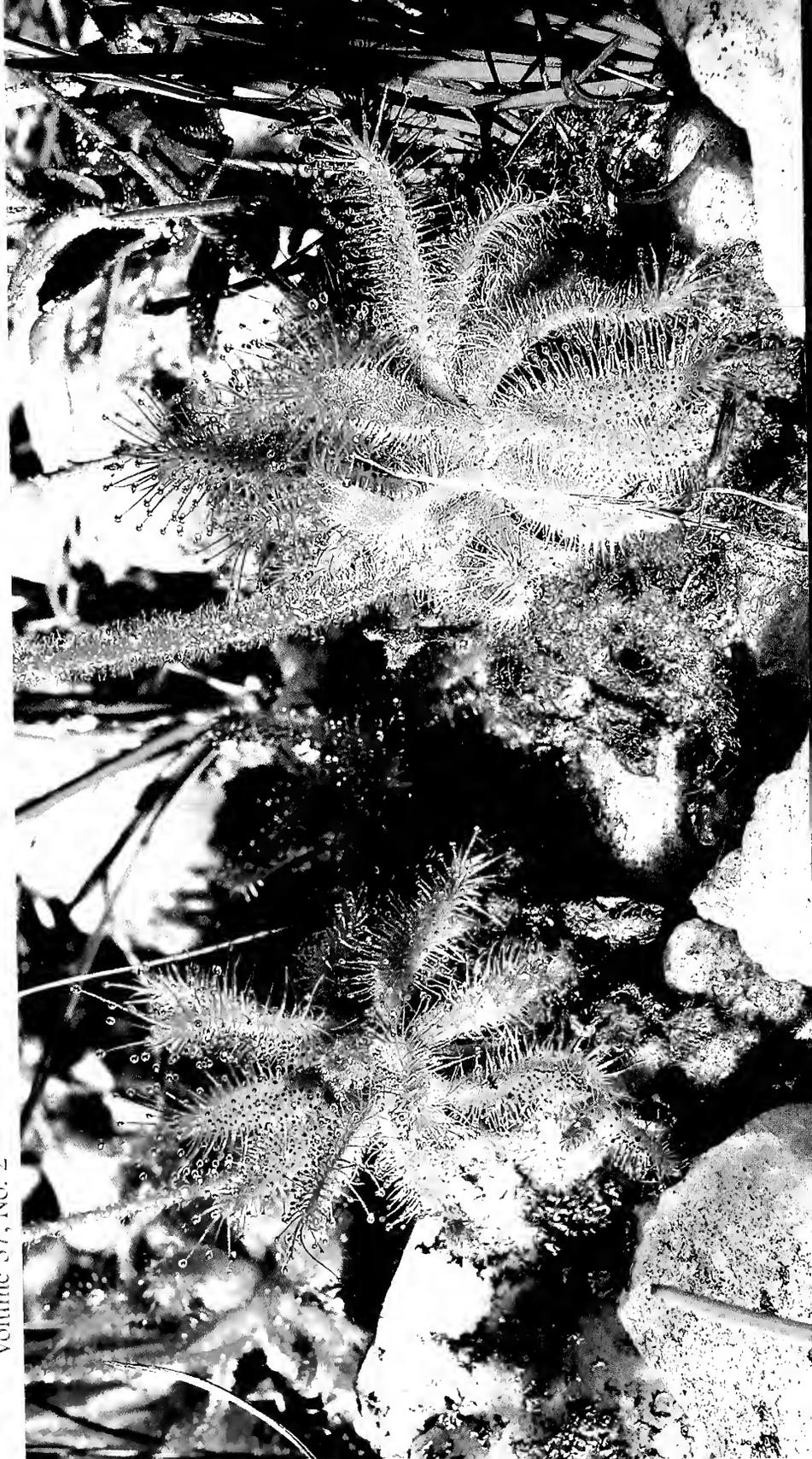


CARNIVOROUS PLANT NEWSLETTER

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Front Cover: Newly recognized as a distinct species, *Drosera schwackei* (Diels) F.Rivadavia, growing on a quartz substrate. See article on page 36. Photograph by Fernando Rivadavia.

Back cover: *Sarracenia* 'Hugh Jampton'. See article on page 44. Photograph by Aidan Selwyn.

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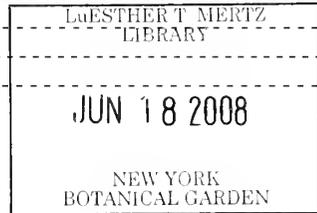
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<p><i>Byblis liniflora</i></p> <p><i>Darlingtonia californica</i></p> <p><i>Dionaea muscipula</i></p> <p><i>Drosera binata</i>—Coromandel, NZ</p> <p><i>D. burmannii</i></p> <p><i>D. capensis</i> 'Albino'—white flower</p> <p><i>D. capensis</i>—narrow leaf</p> <p><i>D. capensis</i>—red</p> <p><i>D. capillaris</i></p> <p><i>D. dielsiana</i></p> <p><i>D. filiformis</i> var. <i>filiformis</i></p> <p><i>D. glanduligera</i></p> <p><i>D. indica</i></p> <p><i>D. intermedia</i></p> <p><i>D. intermedia</i>—New Jersey</p>	<p><i>D. intermedia</i>—North Carolina</p> <p><i>D. intermedia</i>—tropical</p> <p><i>D. peltata</i> subsp. <i>auriculata</i></p> <p><i>D. tokaiensis</i></p> <p><i>D. hybrid</i> (<i>petiolaris</i> group)</p> <p><i>Ibicella lutea</i></p> <p><i>Nepenthes truncata</i></p> <p><i>Proboscoidea louisianica</i></p> <p><i>Sarracenia alata</i></p> <p><i>S. flava</i></p> <p><i>S. leucophylla</i></p> <p><i>S. oreophila</i></p> <p><i>S. rubra</i> subsp. <i>alabamensis</i>—ESA/CITES, USA sales only</p> <p><i>S.</i>—various hybrids</p>
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THE *DROSERA MONTANA* A.SAINT-HILAIRE
(DROSERACEAE) COMPLEX: A NEW COMBINATION,
DROSERA SCHWACKEI (DIELS) F.RIVADAVIA, IS PROPOSED

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Abstract

The *Drosera montana* A.Saint-Hilaire complex is reviewed, discussed and three taxa are excluded from this group: *Drosera hirtella* A.Saint-Hilaire, *D. parvifolia* A.Saint-Hilaire, and *D. roraimae* (Klotzsch ex Diels) Maguire & Laudon. Morphological characteristics, distribution, and habitat preferences, are described for the rare *Drosera montana* A.Saint-Hilaire var. *schwackei* Diels. Based on the differences observed between this taxon and other *Drosera* species native to South America, it is here proposed that it should be elevated to specific status and the new combination *D. schwackei* (Diels) F.Rivadavia is made.

Introduction

Numerous doubts and changes in taxonomic classifications have plagued nearly 200 years in the history of a group of small rosetted sundews (Droseraceae) from South America, ever since Auguste de Saint-Hilaire (1824a, 1824b) described thirteen *Drosera* taxa from Brazil, including *D. montana* A.Saint-Hilaire, *D. parvifolia* A.Saint-Hilaire, *D. tomentosa* A.Saint-Hilaire var. *tomentosa*, *D. tomentosa* var. *glabrata* A.Saint-Hilaire, *D. hirtella* A.Saint-Hilaire var. *hirtella*, and *D. hirtella* var. *lutescens* A.Saint-Hilaire.

Eichler (1872) was the first to suggest alterations in this group, reducing *D. tomentosa* var. *glabrata* and *D. hirtella* var. *lutescens* to synonymy under *D. tomentosa* and *D. hirtella*, respectively. A more drastic reduction was carried out by Diels (1906), who placed *D. parvifolia* as a synonym of *D. montana*, while *D. tomentosa* and *D. hirtella* were considered varieties of *D. montana*. Diels also described three new varieties: *D. montana* var. *schwackei* Diels, *D. m.* var. *roraimae* Klotzsch ex Diels (Diels 1906), and later *D. m.* var. *robusta* Diels (Diels 1914). A reversal in taxonomic reductions began with Maguire & Laudon (1957), who proposed the new combination *D. roraimae* (Klotzsch ex Diels) Maguire & Laudon, with *D. m.* var. *robusta* as its synonym.

The last 30 years have seen the most intense nomenclatural action involving taxa of the *D. montana* complex. Returning in part to the views of Saint-Hilaire, Santos (1989) accepted as valid taxa *D. hirtella* var. *hirtella*, *D. h.* var. *lutescens*, and *D. tomentosa*, but not *D. tomentosa* var. *glabrata*. Oddly enough, no mention was made of *D. montana* var. *schwackei*.

Returning to the views of Diels, Silva (1994) accepted only *D. montana* var. *montana*, *D. m.* var. *hirtella*, *D. m.* var. *roraimae*, *D. m.* var. *schwackei*, and *D. m.* var. *tomentosa*. However, Silva & Giulietti (1997) once again considered *D. roraimae* a valid taxon. A new species described by Rivadavia (2003), *D. tentaculata* F.Rivadavia, is considered a member of the *D. montana* complex because of the morphological, cytological, and phylogenetic affinities with this group (described below).

In the most recent event of taxonomic reversals involving the *D. montana* complex, no varieties were recognized by Correa & Silva (2005), who inexplicably lumped as synonyms under

D. montana numerous taxa: *D. communis* A.Saint-Hilaire var. *pauciflora* Eichler, *D. hirtella* var. *hirtella*, *D. h.* var. *lutescens*, *D. montana* var. *schwackei*, *D. parvifolia*, *D. tomentosa* var. *tomentosa*, *D. t.* var. *glabrata*, and *D. punilla* E.Santos.

Most of the taxonomic confusion involving the *D. montana* complex originated from the excessive taxonomic weight placed on inflorescence indumentum, starting with Diels (1906) in his delimitation of *D. montana* varieties. Other important characteristics, such as leaf shape, were mostly ignored, possibly because herbarium specimens of small rosetted *Drosera* species are often badly pressed and rather difficult to study. Diels' errors were sadly propagated over the past century, helped by the fact that ecological information for the numerous taxa cited above has been mostly inexistent or overlooked. Unfortunately, this lumping reached inexcusable levels with Correa & Silva (2005), whose work will sadly be used as a reference by countless botanists in the future due to the importance of the Flora Neotropica project.

