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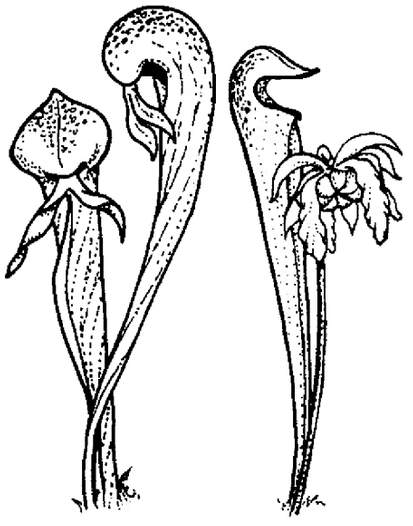

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Front Cover: *Sarracenia jonesii* f. *viridescens,* an anthocyanin free plant from Oxford, Etowah, North Carolina, grown by James Stevens in the UK, originally purchased from Mike King of Shropshire Sarracenias. Article on page 4. Photo by James Stevens.

Back Cover: Meadowview interns Emily Gotschalk (left) and Simret Asgedom (right) in May 2014 at Meadowview headquarters and the National *Sarracenia* Pitcher Plant Collection. Photo by Meadowview, company archive. Article on page 20.

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Contents

Sarracenia jonesii f. *viridescens*: A new combination in Sarraceniaceae

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Keywords: Taxonomy, *Sarracenia jonesii* f. *viridescens*.

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The *Sarracenia rubra* complex has a long history of differing interpretations. Don Schnell has long held the view that the taxa within this species should all be treated as separate subspecies, i.e.

Sarracenia rubra Walter
Sarracenia rubra subsp. *alabamensis* (Case & R.B. Case) McPherson & D.E.Schnell
Sarracenia rubra subsp. *jonesii* (Wherry) Wherry
Sarracenia rubra subsp. *wherryi* (Case & R.B.Case) D.E.Schnell
Sarracenia rubra subsp. *gulfensis* D.E.Schnell

His perspectives on this are clearly articulated in his various works (e.g. McPherson & Schnell 2011; Schnell 2002; and others). An alternative perspective is to treat them as three species:

Sarracenia rubra Walter
Sarracenia rubra subsp. *gulfensis* D.E.Schnell
Sarracenia rubra subsp. *wherryi* (Case & R.B.Case) D.E.Schnell
Sarracenia alabamensis Case & R.B.Case
Sarracenia jonesii Wherry

This is the perspective that I took in my own book (Rice 2006). However, over time I have been increasingly impressed by how similar *Sarracenia alabamensis* is to *Sarracenia rubra* subsp. *wherryi*. The fact that *Sarracenia rubra* subsp. *wherryi* in general occurs (in broad terms) downstream of *Sarracenia alabamensis* sites is also evocative. As such, over time I have slowly evolved to the following perspective:

Sarracenia rubra Walter
Sarracenia rubra subsp. *gulfensis* D.E.Schnell
Sarracenia rubra subsp. *viatorum* B.Rice
Sarracenia alabamensis Case & R.B.Case
Sarracenia alabamensis subsp. *wherryi* Case & R.B.Case
Sarracenia jonesii Wherry

This is the model that I have used for the last several years, mostly in on-line publications such as Rice (2018a). The above list also includes the recently described *Sarracenia rubra* subsp. *viatorum* (Rice 2018b).

In McPherson & Schnell (2011) several new taxa were described, including the anthocyanin-free plant called *Sarracenia rubra* subsp. *jonesii* f. *viridescens* S.McPherson & D.E.Schnell (see Front Cover). To allow for the discussion of this plant under conceptual frameworks similar to mine, I must create a new combination, i.e.

Sarracenia jonesii f. *viridescens* (S.McPherson & D.E.Schnell) B.Rice *comb. nov.*

This new combination is in direct reference to the basionym:

Basionym: *Sarracenia rubra* subsp. *jonesii* f. *viridescens* S.McPherson & D.E.Schnell, Sarraceniaceae of North America: 759 (2011).

References

McPherson, S., and Schnell, D. 2011. Sarraceniaceae of North America. Redfern Natural History Productions, Poole, Dorset, England. 810 pp.

Rice, B.A. 2006. Growing Carnivorous Plants. Timber Press, Portland, Oregon. 225 pp.

Rice, B.A. 2018a. Carnivorous Plant FAQ, v12, http://www.sarracenia.com/faq.html, accessed 18 July 2018.

Rice, B.A. 2018b. The long overdue recognition of *Sarracenia rubra* subsp. *viatorum*, Carniv. Pl. Newslett. 47(4):152-159.

Schnell, D.E. 2002. Carnivorous Plants of the United States and Canada, 2nd ed. Timber Press, Portland, Oregon. 470 pp.

New sundew quinone and emergence data

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Keywords: *Drosera*, phytochemistry, naphthoquinones, chemotaxonomy, micro-morphology, emergences.

Introduction

The acetogenic naphthoquinones, plumbagin (P in this paper) and ramentaceone (7-methyljuglone, M in this paper) are important chemotaxonomic markers in sundews (*Drosera* L., Culham & Gornall 1994, Schlauer *et al*. 2017, 2018). Further accessions have been investigated, and the results are presented and discussed here.

Materials and methods

All plants used in the present study were raised from seed or obtained as cultivated specimens from Sonja Schweitzer (Schermbeck): *D. linearis*, *D. uniflora*; Kamil Pasek (Ostrava-Poruda): *D. neocaledonica*; Carni Flora BV (Aalsmeer): *D. cf. paradoxa*. Tubers of species in *D.* sections *Erythrorhiza*, *Stolonifera* and *Ergaleium* were obtained from Greg Bourke (Sydney) and Darren O'Brien (Perth), respectively. The geographic origin of all accessions was traced as far as possible (see Table 1). The methods used were the same as detailed previously (Schlauer *et al*. 2018). Voucher specimens of the investigated plants were deposited in the first author's private herbarium.

