CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

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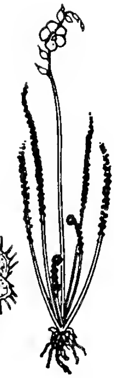

Volume 31, Number 3
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Front Cover: *Heliamphora chimantensis* × *Heliamphora minor* plants. Photograph by Andreas Wistuba. Article on page 78.

Back Cover: *Pinguicula moranensis* 'Libelulita' flowers, photo by Barry A. Rice. Article on page 83.

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

Abiotic Factors, Particularly CO_2 concentration, Affecting Carnivorous Plants from the Eastern Shore of Maryland

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Keywords: Ecology: Maryland (USA), *Utricularia*, wetlands — Field studies: *Utricularia*.

Submitted December 26, 2000

Abstract

Carnivorous plants, particularly bladderworts (*Utricularia* spp.; Lentibulariaceae), have long been known to grow on the Eastern Shore of Maryland, but few if any studies have examined their growth *in situ* or in the laboratory along with the abiotic factors which affect their growth. From the scientific literature, Great Swamp in Maryland (Kent County) clearly stands as an unusual site for the Eastern Shore of Maryland, containing several species of bladderworts. Upon investigation, four species of aquatic bladderworts were identified. Several sites within Great Swamp, containing or lacking plants of *Utricularia* spp., were routinely sampled to seek correlations between abiotic components of the local aquatic environment, such as pH and [CO_2], and the presence of bladderworts. Small samples of various *Utricularia* spp. were subjected to a variety of experimental treatments in the laboratory to examine further the factors identified in Great Swamp. Moderate irradiance levels and elevated concentrations of dissolved CO_2 both promoted the growth of *U. intermedia* and *U. macrorhiza*.

Introduction

Carnivorous plants have been an attraction for both botanists and horticulturists since before the time of Charles Darwin. These plants usually grow in nutrient-poor environments, thriving in conditions which many species find daunting. The occurrence of carnivorous plants in these environments relates to their special traits, since to be considered carnivorous species must lure, trap, and digest prey to obtain scarce nutrients especially nitrogen (D'Amato, 1998). Factors besides the availability of organic nitrogen may influence the growth of particular carnivorous plants in particular environments. For example, just as irradiance levels may dictate the growth of understory plants versus canopy species, some biotic factors such as the levels of inorganic nutrients or of pH might help to determine the presence or absence of certain carnivorous plants.

Among carnivorous plants growing in the Eastern United States are the American pitcher plants (*Sarracenia* spp., Sarraceniaceae); the sundews (*Drosera* spp., Droseraceae); the Venus Flytrap (*Dionaea muscipula*, Droseraceae); the butterworts (*Pinguicula* spp., Lentibulariaceae); and the bladderworts (*Utricularia* spp.; Lentibulariaceae). Bladderworts can be found growing as terrestrial, subaquatic, affixed aquatic, or submersed (suspended) aquatic plants (Taylor, 1989).

As indicated in the works of Tatnall (1946) and Sipple (1999), *Utricularia* spp. seem to be the most common carnivorous plants found on the Eastern Shore of Maryland, and, in particular, Sipple (1999) points to Great Swamp in Kent County, Maryland, as a site containing an unusual abundance of bladderworts. This site (which is actually a bog) consists of several interlinked channels of water created by the mining of sphagnum peat. A portion of this area privately owned and under protection by The Nature Conservancy, Echo Hill Camp and Echo Hill Outdoor School, permitted access to part of Great Swamp.

Several sites were selected for routine measurements of water quality and for observations of bladderworts (see Table 1). These sites varied with regard to the amount of irradiance received, location near the bank or in mid-channel, and the number of species which the sites contained. These sites were tested for a variety of abiotic factors, both chemical factors such as phosphate levels and physical factors such as the amount of ambient irradiance, to determine any relationship to the presence or absence of bladderworts.

In previous studies from other geographic regions, communities of bladderworts have been shown to exist under a wide range of temperatures and nutrient conditions (Roberts, *et al.*, 1985; Adamec & Lev, 2001). It has been shown by previous research that nitrogen and phosphorous levels have a significant impact upon the growth of bladderwort communities (Havens *et al.*, 1999).

Non-destructive laboratory experiments were also conducted on small samples of bladderworts from Great Swamp to further explore connections between levels of illumination or dissolved carbon dioxide and the growth of bladderworts. Previously, Adamec (1999) showed, and others confirmed (Camilleri, 1999) that elevated concentrations of CO_2 in the aquatic environment accelerate the growth of *Aldrovanda vesiculosa* (Droseraceae). This is another aquatic carnivorous plant, native to Europe, Asia, Africa, and Australia, so levels of CO_2 in Great Swamp might influence growth of bladderworts there.

Site #	Description
1	Mid-channel site next to fallen tree, bladderworts present among *Nymphaea odorata.*
2	Bank site under heavy canopy. Largest community of bladderworts seen, also large amounts of hornworts were observed.
3	Center of channel, no bladderworts present.
4	Bank site under heavy cover, receives afternoon sun. Bladderworts pre sent.
5	Bank site with no cover, receives afternoon sun. Small numbers of bladderworts present.
6	Bank site next to birdhouse, receives direct morning sunlight. Bladderworts present among water lilies but not in nearby open water.
7	Bank site receiving evening sunlight, with heavy cover. No bladderworts present.

Table 1: Description of Sites in Great Swamp for Water Sampling

Methods

Using Taylor (1989), a monograph on the genus *Utricularia* currently accepted as the standard taxonomic text, samples of *Utricularia* spp. from Great Swamp were identified.

Water samples were taken from several sites in Great Swamp, described in Table 1, weekly for six weeks during June, July, and August of 2000. These samples were tested as described in the LaMotte Monitors Handbook (Campbell, 1992). Tests were performed for dissolved CO_2 (test kit #7297), toxic ammonia (#59100), salinity (#7459), copper content (#10269), pH (#5090), nitrates (#3110), and phosphate (#3114). New 50 ml polyethylene sample vials were used for each sample collection. At the pHs measured, all ammonia would have been in the form of NH_4^+, and the data presented are for the appropriate test strip portion (Freshwater Aqualab IV Mardel Glendale Heights IL).

For all experiments in the laboratory, clear plastic containers were used as aquaria to contain bladderworts, and all replicates of a given experiment were conducted in identical containers. Plants were grown in a laboratory in which the temperature ranged from 20-25°C, approximately consistent with the range of aquatic temperatures in which the bladderworts were found growing in Great Swamp.

To observe the effects of varying levels of irradiance, plants of *U. intermedia*, *U. macrorhiza*, and *U. gibba* were grown individually in aquaria (three in parallel per repetition; approximately 500 ml of doubly distilled H_20 per aquarium to start) and placed under constant irradiance provided by cool white-type fluorescent bulbs. Controls received full strength irradiance (200-300 lux) while experimental plants were grown with the same placement relative to overhead lights, but their aquaria were covered by two layers of fiberglass window screen to decrease illumination (60-80 lux). The experiment was run for three weeks per repetition for three repetitions, and measurements were taken weekly of plant length, fresh weight, number of traps produced, and the amount of irradiance received. The fresh weight of the plants was measured after blotting excess water, starting with one plant per aquarium or the same initial fresh weight if plants were small in the case of *U. geminiscapa* in some experiments. Irradiance measurements were made using a Fisher Scientific Dual Range Light Meter (Fisher Scientific, Pittsburgh, PA, USA).

Experiments were also conducted to determine the effect of varying levels of CO_2 on the growth of bladderworts from Great Swamp. Controls were placed individually in separate containers and treated as for varied levels of illumination, using the same species as in those experiments. Experimental plants were treated identically to controls except that CO_2 generators assembled according to Camilleri (1999) were used to constantly bubble CO_2 through their aquaria. The experiment was repeated three times for three weeks per repetition, and measurements were taken weekly of plant length, the number of traps produced, fresh weight, and CO_2 levels.