Between 1990 and 2006 nearly all the known *Drosera* species native to South America were studied extensively in their natural habitats by this author, including all type locations of *D. montana* complex taxa. Based on new ecological knowledge acquired in the field together with new morphological information obtained from the study of numerous herbarium specimens, including holotypes, a revision of the *D. montana* complex was deemed necessary, starting with *D. m.* var. *schwackei* (see Figures 1, 2, Front Cover). Recent cytological (Rivadavia *et al.* 2003) and phylogenetic (Rivadavia 2005) data are also here used to define which taxa truly belong in the *D. montana* complex. The type specimen of *D. communis* A.Saint-Hilaire var. *pauciflora* Eichler was examined and is here considered synonymous with *D. montana* var. *montana*.

Results

Morphologically, *D. montana* var. *montana* and *D. m.* var. *tomentosa* are much more similar to each other than either is to *D. m.* var. *schwackei*. In agreement with Saint-Hilaire (1824a), *D. montana* and *D. tomentosa* are here treated as separate species, and not varieties as proposed by Diels (1906). This will be further discussed in a future paper, presenting morphological and ecological data to support their specific rank.

Drosera montana var. *schwackei* is one of the rarest *Drosera* taxa in Brazil, occupying a very specific ecological niche. As a result, it has remained largely understudied and undercollected since its discovery. Since 1997 various naturally occurring populations of this taxon have been discovered and studied by this author in Minas Gerais, southeastern Brazil. The comparison between these new collections with the few previously known specimens of *D. montana* var. *schwackei* shows that it is one of the least variable and most easily distinguishable of all *Drosera* taxa in Brazil. In fact it is so distinct that a new combination is proposed: *D. schwackei* (Diels) F.Rivadavia. The morphological and ecological characteristics that distinguish *D. schwackei* are discussed below, with the help of illustrations and a distribution map.

Although historically considered part of the *D. montana* complex, recent evidence shows that *D. roraimae* and *D. hirtella* should be excluded from this group. The chromosome number of $2n=20$ was reported for *D. roraimae* and *D. hirtella*, while *D. montana*, *D. tomentosa*, and *D. tentaculata* have $2n=40$ (Rivadavia 2005). Furthermore, DNA sequence data (Rivadavia *et al.* 2003) places *D. roraimae* and *D. hirtella* on a branch with mostly New World diploid *Drosera* species, sister to a branch with Brazilian tetraploid (and supposed tetraploid) taxa including *D. montana*, *D. tomentosa*, and *D. schwackei* among others. Morphologically *D. roraimae* and *D. hirtella* differ from remaining *D. montana* complex taxa in having truly spatulate leaves, instead of leaves obovate-cuneate (*D. tentaculata*), linear-lanceolate to oblongo-lanceolate (*D. schwackei*), linear-obovate to obovate-spatulate (*D. montana*), and oblongo-obovate (*D. tomentosa*). Therefore, both *D. roraimae* and *D. hirtella* are here excluded from the *D. montana* complex. In agreement with Duno de Stefano & Culham (1995), *D. parvifolia* A.Saint-Hilaire is here considered conspecific with *D. communis* A.Saint-Hilaire. Diels (1906) placed *D. parvifolia* as a synonym of *D. montana*, probably because it has sparse simple hairs near the base of the inflorescence—a characteristic common in *D. communis* from southeastern Minas Gerais.

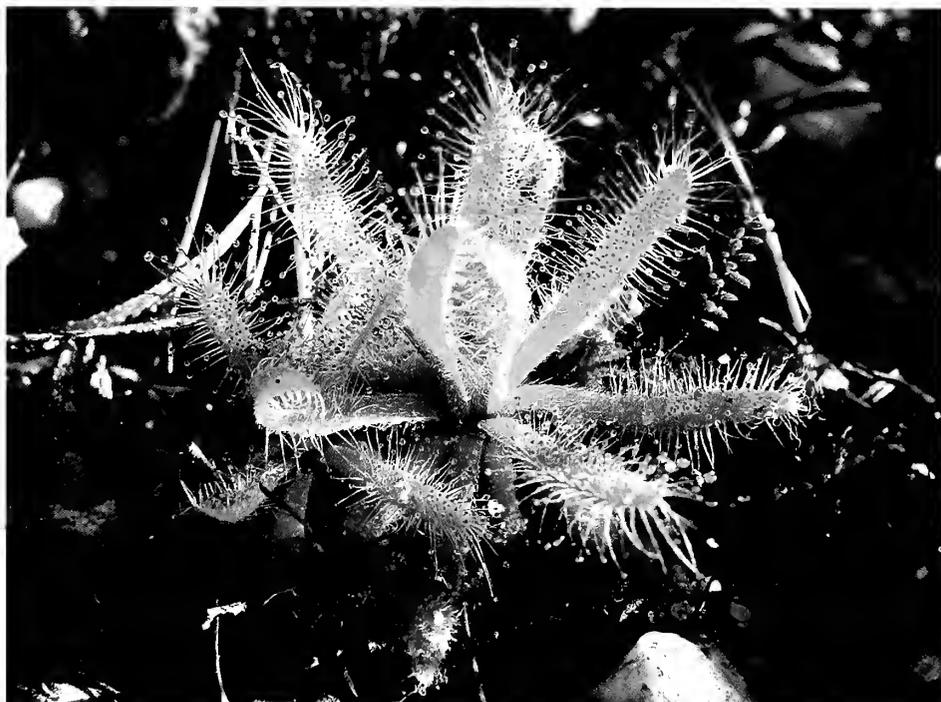


Figure 1: *Drosera schwackei* (Diels) F.Rivadavia rosette near Diamantina, Brazil.



Figure 2: *Drosera schwackei* (Diels) F.Rivadavia plants.

Drosera schwackei (Diels) F.Rivadavia, *comb. nov.* Das Pflanzenreich 4. 112 (26): 89. 1906. Holotype: Brazil, Minas Gerais, Serra do Cipó, Apr. 1892, Schwacke 8234 (B).

Perennial herbs with leaves in rosettes flat on the ground or semi-erect, sometimes forming columns of accumulated dead leaves up to 2 cm high, with 0.5-2 mm long eglandular hairs as well as sessile (or short-stalked) resinous glands distributed on inflorescences from base to apex, pedicels, bracts and sepals abaxially, petioles adaxially and leaves abaxially, the eglandular hairs being especially long and dense towards the base of the petioles abaxially whilst the sessile glands are especially dense on sepals and pedicels and also present on lamina adaxially. Stipules rectangular, membranaceous, 1-4 mm long, 0.8-2 mm wide at the base, translucent bronze-gold in color, the apical 1/2-1/3 divided into several long laciniae. Leaves oblong-oblongeolate, 6-22 mm long, yellow-green in color, eglandular hairs white, longer and denser towards the abaxial base; petioles 1-5 mm long, 0.5-1.7 mm wide; lamina 4-17 mm long, 1.5-4 mm wide, covered with numerous orange-red retentive glands adaxially. Inflorescences erect, 1-2(3) per plant, 6-18 cm long (including scape), yellow-green to a deep red in color, each bearing 1-9 flowers (up to 16 in forked scapes), eglandular hairs white near the base, bronze-gold towards the apex of the inflorescence, 0.2-1 mm long; bracts ovate-filiform, 1-2 inserted between pedicels, 1-3.5 mm long; pedicels 2-6 mm long, inserted 5-15 mm apart from each other, red in color; sepals 5 oblong-ovate 3-8 mm long, 0.7-2 mm wide, united at basal 1/4-1/5 of length, red in color; petals 5, obovate to ellipsoid-obovate, 5-11 mm long, 5-9 mm wide at apex, dark pink-lilac in color; ovary ellipsoid, trilobed to hexalobed, 1-1.5 mm long at anthesis, in fruit becoming ellipsoid, 2-3.5 mm long; carpels 3; styles 3, forked at the base, 2-4 mm long (including stigmas), dark-pink in color, stigmata lobed to flabellate; stamens 5, 2.5-4 mm long, anthers 1-2 mm long; seeds narrowly oblongo-ovate, honeycombed, 0.65-0.8 mm long, 0.2-0.3 mm wide (see Figure 3).

The leaves of *D. schwackei* are yellow-green in color, but the numerous orange-red retentive glands on the leaves give the rosettes a beautiful golden-orange appearance. The only other New World *Drosera* taxa known to have similar coloration is *D. sessilifolia* A.Saint-Hilaire which is easily distinguishable by its annual habit, spatulate-cuneate leaves, 5 carpels, 5 styles, preference for hot lowland savanna areas, and leaf rosettes that often acquire a deep red or wine-red color towards the end of the growing season.

When studying herbarium specimens, the densely eglandular-pilose scapes alone may not be sufficient to distinguish *D. schwackei* from some hairy forms of *D. tomentosa* (although the hairs are sparser and longer in the latter). However the color of the specimen may be diagnostic, since the yellowish leaves of *D. schwackei* become light-brown when dried while the usually red rosettes of *D. montana* and *D. tomentosa* become a dark brown to black in color. A closer analysis will reveal other differences such as more robust leaf rosettes and inflorescences in *D. schwackei*, acute leaf apex in *D. schwackei* versus obtuse in *D. montana* and *D. tomentosa*, abaxial side of leaves more densely eglandular pilose in *D. schwackei* than in *D. montana* and most *D. tomentosa*, and seeds almost double in length and more oblong than ovate in *D. schwackei*.

The semi-erect leaf rosettes of *D. schwackei* with linear-lanceolate to oblongo-lanceolate leaves are more similar in appearance to those of *D. ascendens* A.Saint-Hilaire than to those of *D. montana* and *D. tomentosa* which are mostly flat (except the newest emerging leaf), with leaves linear-obovate to obovate-spatulate or oblongo-obovate, respectively. *Drosera ascendens* and its closer relatives *D. villosa* A.Saint-Hilaire and *D. graomogolensis* T.Silva are easily distinguished from *D. schwackei* by leaves 0.8-13 cm in length; seeds cuneate-fusiform (*D. ascendens* and *D. villosa*) or ovoid (*D. graomogolensis*); and inflorescences 6-46 cm in length, glandular-pilose only or also eglandular-pilose, bearing up to 33 flowers each.

