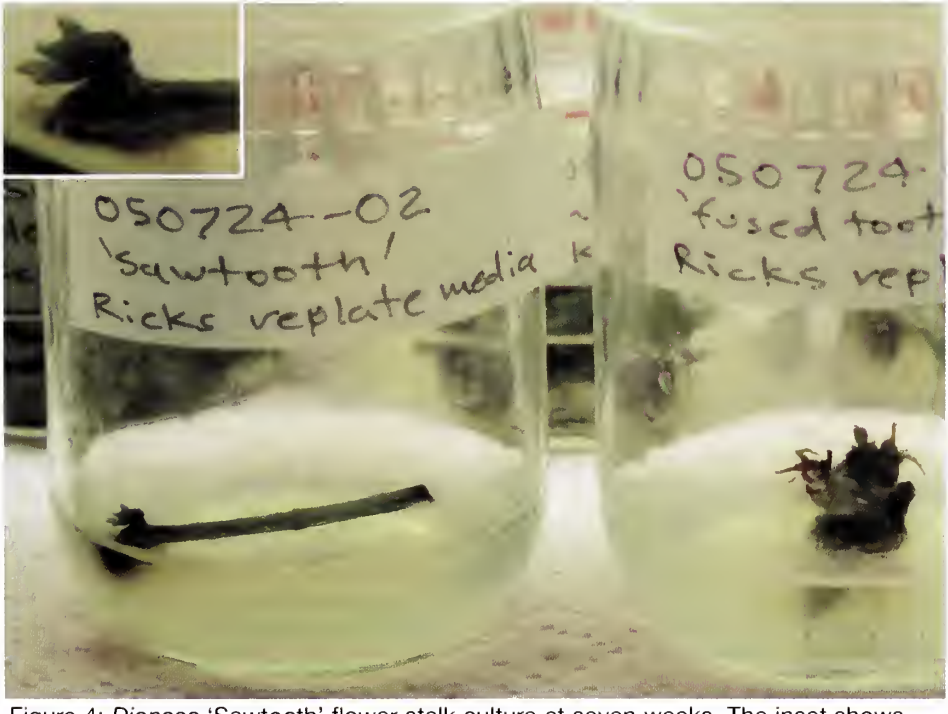

Figure 4: *Dionaea* 'Sawtooth' flower stalk culture at seven weeks. The inset shows the emerging new growth.

does not seem to be very important. I have used very young flower stalks, and flower stalks that were just about ready to flower. The flower stalks do not even have to be very fresh; I have been sent flower stalk material (packed in small plastic baggies containing medium), which were put into medium days later, and was successful in culturing plants!

Process and Procedures

The process is relatively simple. You must first prepare all the materials you will need, such as sterile capped containers containing a gelled medium solution. For the gelled medium, I have been using the formula listed in Rick Walker's on-line article (Walker 1996). The medium consists of the following: 1/2 strength MS Salts (Murashige and Skoog medium), 100mg/l Casein, 100mg/l inositol, 0.2 mg/l NAA and 5.0 mg/l 2iP, 30000 mg/l sucrose and 7 g/l agar. Casein and Inositol can sometimes be found at health or natural food stores. I normally use one packet of MS to make two liters of medium at a time. For more information on these components, refer to Darnowski (2004).

I take 150ml of the medium, add the sugar, and then adjust the pH to around 5.9 using either baking soda to increase the pH, or vinegar to decrease the pH. I use a small plastic syringe (from a farm feed store) to dispense the medium into six baby food jars (25ml per jar). I also add a small amount of agar (as a gelling agent) to each jar, and then cover them with polypropylene-magenta "B-Caps" (caps made specially to fit the kind of baby food jars I use), or metal lids punched with small holes which are covered with waterproof adhesive bandages. The jars are sterilized in a pressure cooker for 15 minutes. I wrap all my cutting and manipulation tools (such as tweezers and knives) in aluminum foil and sterilize them at the same time.

When the jars cool, they are moved into a transfer hood (see Figure 3). This can be any sort of open boxy container that serves to help minimize flow of airborne contaminants such as dust, bacteria and mold. Mine is simply a plastic storage container turned on its side, with a piece of transparent film taped over the front. It is a good idea to wipe out the interior of the box with alcohol, and even spray alcohol into the air adjacent to the box to help settle any airborne contaminants. Cleanliness during culturing operations is very important! Wash hands thoroughly (I also spray them with alcohol), or wear surgical gloves. Minimize any air movement in the vicinity by closing doors and windows, and move about the area slowly. I use a spray bottle of isopropyl alcohol to resterilize my hands and tools used in the transfer hood.