Results

Three species of submersed aquatic bladderworts and one affixed species grew in Great Swamp: *U. gibba* (submersed), *U. geminiscapa* (submersed), *U. macrorhiza* (submersed); *U. intermedia* (affixed). *Utricularia intermedia*, *U. macrorhiza*, and *U. gibba* had been found previously in Great Swamp by Sipple (1999). These plants were identified mainly by leaf shape and bladder shape, and identification was confirmed for *U. macrorhiza* and *U. gibba* by scape characteristics. These were the only two species to flower during the period of observations.

Taylor (1989) clearly states that in spite of the similarities between the European *U. vulgaris* and the American *U. macrorhiza*, they are to be referred to separately, so his authority was followed. *Utricularia gibba* and *U. macrorhiza* formed the great majority of plants found in the open swamp, where the seven sites for study were found. *Utricularia intermedia* was found in an area of much narrower and shallower channels along with those two species. Water quality was examined less frequently in areas hosting *U. intermedia*, but in those sites the concentration of carbon dioxide was similar to other sites containing a large number of bladderworts, i.e. 14-20 ppm. *Utricularia geminiscapa* was only found occasionally, in areas of shaded and open water. For laboratory experiments, *U. macrorhiza*, *U. gibba*, and *U. intermedia* were used.

Water analysis at Echo Hill, Maryland, shows that the area of study had consistent levels for most of the abiotic factors examined at most sites studied during the six weeks (June-August, 2000) of the study: pH (6.0; mean for all sites for 6 weekly measurements), nitrate (0.43-0.46 ppm), phosphate (0.25-0.29 ppm), salinity (1.02 ppt), copper (0.25-0.42 ppm), and temperature (24.4-24.7°C). Temperatures were always within the range 23-26°C, even for the most extreme measurements during this period. Levels of CO_2 and ammonia did vary among sites as shown in Figure 1.

Stands of *U. intermedia, U. gibba,* and *U. geminiscapa* were found growing under heavy to moderate cover along a boardwalk built through the swamp, where the irradiance level varied from 2100-2200 lux from bright overcast to sunny conditions. Similar levels of illumination were found near the banks of channels. Both *U. macrorhiza* and *U. gibba* were found growing in open water in the channels of the swamp, though almost all stands of bladderworts observed were found with at least partial shading by nearby aquatic non-carnivorous species. The irradiance level in those areas and in areas with no floating cover, in which only a few plants of *U. macrorhiza* and *U. gibba* could be found, varied from 20,000-21,000 lux.

All data from the growth experiments were normalized by dividing measurements for both control and experimental plants by the initial value for the control plant in a given repetition. In Figures 2-3, data are shown without error bars because the variation in the size of the plants which were available to start

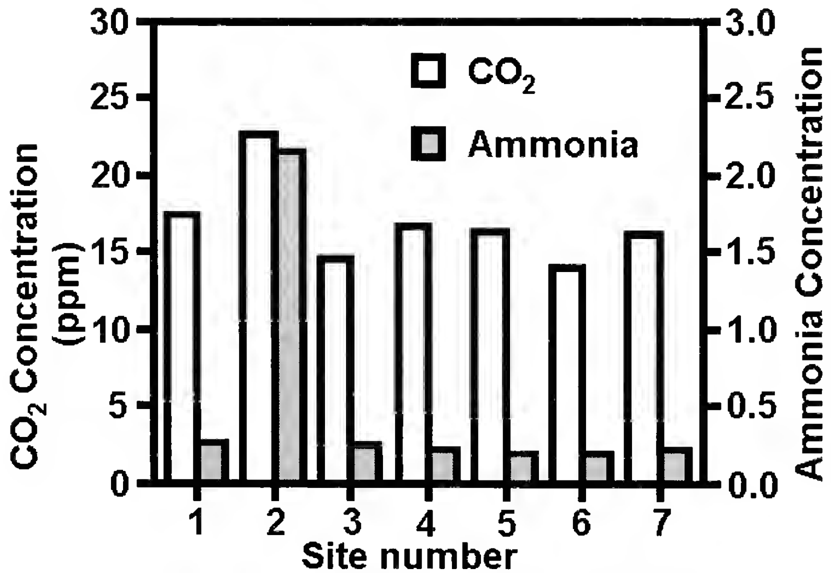

Figure 1: Levels of ammonia and dissolved carbon dioxide at seven sites in Great Swamp. Mean±SD for six weekly measurements (not plotted) is 2.8 ppm for CO_2 and 0.73 ppm for ammonia. For descriptions of sites, see Table 1.

experiments was large. This introduces a large variation when experimental results from separate repetitions are averaged, even after normalization. In spite of this, the trends seen in Figures 2-3 for various experiments can also be seen when examining data from individual experiments.

When the level of illumination was varied in the laboratory, irradiance levels for the control plants were around 200-300 lux and experimental irradiance levels were at 60-80 lux. Controls of *U. intermedia* and *U. macrorhiza* both showed weaker growth in length with reduced irradiance levels. (Figure 2a,b). *Utricularia intermedia* also showed a rather large increase in the amount of traps produced at the control irradiance levels (Figure 2c). *U. gibba* growth was unchanged by changing irradiance levels (data not shown).

When the level of CO_2 was varied, levels for experimental plants rose to around 13 ppm, compared to control levels at around 3 ppm. Elevating levels of CO_2 enhanced growth of *U. macrorhiza* and *U. intermedia*, as exemplified in Figure 3, displaying increases in trap number and fresh weight for *U. intermedia*.

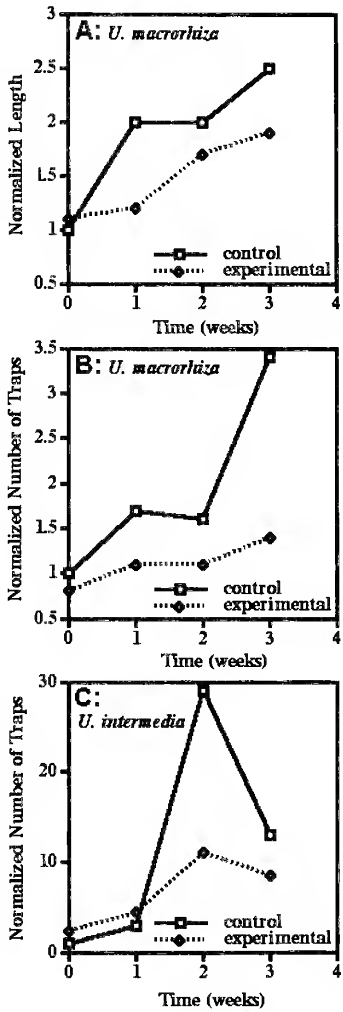

Figure 2: Effect of varied irradiance level (control plants approximately 200-300 lux; experimental approximately 60-80 lux) on the growth of bladderworts in the laboratory. A. Change in length of *U. macrorhiza* over three weeks. B. Change in number of traps for *U. macrorhiza*. C. Change in number of traps for *U. intermedia*. Mean of three repetitions. Normalization and the lack of errors bars are discussed in the text.

Discussion

The trends observed in the water quality analysis fit what is expected for a site containing bladderworts. Bladderworts can be found growing in water within a pH range of 4-8 (Roberts *et al.*, 1985; Adamec & Lev, 2001), and in waters with relatively low levels of nitrogen and phosphorus (Havens *et al.*, 1999), as were found at Great Swamp where pH was typically 6 and nitrogen and phosphorus were both less than 0.50 ppm. Miniscule amounts of copper and ammonia were observed, but as to whether or not they had an effect on the growth of bladderworts is unknown and is a subject for future testing. Carnivorous plants most commonly grow in acidic environments, and this was true for Great Swamp. The levels of ammonia and phosphorus which were measured were near or just below the recommended limits for the testing methods used, so the principal point taken is that Great Swamp is an area of moderate abundance for these nutrients.