Results

Naphthoquinones were detected in all investigated samples except in *D. major* as summarized in Table 1.

Discussion

The presence of P (and absence of M) in *D.* sections *Erythrorhiza* and *Ergaleium* confirms the notion by Culham and Gornall (1994) that P is characteristic in most tuberous sundews while M appears to prevail in *D.* sect. *Stolonifera* instead.

The absence of naphthoquinones is common in pygmy sundews (*D.* sect. *Bryastrum*) and in *D.* sect. *Lasiocephala*, so the detection of P in *D. banksii* (Fig. 1) (the first and so far the only known quinone-producing representative in the latter section) may indicate that this species is close to the branching point at which the ability to produce acetogenic quinones was lost in this alliance.

Drosera serpens is a species in *D.* sect. *Arachnopus* that shows a fairly wide variability in its indumentum and in size. But even the unusually vigorous plant investigated in this study contained P that has so far invariably been detected in *D. serpens*.

Table 1. taxa investigated and quinones detected in the present study. M = 7-methyljuglone (and shinanolone); P = plumbagin (and isoshinanolone); 0 = no quinones found.

Taxon	Provenance	*Drosera* section	Quin.	Reference/Remark
Drosera aberrans (*D. whittakeri* subsp. *aberrans*)	Vic., Australia	*Erythrorhiza*	P	Culham & Gornall (1994) reported P in *D. whittakeri*.
D. lowriei	W.A., Australia	*Erythrorhiza*	P	new (this study)
D. major (*D. bulbosa* subsp. *major*)	W.A., Australia	*Erythrorhiza*	0	Culham & Gornall (1994) reported P in *D. bulbosa*.
D. tubaestylis	W.A., Australia	*Erythrorhiza*	P	new (this study)
D. rupicola (*D. stolonifera* subsp. *rupicola*)	W.A., Australia	*Stolonifera*	M	Culham & Gornall (1994) reported P in this taxon and M in *D. stolonifera* (subsp. *stolonifera*).
D. menziesii	W.A., Australia	*Ergaleium*	P	Culham & Gornall (1994) did not detect quinones in this taxon.
D. modesta	W.A., Australia	*Ergaleium*	P	confirms Culham & Gornall (1994).
D. planchonii (*D. macrantha* subsp. *planchonii*)	Australia	*Ergaleium*	P	Culham & Gornall (1994) did not detect quinones in this taxon.
D. banksii	N W.A., Australia	*Lasiocephala*	P	new (this study)
D. cf. paradoxa	northern Australia	*Lasiocephala*	0	new (this study)
D. aquatica	N.T., Australia	*Arachnopus*	M	confirms Schlauer *et al.* (2017)
D. indica	Ivory Coast	*Arachnopus*	M+P	confirms Culham & Gornall (1994) and Schlauer *et al.* (2018)
D. nana	N.T., Australia	*Arachnopus*	M	new (this study)
D. serpens (very large plant)	N W.A., Australia	*Arachnopus*	P	confirms Schlauer *et al.* (2017)
D. affinis	NE Namibia	*Ptycnostigma*	P	new (this study)
D. cistiflora	South Africa	*Ptycnostigma*	M	confirms Culham & Gornall (1994).
D. uniflora	S Chile	*Psychophila*	M	new (this study)
D. capillaris (long petiole)	Florida, USA	*Drosera*	M	Durand & Zenk (1974) reported P in this taxon (not mentioned in Culham & Gornall 1994).
D. capillaris	Florida, USA	*Drosera*	M	
D. felix	Venezuela	*Drosera*	M	new (this study)
D. filiformis var. *filiformis*	Florida, USA	*Drosera*	M	confirms Culham & Gornall (1994).
D. filiformis var. *floridana*	Florida, USA	*Drosera*	M	new (this study)
D. linearis	Michigan, USA	*Drosera*	M	new (this study)
D. neocaledonica	New Caledonia	*Drosera*	M	new (this study)
D. ultramafica	Philippines	*Drosera*	M+P	new (this study)

Figure 1: *Drosera banksii*. Background: mature plant; A: leaf base with stipule; B: red sessile glands on leaves; C: multiseriate hairs on sepals. All photos: S. Hartmeyer.