Next, cut a *Dionaea* flower stalk into pieces a bit shorter than the width of the mouth of the jars holding the medium. Move these explants into the transfer hood, and surface-sterilize them in separate solutions of 70% isopropyl alcohol, 10% bleach, and 3% hydrogen peroxide for perhaps 1-3 minutes each. Rinse the explants in sterile water and place them onto the surface of the medium in each baby food jar. The explants must be in direct contact with the medium—it does not seem to matter if they are on the surface, partially submerged, or completely submerged. Recap the jars and seal them as I described above. The jar and lid can be sealed using a plastic film tape if desired, but in most cases I have not found it necessary. Perform the transfers as quickly as possible to reduce the possibility of airborne contaminants entering the jars.

When all jars have been prepared and sealed, label them and transfer them to a shelf approximately 25-30 cm (10-12 inches) below fluorescent lights. My lights are operated by a timer set to provide around 18 hours of light per day. Visually check the jars periodically for signs of contamination. If contamination occurs, the contents of the jar should be discarded. If the explant is valuable and still alive, you can try to resterilize it and return it to a new jar of medium (all this should be done in the transfer hood, of course).

With luck, in perhaps 4-8 weeks the explants should swell and new growth should start (see Figure 4). The new growth will usually consist of a tightly packed mass of plantlets with leaves (fully formed with traps) and roots. However, some varieties grow just a few large plantlets. The plantlet mass can be removed from the jar, divided, and either transplanted to soil, or sub-cultured into fresh jars of media to be multiplied even further.

While propagating *Dionaea* from flower stalk material does work, problems can and likely will be encountered. The three main problems I have experienced are mold or bacterial contamination, phenolic bleeding, and callus formation. Symptoms of mold and bacterial contamination are obvious—the contaminants can be seen growing on the explant or into the medium. This is a result of to either insufficient sterilization or poor procedures. If you have problems with this, review your techniques, talk to other tissue culture practitioners, and try again. Phenolic bleeding occurs as a result of the plant material attempting to deal with the affects of a cut wound. Generally the symptom will be a dark reddish-violet or intense yellow color that spreads throughout the media. The yellow phenolics are so volatile they will usually stain the plastic caps! Resterilization and reculturing may reduce and eliminate the bleeding. Callus formation is the result of rapid, undifferentiated cell growth resulting in an amorphous lumpy appearance, rather like a head of cauliflower. Callus formation is usually due to effects of hormones. While callus formation may be fine for some tissue culture programs, eventually the callus must be stimulated into producing leaves and roots. Try transferring the explant to a new medium with smaller or no concentrations of hormones, or changing the ratios of hormones in the medium.

Having successfully tissue cultured *Dionaea* using flower stalk material, my next project is to try the same with other carnivorous plant species. Is the young, rapidly growing flower stalk tissue from *Sarracenia* is relatively free enough of inborn bacterial contaminants as to be viable? Currently I have initiated a number of *Sarracenia* flower stalk cultures that look promising (there is no sign of growth, but very little or no contamination either). As for other species, tissue culture can be tried using information and protocols from additional tissue culture related articles in other issues of Carnivorous Plant Newsletter.

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Aldrovanda vesiculosa and its Cohabitant Algae in Culture

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Keywords: cultivation: *Adrovanda vesiculosa*, algae.

Introduction

Carnivorous plants are usually weak competitors and are restricted to habitats that are unfavourable to noncarnivorous plants. The carnivorous aquatic species *Aldrovanda vesiculosa* L. (Droseraceae) seems in particular to have the least potential to compete successfully with other plants. Neither *Utricularia* nor other vascular hygrophytes (Juniper *et al.*, 1989; Adamec, 1997), or *Sphagnum* (Fijalkowski, 1958, cited in Juniper *et al.*, 1989) are usually tolerated, although exceptions are observed, such as recent observations of Aldrovanda in Western Australia with *Utricularia australis* (Gibson, 2004). In all cultivation protocols, even algae are considered to be a hazard for *Aldrovanda* (e.g. Adamec, 1997; Braem, 2002; D'Amato, 1998; Slack, 2000).