Stands of bladderworts were most often observed growing in moderately to heavily shaded areas, most often crowded among *Nymphaea odorata* (Nymphaceae), hornwort (*Ceratophyllum demersum*, Ceratophyllaceae), and *Nuphar advena* (Nymphaceae). Levels of irradiance in the shade were not fully replicated in the laboratory by control treatments, but plants grown in the laboratory at levels closest to those preferred in nature showed increases in both plant length and trap production compared to plants treated with lower levels of irradiance (see Figure 2).

Bladderworts in Great Swamp probably prefer irradiance levels lower than those of full sunlight, but very strong shade, represented by the experimental irradiance treatment used in the laboratory, would be inhibitory of their growth. Even those few plants which were found in full sun in open water grew among other non-carnivorous aquatic plants which provided ample local shade. Production of irradiance intensities in the laboratory closer or equal to those of full sun should be examined in future, using a method which offsets heat production to avoid confounding experimental results. Higher levels of irradiance would also help to resolve any concerns about the levels used here having been at or below the compensation point for photosynthesis. (Although it should be noted that the laboratory plants did grow actively.)

Bladderworts growing both in the wild and in the laboratory at these irradiance levels maintained a vibrant green color, while plants in the laboratory and in the wild turned a reddish-yellow when subjected to higher irradiance levels. At Echo Hill, *U. macrorhiza* was observed as the species most tolerant to a range of irradiance levels, as it could be found both in full shade crowded among other plants or in full sunlight. However, in full sunlight it was usually found growing among other aquatics and was probably not exposed to full sunlight. *Utricularia gibba* was also observed in both areas, while *U. intermedia* only occurred in shallow and shaded sites.

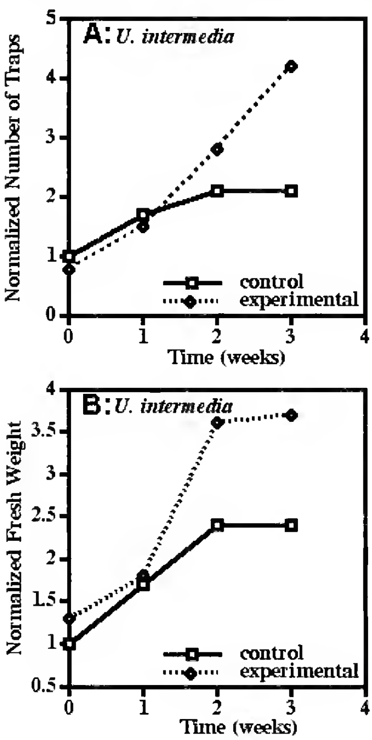

Figure 3: Effect of varied levels of CO_2 on the growth of *U. intermedia*. A: Change in number of traps. B: Change in fresh weight. Control level of CO_2 was approximately 3 ppm; experimental level was approximately 13 ppm. Mean of three repetitions. Normalization is explained in the text.

Utricularia gibba and *U. macrorhiza* in full sun grew slightly submerged and did not form partially-exposed surface mats. Such mats did occur in the shade, however. Inflorescences of both of these plants were observed during the first three weeks of July (*U. macrorhiza*), and during the last week in July and the first week in August (*U. gibba*), but only along bank sites that received partial to full shade.

Levels of CO_2 in the wild were higher than those achieved in the laboratory using a CO_2 generator. However, the strongest growth of plants in the wild occurred at sites 1 and 2, where the highest levels of CO_2, significantly higher than other sites in the case of site 2, were recorded (see Figure 1). However, levels in the laboratory may have been depressed by strong absorption of CO_2 by the rapidly growing plants, or because the temperatures was higher in the laboratory. It was observed that *U. intermedia*, like *Aldrovanda vesiculosa*, showed increased growth in length and trap production due to increased CO_2 levels (see Figure 3), probably due to the use of CO_2 in photosynthesis (Adamec, 1999). The trends in

Figure 4: *Utricularia* habitat. Photo by Matthew McDermott.

growth, comparing control and experimental plants, were visible in the replicates performed for each experiment, even though variations in the size of starting plants made statistical analysis difficult.

Both *U. macrorhiza* and *U. gibba* seemed insensitive to CO_2 levels alone. Perhaps both irradiance and CO_2 levels are important for the growth of bladderworts. *U. gibba*, the most widespread bladderwort in the world (D'Amato, 1998) and perhaps the most adaptable, may not be affected strongly by the CO_2 levels used in this study, but irradiance levels do seem important based on the placement of this plant. Field observations by one author (DWD) of *U gibba* and *U. muelleri*, another floating bladderwort, in the Northern Territory of Australia indicate a similar preference there.

The distribution of traps and comparisons of trap production in response to biotic versus abiotic factors were not attempted in this pilot study. However, such work should be conducted in future in view of two papers: Knight & Frost (1991) demonstrated that *U. macrorhiza* may change the numbers of bladders in response to abiotic factors, while Friday (1989) showed that trap age and position are crucial for evaluating the growth responses of bladderworts. Furthermore, Richardson (2001) has recently suggested with a study of *U. purpurea* that bladders may also have non-carnivorous importance in their functional ecology *viz.* a mutualistic relationship with microinvertebrates surviving in the traps.

Utricularia macrorhiza and *U. intermedia* seem to be affected by both irradiance and the concentration of CO_2, and the different responses of these plants to elevated concentrations of CO_2 might have explanations related to growth patterns—*e.g. U. macrorhiza* may grow to greater lengths at first to allow its modified stems to photosynthesize more. Increased trap production may be more important for the normally short *U. intermedia*, which seems to grow only in shade, than for *U. macrorhiza*. Such factors, with the addition of biotic factors such as prey availability, will be examined in future summers.

In future studies tests for potassium, calcium, and magnesium should be added to the suite of tests used in this study as they have been shown to have an impact upon the occurrence of *U. intermedia* and *U. ochroleuca* at sites studied in the Czech Republic (Adamec & Lev, 2001). The experiments performed during the period considered here did not allow for correlation between levels of some abiotic factors, such as ionic concentrations, and distributions of bladderwort species. This may be due in part to the nature of the tests used, and further experiments to explore such variables are planned for summer 2001. Measurement of photosynthetically active radiation using radiometric units will then be possible as well, due to recent acquisition of equipment, and a broader range of CO_2 concentrations should also elucidate the requirements of these species.

Acknowledgements

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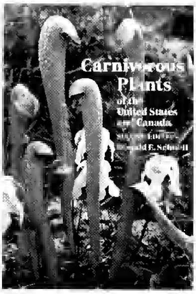
Book Review



Schnell, Donald E. 2002. Carnivorous Plants of the United States and Canada (2nd Edition). Timber Press; Portland, Oregon (timberpress.com). 0-88192-540-3, 468 p. Hard cover, 16.5 × 23.5 cm (6.5 × 9.25 in), $US39.95.

Reviewed by David O. Gray

All those interested in carnivorous plants have been eagerly awaiting the revised edition of Dr. Donald Schnell's monograph on the carnivorous plants of North America. Happily, the 25 year wait was worth it; the book is a masterpiece.

Its a hefty book, with a solid 373 pages of subject text, and over 200 good quality photos throughout. The text is also illustrated by many clear botanical sketches by David Kutt and other artists. For readers who are new to the carnivorous plant world, the introduction includes a competent overview of the carnivorous plant syndrome, relevant current scientific findings, and wetland ecology. Like the first edition, there are chapters for each genera with an entry for each species, and while the publicity says 45 species are discussed, I counted more that that. Each species account has notes on cultivation, and with the author's keen observations on habitats and many ravishing photos of plants in situ, hobbyists will find this book a great aid in understanding their plants' needs. The books concludes with a chapter on possibly-carnivorous species, and one covering conservation issues, a glossary, and a comprehensive bibliography.