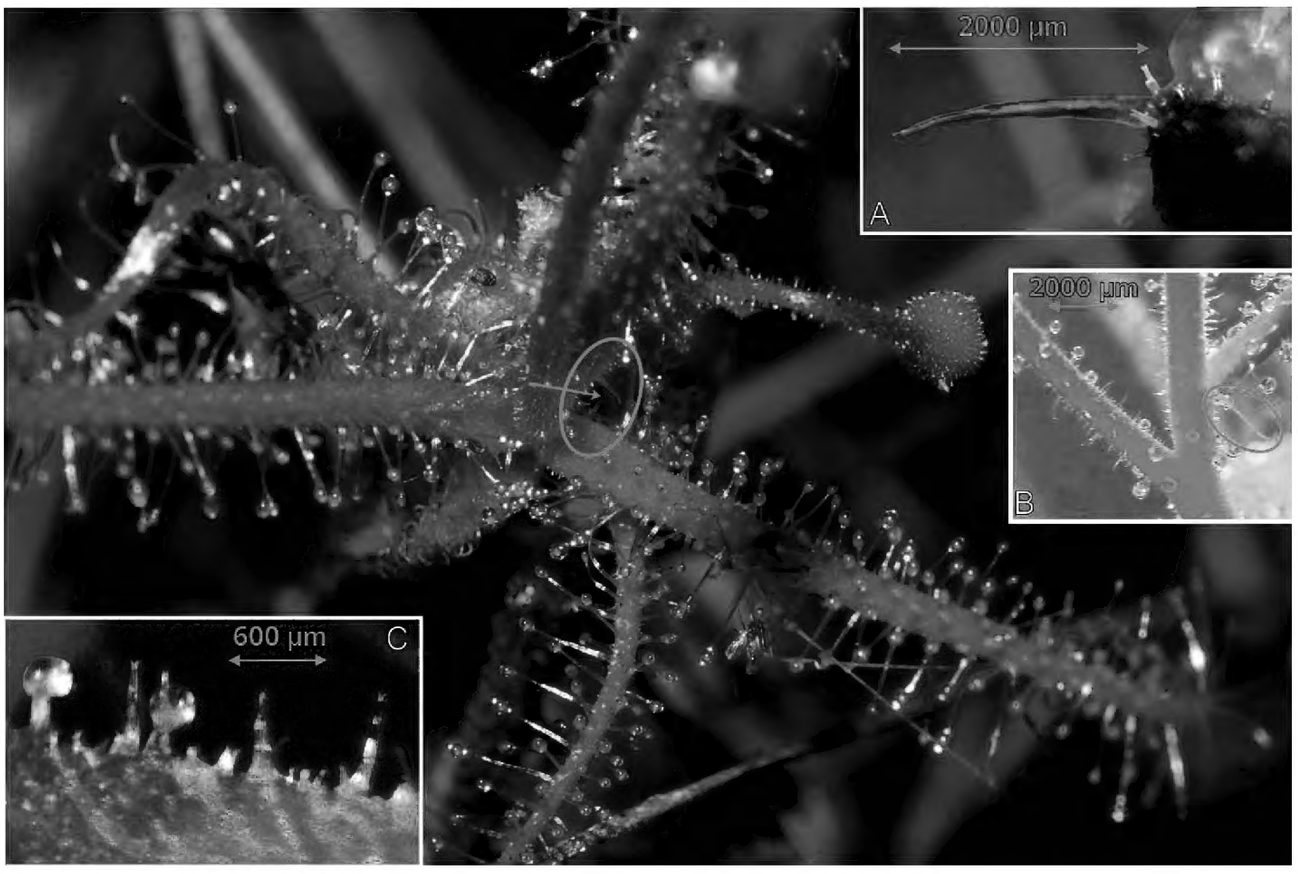

Figure 2: *Drosera nana*. Background: mature stem with leaf bases showing lateral "stipuloid" emergences at leaf bases (arrow and red oval); A: "stipuloid" emergence at side of leaf base; B: elongated double-tipped caps ("hairs") and stalked glands on stem and pedicel; C: double-tipped cap emergences. Background photo: H. and A. Hennern, remaining photos: S. Hartmeyer.

Drosera nana (M in all three distinct populations studied) is occasionally regarded a dwarfed close relative of *D. aquatica*, and its quinone pattern is in line with this view (cf. Schlauer *et al.* 2017). Also, the indumentum is similar (Fig. 2, cf. Schlauer *et al.* 2018) with a predominance of conspicuously elongated double-tipped cap emergences especially along the stems. Frequently "stipuloid" emergences (likewise elongated, double-tipped caps) that are somewhat obscured by the dense stem indumentum are found on either side of the leaf base.

Drosera indica s.str. has been investigated several times before, and the present study discloses that plants from Africa share the same quinone pattern with their Asian conspecifics. As this species is the only known representative of *D.* sect. *Arachnopus* that contains both M and P (which suggests a hybrid origin, cf. Schlauer & Fleischmann 2016), the present result indicates that the hypothetical hybridization event must have occurred before the spread of this species to Africa (where no other species of *D.* sect. *Arachnopus* is known).

Drosera sect. *Ptycnostigma* has been redefined recently (Fleischmann *et al.* 2018) to contain all African species except *D. regia* (*D.* subgen. *Regiae*) and *D. indica* (*D.* sect. *Arachnopus*). Almost all species of *D.* sect. *Ptycnostigma* studied so far contained M, so the detection of P in *D. affinis* provides a valuable tool to define a subgroup of the stem-forming species.

Drosera uniflora is the first species of *D.* sect. *Psychophila* investigated for naphthoquinones. The presence of M confirms gene sequence data (Rivadavia *et al.* 2003) that place it close to *D.* sect. *Drosera* which likewise contains M in the vast majority of its species.