In the greenhouse at the Institute of Ecology and Conservation Biology in Vienna, we have cultivated *Aldrovanda* in numerous different pots indoor for over two years now. During our first experiments, we had immediate losses due to a heavy growth of algae but after the reduction of algae by *Typha*-extracts (Slack, 2000), we had better success. Finally, we were so successful that our plants flowered and fruited but to our great surprise, we observed thick mats of algae between these perfectly growing plants. Since this is contradictory to all literature on cultivation of *Aldrovanda*, a closer examination of these algae seemed appropriate.

Materials and Methods

Monitoring of algae in *Aldrovanda* cultivation pots was done during 2002-2004. Algal identifications were determined using Streble (2002), Migula (1907), Prescott (1978), Lenzenweger (1996; 1997; 1999), and Klotter (1970).

The thorough investigation of algae also revealed bacteria that apparently are tolerated by *Aldrovanda*. Analysis of bacteria was done by scanning electron microscopy and DAPI staining.

Microscopic investigations were done using Reichert Univar and Nikon Labophot II light microscopes and a Jeol JSM 35CF scanning electrone microscope.

Results and Conclusions

The analyses of algae resulted in the identification of twelve different genera of algae growing in the culture pots (Table 1). Of these, three genera occurred in combination with poorly growing plants. *Selenastrum* especially appears to be a real killer of *Aldrovanda*; after its mass development, our plants were dead within one week. Filamentous *Oedogonium* and unicellular *Characiopsis* (see Figure 1) grow as epiphytes (i.e. on the surface of the *Aldrovanda*) and kill *Aldrovanda* simply by overgrowing it.

The filamentous algae *Tribonema vulgare* (see Figure 2), *Oscillatoria* spp. and the coccal cyanobacterium *Gloeocapsa* were growing in very high abundance between flowering *Aldrovanda* plants, obviously doing no harm. In between the trichomes of *Tribonema*, six genera of unicellular, microscopic algae were found in low abundance (see Table 1, column 3), but these taxa were not restricted to well-growing plants. Sometimes we observed these species trapped and dead in the traps.

Bacteria were found in high abundance in all the pots used in our *Aldrovanda* cultivation:

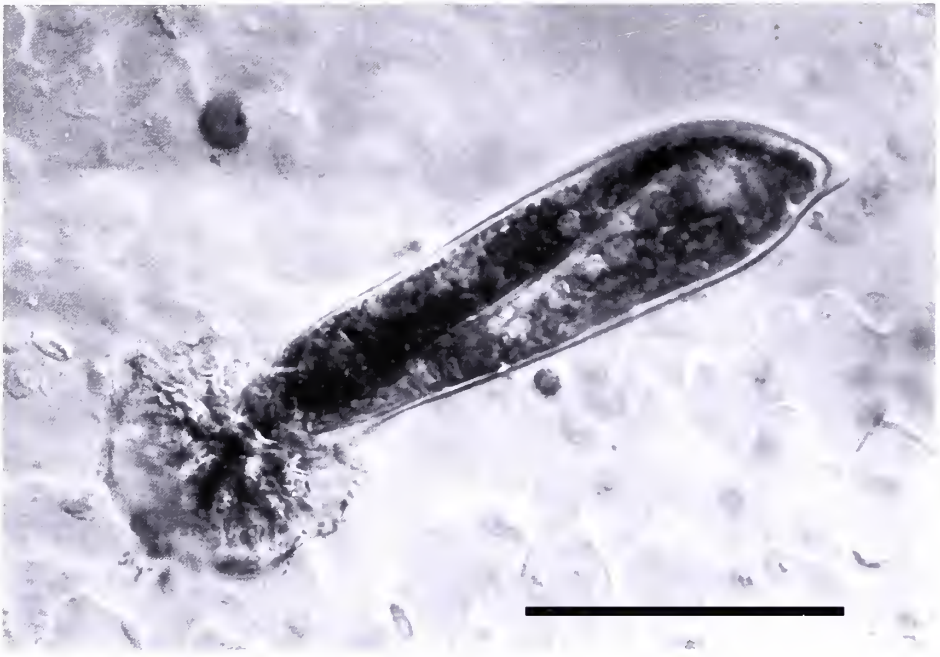

Figure 1: *Characiopsis* sp. The unicellular alga is attached to an *Aldrovanda* trap by a disc-like rhizoid. Differential interference contrast image; scale bar indicates 20 microns.