Seemingly written for an American audience (although all measurements are metric), readers from all parts of the globe will find this work valuable, with its detailed discussions of habitat, conservation, and ecology, especially of the popular *Sarracenia*. The text is not overly weighted with botanical jargon (there is a glossary of terms if you are rusty on your Latin), and the discussions are in a pleasing vernacular. A variety of anecdotes add greatly to its readability and gives the book charm. There are literature citations throughout, signaling this is a serious botany as well.

Relevant nomenclature is sensible and logically discussed, and there will be few surprises for most enthusiasts. Schnell is well know for his many papers on *Sarracenia* (19 are listed in the bibliography), and here he clearly and logically discusses the arguments on individual taxonomic controversies, and graciously refers the reader to the works by authors with opposing views. The species and synonyms are cross-referenced in the index and there is a list of the common names of *Sarracenia* hybrids. The vexing *Utricularia* are clearly delineated for the amateur, and similar species are cleverly paired in one description, which aids in learning their differences.

One of the most valuable portions for this reader was the chapter on conservation issues. Here is a sobering, if not depressing assessment from the author's experience of watching wetland habitats disappear over the last half of the century. He details several conservation and recovery strategies, but the picture is not promising. We can hope this will motivate stronger conservation efforts.

The book stumbles in its coverage of the western species. In discussing

Darlingtonia, various common inaccuracies are reprinted on that plant's preferences. The range map for this pitcher plant is wildly overdrawn and includes one fictitious site and one well-known, but tiny introduced site. Other species' western ranges are misrepresented to various degrees, and the plants generally get short shrift in print. These flaws are curious as the author cites the work of those such as Rondeau who have great West Coast field experience. It is clear that Schnell's strength is in his long and great experience with the species of the American Southeast. He could have profitably visited more sites in the Pacific states and enlisted more input from colleagues in the West.

Interestingly, he states that *Darlingtonia* has no known enzyme production, but includes its description with the known carnivorous species, rather than with the "possible carnivorous species" such as certain species of *Ibicella*, *Dipsacus*, *Catopsis*, and *Capsella*. *Passiflora foetida* is not mentioned at all, although it bears retentive hairs, and homogenates from its tissues have been demonstrated to contain digestive enzymes (furthermore, it is native to Florida and the Southwest, and is a widely introduced weed elsewhere).

Still, none of these shortcomings change the value of this important work. The author has skillfully crafted a book that bridges important botanical work with readable popular accounts. The cliché in this case fits: its should be on every bookshelf of those concerned with carnivorous plants. If you wish to inspire new generations of botanists and enthusiasts, consider buying a second copy for donation to your local botanical garden, nature center, or high school.

ICPS on the World Wide Web

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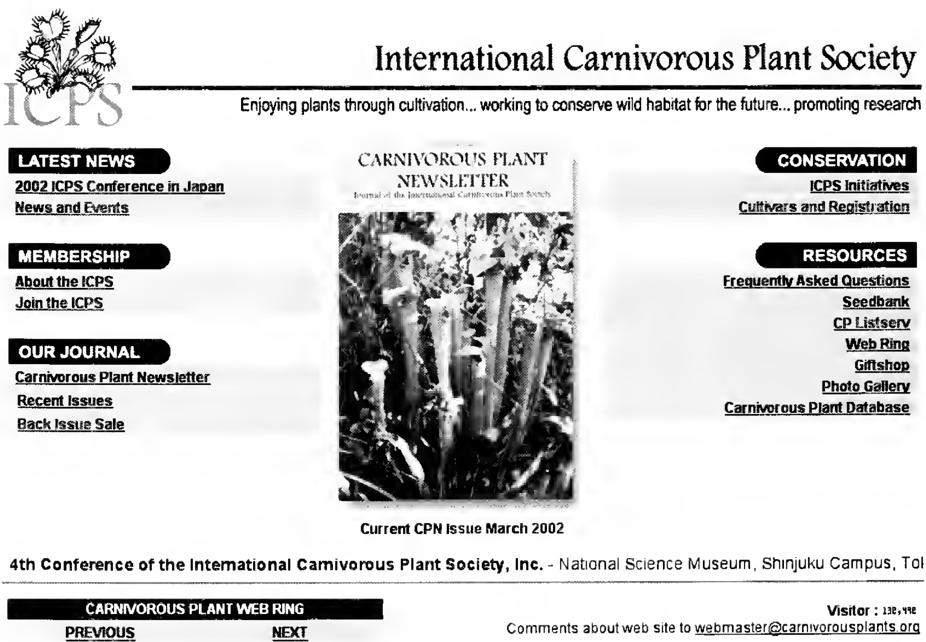
Keywords: computers: internet.

If you have visited the ICPS web site recently you will have noticed the new home page for your web site designed by überwebmaster and ICPS Vice President, Carl Mazur. The main web site is produced and maintained by a team led by Carl. The other members who work on the main site are Steve Venter, Pete Thiel, and myself with the assistance of Ron Baalke, Steve LaWarre, Chris Teichreb, and Mike Wilder. Barry Rice maintains the associated FAQ web site and Rick Walker and Jan Schlauer keep up the Carnivorous Plant Database web site. Our design goal was to have an uncluttered home page that is easy to use and would highlight what the ICPS is all about. We did a series of "better one or better two" trials and discussed the merits of each. It was fun watching the design change and improve over time.

Of course a new home page meant a new design for the 300-odd pages of the web site. Even though I have done a large fraction of the site, I had forgotten how much stuff is there. The process was slowed down because I had to re-read some of the abstracts of talks and laugh again at the photos from the ICPS Conference 2000. They are hidden in the New and Events section. And while I was checking that section I had to get caught up on what events were posted. The same thing happened when I updated the archive of sample CPN articles. OK, so they are not as funny as the conference banquet talk (what we could post on the web) but it had been a while since I read Fernando Rivadavia's travelogue of his expedition to find giant *Genlisea uncinata* or about Chris Teichreb's trek into Canada's Northwest Territories. It also reminded me that I had not gotten around to scanning in the article pictures we do not have in electronic form. Maybe by the time this is in print they will be in electrons.



HELIAMPHORA CHIMANTENSIS, A NEW SPECIES OF *HELIAMPHORA* (SARRACENIACEAE) FROM THE 'MACIZO DE CHIMANTA' IN THE SOUTH OF VENEZUELA

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Introduction

During our January 2001 expedition to the tepuis of Venezuela (Wistuba *et al.*, 2001), we also explored parts of the 'Macizo de Chimanta', the Chimanta Massif in the southwest part of the Gran Sabana. This huge massif covers a total area of 1470 km^2 and is actually a cluster of tepuis including the central Chimanta Tepui itself. Their peaks range in altitude from 1700 m (at the central part of the massif) to 2698 m (on Eruoda Tepui). The ten tepuis that reach 2000 m above sea level cover an area of some 700 km^2 in total (Huber, 1992). The size and the diverse altitudes of the Chimanta Massif support numerous habitats including rivers, green valleys and forests as well as rocky plateaus and moist savannas. Starting in the 1950s, various expeditions explored the unique flora and fauna of this area. Many endemic plants and animals were discovered during these expeditions and certainly many more await discovery.

During this exploration we found a previously undescribed species of *Heliamphora* most notable for its pitcher shape and the spoon shaped lids. This species seems to be more closely related to *Heliamphora tatei* than to any of the other species described so far from the Gran Sabana.

Heliamphora chimantensis Wistuba, Carow & Harbarth *spec. nov.*

Caudex ramosus; foliis caulescentibus vel rosulis; amphoriis in parte inferiore infundibuliformibus, in parte media subventricosis, et in parte superiore cylindricis ad leviter infundibuliformibus, longis 20-30 cm, latis (in parte superiore) 3.5 - 5 cm.