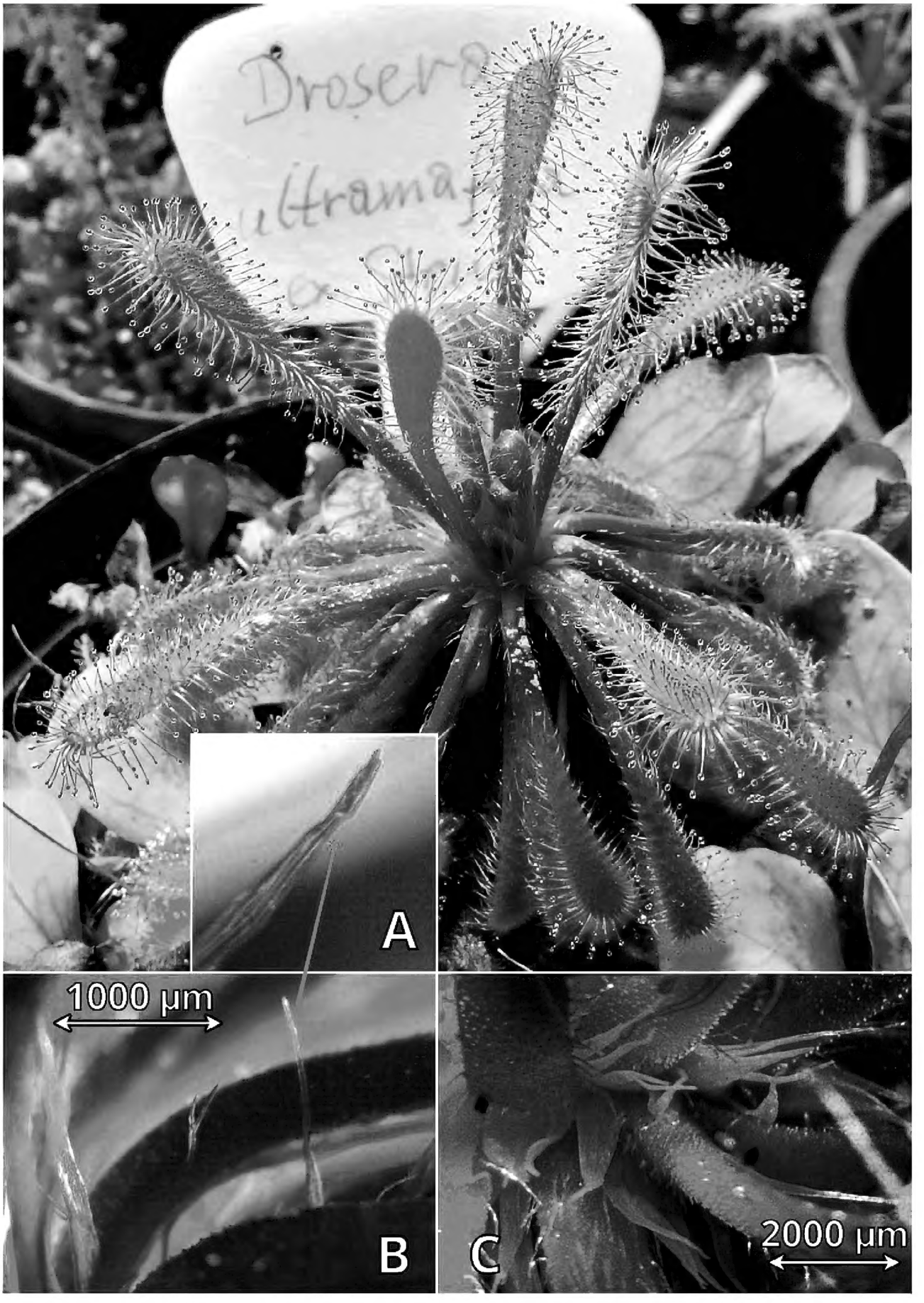

Figure 3: *Drosera ultramafica*. Background: mature plant; A: magnified tip of multiseriate hair (B); B: multiseriate hair; C: leaf bases with stipules and hairs. All photos: S. Hartmeyer.