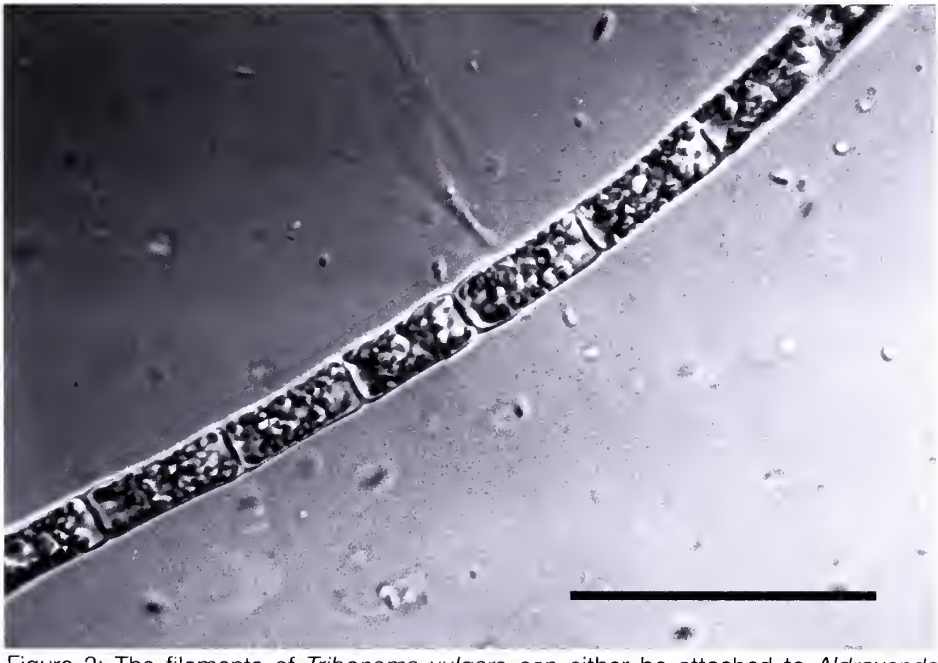

Figure 2: The filaments of *Tribonema vulgare* can either be attached to *Aldrovanda* plants or occur free floating. Differential interference contrast image; scale bar indicates 20 microns.

On well-growing *Aldrovanda*	On poorly-growing *Aldrovanda*	Very rare or apparently uncorrelated to the health of *Aldrovanda*
Tribonemavulgare[1] (Tribonemataceae)	*Selenastrum* (Oocystaceae)	*Navicula* (Naviculaceae)
Gloeocapsa (Chroococaceae)	*Oedogonium*[1] (Oedogoniaceae)	*Closterium* (Desmidiaceae)
Oscillatoria (Oscillatoriaceae)	*Characiopsis*[1] (Characiopsaceae)	*Cosmarium* (Desmidiaceae)
		Chlorella (Oocystaceae)
		Gomphonema[1] (Gomphonemataceae)
		Dactylococcopsis (Chroococcaceae)
[1]Grows epiphytically.		

Table 1: Genera of algae found with *Aldrovanda vesiculosa*.

in the water as well as between algae and on the surface of the water. Bacteria also grew epiphytically on the surface of the *Aldrovanda,* but in a much higher abundance on poorly growing individuals (see Figure 3). In all plants, bacteria were less frequent on the inner side of the trap than on the outside. We found a high abundance of protozoa in all pots and on all plants. *Paramecium caudatum* and *Zoothamnium arbusula* (see Figure 4) were the most common.

In contrast with most of the literature, we conclude that *Aldrovanda* is able to tolerate the presence of specific algae. Although some taxa are dangerous, others are completely harmless even after they grow into large masses. This is in agreement with the observations of Darnowski

Figure 3: Numerous bacteria around a quadrifid gland on the inner surface of an *Aldrovanda* trap. Scanning electron microscope image; scale bar indicates 20 microns.