Inflorescentiis 3-5-floris, racemosis, ad 65 cm longis; flores nutantes; pedicellis 5-13 cm longis; petalis 4 lanceolatis, albidis vel pallide-roseis, 4-5.5 cm longis, 1.2-1.7 cm latis; staminibus ca. 20, 1-serialibus, filamentis 6 mm longis; antheris oblongo-lanceolatis, ca. 5 mm longis; ovario valde tomentoso; stylo glabro; stigmate 3 lobato; seminibus fuscis, oblongis, ca. 3 mm longis, testa conspicue membranaceo-alata.

Rhizomes branching. Plants forming dense and often huge patches up to several meters across.

Pitchers infundibulate in the lower half, slightly ventricose in the middle and cylindrical to slightly infundibulate in the upper third (see Figure 1); pitchers 20 to 35 cm long, 3.5-5 cm wide in the upper part; upper part of the pitchers completely glabrous on the inner side; pitchers entirely green with deep red lids. Lid 1-2 cm wide and 2-2.5 cm long, spoon-shaped, upright, ending with a sharp tip; the two lobes of the lid compressed from the sides near the tip, often touching each other at the front, forming a quasi-helmet; lobes are expanded in the lower part of the lid and narrowed sharply near the base; the inner side of the lid with prominent irregularly shaped patches of glands, up to 5 mm across. Inflorescence 60 to 65 cm long, 3-5 flowers, peduncle slightly pubescent, pedicels 5-13 cm long. The lowest peduncle is the longest and bears a bract that frequently is transformed into a rudimentary pitcher. Tepals lanceolate, 4.5-5.5 cm long, 1.2-1.7 cm wide, white to whitish-pink; ca. 20 stamens in 1 series, filaments 6 mm long, anthers oblong lanceolate, 5 mm long, 1 mm wide; ovary 3 celled, pubescent, style glabrous. Seed approximately 2 mm long, compressed, ovate, irregularly winged.

Specimens examined

Heliamphora chimantensis: Macizo de Chimanta, Section centro-oriental, 1921 m a.s.l., N 05°16.672'; W 062°11.438' Wistuba, Carow & Harbarth No. Chim 10.01.01/1, holotype, flowering plant (VEN)

Heliamphora chimantensis: Macizo de Chimanta, Section centro-oriental, 1921 m a.s.l., N 05°16.672'; W 062°11.438' Wistuba, Carow & Harbarth No. Chim 10.01.01/2, isotype, flowering plant (VEN)

The two herbarium specimens nicely exhibited the characteristics typical of the new species. The comments in this paper are based both upon these two specimens as well as our field observations of many other plants in situ.

Figure 1: *Heliamphora chimantensis* pitcher. Photograph by Andreas Wistuba.

Figure 2: Cluster of *Heliamphora chimantensis* pitchers. Photograph by Andreas Wistuba.

Figure 3: *Heliamphora chimantensis* pitcher appendage nectar patches (left inset) and insect visitation; ant (left), wasp (right). Photographs by Thomas Carow.

Distribution

Heliamphora chimantensis sometimes grows together with *H. minor*, the only other species of *Heliamphora* recorded from Chimanta. As a consequence, hybrids frequently could be found. However, *H. chimantensis* seems to prefer valleys growing at around 2000 m while *H. minor* also has been found in higher altitudes and usually prefers more open habitats.

The *H. minor* plants on Chimanta are notable for the long and prominent bristles inside the pitchers. This variant form of *H. minor* is actually fairly widespread and has been found on many tepuis of the Chimanta Massif as well as on Aprada Tepui, but not Auyan Tepui. Meanwhile, the typical form of *H. minor* is only known from Auyan Tepui. The differences between these two forms of *H. minor* may merit further taxonomic study.

Ecology

Heliamphora chimantensis plants were found growing exposed, in short vegetation such as grasses, bromeliads, *Xyris* (Xyridaceae) or *Stegolepis* (Rapateaceae). These plants do not grow taller than the *H. chimantensis*. In fact, we never found plants growing in shaded locations. Often they grow near rivers in the valleys of Chimanta. In all cases we found *Heliamphora chimantensis* growing together with *Stegolepis ligulata*, and also often associated with *Adenanthe bicarpellata* (Ochnaceae) and various species of *Brocchinia* (Bromeliaceae).

In comparison to the species found on the plateaus of the various tepuis, where the surface usually is much more rocky and sandy and plants often can grow only on 'islands' of debris, highly limited in space, the moist savannah-like habitat *H. chimantensis* prefers allows the formation of huge clumps. We have visited many tepuis on this and other expeditions, and had never before seen clumped *Heliamphora* colonies of comparable in size to the ones typical of *H. chimantensis*. Vegetative reproduction seems to play an important role as the seedling activity we observed was very low.

The lids of *H. chimantensis* bear strange, huge patches (up to 5 mm across) of glands on their inner surface (Figure 3). They should be studied in more detail as they seem to be involved in the attraction of prey. We observed ants and wasps being attracted by secretions of these glands but unfortunately our limited time on Chimanta did not permit a detailed study. As we have observed with other species of *Heliamphora*, the pitchers usually do not contain many captured insects.

Related species

The discovery of *H. chimantensis* on Chimanta and its characteristics came as quite a surprise, as they clearly indicate that it is much more closely related to the southern *H. tatei*, than to any of the northern species known to be growing in the Gran Sabana. The flowers of all other species known from the Gran Sabana have 10-15 anthers, while *Heliamphora tatei* var. *tatei* and *H. tatei* var. *neblinae* from the Amazon, and *Heliamphora chimantensis* have about 20; however, while the anthers of *H. tatei* and *H. tatei* var. *neblinae* are 7-9 mm long, those of *H. chimantensis* just reach 5 mm in length (Maguire, 1978; Steyermark, 1984).

The nectar spoons of the other species from the Gran Sabana are shaped more or less concave to form helmet-like structures under which nectar can accumulate, protected from the frequent rainfalls. In *H. tatei*, as well as in *H. chimantensis*, the lids are more upright. However, *H. chimantensis* protects its nectar production by the two lobes of the lid which are bent forwards and are compressed from the sides to form a roof reminiscent of the helmets of the other north-eastern species. From the ones of *H. tatei* the lids of *H. chimantensis* differ by the spoon-shape and the sharp contraction at the base. In *H. tatei* the lids are only very slightly contracted at the base and rather rectangular in shape.

Hybrids

We observed numerous hybrids between *Heliamphora chimantensis* and the *Heliamphora minor* on Chimanta. These hybrids can be easily distinguished from pure *Heliamphora chimantensis* by the shorter pitchers, the red veins and the coarse bristles inside the pitchers. Some of the hybrids' pitchers showed deep red coloration, similar to the form of *H. minor* growing on Chimanta. The helmet shaped lids of these show a strong influence of *Heliamphora minor*. Apparently the hybrids are much more vigorous than either of the parent plants; we found patches of single clones measuring more than 5 meters across (see Front Cover).

Etymology

This name was chosen as *Heliamphora chimantensis* because it is the only species known to be restricted to Chimanta Tepui.

Discussion

The formation of huge clumps and the low seedling activity seem to be the consequence of the savanna-like habitat. In general, the seeds of *Heliamphora* clearly show adaptations to dispersal by water. This works excellently on a "typical" tepui where little streams and shallow ponds carry the seeds to new small patches of debris, making *Heliamphora* a kind of pioneer plant. However, the environment in the valleys on Chimanta where we found *Heliamphora chimantensis* seems to be far more static, with a well developed, continuous soil layer. The low vegetation might be too dense for seedlings to germinate and grow. Those few seedlings which do survive to maturity can develop into patches of huge size.