The robust inflorescences of *D. schwackei* vary from yellow-green to a deep-red in color, with red pedicels and calyx lobes. Together with the relatively large lilac-pink flowers, the inflorescences of *D. schwackei* resemble most those of *D. graminifolia* A.Saint-Hilaire, which is eas-

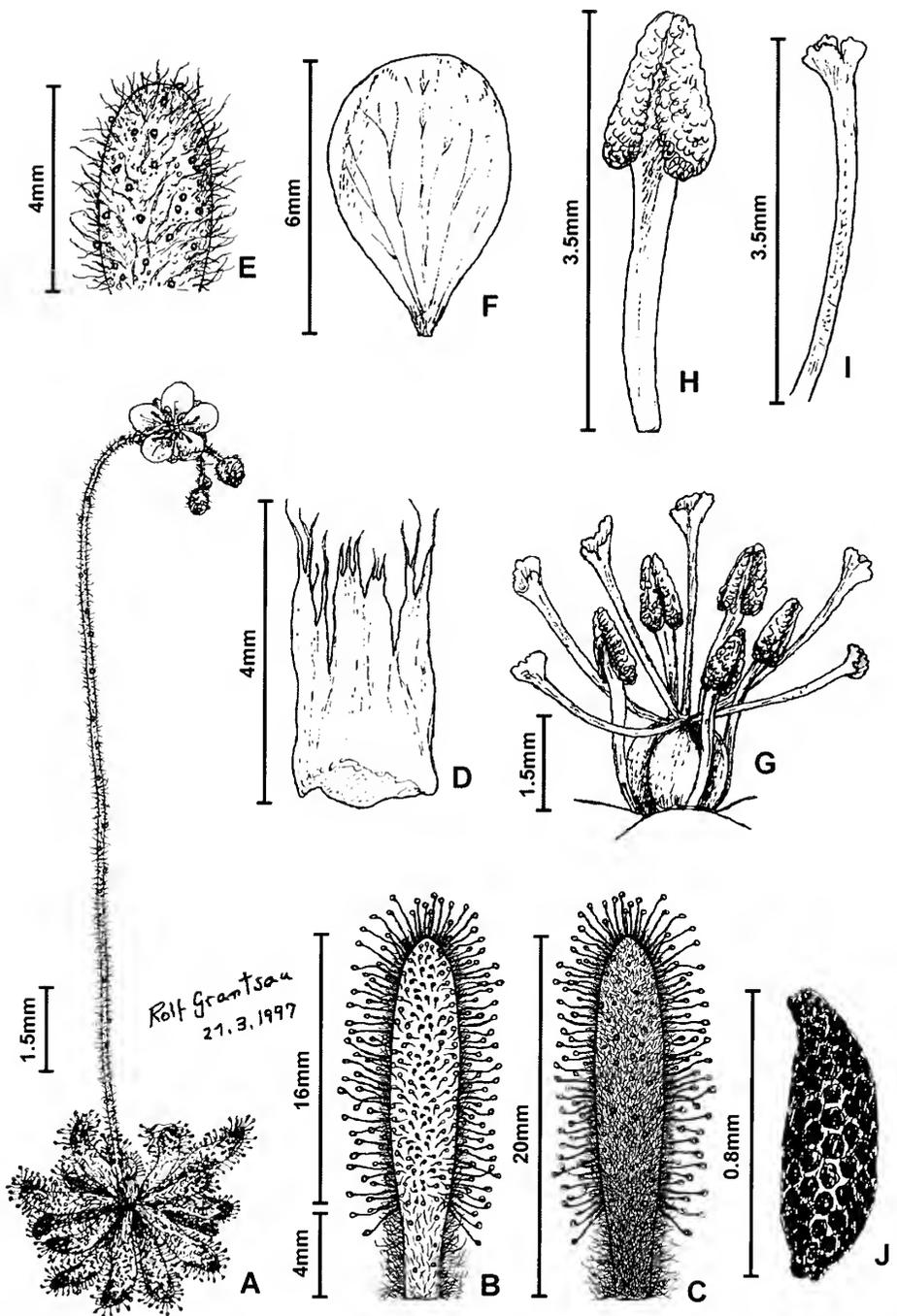


Figure 3: *Drosera schwackei* (Diels) F. Rivadavia; A: habit; B: leaf, adaxial view; C: leaf, abaxial view; D: stipule; E: sepal, abaxial surface; F: petal, adaxial surface; G: gynoecium and androecium; H: filament and anther; I: a single style/stigma segment; J: seed. Based on live specimens from Congonhas do Norte, Serra da Mangabeira (herbarium specimens from this location deposited at SPF: Rivadavia & Pinheiro 566).

ily distinguished by its narrow leaves reaching 34 cm in length; stipules triangular, golden-bronze colored, 10-25 mm long, 10-15 mm wide; and inflorescences with shorter eglandular hairs, often forking more than once, bearing 7-72 flowers. The scapes of *D. chrysolepis* Taub. and *D. camporipestris* F.Rivadavia are also eglandular-pilose (although less dense than in *D. schwackei*), but these species are easily distinguished by their longer spatulate-lanceolate leaves.

The only other *Drosera* taxon in Brazil south of the Amazon Basin that may have eglandular-pilose inflorescences is *D. cayennensis* Sagot ex Diels, here including as its synonyms *D. colombiana* Fernández-Pérez, *D. panamensis* Correa & A.S.Taylor, *D. pumilla*, and *D. sanari-apoana* Steyermark. The indumentum of the scapes is very variable for this species and has been one of the main characters used by taxonomists in attempts to separate *D. cayennensis* into the different taxa here listed as synonyms. While in some populations only eglandular hairs are present on the scapes, others will have glandular hairs only—or even both. One of these *D. cayennensis* collections with eglandular-pilose indumentum from the Chapada dos Guimarães (Mato Grosso state, western Brazil) was mistakenly identified as *D. montana* var. *schwackei* by Silva (1994) and Silva & Giuletta (1997) and as *D. montana* by Correa & Silva (2005), but is easily differentiated from either by its spatulate-obovate to spatulate-cuneate leaves in flat rosettes and fragile flower scapes usually no longer than 10cm with only 1-5 flowers.

Drosera schwackei flowers from around March to April, which corresponds to the late wet season/early dry season (or late summer/early autumn). This is a rather unusual flowering period among Brazilian *Drosera* species, especially for a perennial that does not go dormant. The only other taxon that flowers around this same time of year in Brazil south of the Amazon Basin is *D. cayennensis* Sagot ex Diels. Similar to *D. montana* and *D. hirtella*, *D. cayennensis* also remains dormant as roots in the dry season, but usually flowers and loses its leaf rosettes earlier in the growing season than the former two species.

One of the most unique characteristic of *D. schwackei* is the habitat in which it grows. It forms small populations in areas of milky-white quartz gravel mixed with fine white sand. This habitat is sparsely vegetated and prone to intense desiccation in the dry season. Although *D. schwackei* surprisingly does not go dormant, during drier months its rosettes will lose vigor, the leaves become reduced in size, and the retentive glands often lose their mucilage and curl inwards.

Drosera schwackei is only known from the Cadeia do Espinhaço highlands in central and southern Minas Gerais state, Brazil), where it is known to occur around the towns of Congonhas do Norte, Diamantina, and disjunctly near Ouro Preto. The holotype of *D. schwackei* was collected at the Serra do Cipó, but the exact location on these highlands is not specified (Diels 1906) (see Figure 4). In the Diamantina area this species occurs between 1200-1300m altitude, at Congonhas do Norte at c.1350 m; whilst the elevations for the other *D. schwackei* sites are not known.

Drosera schwackei belongs in subgen. *Drosera* sect. *Oosperma sensu* Schlauer (1996) due to its seeds being more ellipsoid than fusiform. The closest relative of *D. schwackei* is believed to be *D. tentaculata*, which is overall less robust; has orange-reddish obovate-cuneate leaves, each with 8-12 distinct, horizontally flat, retentive glands on the apical margin; inflorescences more sparsely eglandular-pilose as well as glandular-pilose; and seeds 0.3-0.45 mm long, ovoid-ellipsoid, reticulate. Although *D. tentaculata* regularly grows in similar neighboring quartz gravel habitats, it has curiously never been seen growing sympatrically with *D. schwackei*, indicating differences not yet fully understood in ecology between both taxa. Other *Drosera* species observed growing near (but never sympatrically with) *D. schwackei* are *D. graminifolia* and *D. tomentosa*.

Specimens Examined—BRAZIL. Minas Gerais: Congonhas do Norte, Serra da Mangabeira, 23/Apr./1982, Furlan *et al.* 8463 (SPF); Congonhas do Norte, Serra Talhada, 24/Apr./1982, Furlan *et al.* 8472 (SPF); Congonhas do Norte, S. da Mangabeira, 26/Feb./1997, Rivadavia & Pinheiro 566 (SPF); Diamantina, estr. p/ T.Arraiolos, 27/Feb./1997, Rivadavia & Pinheiro 577 (SPF); Diamantina, estr. p/ T.Arraiolos, 2/Mar./1997, Rivadavia *et al.* 593 (SPF);

Diamantina, estr. p/ T.Arraiolos, 3/Mar./1997, Rivadavia 596 (SPF); Diamantina, estr. p/ T.Arraiolos, 3/Mar./1997, Rivadavia 597 (SPF); Diamantina, estr. p/ T.Arraiolos, 10/Jul./1999, Rivadavia *et al.* 1105 (SPF); Diamantina, estr. de T.Arraiolos, 31/Jul./2002, Rivadavia & Gibson 1375 (SPF); Diamantina, estr. p/ Cons.Mata, 29/Jun./2003, Rivadavia 1631 (SPF); Diamantina, estr. de T.Arraiolos, 6/Apr./2003, Rivadavia 1588 (SPF); Diamantina, 2km da cidade, 12/May/2007, Rivadavia 2537 (SPF); Ouro Preto, Itacolomi, 25/Jun./1884, Glaziou 14482 (mixed with *D. tomentosa*) (R); Serra do Cipó, Apr./1892, Schwacke 8234 (OUPR) (Lectotype).

Acknowledgements: I would like to thank Rolf Grantsau for the botanical drawing of *D. schwackei*; Allen Lowrie and Jan Schlauer for numerous taxonomic discussions over the years; Fabio Pinheiro, Robert Gibson, Marcelo A.K. Fontana, Charles and Jackie Clarke who helped discover and study natural populations of *D. schwackei*; Barry Rice and Andreas Fleischmann for helpful comments and suggestions; and especially Thomas Carow whose pictures of *D. schwackei* near Diamantina in 1987 tantalized me for many years, long before I knew what it was, and until I finally rediscovered this rare taxon in nature in 1997. The easily accessible and numerous *D. schwackei* populations present in a small area near Diamantina were essential in my study of this taxon and were found thanks to a picture taken by Thomas Carow where Diamantina was visible in the background. Thomas took the risk of killing the only surviving *D. schwackei* in cultivation, by plucking leaves and a flower scape and sending these to me in alcohol for study. I am indebted to Thomas for this sacrifice, especially knowing the anguish it must have caused him. Without the help of Thomas Carow, the present work would not have been possible. No permits were required to conduct the studies described in this paper.