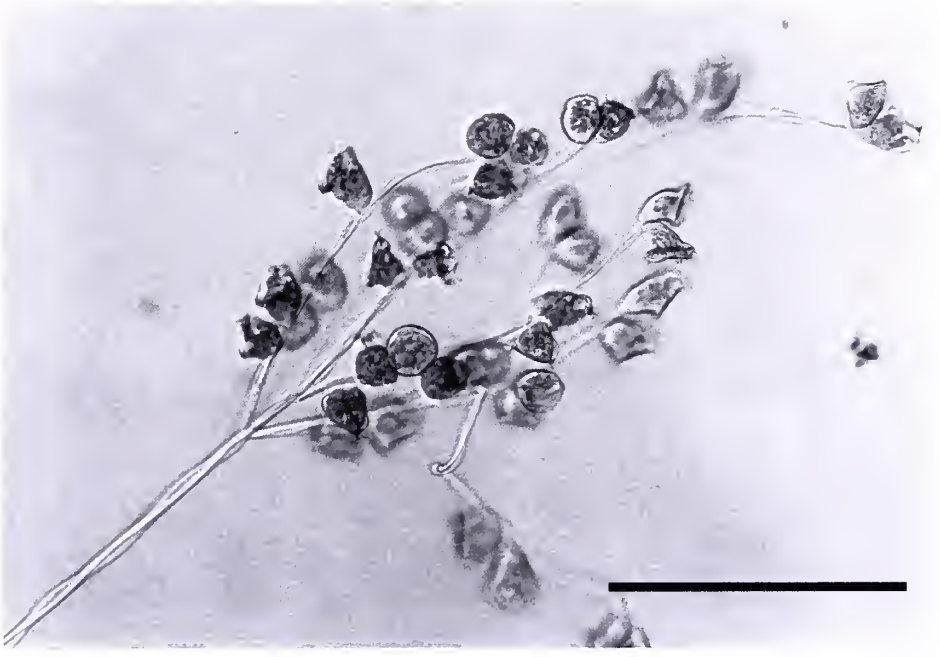

Figure 4: The sessile ciliate *Zoothamnium arbusculare* is often observed growing epiphytically on *Aldrovanda* plants. Bright field image; scale bar indicates 200 microns.

(2004) who found cyanobacteria and undetermined eukaryotic algae in *Aldrovanda* sites in Australia. All cyanobacteria occuring in our *Aldrovanda* pots are correlated with good growth and assimilating atmospheric nitrogen (Fogg *et al.*, 1973). The growth of *Aldrovanda* may be supported by this additional nutrient input. Bacteria do not appear to disturb the growth of *Aldrovanda*, but they are more associated with poorly growing plants. The presence of protozoa does not seem to affect the plants at all.

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News and Views

Dr. Thomas C. Gibson (tomgibson_5@hotmail.com) writes: Readers of Carnivorous Plant Newsletter might know that the Venus flytrap is now being considered for endangered status: about 70% of the populations monitored are now extinct and the last census found only an estimated maximum of 35,800 plants in nature. Decades of ruthless collection, as well as lack of fire and drainage of its habitat, have brought the flytrap close to extinction. (65,000 plants were dug each week from nature by one North Carolina Company alone in 1981). If you are interested in this conservation problem, what can one do? The safest place is preservation in nature, as agreed by most plant conservationists, and this means protection of its habitat, augmenting population sizes, and restoring most of the whole species. This is a costly and ambitious process. In essence, I propose a voluntary premium placed on each plant sold, perhaps 25-50 cents. This small added cost could generate $250,000 per year for restoration and conservation of this remarkable and unique carnivorous plant species. Such donated funds would be dispersed by an *ad hoc* Venus flytrap Conservation Committee, now forming. To learn about this, contact me for a summary of the proposal. What can you do as a reader of the Carnivorous Plant Newsletter? First, I would buy only genuinely propagated flytraps. You might donate to the fund, as instructed in the article. Just spreading the word alone might help immensely. With a small premium but big volume sold each year, the Venus flytrap can pay for its own conservation and be restored to its former glory where suitable habitat still exists.
Note: The ICPS is not affiliated with the organization mentioned in the above message.

Barry Rice (barry@sarracenia.com) writes: I have been studying a *Darlingtonia californica* site in Nevada County, California since 1997. This is the site famous for having the anthocyanin-free *Darlingtonia* 'Othello.' I have been very interested in the pollination biology of *Darlingtonia*, and those familiar with this topic know that despite many field studies, no one has ever identified the pollinator for *Darlingtonia*. It has been widely proposed that certain spiders are the pollinators. Like many other scientists who study *Darlingtonia*, I have never seen any pollination activity in *Darlingtonia* sites, despite having logged a great many hours in my research plots. However, on 21 June, on a trip to my research site to monitor this year's set of experiments on pollinator exclusion, I was astonished to see active pollination of the flowers by two species of bee. Extraordinarily, one of the bees was the non-native *Apis mellifera*, i.e. the common European honeybee. The second bee was a wild Californian species, *Andrena nigrihirta*. Stephen Davis was with me at the time, and together we observed as both species of bees repeatedly visited flowers, climbed up to the anthers, and subsequently left to visit other flowers. Obviously, the *Apis mellifera* cannot be considered part of the normal pollination biology of this plant, but the *Andrena* is apparently a pollination agent. A more detailed publication on this year's research is in development. You can see some of our preliminary results, including photographs of the pollinators, at: http://www.sarracenia.com/trips/ca012006.html

History of the name *Pinguicula hirtiflora* Ten. (Lentibulariaceae), or on the uncertainties of Michele Tenore about butterworts

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Keywords: History: Lentibulariaceae, *Pinguicula crystallina*, *Pinguicula hirtiflora*—history: Michele Tenore.