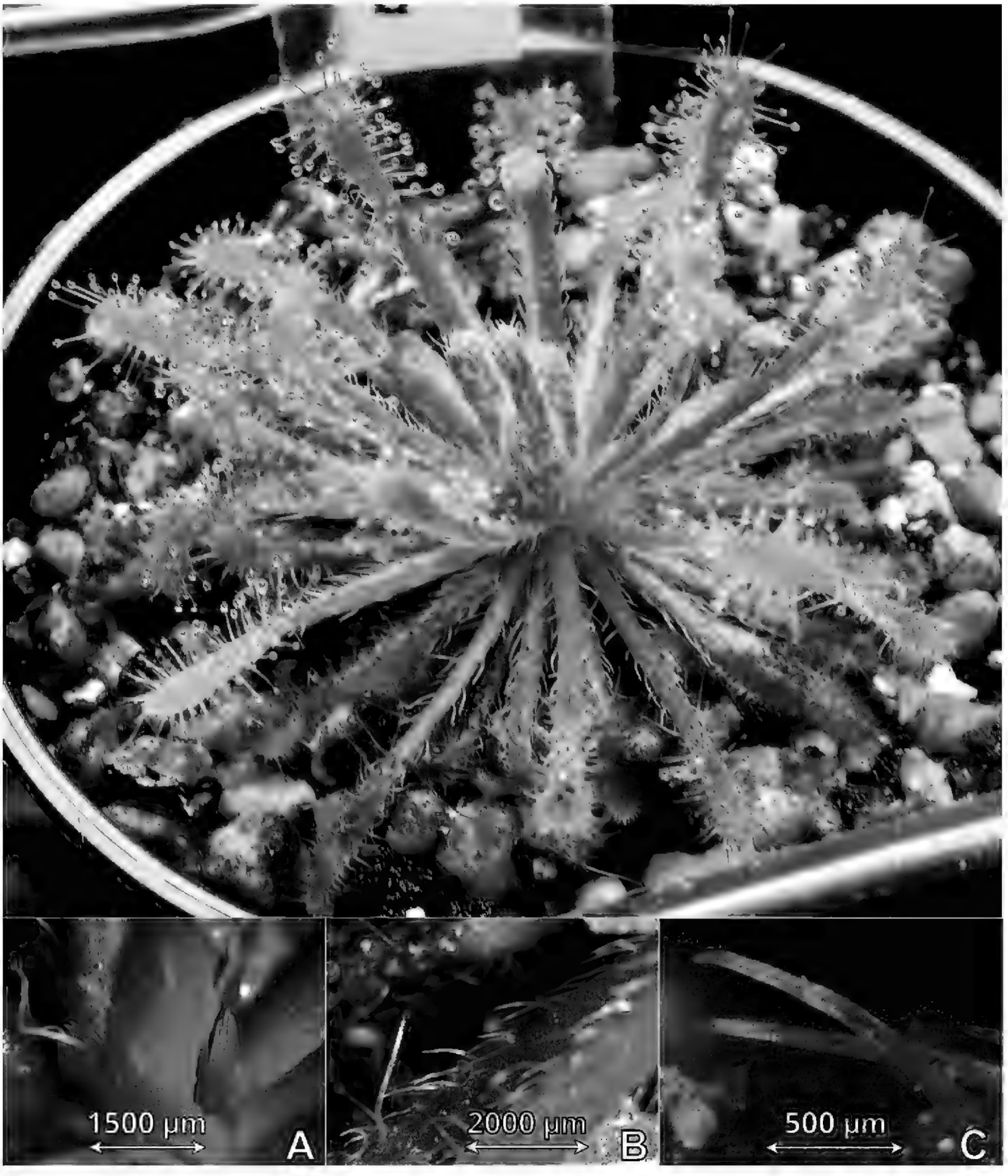

Figure 4: *Drosera neocaledonica*. Background: mature plant; A: leaf base with stipule and hairs; B: leaf with multiseriate hairs; C: magnified multiseriate hair. All photos: S. Hartmeyer

An unusually long petiole in some individuals of *D. capillaris* from Florida has prompted the suspicion that these may be hybrids with *D. intermedia*. A previous investigation reported P from *D. capillaris*, and *D. intermedia* is likewise known to contain this quinone, so hybrids could be expected to be impossible to distinguish from either parent by their quinone pattern. Our investigation of a "typical" individual of *D. capillaris* (with short petioles) from Florida has, however, demonstrated that it contains M. The presence of only this same quinone in the long-petiolate plant grown from seed (i.e., evidently from a fertile mother) and investigated here is not sufficient to prove its hybrid nature.

The presence of both M and P in *D. ultramafica* (see discussion for *D. indica* above) indicates a hybrid origin. While the morphologically somewhat similar *D. neocaledonica* (cf. Figs. 3 and 4) contains M, the other parent (that contributed the ability to produce P) is somewhat enigmatic, as no close relative of *D. ultramafica* containing P is known in SE Asia.

Acknowledgements: This work was supported by the generous donation of seeds of *D. indica* by Matt Hochberg (New York), of *D. capillaris* and *D. capillaris* "long petiole" by Brian Barnes (Longwood), and *D. ultramafica* by Stewart McPherson (Poole), for which we have the pleasure to express our gratitude. We appreciate the careful review and constructive suggestions by Paulo Gonella and Andreas Fleischmann that have led to the improvement of this paper.

References

Culham, A., and Gornall, R.J. 1994. The taxonomic significance of naphthoquinones in the Droseraceae. Biochem. Syst. Ecol. 22: 507-515.

Durand, R., and Zenk, M.H. 1974. The homogentisate ring-cleavage pathway in the biosynthesis of acetate-derived naphthoquinones of the Droseraceae. Phytochemistry 13: 1483-1492.

Fleischmann, A., Gonella, P.M., and Rivadavia, F. 2018. A new sectional name for the Brazilian tetraploid clade of *Drosera* subgenus *Drosera*. Carniv. Pl. Newslett. 47: 4-9.

Rivadavia, F., Kondo, K., Kato, M., and Hasebe, M. 2003. Phylogeny of the sundews, *Drosera* (Droseraceae), based on chloroplast *rbcL* and nuclear 18S ribosomal DNA sequences. Amer. J. Bot. 90: 123-130.

Schlauer, J., and Fleischmann, A. 2016. Chemical evidence for hybridity in *Drosera* (Droseraceae). Biochem. Syst. Ecol. 66: 33-36.

Schlauer, J., Hartmeyer, S.R.H., and Hartmeyer, I. 2017. Unexpected discovery of 7-methyljuglone (ramentaceone) in several Australian sundews. Carniv. Pl. Newslett. 46: 20-22.

Schlauer, J., Hartmeyer, S.R.H., Hartmeyer, I., Hennern, H., and Hennern, A. 2018. Sundew chemistry and emergence updates. Carniv. Pl. Newslett. 47: 10-17.

Quinones from "Gondwanan" sundews

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Keywords: *Drosera*, phytochemistry, naphthoquinones, chemotaxonomy.

Introduction

The acetogenic naphthoquinones, plumbagin (P in this paper) and ramentaceone (= 7-methyljuglone, M in this paper), are important chemotaxonomic markers in sundews (*Drosera* L.) (Durand & Zenk 1974; Culham & Gornall 1994; Schlauer & Fleischmann 2016; Schlauer *et al.* 2017; 2018). Most of the previous phytochemical data relate to the chemotaxonomy of the genus in Australia, where several endemic lineages have evolved into the bulk of the species diversity. In this study several taxa presumed to occupy crucial branching points in the phylogenetic backbone of the genus (Rivadavia *et al.* 2003; Fleischmann *et al.* 2018a) have been investigated together with taxonomically established representatives of the sections that account for the diversity of the genus outside Australia. The geographical distribution of these taxa is conspicuously Gondwanan (Brewer & Schlauer 2018), reminiscent of the former (pre-Cretaceous) coherence of South America, Africa (incl. Madagascar), Australia, and New Zealand.