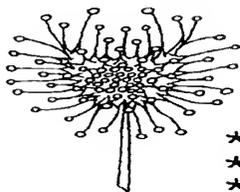


Figure 4: Map showing the known distribution of *D. schwackei* (Diels) F.Rivadavia. Sites indicated on the map may represent more than one collection listed in this paper. The Serra do Cipó location for *Schwacke* 8234 (OUPR) is approximated due to the lack of more specific location data.

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NEW CULTIVARS

Keywords: cultivar: *Sarracenia* 'Bris', *Sarracenia* 'Hugh Jampton', *Sarracenia* 'Juthatip Soper'.

Sarracenia leucophylla 'Bris'

Submitted: 18 March 2008

The particular attributes of this extraordinary *Sarracenia leucophylla* plant were first noticed in 2004, when I (PD) was working with the plants in the collection at California Carnivores. As a juvenile, the plant had shown good color and coloration, but otherwise did not seem particularly remarkable. However, as it matured, it showed a bizarre mutation in the nature of the lid! Unfortunately, since the inventory at California Carnivores is huge, I (PD) could not trace this plant's origin, but I suspect it probably originated from ICPS seed bank material.

Unlike the lids on normal plants, which when viewed from overhead completely cover the pitcher opening, the lid on this new cultivar is reduced significantly in size (see Figure 1). The lateral development of the lid is highly reduced, so that the lid is often little more than a narrow strip of tissue. The length of the lid is also somewhat shorter than normal, although it terminates in a spur as is normal for the species. On most pitchers, the lid tends to curve slightly downwards, over the pitcher opening, in a manner that is also somewhat atypical for the species.

These characters are somewhat peculiar, but we do not believe they originate from hybridization. They are stable in cultivation, as plants cultivated for several years at both California Carnivores and the University of California, Davis, consistently show the peculiar characteristics. It is unlikely that plants propagated by seed would faithfully reproduce the cultivar characteristics, so we recommend propagation by vegetative means. Despite several years of cultivation, we have not yet observed flowers on this clone.

The overall appearance of the plant has caused many viewers to remark that this looks like a species of *Heliamphora*! Because the erect, columnar pitcher appears to have a trimmed appearance to its terminal structures, one of us (BR) proposed the cultivar name in late 2006. The name was instantly approved with teary-eyed laughter by both authors.

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—Barry Rice • P.O. Box 72741 • Davis, CA 95617 • USA • barry@sarracenia.com

Sarracenia 'Hugh Jampton'

Submitted: 18 July 2007

This new cultivar has stout, greenish yellow pitchers, rising from a large rhizome to a height of at least 56cm (22 inches). The lower two-thirds of the pitcher is characterised by very fine, vertical venation. Thereafter the pitcher flares outward to a wide mouth some 6cm (2.5 inches) across, with a substantial nectar roll that dips to form a graceful spout. Initially a pale yellowish green, the nectar roll becomes bright yellow at maturity. A narrow, linear ala not exceeding 3mm (1/8 inch) extends from lip to base.

Pitcher venation becomes more extensive and coarser with height, reaching a maximum on both upper and lower surfaces of the hood. Here the colouration appears to bleed from the veins into surrounding tissue. Areas between the deeply coloured veins may be shaded with colour or speckled as if spattered with paint (see Back Cover).

A substantial throat patch liberally supplied with nectar glands spans the full width of the column, the central portion extending vertically down into the pitcher interior and upwards the full length of the hood. This vertical extension of the throat patch may also be repeated on the

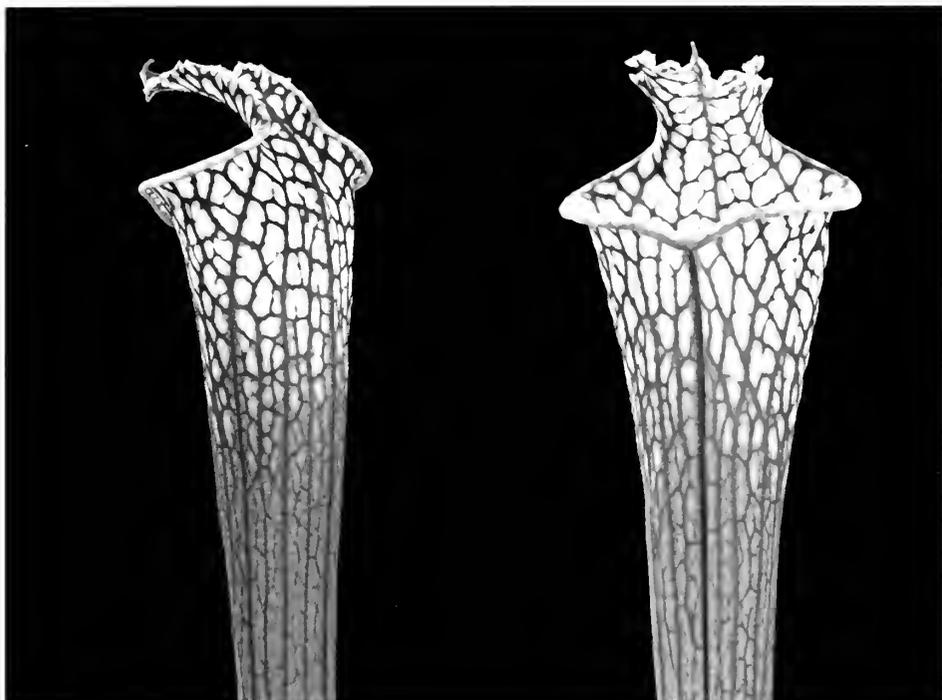


Figure 1: *Sarracenia leucophylla* 'Bris.' Photograph by Barry Rice.



Figure 2: *Sarracenia* 'Juthatip Soper.'

upper surface of the hood and down through the column. Viewed from above, the near circular hood has a distinct wave and a pronounced spur. Flexure of the column may draw both sides of the hood together until they touch abaxially.

Initially red, both the pitcher venation and throat patch darken to purple as the pitchers mature.

In autumn, recurvate phyllodia up to 15cm (6 inches) tall are grown which persist through the following winter and spring. Curvature of phyllodia is of a much lesser extent than is typically seen in *Sarracenia oreophila*.

Large, butter-yellow flowers appear to share the characteristics of both *Sarracenia flava* and *Sarracenia oreophila* equally. There is a faint, musty perfume reminiscent of *S. flava*.

Sarracenia 'Hugh Jampton' was raised from seed in 1989 by UK grower Stephen Locke. The seed was sourced from the Carnivorous Plant Society seedbank and labelled as being *Sarracenia flava* var. *rugelii*. As the plant grew, Stephen soon realised that it was in fact a hybrid. The true parentage is uncertain, but it seems likely that the plant is a back-crossed hybrid of *Sarracenia flava* and *Sarracenia oreophila*.

The cultivar name *Sarracenia* 'Hugh Jampton' is a reference to the short-lived character voiced by Peter Sellers and created by Spike Milligan for the BBC radio series "The Goon Show", first broadcast during the 1950s. The name was coined in June, 2006.

In order to maintain the unique characteristics of the plant, reproduction must be achieved by vegetative methods only.

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Sarracenia 'Juthatip Soper'

Submitted: 25 October 2007

The description of this *Sarracenia* × *mitchelliana* back cross was published in 1998, but the previously published photographs have been somewhat small. As such, for your reference, additional photographs of this plant are being published here as standard illustrations (see Figure 2).

—Matthew Soper • Yamayla • Allington Lane • West End • Southampton • UK • matthew@msoper.freeserve.co.uk

Erratum: *Dionaea* 'Microdent'

In the description of a new cultivar of *Dionaea* (*Carniv.Pl.Newslett.* 37: 26, 2008), the epithet was spelt "Microdents" (as originally submitted in the registration form). The author and registrant has informed us he would prefer the epithet to be 'Microdent' (without terminal "s"). The correct name is, therefore, *Dionaea* 'Microdent'.

NEWS AND VIEWS

Barry Rice (barry@sarracenia.com) writes: This recent holiday season, my wife gave me, as a joke, a retail "Grow your Own Venus Flytrap" kit she bought. Marketed by runningpress.com, the kit included a small amount of peat, sand, a tiny saucer as a planter, a plastic bag (for humidity), and a thumb-sized booklet. I was pleasantly surprised to discover that the information in the booklet was surprisingly accurate. In fact, parts of it sounded evocatively like my own on-line FAQ! However, most striking was that the \$6.95 kit included a pathetic allotment of but two *Dionaea* seeds for the novice gardener. My kit was particularly hope-damning in that both seeds had been pulverized into fragments and powder. The box contained little more than heartbreak for developing botanists!

Freeze-Drying Carnivorous Plant Pitchers At Home

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Keywords: arts, practical uses—*Nepenthes*, *Sarracenia*.

This article is directed to hobbyists and others who do not have access to elaborate laboratory equipment and are looking for alternatives to silica gel, sand and other desiccants and who want to have long lasting, somewhat durable dried pitchers that are not pressed. Cliff Dodd II first showed me a *Nepenthes bicalcarata* and *N. lowii* that he had dried by simply placing them in his home freezer until they seemed dry. Cliff let me handle the two sturdy dried pitchers, and I was impressed that he did have much obvious concern. Cliff had other preserved specimens of *Nepenthes*, but I was most impressed by the two species I had closely examined.

There have been several very good articles already printed in the Carnivorous Plant Newsletter about drying and preserving carnivorous plants (Lamb 1989; Shanos 1985; Shivas 1983). In this article I will go into exact details so others can reproduce my technique, and so enjoy their favorite pitchers not only in pictures, but by handling, arranging, altering colors, or sharing them with others. Arranging and use of freeze-dried pitchers is limited only to one's imagination (see Figures 1, 2).



Figure 1: Freeze dried *Nepenthes* pitchers. Top pitcher set: *N. bicalcarata*, all six or more years old, spray painted (left to right) copper, gold, burgundy, white and burgundy. Bottom set: four *N. bicalcarata* (top left waxed finish, others natural finish), *N. × hookeriana* red form (waxed), *N. fusca* from Sarawak (natural), *N. spectabilis* × *spathulata* (waxed), *N. veitchii* × *lowii* (natural), *N. ventricosa* (natural), *N. ampullaria* (just out of freezer and thawed).



Figure 2: Dried arrangements: Sarraceniaceae on left, *Nepenthes* on right.