The Central Mediterranean unit *Pinguicula crystallina* Sibth. et Smith subsp. *hirtiflora* (Ten.) A. Strid was recently the object of a survey (Peruzzi *et al.* 2004). Interestingly, this plant is known as the most variable in the genus *Pinguicula* (commonly called butterworts), at least from a karyological point of view (Peruzzi 2004). It is noteworthy to say that recent investigations on its seed morphology and anatomy were also carried out (Degtjareva *et al.* 2004), supporting the (specific) distinction of *P. hirtiflora sensu stricto* from *P. crystallina*.

This short note aims to put in evidence and discuss the singular and controversial history of the name *Pinguicula hirtiflora* Ten. This name was created and described by Michele Tenore (1780-1861) in the "*Prodromus*" placed at the beginning of the first volume of his monumental "*Flora Napolitana*", without any indication of herbarium specimens and/or type localities (Tenore, 1811: 6 "VI"; "Pinguicula hirtiflora. *Nectario subulato erecto, flore breviore, labio superiore patente profunde bilobo, inferiore tripartito, fauce pilis hirta. Nobis*"). It is useful to note that Napoli's Kingdom, in nineteenth century, covered approximately one half of what since is now Italy (i.e. from Abruzzo to Calabria) and Tenore's flora was devoted to all this ample territory. In this work in 1811, he recognised only one butterwort species. Four years later, Tenore (1815) removed this species from his Flora; the reason for this choice can be found in the following volume (Tenore 1824) — the author had concluded that his butterworts were identifiable with *P. grandiflora* Lam., which had been described in 1789.

Consequently, the great botanist recognised both *P. grandiflora* Lam. from Campania (presently the *locus classicus* of *P. hirtiflora*) and his "exhumed" *P. hirtiflora* Ten. (Tenore 1824). In that volume, this latter name is applied to the plants from Abruzzo ("*Nasce alla Maiella, presso le scaturigini de' ruscelli, all'Ospizio, alla Valle dell'Orfenta; fiorisce in luglio; perenne*"), and it is considered as possibly synonymic with *P. longifolia* Ram. ex DC. (a name described in 1805 which would have had priority if the current nomenclatural rules were in effect at that time). Also the description is slightly different ("*Foliis oblongo-lanceolatis obtusis in petiolis longe attenuatis; scapo glabro; corollae labio superiore bilobo, inferiore trilobo duplo longiore, fauce, pilis erectis glandulosis albis, villosa; nectario incurvo acuto corolla breviore*"), but it consistently points out the same characters as important: spur features and hairiness of the flower's mouth; he notes also that this plant should have glabrous scapes. However, it must be said that Tenore observes: "*...del resto considero la mia pianta come suscettibile di migliore esame, e solo mi duole di non averne potuto dare la figura, perché da' saggi secchi essa non può rilevarsi; né mi è stato possibile ritornare negli stessi luoghi ove la raccolsi per la prima volta nel 1806.*" ("...however, I consider my plant as worthy of better examination, and I am sorry not to have produced an iconography (Note: He would eventually do it in 1830 with the right plant!), because from herbarium specimens it cannot be studied well; I have not even been able to return to the same places where I collected it for the first time in 1806.") So, it is very likely that Tenore based his original description of *Pinguicula hirtiflora* both on plants from Abruzzo and Campania, based only on the spur length and hairiness of the corolla mouth (the term "*hirtiflora*" means indeed "with hairy-flowers").

In the fourth volume of "*Flora Napolitana*", Tenore (1830a) returned to this matter, always recognising *P. grandiflora* and *P. hirtiflora*, but (apparently in error) exchanging the place of the localities so *P. hirtiflora* of the previous volume ("*excl. locis natalibus ad praecedentem [*P. grandiflora*] spectantibus*"), became the plant from Campania (instead of from Abruzzo), "*Ad fontium scaturigines montium Stabiarum et Principatus Citerioris: all'acqua Santa di Monte S. Angelo di Castellammare, all'Avvocatella, alla Molina presso la Cava, e presso la Trinità di Cava*". Also the descriptions were changed and the author, now aware that many butterworts have a hairy corolla mouth, notes also the peculiar, two-lobed form of the petals in *P. hirtiflora* ("*Calcare subulato corollam subaequante, laciniis subaequalibus subrotundis profunde bilobis, fauce villosa, germine staminibus superincumbente*"); the author says also that the plant can indifferently have glabrous or hairy upper scape.