Although the large sizes of the clumps that *Heliamphora chimantensis* makes are remarkable, they are not completely unprecedented. *Heliamphora* can multiply vegetatively by division, but in most species the resulting clumps still remain small due to limitations of the detritus patches they grow in. Even so, we have observed similar, large-clump growth patterns in *Heliamphora hispida* (Nerz & Wistuba, 2000), *Heliamphora heterodoxa* (in the Gran Sabana) and *Heliamphora nutans* growing on the sandy foothill area of Tramen Tepui.

As we already discussed in our publication on *Heliamphora folliculata* (Wistuba *et al.*, 2001) the pitcher-lids or so called nectar-spoons of *Heliamphora* are highly elaborate structures for the attraction of prey. Apparently various strategies have been developed by the different species of *Heliamphora* all using the lids in altered ways. *Heliamphora chimantensis* with its gland-patches shows yet another way to use the lid-structure for the attraction of insects.

Being morphologically fairly constant organs, the lids offer superb, yet previously under-utilized, characters of taxonomic relevance (cf. Nerz &Wistuba, 2000; Wistuba *et al.*, 2001).

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New Cultivars

Keywords: cultivar: *Pinguicula moranensis* 'Libelulita'.

Pinguicula moranensis 'Libelulita'

Submitted: 22 April 2002

In 1998, the Botanical Conservatory at the University of California, Davis, was given an unsolicited gift of a crate of field collected plants, including many tens of dormant rosettes of heterophyllous *Pinguicula* from southern Mexico. We accessioned these plants into the collection, and over the next several years observed their characters. All the plants turned out to be *Pinguicula moranensis*, as we anticipated. The most striking specimen has a number of remarkable attributes, and is being given the name *Pinguicula moranensis* 'Libelulita'. This plant has already been mentioned in the pages of this journal (Carniv. Pl. Newslett. 29:2, p.55, 2000), when one of us (BAR) reported on how the only specimen we had of this plant nearly rotted to extinction.

In foliage, *Pinguicula moranensis* 'Libelulita' is not particularly different from any of the other many clones of *Pinguicula* in cultivation, but in flower it is so striking that some horticulturists have remarked that it nearly appears to be a new species (see Back Cover). The five petals are large and square-tipped. They are overall pink-purple, deeper so on the distal 2/3rds, and pale to near-white closer to the petal bases. Where the petals fuse, they suddenly darken to a deep velvet red, marked with a few white streaks on the lower-most petal. For us, the most amazing feature of this cultivar is the bold petal venation. This venation reminds one of us in particular (EMS) of the reticulated network of veins visible in the transparent wings of dragonflies.

Since 2000, we have industriously propagated the plant vegetatively. (It is amenable to leaf cuttings.) This plant will first be offered to the general public at the annual University of California, Davis (USA) plant sale in October. We will subsequently distribute *Pinguicula* 'Libelulita' to specialists around the world. (Specimens have already been sent to other horticulturists in the USA and Europe.) *Pinguicula moranensis* 'Libelulita' should only be propagated by vegetative means as there is no guarantee that seed progeny would maintain the cultivar's subtle characters.

The cultivar name was coined by Elizabeth M. Salvia on 18 October 2000, and submitted by us for registration on 22 April, 2002. The Spanish cultivar epithet means "little dragonfly". Spanish was chosen to honor the country that houses *Pinguicula moranensis*. According to ICNCP rules, either *Pinguicula* 'Libelulita' or *Pinguicula moranensis* 'Libelulita' may be used for this cultivar. Additional photographs of *Pinguicula moranensis* 'Libelulita' may be seen archived at http://www.sarracenia.com.

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D. intermedia—Florida, USA
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D. intermedia—Rhode Island, USA
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Literature Reviews

Araki, S. 2000, Isozyme Differentiation between Two Infraspecies Taxa of *Utricularia australis* R. Br. (Lentibulariaceae) in Japan. Acta Phytotax. Geobot. 51: 31-36.

The author demonstrates that the plants identified as *U. australis* that grow in Japan can be differentiated into two distinct groups (named f. *australis* and f. *tenuicaulis*) on the basis of isozyme comparison. Different banding patterns have been found for alcohol degydrogenase (ADH) and phosphoglucoisomerase (PGI), the remaining 12 enzymes studied did not yield clear bands or different patterns. The author suggests that the two Japanese groups investigated, corresponding to morphologically defined and geographically segregated taxa, may represent populations resulting from at least two independent invasion events. (JS)

Casper, S.J. and Steiger, J. 2001, A new *Pinguicula* (Lentibulariaceae) from the prealpine region of northern Italy (Friuli-Venezia Giulia): *Pinguicula poldinii* Steiger et Casper spec. nov., Wulfenia 8: 27-37.

An issue of interest to some botanists is the apparent lack of *Pinguicula leptoceras/Pinguicula balcanica* type butterworts in northeast Italy, especially since the conducive climate, geography, and soils of the area suggest they could occur there. Even though the region has been heavily and repeatedly botanized, this kind of *Pinguicula* was never detected. As such, the recent discovery of a new species in this region came as a great surprise. This paper reports on the detection and compares the new plant to related species (i.e. *P. vulgaris*, *P. leptoceras*, *P. balcanica*, *P. reichenbachiana*, and *P. fiorii*).

The new species, *Pinguicula poldinii*, has relatively large flowers with the upper petals reflexed. It is remarkable in having a somewhat irregular number of petals—while most flowers have 5 petals, flowers with 6, 7, or 8 petals (and calyx lobes) are apparently easily observed.

In some ways, this paper raises more mysteries than it answers. The plant's homophyllous nature sets it apart from the (heterophyllous) species most closely related to it. It is also peculiar this plant has never been detected before, even though in one area the plants were even growing on road banks! The paper proposes that *Pinguicula poldinii* has recently colonized these road cuts from as yet undetected nearby populations.

Some skeptical botanists may not believe that the new plant merit separate species status, but the authors of this paper have a great deal of experience with *Pinguicula*, and their opinions cannot be casually discounted. (BR)

Ellison, A.M. & Gotelli, N.J. 2001, Evolutionary Ecology of Carnivorous Plants. Trends in Ecology and Evolution 16: 623-629.

The weakest point in this paper is the authors' oversimplification of carnivorous plant phylogeny. Contrary to statements made in the paper, Droseraceae and Dioncophyllaceae (both Nepenthales) are not really independent lineages. They are just not sister groups. It was only a single, eccentric researcher who has maintained a monophyletic origin of all carnivorous plants until the 1980s. The sticky glands of Droseraceae, Drorophyllaceae, and Dioncophyllaceae (as well as the remarkably similar glands in Nepenthaceae and the non-sticky genera in Droseraceae) are actually homologous organs and they are not at all merely homoplasic (cf. CPN 26:34-38, 1997). Although both families probably belong to the same order Ericales (s.lat.), a sister group relationship between Sarraceniaceae and Roridulaceae is by no means supported unanimously by all gene sequence comparisons (only rbcL alignments suggest such a close relationship). The proximity of Byblidaceae to Solanaceae was caused by poor taxonomic sampling in the first (1993) genetic analysis. More recent data suggest a placement of Byblidaceae in Scrophulariales, not in Solanales. Cephalotaceae are not placed in Geraniales but in Oxalidales, which is a separate lineage. It is not sure if Roridulaceae are ancestral to Sarraceniaceae (it is not even clear if the two are sister groups), and therefore it cannot be stated that adhesive traps are "simpler" (from a phylogenetic perspective) than pitchers in Ericales.