All of the methods used in this and the previously noted articles are very useful in some ways but problematic in others. I have used silica gel to dry *Nepenthes*, *Sarracenia*, and *Cephalotus* successfully, but found the finished product to be very fragile when over-dried. Also, it was difficult for me to completely clean the silica gel from the pitchers without doing damage to their fine details. I have tried preserving *Nepenthes* pitchers in blocks of acrylic, but I never found the finished product to be worth all of the time and effort, though I have been told that acrylics have improved a great deal since the 1970s. My first attempts with liquid acrylic and *Nepenthes* were nothing short of disaster. I have used glycerin to preserve leaves, but I never liked the dark oily look it gives flowers or leaves. Shanos (1985) described methods, including a -50°C vacuum, which I do not have access to!

While it is possible that early pitcher removal does take some energy away from the plant, in the form of unutilized or pre-digested food and photosynthesis, I have found the impact is minimal if a low percentage of pitchers on each plant are used for drying. I have worked in greenhouses, cutting roses and carnations, and perhaps this has made harvesting material from plants less difficult for me. If my plants suffer from the removal of a few leaves, it is because of poor cultivation and not the loss of the leaves.

I do not condone wild harvesting of pitchers by hobbyists for drying, and have never done so myself. Using field grown material for this purpose is a topic for a separate article.

The typical frost-free freezer, as is found in most homes, operates at about -7°C (20°F) and is perfect for the job. However, in family situations they can be a minor challenge to use. While pitchers are freezing, they are very prone to damage. Dedicating a shelf or secure area to this project is an obstacle that has to be worked out in advance with those who are using the freezer to store food!

The two crux periods in the process are when the pitchers are first cut for freezing, and the thawing period. Cut the pitchers off the plant after the pitcher has matured, and as soon as the lid shows the slightest sign of browning. I realize how difficult it is to remove a perfect pitcher from the plant, but remember that the leaf will be replaced by new leaves. Also, instead of lasting only a few months on the plant, a preserved pitcher will last many years. Do not wait for the pitcher to begin to fade or even brown on the plant—doing so will usually give unsatisfactory results.

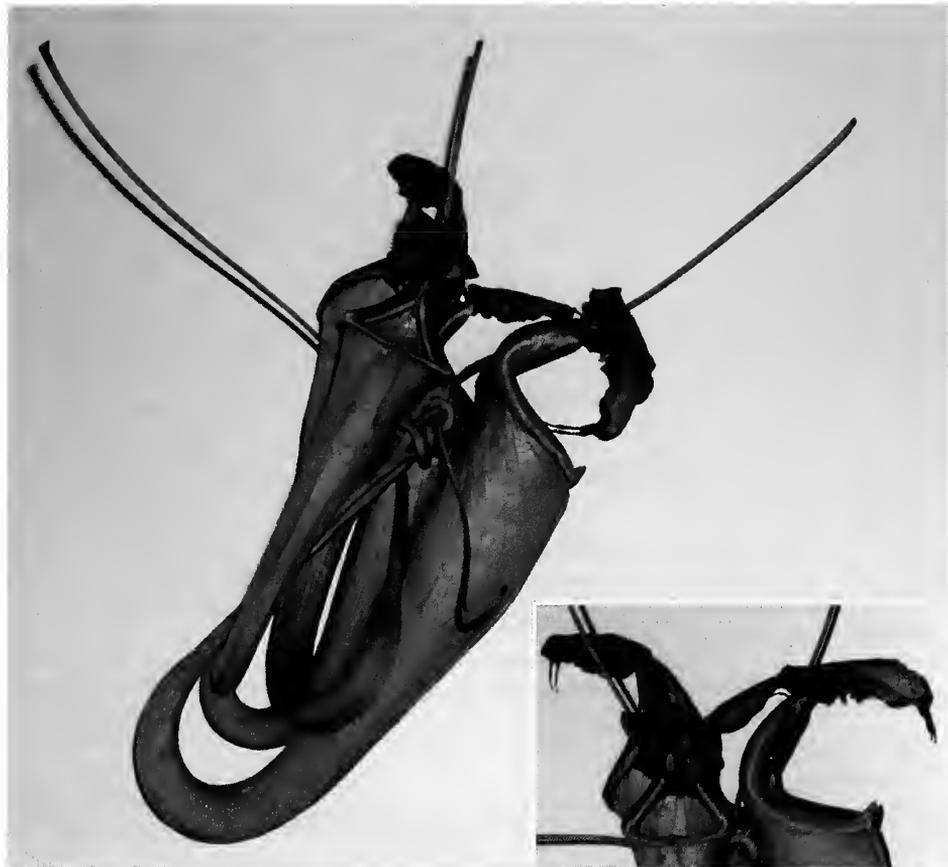


Figure 3: Bent *Nepenthes maxima* lid repair; inset shows after straightening.

I have tried to dry pitcher plant inflorescences, but those of *Heliamphora* are the only ones that I have been satisfied with (although they are very fragile). All my many attempts of home freeze-drying *Sarracenia* flowers have all turned out so badly, they were not worth keeping, nor was the loss of good seed worth it!

It is important that the pitchers be washed thoroughly, and any obvious mildew, nectar or chemical residue should be carefully scrubbed from the still fresh and turgid pitchers. A soft toothbrush works well for this task. Use care to brush in the same direction of any fine hairs, wing cilia, ridges, etc. The peristome of *Nepenthes* is especially important to clean if you want to see its smooth natural sheen in the finished product. When you have finished cleaning the pitchers, lightly shake off excess water and dry them with paper towels or absorbent cloth rags for a few minutes. Then place them in the freezer.

Deciding when the pitchers are thoroughly freeze-dried is something of a trial and error endeavor. The weight of the frozen pitchers helps indicate their dryness—a good deal of the pitchers weight is water and they become very light when dry. Pitchers of different individual plants of the same species have different size and thickness. Depending on the kind of material of the species used, and its stage of maturity, the pitchers will have different drying times. Small juvenile plant pitchers are the easiest to dry—four to eight weeks is usually plenty of drying time for most 15cm (6") pitchers, but patience never hurts, and incomplete drying will result in wrinkled or unsightly, curled brown pitchers.

For *Nepenthes* with thin walls like those on *N. × hookeriana*, *N. ampullaria*, *N. rafflesiana*, and *N. alata*, the drying time is relatively short (four to six weeks), but great care in handling thin walled pitchers must be given when thawing. *Heliamphora* also usually dry well in this period.



Figure 4: *Nepenthes bicalcarata* lid repair. Left—curled lid; middle—flattening lid next to another pitcher that is drying after being painted; right—flattened lid.

Thick walled or woody pitchers, such as giant forms of *N. rafflesiana* or large hybrids like *N. × dyeriana* are best dried a couple of weeks longer than young or smaller varieties. I have left pitchers in the freezer for 6 months with no apparent damage, so longer freezing time is better if you are in doubt. Mature *Sarracenia* need the same amount of time as large *Nepenthes* pitchers. Upper *Nepenthes* pitchers usually dry more easily and uniformly than most species with large lower pitchers.

Oddly, *Cephalotus* and *Darlingtonia* need a long freeze-drying time, eight weeks at least.

It is important to treat frozen pitchers with a delicate touch. The frilled wings on *Nepenthes* lower pitchers are very fragile. Handle frozen *Nepenthes* and *Cephalotus* by the tendrils only, and *Sarracenia* by their bases; any dents in the pitcher walls from rough handling will remain and be obvious.

After the freeze-drying period, the pitchers must be carefully thawed. This takes about 4-8 hours. Thawing the pitchers upside down makes for a superior finished product for several reasons. First, there is almost always some condensation and other minimal amount of frost liquid that is left in pitchers after the whole freezing process; turning the pitcher upside down allows this liquid to escape rapidly as it thaws. Second, the lids on all types of pitchers, except *Heliamphora* and *Darlingtonia*, tend to curl inward towards the mouth of the pitcher when dry. When thawed upside down, gravity works to help keep this type of curling from being a problem. Any frozen prey residue that was not cleaned out prior to freezing will also drop out of inverted pitchers when thawing, and this residue is not pleasant to smell when discovered at a later time. Hanging from string, or placing on vertical wooden dowels or thin upright wooden twigs will work well to support pitchers in the upside down position until completely thawed.

The most common problems I have encountered with freeze-drying is that the lids of many pitchers curl on the edges or roll inward toward the pitcher opening, even though the rest of the pitcher is well dried and in good shape (see Figure 3). Even pitchers still on the plants do this when experiencing extreme drought conditions. The thin nature of pitcher lids makes this an easily overcome problem, but it is also critical to use care when working on the lids of freeze-dried material. Simply remoisten the lid of the pitcher being worked on, by placing it under water for a few seconds and letting the pitcher stand for about 15 minutes to absorb the moisture evenly.

Once the lid is soft and pliable it is very prone to tearing, so use care. Methods for reshaping

the lid are unlimited and depend mainly on the natural shape of the lids being worked on. For examples, I have used paper clips, notebook clips, and many other tools (see Figure 4). Many pitcher lids will straighten out simply by moistening them, hanging the pitcher upside down and re-drying the pitcher at room temperature for 8-12 hours—gravity does all of the work. Rapidly drying with a hair dryer will cause curling and wrinkling of any thin portions of the pitchers.

In a more extreme case of deformation, the lid and neck of the pitchers of *Sarracenia* and *Nepenthes* will roll forward and inward. As before, moisten the relevant part of the pitcher—in this case the column and lid. A splint can be constructed from popsicle sticks, pieces of cardboard, plant labels, or any other materials that are light and easy to work with. Make a form for the individual pitcher lid and then re-dry at room temperature for 8-12 hrs in the preferred shape. I have several *N. bicalcarata* pitchers that I chose to reform the pitcher opening to a wider than normal point, to better show the abnormalities such as crossed fangs or three-fanged pitchers. Broken off and torn lids can be easily repaired with a small amount of carpenter's wood glue when dry.

Sometimes the pitcher is so deformed after drying that it would take a lot of work to repair it. In my opinion, easier is better, and unless the pitcher is very special to you, starting all over again by freeze-drying a new pitcher is often the wisest choice. After all, they do grow on trees! (At least, some *Nepenthes* do!)

Some *Nepenthes* will retain some pigmentation for years. Dried *N. rafflesiana* × *hookeriana* (red forms) and *N. spectabilis* × *spatulata* have stayed red for longer than six years. *Sarracenia* will hold some color for many months, but then turn assorted shades of brown. *Heliamphora* turn light brown while freezing, so I may let them brown on the plants before harvesting.