Finally convinced of his own opinions, Tenore (1830b) felt confident enough to write a brief dissertation on the differences separating *P. hirtiflora* from other butterwort species such as *P. vulgaris* L. and *P. alpina* L.

The history above could leave you with a bad impression of Michele Tenore as botanist; he was instead a great one (and many other cases showed it), but evidently not so confident with the genus *Pinguicula*!

To clear up the confusion, Peruzzi *et al.* (2004) formally lectotypified the name *Pinguicula hirtiflora* with an herbarium specimen from Campania ("*M.te della Cava di Castellammare, all'acqua Santa, s.d., Tenore*, NAP"), acknowledging its current application (e.g. Casper 1962, 1966). Finally, it is worth noting that Tenore, when quoting Abruzzo, (mis-)applied the name *P. hirtiflora* to the plants known today as *P. fiorii* Tammaro et Pace, a stenoendemic species described from Maiella at the end of twentieth century (Tammaro & Pace 1987).

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On Growing Mexican *Pinguicula*

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Keywords: cultivation: Mexican *Pinguicula.*

I would like to write about growing Mexican *Pinguicula* for those enthusiasts that do not grow them. You may not know what you are missing. Most that do grow them would agree that they are a very beautiful plant to have. I have grown temperate species, but do not think there is any comparison; the Mexican *Pinguicula* get so much larger, they live much longer, are a little easier to grow, propagate very easily from leaf cuttings, and bloom so beautifully for such a long time. Most of mine bloom continuously for three to four weeks, with three or four blooms at a time. Most of the flowers are shades of white, pink, and blue, but since I have a form of color blindness so all the pinks and blues look the same to me. *Pinguicula laueana* is the only butterwort that has all-red flowers. Some species (such as *P. immaculata*) have all-white flowers, as do some clones of commonly grown species such as *P. moranensis*. Imagine about twenty of these various *Pinguicula* all in bloom with three or four flowers per plant—reds, whites and blues all mixed together—it is a very pretty sight.

As for size, Mexican *Pinguicula* are surpassed only by a few of the largest European species (such as *P. longifolia* and *P. vallisneriifolia*). The leaves of some of *P. moranensis* plants frequently reach about 15 cm (6 inches), long, and one of mine produces leaves over 18 cm (7 inches) long. Butterworts are not hard to obtain, although some are a little more time consuming to find—have patience!

Mexican *Pinguicula* are very easy to propagate with leaf cuttings. Simply pull gently at a leaf base until it twists off, then set it on slightly dampened pure vermiculite (this prevents leaf rot) in a covered container in good light. Presto! In a week or two you will notice little bulges where new plants are forming (usually at the leaf base). When these form roots, plant them in 50/50 sand/peat (with a little vermiculite added). Now you have more Mexican *Pinguicula* growing!

I grow my Mexican *Pinguicula* under two 1.2 m (4 foot) fluorescent lights. I keep my plants sitting in trays filled with about 2-3 cm (1 inch) of rainwater. They catch plenty of fungus gnats during the summer, but I also apply a foliar spray of acid fertilizer a couple times a month. In fall you must recognize their dormancy period and grow them much drier, otherwise they will rot! During the winter dormancy they are much more like a succulent plant, and it easier to have rot problems keeping them too damp than too dry. It is best to grow them with no water in the tray, but I do mist them heavily every few days until the resume spring growth.

I would like to encourage folks to give them a try. If you are not growing them already, you might just like it. And for those that are growing them, especially the rarer ones, make sure you propagate them so they can be enjoyed by others. Propagating them and spreading them around only helps to insure their survival in cultivation well into the future.

As I write this it is fall and winter is quickly approaching. All my temperate carnivorous plants are slowly going dormant—calling it quits for another year—including my Mexican *Pinguicula*. But this means I have time to plan for spring: new carnivorous plant acquisitions, collecting seed, plans for repotting and dividing plants. It is time for all of us to look back and learn from our plant successes and losses, and for many, for finding even more space for the ever increasing size of our carnivorous plant collections. But also, my attention turns to my winter growing *Drosera* and the few *Nepenthes* I keep. Good growing to you all, and remember to propagate, trade, sell and buy; keep this good hobby flourishing for us all.