Materials and methods

All plants used in the present study were raised from seed or obtained as cultivated specimens from commercial sources. Species that are rarely cultivated or easily confused are documented here with photographs taken in cultivation. The geographic origin of all accessions was traced as far as possible (see Table 1). The methods applied were the same as detailed previously (Schlauer *et al.* 2018). The experimental setup is illustrated in Fig. 1.

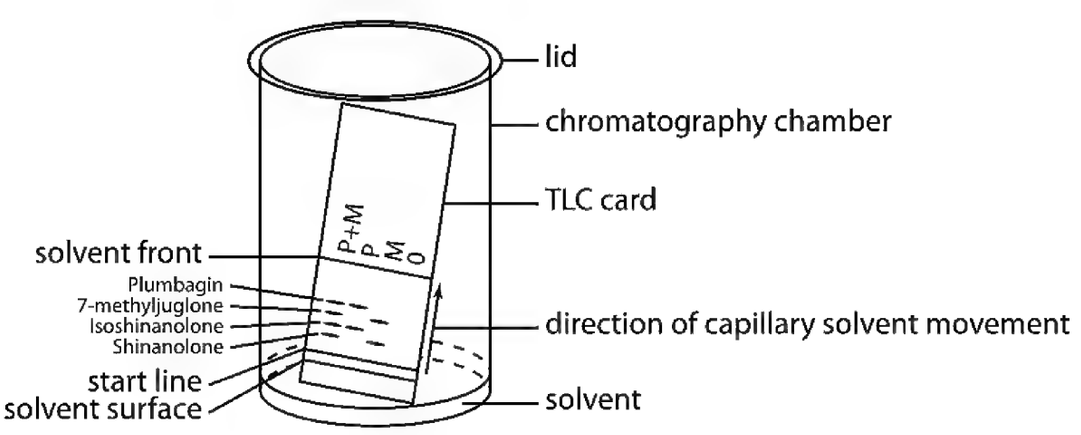

Figure 1: Schematic drawing of experimental setup for thin layer chromatography (TLC) as applied in this work.

Table 1. The naphthoquinones detected in the investigated taxa, their geographic origin, and their sectional classification. M = 7-methyljuglone (and shinanolone); P = plumbagin (and isoshinanolone); 0 = no quinones (nor tetralones) found.

Taxon	Provenance	Fig.	*Drosera* Section	Quinone(s)	Reference/ Comment
Drosera regia	South Africa		*Regiae*	M+P	confirms Culham & Gornall (1994).
D. arcturi	Australia (Tasmania)		*Arcturia*	M (trace)	Culham & Gornall (1994) reported 0 in this taxon.
D. stenopetala	New Zealand		*Psychophila*	M+P	new (this study)
D. admirabilis	South Africa	2A	*Ptycnostigma*	M	new (this study)
D. burkeana	South Africa		*Ptycnostigma*	M	confirms Culham & Gornall (1994).
D. collinsiae	South Africa		*Ptycnostigma*	M	confirms Kovacik & Repcak (2006)
D. cuneifolia	South Africa		*Ptycnostigma*	M	confirms Culham & Gornall (1994).
D. madagascariensis (2x)	Zambia, Madagascar		*Ptycnostigma*	M	confirms Culham & Gornall (1994).
D. nidiformis	South Africa		*Ptycnostigma*	M	new (this study)
D. ramentacea	South Africa	2B	*Ptycnostigma*	M	new (this study)
D. rubrifolia	South Africa	2C	*Ptycnostigma*	0	new (this study)
D. slackii	South Africa		*Ptycnostigma*	P	confirms Culham & Gornall (1994).
D. venusta	South Africa		*Ptycnostigma*	M	Culham & Gornall (1994) reported P in this taxon.
D. arenicola	Venezuela	2D	*Drosera*	M	new (this study)
D. communis	Brazil		*Drosera*	P	confirms Sauerwein *et al.* (1994); Kovacik & Repcak (2006) reported M in this taxon
D. kaieteurensis	Venezuela	2E	*Drosera*	0	new (this study)
D. oblanceolata	China		*Drosera*	M	new (this study)
D. spatulata	New Zealand		*Drosera*	M	confirms Culham & Gornall (1994).
D. camporupestris	Brazil		*Brasilianae*	0	new (this study)
D. chrysolepis	Brazil		*Brasilianae*	0	new (this study)

Table 1. Continued.

Taxon	Provenance	Fig.	*Drosera* Section	Quinone(s)	Reference/ Comment
D. x *fontinalis* (=*D. grantsaui* x [*montana* var.] *tomentosa*)	Brazil		*Brasilianae*	M	new (this study)
D. grantsaui	Brazil	2F	*Brasilianae*	M	new (this study)
D. graomogolensis	Brazil		*Brasilianae*	0	new (this study)
D. latifolia	Brazil	2G	*Brasilianae*	M+P	new (this study)
D. spiralis	Brazil		*Brasilianae*	M	new (this study)
D. villosa	Brazil	2H	*Brasilianae*	M+P	confirms Culham & Gornall (1994).

Discussion

Drosera regia (endemic to South Africa) represents the most basally branching lineage in the global phylogeny of sundews (Rivadavia *et al.* 2003; Fleischmann *et al.* 2018a). Previously (Culham & Gornall 1994) P has been identified as the main quinone together with traces of M. Especially the presence of M is interesting because the phylogenetically closest genera, *Aldrovanda* (waterwheel plant) and *Dionaea* (Venus' flytrap) contain only P. In our study we likewise observed M together with its possible biosynthetic precursor (Schlauer *et al.* 2018), the tetralone shinanolone, and P with its corresponding tetralone, isoshinanolone. This indicates that sundews may have been able to produce either isomer from the very beginning of the evolution of this genus but the retention of specific isomers (or the loss of both) differs from section to section, and even within some sections a certain diversity may occur.