I have done some work with artificially coloring the freeze-dried pitchers. Spray paint can produce excellent results. I was surprised to discover that pitchers very lightly spray painted burgundy, or thoroughly spray painted with metallic paint, results in a nice finished product. I am certain there are many better artists than me that can come up with exceptional coloring, and can make any work I have done look amateurish.

I have used wood stains to attempt a carved wood appearance and although I have not tried every color of wood stain, I was not pleased with the results. The pitchers take up stains unevenly because of the waxy tissue and glandular areas, making for an uneven, messy look. Finishing wax paste used on wood, applied to brown pitchers and heated over a stove top to flow evenly into all pitcher areas makes for the most wooden look I have come up with. The wax probably helps the pitchers last longer as well. Paint cannot be applied after waxing, so if a pitcher is waxed this should be the last step of the project. Varnish and acrylic look good and can add durability to freeze-dried pitchers if not applied too liberally.

I have also tried carefully covering freeze-dried pitchers with expensive gold leaf. The materials for applying gold leaf are available from online sources such as (i.e., Mona Lisa Products, at www.houstonart.com). To my untrained eyes, gold leaf made the pitchers look like chocolate candies and make me hunger for a snack. I have not found an affordable and reliable electroplating company to apply any bronze or other metal finishes, but I do think it can be done. Electroplating would not be an environmentally friendly way to finish pitchers and would work best on very small material.

I have also tried a few methods that were not worth repeating! Green paint just looks wrong to me. If you paint the pitcher so that it looks artificially real, you should instead just work with making pitchers out of silk or cloth; these materials are easier to work with and are more flexible than freeze-dried pitchers.

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SURVIVAL OF DRIED TURIONS OF AQUATIC CARNIVOROUS PLANTS

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Keywords: ecology: *Aldrovanda*, *Utricularia*.

Introduction

Aquatic carnivorous plants in the genera *Aldrovanda* and *Utricularia* produce turions: dormant, overwintering buds modified into storage organs (Sculthorpe 1967; Bartley & Spence 1987; Adamec 1999, 2003). Turions are durable, partly frost-tolerant organs which usually overwinter in shallow water close to the bottom, below ice cover. However, in some species turions overwinter also above the water surface in the terrestrial ecophase, on wet organic soil. Thus, these turions can face drying *in situ*. Maier (1973a) found that *U. vulgaris* turions, dried at 33% relative humidity (RH) and 23°C for 1-123 days, were able to sprout and grow. These turions contained water equivalent to only 5-6% of their dry weight (DW). However, the longer the turions were stored in a refrigerator before drying, the less tolerant of drying they were. Turions refrigerated for five months before being dried out survived very poorly. In another study (Maier 1973b), turions of *U. vulgaris*, *U. australis*, *U. intermedia*, and *U. minor* were able to withstand drying out (24±3°C, 33% RH) for 5-19 days and, in addition, the drying markedly shortened innate turion dormancy. Upon being returned to suitable growing conditions at 24°C, partially dried turions sprouted after only 5-7 days while control turions sprouted after 12-48 days. Although the fresh-weight based respiration rates of carnivorous plant turions are relatively low when compared to those of adult shoots of the same species, turions lose major part of their storage carbohydrates over winter (Winston & Gorham 1979a; Adamec 1999, 2003, 2008). Therefore, under natural conditions (and usually also in a refrigerator), they can survive only from one season to another (Adamec 1999, 2003). It was demonstrated in *U. vulgaris* turions that their overwintering and stages of dormancy were regulated by native phytohormones, mainly by abscisic and gibberellic acid (Winston & Gorham 1979b; see also Minorski 2003).

The life-spans of intact wet turions are relatively short (Adamec 2003). If dried turions have a longer life span, storing turions after a drying period might improve their long-term survival. The aim of this paper was to investigate sprouting of turions of four aquatic carnivorous plant species after various periods of drought in a combination with frost.

Materials and Methods

Experiment #1 began on 9 March 2003 and tested the effects of cold desiccation on dormant turions. Thirty turions of *U. ochroleuca*¹ collected from a wet sediment in an outdoor culture (which had been dormant for about five months and had withstood a normal Czech winter (temperatures ranging from about -20°C to 6°C), and twenty turions of *U. australis* overwintered in water in a refrigerator at 3±1°C, were thoroughly blotted dry. As a drying treatment, they were put on an open Petri dish in a refrigerator at 3±0.5°C and 63-65% RH for 5 days. As a control sample, wet turions of both species were kept on a wet paper tissue in the same refrigerator for the same time. After 5 days, dry and wet turions were allowed to sprout in tap water in natural light (day-length approximately 11.5 h) at 20±1°C. The time of the first sprouting symptoms and percentage of turion sprouting were estimated for 7 days as this period markedly extended that necessary for full sprouting of the controls. Turions were scored as sprouting if they distinctly reflexed their basal leaf whorls and partly opened themselves (see Adamec, 2003).

Experiment #2 was started on 18 March 2003, and explored the effects of desiccation and freezing on dormant turions. We used 5-10 turions of each of *Aldrovanda vesiculosa* (E Poland), *U. aus-*

¹All references to *U. ochroleuca* in this paper involve plants that, on the basis of microscopic characteristics, could be considered *U. stygia*.



Figure 1: *Utricularia* turions. Clockwise from top left: *Utricularia vulgaris*, *U. stellaris*, *U. macrorhiza* (Massachusetts, USA), *U. intermedia* (Massachusetts, USA), *U. ochroleuca* s. lat. (*U. stygia*). All images by author, except *U. macrorhiza* and *U. intermedia* by Barry Rice.

tralis, *U. bremii* (Lake Oniega in N. Russia), and *U. ochroleuca*). These turions had been previously kept in water in a refrigerator at $3\pm 1^\circ\text{C}$ for four months, and were then dried at $3\pm 0.5^\circ\text{C}$ and 63-65% RH for 5 days. Once dried, they were kept frozen at $-11\pm 1^\circ\text{C}$ for 5 days.

Experiment #3 (also begun on 18 March 2003) tested the hypothesis that dried *Utricularia* turions (*U. australis* turions freshly collected from a dystrophic pool nearby, the other species from a refrigerator) are much more tolerant of freezing at $-11\pm 1^\circ\text{C}$ for 5 days than wet turions are. To investigate the effect of long-term drying of turions on their sprouting, 10-47 turions of the above 4 species (*U. australis* turions both from the culture and the field) were kept dry at $3\pm 1^\circ\text{C}$ and 63-65% RH for 370-375 days. Turion sprouting in tap water was tested in a miniphytotron at $20\pm 1^\circ\text{C}$ in white fluorescent light (irradiance of $280\pm 30 \mu\text{mol m}^{-2} \text{s}^{-1}$; 12/12 h L/D regime).

Results and Discussion

Turions of *U. ochroleuca* and *U. australis* were able to fully sprout after a 5-day desiccation period and the first sprouting symptoms were visible after 2 days (Table 1). Sprouting turions grew and sprouted normally. Moreover, the dried turions of both species sprouted slightly faster than the control ones. Thus, drying out reduces partly not only the innate dormancy (Maier 1973b) but also the imposed dormancy of turions. The protective effect of turion drying upon subsequent freezing was clearly demonstrated in *U. australis* (Table 2); in this species, control wet turions were totally killed by freezing at $-11\pm 1^\circ\text{C}$ for 5 days, while dried ones sprouted fully. However, while *U. australis* turions were able to fully sprout after this combined treatment, only 20% of *U. bremii* turions survived and *U. ochroleuca* turions did not survive at all (Table 2). *Aldrovanda* turions proved to be very susceptible to drying out and a 5-day desiccation period killed them totally, regardless of freezing treatment. During rehydration, the *Aldrovanda* turions released a yellow naphthoquinone plumbagin after 30-40 min which indicated their dead status. After one-year desiccation period, only *U. australis* turions were viable (Table 2). Minor differences in germination were found between the batches of *U. australis* turions; those overwintered in a refrigerator germinated at 100%, while those collected from the field at only 89%.

In this study, great interspecific differences were found in the tolerance of short-term (5 days) drying of turions of aquatic carnivorous plants. Turions of the *Utricularia* species tested were tolerant of drying while *Aldrovanda* turions were intolerant of. It is not clear what physiological differences cause these disparate responses. The temperate *Utricularia* and *Aldrovanda* all grow in ecologically similar shallow dystrophic waters. During the summer season, the probabilities of their growing shoots becoming stranded and drying out should be the same. On the other hand, considerable ecological differences between both genera can occur during turion overwintering. As *Aldrovanda* turions detach from mother shoots and sink to the bottom in autumn, the turions of these *Utricularia* do not. So while only a negligible portion of *Aldrovanda* turions are at risk of drying and freezing over winter (Adamec 1999), a relatively large fraction of *Utricularia* turions are at risk of drying out or freezing over winter. So while the origins of the differences in the tolerance of drying out and freezing between both genera are not well understood, their value of these adaptations to the environment are clear and reflect differences in turion ecology.

The tolerance of *Utricularia* turions of desiccation and freezing apparently varies within the genus (Table 2). In some *Utricularia* species, great resistance of turions to drying out and freezing could be of a great ecological importance. However, it is not clear which physiological characteristics result in the different tolerances turions have of drying and freezing (Table 2). Since the tolerance of *U. vulgaris*

Species	Number of turions	Drought period (d) at $3\pm 1^\circ\text{C}$	First sprouting symptoms (d)	% of sprouting (by the time)
<i>Utricularia ochroleuca</i>	20	0 (control)	2	100 (3 d)
- "-	30	5	2	100 (3 d)
<i>Utricularia australis</i>	20	0 (control)	2	100 (3 d)
- "-	20	5	2	100 (3 d)

Table 1. Percentage of sprouting of turions at $20\pm 1^\circ\text{C}$ and 11.5/12.5 h L/D regime on 9 March. Before the experiment, the turions overwintered in water at $3\pm 1^\circ\text{C}$ in darkness (*U. australis*) or outdoors on a wet sediment (*U. ochroleuca*). Treated turions were dried at $3\pm 0.5^\circ\text{C}$ and 63-65% RH in darkness.

turions of drying decreases markedly during the overwintering period (Maier 1973a) it seems likely that decreasing starch (and free sugar?) content in turions (Winston & Gorham 1979a; Adamec 1999, 2003) may be responsible for this decreasing tolerance. Another possibility might be the different phytohormone content turions have in different part of their overwintering (Winston & Gorham 1979b).