Great emphasis is laid on a weak hypothesis that "most" carnivorous plants are restricted to well-lit, nutrient-poor, waterlogged habitats. This generalization and the largest part of the academic speculation derived from it are bound to collapse if butterworts (most of which dwell in shaded situations) or epiphytes (that do not inhabit permanently waterlogged places) are considered. (JS)

Komiya, S., Toyama, M., Okita, S. & Shibata, C. 2001, *Utricularia macrorhiza* Le Conte is Distributed in Northern Japan. Journal of Japanese Botany 76:120-122 (in Japanese)

Unfortunately, no English abstract is provided in this paper but the distribution map on p. 121 shows that most probably the plants treated as different Japanese forms of *U. australis* in Araki's paper discussed above are actually two different species, viz. *U. australis* proper and the well-known north American and northeast Asian *U. macrorhiza*. The latter species has not been recorded from Japan before, probably because it had been confused with *U. australis* so far (even by respected authorities such as Peter Taylor). Chorologically a southward range extension of *U. macrorhiza* to northern Japan is plausible, and the present interpretation may be the solution of a series of problems concerning these plants. In this light all records of allegedly fertile specimens of "*U. australis*" should be re-examined very carefully to determine if they really belong to this species. (JS)

5th International Carnivorous Plant Conference: Call for Proposals

Dear fellow carnivorous plant enthusiasts,

Now that the 4th International Carnivorous Plant Conference at Tokyo has successfully concluded, the qualification process for the next conference is opened.

According to the geographic/chronological scheme for International Carnivorous Plant Conferences, the next event should preferably be held in Europe, the Near East, or Africa, in 2004.

All persons or societies interested in hosting the 2004 conference in or near the intended region should contact me (Jan Schlauer, Zwischenstr. 11, 60594 Frankfurt/Main, Germany, <jan.schlauer@uni©tuebingen.de>) for further details.

Please note that suggestions for a venue alone (without a proposal to actually organize the conference) cannot be considered in the qualification process.

An Interview with Dr. Rob Naczi About *Sarracenia rosea*

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Keywords: Observations, taxonomy: *Sarracenia purpurea*, *Sarracenia rosea* — recollections: Robert Naczi.

The following text is excerpted from an interview conducted by Tim Stevens on 2 October 2000. Stevens requested the interview from Robert Naczi in order to learn more about the circumstances surrounding the description of *Sarracenia rosea* as a new species (Naczi et al. 1999), as well as its conservation. Prior to the publication of this paper by Naczi, Eric Soper, Frederick Case, and Roberta Case, the plant was known as *S. purpurea* subsp. *venosa* var. *burkii*.

At the time of the interview, Naczi was an associate professor at Northern Kentucky University. Since that time, he has moved to Delaware State University, where he is curator of the Claude E. Phillips Herbarium.

Q: How did you become involved in studying *Sarracenia rosea*?

RN: It's actually an interesting story. It might not be exactly what most people would suspect but I'm very interested in the whole community of arthropods that live inside pitcher plants. There are some mites and insects that are actually able to survive the plant. Most, as you know, get trapped and digested by pitcher plants but there are some that live inside these pitchers and they live nowhere else. I'm speaking of *Sarracenia* pitchers generally.

So I began a project as an undergraduate. I was looking at the mites that live inside these pitchers and I was really fortunate to get a small grant and to make a trip south in 1984. George Folkerts and some other folks from Auburn University helped me a lot on that trip. So, they introduced me to these plants that I hadn't seen. I'd seen the northern purple pitcher plant but not this southern thing. Then, when I entered graduate school, I did not pursue pitcher plants or their mites for my doctoral research, but I did work on a group of plants that allowed me to do field work in the southeastern United States. So I continued to collect from pitcher plants and I did that in graduate school. I realized that the northern purple pitcher plant looked quite a bit different to me than this plant on the Gulf Coast. So really, to make a long story short, it was because of my work on the mites that live inside these plants that I was taking a closer look at the plants themselves.

The more I worked on this the more I got interested in the plants themselves. I had started out thinking that it had all been studied. But I realized, delving into the literature, it hadn't. So then I realized there was this potential to do something here botanically.

Q: How did you become involved with Fred and Roberta Case?

RN: When I was a graduate student at the University of Michigan, I was fortunate to meet Fred and Roberta Case. They really took me under their wings and were very generous with me, doing things like telling me about certain field locations for various pitcher plant species. I've been in the field with them a few times. So after I had started working on this project of just what is the status of these Gulf Coast pitcher plants, I invited them to work with me. They had independently noticed a lot of the differences I had, so we agreed that we'd work on this together. That's why they're co-authors on the paper.

Q: They had been collecting and growing the species for some time in Saginaw?

RN: Yes, very much so. Their work in the greenhouse was a critical contribution to realizing that *Sarracenia rosea* really is a species distinct from *Sarracenia purpurea* because they had grown both *Sarracenia purpurea* and *Sarracenia rosea* together in the same greenhouse, under the same conditions for years and years. They didn't need much convincing when I said, "Hey, I have evidence that these things are different." So when we put it all together we realized it was a compelling case and that was another reason why I was glad to have them included.

Q: What role did Eric Soper play?

RN: He was an undergraduate when I was doing much of the study here at Northern Kentucky University. He helped by measuring a lot of the specimens. It was nice to have his contributions with all of his diligent work of measuring. He had approached me about doing research and I described various projects to him in which I was engaged, and he seemed to be interested in this one.

Q: When did you realize that this was probably a new species? How long did the study actually last?

RN: Well, I didn't realize—when I was an undergrad—that this plant was any different. It was about 1987 or 1988 when I realized that the plant on the Gulf Coast was different. I earnestly started work on it probably about 1990. In a way it's embarrassing that it took me so long but, on the other hand, it took me a while because I wanted to do a thorough job. First, requesting all those specimens and getting them in from various herbaria, and visiting herbaria; doing the field work and then all the measurements—it just took a long time.

The nice thing about doing all that field work is I was killing two birds with one stone. I was working on the plant but I was also collecting mites and I'm continuing to work both on the botany of *Sarracenia* and the mites.

The mites have been very little studied. People have overlooked them but it ends up they're a major component of this micro-ecosystem. But one of the reasons I'm so interested in them, from the botanical standpoint, is that with many of the *Sarracenia* species being rare I wonder what these arthropods are doing to or for the plants.

There was one study published in the eighties by William Bradshaw from the University of Oregon. He showed that the mosquitoes and the midge larvae that live inside purple pitcher plants actually benefited the plants. When the mosquitoes and midges were present, the levels of nitrogen inside the pitchers were higher than when the insect larvae were absent. So apparently, these insect larvae, by wriggling through the prey remains, process them and release the nutrients faster.

Well, the mites are present in much higher numbers and they crawl through the prey remains also and they fragment them. I don't have any experimental evidence for this, but I hypothesize that the mites are actually beneficial to the plants too. When I sample populations of the plants I find that the mites are almost always present.

Q. What is your connection with George and Debbie Folkerts?

RN: I know Debbie and she's done a lot of work on the moths. George has been very, very generous with me in sharing his knowledge. So I really have high regard for both of them. In fact, George's paper, in 1982, in American Scientist, is one that was really important to my undergraduate research. So I think it's because of George Folkerts, more than any other person, that I am pursuing these things.

Q: What are some features that distinguish *Sarracenia purpurea* from *Sarracenia rosea*?

RN: That's easy. First, the thing to realize is that everything that has been called *Sarracenia purpurea* from the Gulf Coast is this new species. It's the only one there in this group of *Sarracenia*. In other words, *Sarracenia purpurea* does not make it that far south and west. So geography does it.

But that's not very satisfying. If one is fortunate enough to be in the field during the blooming season, *Sarracenia rosea* has pink petals but *Sarracenia purpurea* has maroon petals. The blooming season is quite short so most people would not be there. So there are nice features that are present almost all year round. In terms of the pitchers, the lip of the pitcher in *Sarracenia rosea* is much thicker than the lip of *Sarracenia purpurea*. I give measurements in our paper but generally, just telling people that it's a thicker lip will do it.