Drosera arcturi (Australia to New Zealand) is likewise a fairly isolated, early-branching species, and its ability to form trace amounts of M (while the majority of Australian species contain P; Culham & Gornall 1994; Schlauer *et al.* 2017) accords with this position.

Drosera stenopetala (endemic to New Zealand) is the East Gondwanan representative of the small section *D.* sect. *Psychophila* (the only other member being the southern South American *D. uniflora*) that is sister to the lineage that leads to the majority of sundew species outside Australia (*D.* sects. *Drosera*, *Ptycnostigma*, and *Brasilianae*; Fleischmann *et al.* 2018b). The presence of both M and P is somewhat surprising, as the more derived sections predominantly produce only M, and there is no obvious close relative of *D. stenopetala* that produces P and could have provided this ability e.g., by hybridization.

The speciose sections (*D.* sects. *Drosera*, *Ptycnostigma*, and *Brasilianae*) are chemically characterized by the clear predominance of M in most species, so the presence of P in a few species allows the identification of segregative processes where morphology may be inconclusive. In *D.* sect. *Ptycnostigma*, *D. slackii* has been known as a P-containing "outlier" (Culham & Gornall 1994), which we can fully confirm by our own results.

The detection of M in *D. ramentacea* (Fig. 2B) is not surprising from a phytochemical perspective but is of some historical interest because the quinone was called "ramentaceone" when it was isolated from *D. madagascariensis* (wrongly identified as "*D. ramentacea*", Paris & Delaveau

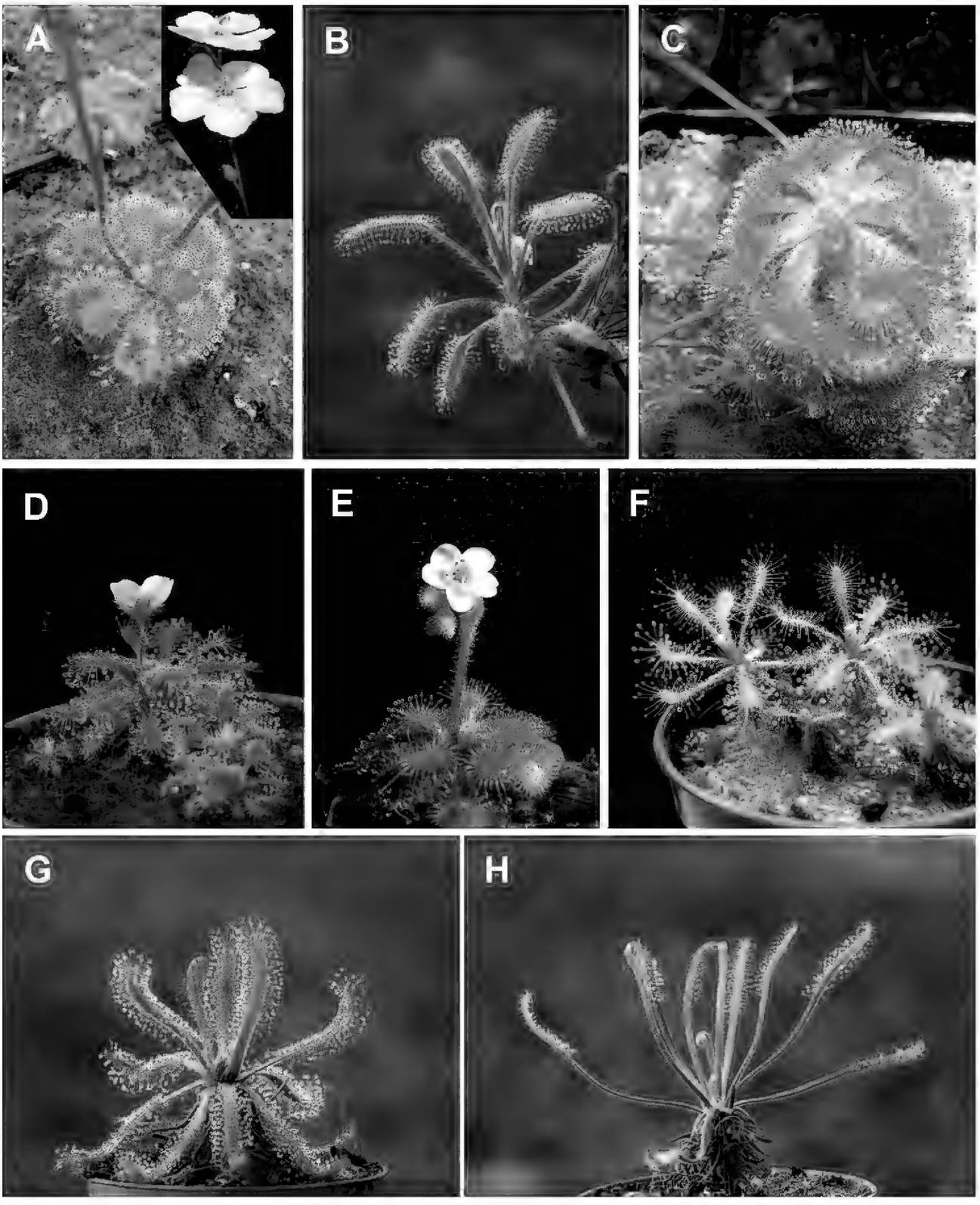

Figure 2: A. *Drosera admirabilis*; B. *Drosera ramentacea*; C. *Drosera rubrifolia*; D. *Drosera arenicola*; E. *Drosera kaieteurensis*; F. *Drosera grantsaui*; G. *Drosera latifolia*; H. *Drosera villosa*. Photos A, C, D, E, F by A. Fleischmann; B, G, H by T. Carow.