It is well-known that stored plant material is able to withstand freezing much better at a dried state than at a wet (hydrated) state. The results show that the effect of drying out on *Utricularia* turion sprouting is rather of a quantitative than qualitative character, depending on the length of the dried state (cf. Tables 1, 2). *Utricularia ochroleuca* and *U. brenii* turions were able to sprout after 5 days of drying out but one-year drying killed them totally. Therefore, it is possible to assume that certain, though very low, respiration rate persists even in dried turions kept at $3\pm 1^\circ\text{C}$ in a refrigerator. Out of all four aquatic carnivorous plant species investigated, turions of *U. australis* showed clearly the greatest tolerance of drying and freezing. This great tolerance of *U. australis* turions might be associated both with the eurytopic character of this species and its cosmopolitan spread on all continents of the Old World. Out of all European temperate *Utricularia* species, only *U. australis* turions were able to survive in water in a refrigerator at $3\pm 1^\circ\text{C}$ for 23 months and sprout (Adamec unpubl.). Nevertheless, if a long-term survival of autumnal, freshly collected *Utricularia* turions at a dry state in a refrigerator is much better than that in water, then storage of dry turions might be a convenient way of their long-term keeping in collections.

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Species	Number of turions	Drought period at $3\pm 1^\circ\text{C}$ (d)	Exposure to -11°C in dry state (d)	First sprouting symptoms (d)	% of sprouting (by the time)
<i>U. ochroleuca</i>	10	5	5	—	0 (7 d)
<i>U. australis</i> ¹	5	5	5	2	100 (2 d)
<i>U. brenii</i>	10	5	5	2	20 (7 d)
<i>Aldrovanda</i>	10	0 (control)	0	2	100 (3 d)
<i>Aldrovanda</i>	10	5	0	—	0 (7 d)
<i>Aldrovanda</i>	10	5	5	—	0 (7 d)
<i>U. australis</i> ²	10	0 (control)	0	2	100 (2 d)
<i>U. australis</i> ²	10	5	0	2	100 (4 d)
<i>U. australis</i> ²	10	0	5 (wet turions)	—	0 (7 d)
<i>U. australis</i> ²	10	5	5	2	100 (4 d)
<i>U. australis</i> ¹	15	375	0	1.5	100 (2.5 d)
<i>U. australis</i> ²	47	370	0	1.5	89 (7 d)
<i>U. ochroleuca</i>	20	375	0	—	0 (4 d)
<i>U. brenii</i>	20	375	0	—	0 (4 d)
<i>Aldrovanda</i>	10	375	0	—	0 (4 d)

¹Turions overwintered in a refrigerator.

²Turions collected fresh from the field before the experiment.

Table 2. Percentage of sprouting of turions at $20\pm 1^\circ\text{C}$ and 12/12 h L/D regime on 18-23 March. Before the experiment, the turions overwintered in water at $3\pm 1^\circ\text{C}$ in darkness. Treated turions were dried at $3\pm 1^\circ\text{C}$ and 63-65% RH in darkness. Some variants of dry turions were exposed to the frost of $-11\pm 1^\circ\text{C}$. Different experimental runs are separated by dashed line.

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PROGRESS REPORT ON THE ICPS CONSERVATION PROGRAM

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Keywords: Conservation: reports, seed bank.

The ICPS has “conservation” as one of its key goals. How has it been encouraging conservation, and especially, just how has it been spending the portion of your membership dues budgeted for conservation?

Perhaps some history will help to set the stage. The ICPS has always been friendly and receptive to conservation, but in 1997 when I joined the core group of volunteers that run the society I hoped to enhance this. Little did I know what an interesting challenge it would be!

The ICPS had worked on various conservation projects in the past (most notably with the IUCN), but I wanted to see the ICPS involved in land stewardship. In my day job I work in land conservation issues, and my goals with the ICPS reflected my professional interests. Unfortunately, during those early years (1997-2000) the ICPS was on financially rocky shores, so there was little I could do in my new position except be an advocate for conservation. Another hurdle, and ultimately the most difficult to overcome, came when I discovered that decades of poaching by carnivorous plant enthusiasts had distanced conservation workers from the ICPS. Conservation workers in the major organizations and agencies would become very cagey if I mentioned I was representing the ICPS. Even my most harmless of phone calls would not be returned.

A breakthrough occurred in 2000, when I was contacted by Carlen Emanuel, a staffer I knew from the Alabama Natural Heritage Program. Carlen was trying to organize a meeting to be attended by everyone who was managing *Sarracenia oreophila* sites. The goal was to create a forum where participants could meet, exchange stories, and share notes. Carlen did not have the money to support the meeting, but she felt she could trust and work with me, even though I was from the ICPS. I organized a fundraising drive, and ultimately the ICPS membership donated enough money to make the meeting happen. I attended the meeting (paying for the travel expenses myself) and was pleased with its outcome (Meyers-Rice 2001).

I recall in particular an evening chat I had with Ron Determann from Atlanta Botanical Garden (ABG) on the wooden porch of a rustic cabin on the grounds of the meeting facility. I had expressed to Ron my concerns that perhaps I should resign from the ICPS since it had such a bad reputation among conservationists. After all, conservation was my career, and I had no interest in tarnishing my reputation. Under the starry skies of northern Alabama, Ron advised me to continue my work within the ICPS. That is what I did, and that night I hatched the idea of the ICPS grant program.

Georgia, USA: 2002-2007

A year after the *Sarracenia oreophila* meeting, I was traveling in the southeastern USA. Ron Determann had time to botanize northern Georgia with me, and he took me to a site where ABG had been working to steward one of the only places that *Sarracenia purpurea* occurs in the state. Ron showed me the site, and described how he was cutting back the encroaching trees, propagating plants from the site for reintroduction to the site, and in general improving the plant population (Rice 2003c). I was impressed and hooked! A few weeks later I wrote a stewardship check to ABG for \$1000, the first grant the ICPS had ever done! Amazingly, ABG was the only conservation organization I found that would accept my offer of a grant; all the others were concerned that accepting a grant would mean the ICPS would demand access to the site, or even the right to collect plants!

The work supported by this grant has been a success, and the populations of plants have been enhanced each year. Furthermore, continued grant support by the ICPS has enabled ABG to steward other rare carnivorous plant populations throughout the southeastern USA, such as the only Georgia population of *Sarracenia leucophylla*. The ICPS has supported ABG's conservation work with renewed grants in 2004, 2005, 2006, and 2007 for \$2000 each year. In total, the ICPS has been able to grant ABG \$9000!

North Carolina, USA: 2003-2007

At a conservation meeting I attended in 2002, I met Beth Bockoven, a highly motivated and enthusiastic land steward for The Nature Conservancy (TNC). Beth worked for TNC's program in the mountains of far western North Carolina. She faced a big challenge, because one of the sites she was responsible for was a bog with serious invasive species problems. Woody vegetation, both native and non-native, was encroaching on the bog and displacing the natives. Some of the natives at this bog were carnivorous plants, including *Sarracenia jonesii* and *Sarracenia purpurea*. *Sarracenia jonesii* occurs at only ten sites in the wild. In fact, this site is the only place where the anthocyanin-free *Sarracenia jonesii* naturally occurred, although this form of the plant no longer occurs there because of poachers.

This bog has many other problems too, including large changes in hydrology, fire regime, and grazing. And it is not clear how many of these changes can be fixed since the site is bound on all sides by human development. Still, it was critical to slow, stop, and reverse the invasion of woody plants that was choking out the bog.

Beth sent me a work plan explaining what she wanted to do at the bog, including a budget and clear set of goals. Although at the time the only grant the ICPS had funded was the 2002 ABG grant for \$1000, I found Beth's arguments so compelling that the ICPS granted her \$2000 for 2003. Using ambitious and energetic interns, Beth's program was a success in creating weed-free zones within the bog.

The ICPS has continued to fund work at this bog, and over the years the habitat available to the carnivorous plants has enlarged from only four small zones, each 30 meters in diameter, to a current area of more than three times as large! I visited this site before and after the work began (at my own expense), and was dazzled by the improvement (Rice 2005).

Unfortunately, Beth has since left TNC, but the ICPS has continued to provide grant funds to her successor. Work at this mountain bog continues. The ICPS granted \$2000 in 2003, 2004; \$2500 in 2005; \$2000 in 2006; and \$1500 in 2007. (The large grant in 2005 was to provide funds to replace the money when another agency failed to provide support that year.) The total amount of ICPS support at this site has been \$12000!

Alabama, USA: 2005-2007

It was becoming easier for me to find conservation partners for the ICPS. Word was getting out that the ICPS was not publishing locations of rare plants. Also it became clear that the ICPS did not demand access to preserves, or propagules such as seeds or plants.

In 2005, I started talking about grant possibilities with Keith Tassin, a conservation land manager in Alabama (again a staff member of TNC). Keith managed Splinter Hill Bog, a site that is home to one of the largest remaining intact stands of *Sarracenia leucophylla*. Photographs from the site also showed many other species of carnivorous plants including *Sarracenia rosea*, *S. psittacina*, *Drosera capillaris*, *D. intermedia*, *D. filiformis*, *Pinguicula lutea*, *P. planifolia*, and *Utricularia*. It is a carnivorous plant gold mine! I have never seen Splinter Hill Bog—but boy do I want to! You can read about this site on line at:

<http://www.nature.org/wherewework/northamerica/states/alabama/preserves/art12813.html>

Unfortunately, TNC was strapped for the money to conduct key management activities such as planning and conducting prescribed burns. The ICPS stepped in, and with grants of \$1500 in 2005 and \$2000 in 2006, the site's management has been enhanced. In 2007 TNC decided to



Figure 1: *Sarracenia oreophila* in North Carolina, just after a burn.



Figure 2: The boardwalk trail at Abita Creek Flatwoods Preserve (Louisiana), during a flood.

enlarge Splinter Hill Bog by buying an additional 40 acres of carnivorous plant and pine flatwoods; an ICPS grant of \$2000 was important seed money for TNC's fundraising efforts. In 2008 the ICPS helped in fundraising at the bog with a matching donation program. How much money will be donated to Splinter Hill Bog by the ICPS fundraising campaign is yet to be determined. You will determine it!

Factoring out the 2008 fundraising, during the 2005-2007 period the ICPS has invested \$5500 in maintaining the carnivorous plants at Splinter Hill Bog!

Louisiana, USA: 2005-2007

In April 2005, my wife and I were vacationing in coastal Louisiana. A few of the places we visited were beautiful natural areas that had been set aside as preserves. We saw many fine stands of *Sarracenia alata*, *Drosera*, and *Utricularia*. The sites managed by TNC were particularly well-maintained, and had excellent trails and signage. We particularly enjoyed Abita Creek Flatwoods Preserve and Lake Ramsay Preserve. The signs at Abita Creek Flatwoods Preserve even mentioned that useful resources were available at the ICPS web site! I goggled when I saw this, and tried to imagine the ICPS (once viewed as a nest of poachers) being mentioned in such signage just a decade earlier.