Another thing that works very, very well—and this will work most of the year because the plants are in fruit most of the year—is that the flowers and fruits of *Sarracenia rosea* are quite a bit larger than *Sarracenia purpurea* and it becomes especially conspicuous when you look at the relationship of flower size to height of the scape. *Sarracenia rosea* has a large flower but a short flower stalk, or scape. *Sarracenia purpurea* has a relatively small flower but a tall scape (see Figures 1,2).

So these are the most conspicuous differences. We found plenty of others. Generally speaking, all aspects of the flower are larger, including petals. Petals are longer and wider in *Sarracenia rosea*, and the pitchers tend to be larger, though there's a lot of overlap in that. So I really think I gave you the best differences, and the ones that work best in the field as well as in the herbarium.

Q: Are these differences consistent in cultivation?

RN: Yes. That was important to us because we wondered, are some of these things merely ecologic? So take it out of its geographic range and put it with *Sarracenia purpurea*, and does it maintain those distinctions? Yes. It does for these key differences.

Q: How is *Sarracenia rosea* the most "genetically divergent"?

RN: It wasn't the most divergent member of the genus. Mary Jo Godt and Jim Hamrick from the University of Georgia were looking at genetic diversity within the *Sarracenia purpurea* complex. So they had quite a narrow scope, but within that group, the one plant that stood out the most—it was the most different genetically from all the others and that's what we mean by genetically divergent—was *Sarracenia rosea*. The genetic difference between it and the next most genetically closely related member of the *Sarracenia purpurea* complex, was as much as or greater than a lot of investigators have found for separate species. Basically, it was the most different among any of those that they looked at, and they looked at four taxa—*Sarracenia rosea*, the northern *Sarracenia purpurea* subsp. *purpurea*, the mid-coastal *Sarracenia purpurea* subsp. *venosa*, and the mountain *Sarracenia purpurea* subsp. *venosa* var. *montana*.

Q: What about the ranges of *Sarracenia rosea* and *Sarracenia purpurea*?

RN: The thing that worries me is the map that I provide. If one just looks at that they may get a false sense that this plant is more common than it is. For instance, we found herbarium specimens from two populations in Georgia, but those are unknown presently. The plant is most likely extirpated from Georgia and a lot of the mapped locations are gone. So even though the region from the mid-Florida panhandle west to Mississippi is kind of thick with dots on our map, a lot of those dots are no longer there—a lot of those populations are no longer there. I'm very concerned about the conservation of the plant.

Q: In Alabama, is the plant mostly found in Baldwin and Mobile counties?

RN: Yes. Baldwin and Mobile are—in terms of Alabama—the only places where this plant is fairly frequent. It's still a rare plant. So I think we need to be worried about it and I mention in the paper two instances that I myself witnessed of poaching of the plants.

Q: Are the plants well distributed throughout the known sites or do two or three sites have most of the known plants?

RN: That's just what I was going to say, that a lot of the sites I found when I was doing all that field work for all those years and really scouring the areas, I would find five, six, seven, eight, nine, ten, a dozen. Very few sites have what I would call large populations. So I'm hoping the plant is a lot more common than we realize. I think there needs to be a status survey done. But in my experience, even in areas where I know it is and it's good habitat, I don't find much of it.

Q: Are the good sites on public or private lands?

RN: Both. Like two of the best populations I know—one of which is the type locality in the Apalachicola National Forest in Florida. Then, in Alabama, the places I've seen the plant are all private land.

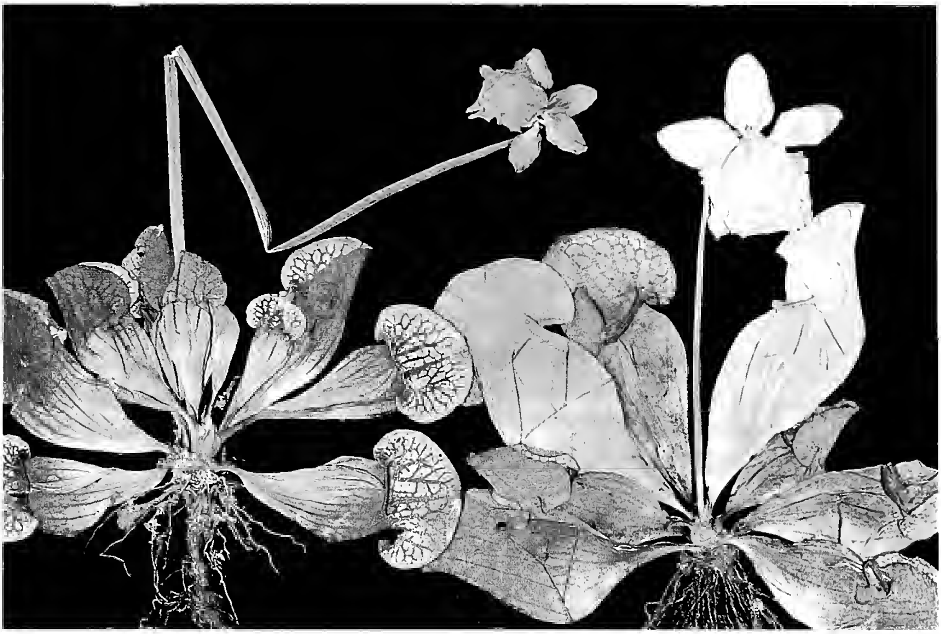

Figure 1: Pressed specimens of *Sarracenia purpurea* (left) and *Sarracenia rosea* (right). Photograph compliments of Robert Naczi.

Figure 2: *Sarracenia rosea* in Florida. Photograph by Barry A. Rice.

Q: Are these burned regularly?

RN: One of the places definitely is.

Q: What is the typical *Sarracenia rosea* habitat like? Is it always found with *Sarracenia leucophylla*?

RN: That's the real indicator. I'm not saying that every place you find *Sarracenia leucophylla*, you find *Sarracenia rosea*. In fact, no. But if *Sarracenia leucophylla* is there one could get out and really look around.

Q: What are the greatest threats?

RN: I really think it's habitat destruction. It's not the over collecting or poaching. I mean those are threats and I'd rank them as serious threats, but the most serious threat, in my experience, is this destruction of habitat because of the rapid development. I myself have seen pitcher plant habitats disappear in the relatively few years that I've been at it. The boom of development, especially right along the coast, is just astounding. So I see that as the worst. Fire suppression, I would say, would be the second most serious threat. Then I would rank poaching as the third most serious threat. Again, we need a status survey but, in my experience, those are the most serious threats prioritized.

Q: How do other workers feel about recognizing *Sarracenia rosea* as a distinct species?

RN: I know there will always be differences of opinion. There will be a lot of people who'll say I'm just a splitter or I just wanted to describe a new species. I think the best way to go is to document diversity and I think if we don't recognize something that's truly distinct as a species, we do an injustice to it because, especially for conservation purposes, these things don't get as much priority when they're varieties or subspecies as when they're species. In my opinion we provide many reasons why this is distinct as a species: the morphology, we cite the genetic work of Godt and Hamrick, we have the greenhouse common growth experiments that the Cases did. I know people will disagree with me. The best I can do is lay my cards on the table, show the evidence of it, and let people make their decisions.

Papers mentioned in this interview:

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LOOKING BACK: CPN 25 YEARS AGO

Steve Rose supplied an excellent five page review of tuberous *Drosera* of Western Australia—fine reading for those who cultivate plants in the group. Meanwhile, Don Schnell found a street named "Sarracenia", appropriately enough in *Sarracenia alata* territory in Escatawpa, Mississippi. The discovery drove him to poetic musings: "...perhaps it would be appropriate one day if on this road someone built a home for aged and retired CP botanists who in senior and calmer years, somewhat like old warriors looking back on ancient battles, might sit on a wide veranda and discuss old times in fields long grown over...."

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