—Ed: It is interesting to read Gary's technique since it shows that what works for some does not work for others. Conventional wisdom on Mexican *Pinguicula* is that one should never use acid fertilizers on them! (BR)

Figure 1: *Pinguicula* 'John Rizzi' at Peter D'Amato's nursery. Photograph by B. Rice.

Figure 2: *Pinguicula emarginata* flower. Photograph by B. Rice.

Cieslak, T., Polepalli, J.S., White, A., Müller, K., Borsch, T., Barthlott, W., Steiger, J., Marchant, A., and Legendre, L. 2005. Phylogenetic analysis of *Pinguicula* (Lentibulariaceae): chloroplast DNA sequences and morphology support several geographically distinct radiations. Am. J. of Bot. 92: 17223-1736.

The authors tackle the heady task of a large sampling of molecular data and morphological characters to examine the relationships among nearly fifty members of the Lentibulariaceae (mostly *Pinguicula*). This kind of analysis can shed light on whether or not groups of plants are monophyletic, i.e. all closely related in a natural set. In recent years, this kind of analysis has revealed that many plant groups (such as the Scrophulariaceae; the snapdragon family) are actually assemblages of plants that are not particularly closely related to each other. Cieslak *et al.* demonstrate that *Pinguicula* is apparently monophyletic (so no compelling evidence that it should be split into separate genera was revealed), and that the family Lentibulariaceae is also apparently a natural group with no need for major revision.

The analysis suggests further, very interesting results within the genus *Pinguicula*. First and foremost, that the genus is perhaps subdivided into five major groups (or clades). The first clade consists of all Mexican and Caribbean species. This is comparable to De Candolle's (1844) section *Orcheosanthus*. Clade I is sister to clade II, which consists of the single species *P. alpina*. These two clades are, in turn, related to clade III (*P. ramosa*, *P. villosa*, and *P. variegata*). Clade IV consists of all the temperate, hibernaculum-forming species (except *P. alpina*). Finally, clade V consists of tropical growth type species, such as the remaining USA species and a few others.

This paper represents a great advance in our understanding of the genus *Pinguicula*, and it should be studied carefully for its many insights and interesting results. For example, the analysis suggests that some of the plants currently distributed under the name "*P. moranensis*" may be hitherto undescribed species. Furthermore, the species in clade IV are all very closely related to each other. This kind of research will only become even more fascinating as more species are included in the analysis—nearly half the genus awaits inclusion! (BR)

Li, H. 2005. Early Cretaceous sarraceniacean-like pitcher plants from China. Acta Bot. Gallica, 152: 227-234.

This is one of a large cluster of papers reporting on talks given at the ICPS conference in Lyon, all of which merit careful reading. The author reports on a remarkable set of fossils that are remarkably suggestive of pitchers of a pitfall carnivorous plant. The fossils are given the name *Archaeamphora longicervia*, and include small (30-40 mm long) pitchers and a structure that is consistent with a nectar spoon. Seeds found with the fossils are remarkably similar to those of modern *Sarracenia*. (BR)

Luken, J.O. 2005. *Dionaea muscipula* (Venus flytrap) establishment, release, and response of associated species in mowed patches on the rims of Carolina bays. Restoration Ecology. 13: 678-684.

Luken, J.O. 2005. Habitats of *Dionaea muscipula* (Venus; fly trap), Droseraceae, associated with Carolina bays. Southeastern Naturalist. 4: 573-584.

These two papers discuss issues related to Carolina bays, particularly those few remaining in South Carolina. The first paper outlines general *Dionaea* habitat characteristics, and the second focuses on active management methods. Plant communities associated with Carolina bays were historically associated with frequent wildfires that cleared competing plants. Fragmentation of habitat by human development has made the implementation of prescribed fire difficult because of fire safety and smoke issues, so land managers are seeking alternative management methods. Managing the rims of Carolina bays for *Dionaea muscipula* by mechanical mowing was found to be conducive to *Dionaea* (and other carnivorous species), although too much disturbance encouraged invasion by grasses and other monocots. This study also followed the success of introducing new propagules, such as seeding with *Dionaea*.

Luken has been trying to determine the best methods of stewarding *Dionaea*, an increasingly rare plant. It has been particularly frustrating that his research has been hampered by the effects of poachers stealing plants from his study areas. Poaching does not help scientific studies that could be used to help protect our remaining wild populations of *Dionaea*! (BR)