A few months later, Hurricane Katrina struck Louisiana, bringing its attendant catastrophes. For the most part, wild lands were not as damaged as were human structures, as much of the affects of Hurricane Katrina were within the range of phenomena the habitats have evolved to withstand. However, at Abita Creek Flatwoods Preserve 10-30% of the trees were knocked down; the trails were impassable and the signage was heavily damaged. The ICPS helped the cleanup efforts with a grant of \$2000. In 2006, TNC staff in Louisiana continued their restoration work and with ICPS funding organized a *Sarracenia alata* rescue to save plants being killed in a local development. In 2007, ICPS funding helped improve signage at the nearby Lake Ramsay Preserve, home to many more carnivorous plants including *Sarracenia alata*. You can read about these sites on line at:

<http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/art6859.html>

<http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/art6860.html>

All in all, the ICPS has helped the Louisiana carnivorous plants with \$6000!

North Carolina, USA: 2006-2007

In the fall of 2003, I visited the only two known *Sarracenia oreophila* sites that are not within the state of Alabama. At the time, I felt that the Georgia site was in need of help, while the nearby North Carolina site seemed fine. In early 2006 I contacted the manager maintaining the Georgia plants, and asked if the ICPS could help. He told me, in a remarkable show of broad vision, that while he could certainly use the money, he thought it might be even more desperately needed at the North Carolina site. I contacted the folks in North Carolina. Yes, they needed to burn the site, but were short on cash to do this.

This initiated the ICPS involvement at this site. In 2006 we provided a mere \$1000 so the burn could be planned and conducted. And in 2007 another \$1000 was sent to continue the management at this site.

I visited this site before and after the burn, and saw that the plants have rebounded with vigor. I also observed interesting mountain populations of *Drosera capillaris* and *Drosera intermedia* and *Utricularia*. Although the ICPS has not contributed much to this site, its donations have been well received and are fulfilling the ICPS mission.

And that, my dear member, is a complete accounting of the ICPS grant program from 2002 to 2007. I am happy to report that, because of its work, the ICPS has directed \$34,500 towards conservation. Read that again: \$34,500! And that is something we can all be proud of!

Prior to 1997, the ICPS had been given conflicting reports on whether we could legally distribute seeds of Threatened and Endangered species (*Sarracenia alabamensis*, *S. jonesii*, *S. oreophila*, *Pinguicula ionantha*) via our seed bank. Upon my recommendation the ICPS stopped distributing such seeds—I saw little value in risking a Federal lawsuit! In 2002 the ICPS became a non-profit organization, and with that authority, I applied to the US Fish & Wildlife Service for the necessary permits. In 2003 we finally obtained them, and the ICPS has been distributing seeds (at least within the USA) ever since (Rice & Brittnacher 2003). I even obtained a short-term permit to distribute *Sarracenia alabamensis* plantlets to ICPS members in the USA (Rice 2003b; Rice & Brittnacher 2005). This effort was extremely involved and included labor by many volunteers, as well as support from the Botanical Conservatory (University of California, Davis), but was successful at establishing the plant in many collections throughout the USA. A follow-up program would be quite interesting, especially if it involved *S. oreophila*, as has often been suggested by ICPS members.

Another challenging topic was the creation of a set of guidelines for wild seed collection. We like to say, over and over, that wild collection is rarely justified. However, some times it is appropriate; in such conditions, what guidelines should the collector follow? To address this vacuum of reasoned opinion, I drafted a set of wild seed protocols, and had them reviewed by conservation partners including staff from TNC, US Fish & Wildlife Service, and Natural Heritage Programs. Since having been published in Carnivorous Plant Newsletter (Rice 2003a) and on our web site, these policies have been well received, and have been adopted by other organizations as well.

Finally, another major ICPS effort has been the *Nepenthes clipeata* Survival Program (Cantley *et al.* 2005). *Nepenthes clipeata* is likely to go extinct in the wild soon, and there are certainly more plants in cultivation than in the wild. The initial goal behind the *Nepenthes clipeata* Survival Program has been to catalogue all the known lineages of *Nepenthes clipeata* in cultivation, and the medium and long term goals are much more ambitious. This program has been slow to advance, and I would even say that despite some effort, it has been a failure. However, it was an innovative failure, and if you do not make risks and try new tactics, you are less likely to succeed.

Where now?

Managing the ICPS conservation program requires a diverse set of skills. I have had to be politically sensitive at all times. I have had to respond calmly to infuriatingly incendiary email. I have had to compose politic, yet firm letters on many issues; to organizations (that should know better) like a North Carolina Aquarium that would lead frequent expeditions to collect carnivorous plants for their displays; to politicians in New York who were proposing building on carnivorous plant habitat; to those stakeholders in North Carolina who think it would be sensible to fragment yet further the Green Swamp.

It is hard not to spring to the phone when you hear about possible mismanagement at a preserve in Georgia, or land destruction in New York, or possible poaching in Australia, or stolen plants surfacing in Japan. It is important to work rapidly and authoritatively, but not emotionally or stridently.

The paperwork can be deadly at times. I dread the annual seed bank report needed to maintain our US Fish & Wildlife Service permits. But the benefits are enormous. It is marvelous to hear about the on-the-ground benefits that the ICPS is having at carnivorous plant sites; sites that would be degrading if it were not for our work and support.

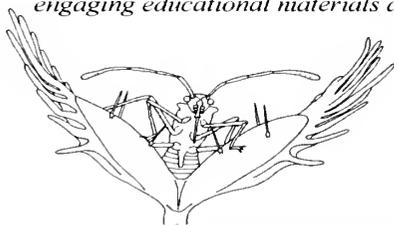
If you are interested in this kind of work, please contact me or the ICPS board. This will be my last year as Director of Conservation for the ICPS. It is time to let someone else lead this program, and to continue to foster its growth. During our current era of extinction, conservation programs like that of the ICPS are crucial.

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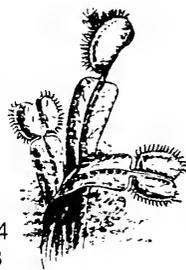
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Looking Back: CPN 25 years ago

ICPS member Glenn Hicks wrote about the dangers of sporotrichosis, the now well-known fungal infection that can be contracted from dried *Sphagnum* moss. I draw attention to this article primarily because I met Glenn when I was a graduate student in Arizona and had a single tiny carnivorous plant terrarium. Glenn was taking a break from carnivorous plant horticulture and needed someone to care for his greenhouse filled with carnivorous plants! I changed from growing ten plants to thousands! I am happy to report that Glenn is still growing carnivorous plants, and is still a member of the ICPS! (BR)

LITERATURE REVIEWS

By Doug Darnowski and Jan Schlauer.

Fleischmann, A., Wistuba, A., & McPherson, S. 2007. *Drosera solaris* (Droseraceae), a new sundew from the Guyana Highlands. *Wildenowia*, 37, 551-555.

The authors, all ICPS members, discovered this new species on Mt. Yakontipu, Guyana, near the Brazilian border. This is in *Helianthophora* country, near the famous Mt. Roraima, and it was indeed found growing in company with *H. glabra* and *H. nutans*. The closest relatives are two other species from the same general region, *D. felix* and *D. kaieteurensis*, which share short scapes opening into cup-like structures promoting seed dispersal by rain. *D. solaris* was only found in openings in the cloud forest near the summit, not in nearby wetlands containing *D. roraimae*. Some readers' hearts might skip a beat on seeing Figure 1 and the apparent resemblance between *D. solaris* and the fabled *D. meristocanlis* shown in that figure. However, the authors assure readers that the resemblance is superficial. The specific epithet has to do with the brightness of the plant and not the badly-received movie starring George Clooney. (DWD)

Lowrie, A., and Conran, J.G. 2008. *Byblis guehoi* (Byblidaceae), a new species from the Kimberley, Western Australia. *Telopea*, 12, 23-29.

The Western Australian botanist known to all carnivorous plant enthusiasts for his three books has again increased the number of species in *Byblis*, previously having added three northern, ephemeral species and one southern, perennial species to the genus. This new, compact species grows low to the ground and branches frequently, with abundant flowers. It will be interesting to see what the Japanese horticulturalists do with this species and their existing hybrids. It, like *B. liniflora*, and unlike the other three northern species, is a tetraploid. The specific epithet is derived from the name of the original discoverer, Russ Guého. (DWD)

Lowrie, A., Cowie, I. D., and Conran, J. G. 2008. A new species and section of *Utricularia* (Lentibulariaceae) from northern Australia. *Telopea*, 12, 31-46.

A truly amazing new bladderwort, *Utricularia simmonsii*, has been discovered in northern Australia which gives *U. olivacea* a run for its money as the world's smallest flowering plant. The flowers are tiny and red/purple, with a reduced structure compared to what many carnivorous plant fans are accustomed to from the genus. The traps are also very small, with greatly reduced hairs near the trap opening. This species is named for Paul Simmons, a naturalist and school teacher from Queensland who showed one reviewer (DWD) his first live triggerplant. Paul has done many a service to the carnivorous plant community and is highly deserving of this honor. *Utricularia simmonsii* is placed in a new section *Minutae* by the authors and two sections quite remote from each other are discussed as possible relatives, viz. sect. *Pleiochasia* (type: *U. dichotoma*) and *Enskide* (type: *U. chrysantha*). But except for geographical coincidence and the apparently consistent absence of scales on the scape, *Pleiochasia* displays more significant differences than similarities to *U. simmonsii*, of which the traps originate irregularly on rhizoids, stolons and on the lower portion of the foliar organs (predominantly at nodes side by side with foliar organs and inflorescences in *Pleiochasia*), have short stalks (long to very long in *Pleiochasia*), no ventral wings and a blunt dorsal beak without trigger or guiding hairs (frequently ventrally winged, pronouncedly beaked and usually densely glandular or with antennae in *Pleiochasia*). The bracts and the distinctly smaller bracteoles are basifixed in *U. simmonsii* (similar to each other and frequently peltate or basally swollen in *Pleiochasia*) and its pollen is 5-6 colporate (usually 3-colporate in *Pleiochasia*). On the other hand the minute corolla, almost without a spur and with entire rounded lips without palate, the elliptic capsule pore (pandurate in *Enskide*) and the unique seed testa structure with elongated cells "longitudinally striate-swirled cells, resembling a fingerprint" appear to be the only systematically significant differences to separate *Minutae* from *Enskide*. (DWD & JS)