1959). Our result from the first (as far as we are aware) investigation of the true *D. ramentacea* shows that the designation "ramentaceone" is at least not misleading and thus suitable as a later but less cumbersome synonym of 7-methyljuglone.

The same applies to *D. communis* in *D.* sect. *Drosera*, which was already reported earlier (Sauerwein *et al*. 1994). The identification of the species and of the obtained quinone(s) in the latter study

was, however, highly doubtful (the published picture of the investigated plant shows more similarity to *D. spatulata* or *D. tokaiensis* than to true *D. communis*, which was hardly cultivated anywhere in 1994, and no analytical data were provided to clearly distinguish between the chromatographically similar M and P), so our study corroborates the claim on more reliable data. The fact that M was reported from "*D. communis*" more recently (Kovacik & Repcak 2006) is most probably attributable to another (or the same?) wrong identification of plant material.

The identification of several species that contain both isomers (M and P) in *D.* sect. *Brasilianae* that is furthermore composed of tetraploids (Fleischmann *et al*. 2018b), strongly suggests that hybridization (cf. Schlauer & Fleischmann 2016) might have played a major role in the evolutionary history of this lineage. The plant studied under the name *D. villosa* before (Culham & Gornall 1994) was probably not this species in the strict sense (Fig. 2H, introduced to cultivation in Europe after 1996) but *D. latifolia* (Fig. 2G, widely cultivated and formerly united with *D. villosa*), but as both share the same quinone pattern, the chemotaxonomic significance of the previous result remains unchanged.

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References

Brewer, J.S., and Schlauer, J. 2018. Biogeography and habitats of carnivorous plants. In: Ellison, A.M., and Adamec, L. (eds.). Carnivorous Plants: Physiology, Ecology, and Evolution. Oxford University Press, pp. 7-21.

Culham, A., and Gornall, R.J. 1994. The taxonomic significance of naphthoquinones in the Droseraceae. Biochem. Syst. Ecol. 22: 507-515.

Durand, R., and Zenk, M.H. 1974. The homogentisate ring-cleavage pathway in the biosynthesis of acetate-derived naphthoquinones of the Droseraceae. Phytochemistry 13: 1483-1492.

Fleischmann A., Cross, A.T., Gibson, R., Gonella, P.M., and Dixon, K.W. 2018a. Systematics and evolution of Droseraceae. In: Ellison, A.M., and Adamec, L. (eds.). Carnivorous Plants: Physiology, Ecology, and Evolution. Oxford University Press, pp. 45-57.

Fleischmann, A., Gonella, P.M., and Rivadavia, F. 2018b. A new sectional name for the Brazilian tetraploid clade of *Drosera* subgenus *Drosera*. Carniv. Pl. Newslett. 47: 4-9.

Kovacik, J., and Repcak, M. 2006. Naphthoquinones content of some sundews (*Drosera* L.). Carniv. Pl. Newslett. 35: 49-51

Paris, R., and Delaveau, P. 1959. Recherches sur les Droséras. Ann. Pharm. France 12: 585-592.

Rivadavia, F., Kondo, K., Kato, M., and Hasebe, M. 2003. Phylogeny of the sundews, *Drosera* (Droseraceae), based on chloroplast *rbcL* and nuclear 18S ribosomal DNA sequences. Amer. J. Bot. 90: 123-130.

Sauerwein, M., Schmidt, S., Reichling, J., and Wink, M. 1994. Naphthoquinone production in in vitro cultures of *Drosera communis* St. Hil. BIOforum Extra Prague '94: 26-27.

Schlauer, J., and Fleischmann, A. 2016. Chemical evidence for hybridity in *Drosera* (Droseraceae). Biochem. Syst. Ecol. 66: 33-36.

Schlauer, J., Hartmeyer, S.R.H., and Hartmeyer, I. 2017. Unexpected discovery of 7-methyljuglone (ramentaceone) in several Australian sundews. Carniv. Pl. Newslett. 46: 20-22.

Schlauer, J., Hartmeyer, S.R.H., Hartmeyer, I., Hennern, H., and Hennern, A. 2018. Sundew chemistry and emergence updates. Carniv. Pl. Newslett. 47: 10-17.

Jim Bockowski (1943-2018)

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Jim Bockowski in his greenhouse. Photo by Tim Krug.

If you didn't know Jim Bockowski personally, you can thank him at least in part for the discovery and introduction of a number of carnivorous plants into cultivation, including the anthocyanin-free forms of *Sarracenia leucophylla*, *S. minor*, and *S. rubra* subsp. *gulfensis*, as well as the *Drosera* × *eloisiana* cultivar 'Nightmare'.

If you did know him, you were fortunate enough to be the beneficiary of his enthusiasm, his humor, his knowledge and experience and his generosity: in plants, in time, in hospitality, and in friendship.

A native of Staten Island, New York, Jim spent countless hours exploring the New Jersey Pinelands in search of reptiles and carnivorous plants. And, as a paratrooper during the Vietnam War, he found – and fell in love with – *Nepenthes*.

His close friend, Bill Scholl, met Jim in the mid-1980s. "I was interested in the green (*S. rubra*) *gulfensis* he had discovered so I called him on the phone," he said. "Right away, Jim put one in a box and sent it to me. That was always his way. I don't think he ever sold a plant in his life."

With Bill, Jim traveled across the globe to see carnivorous plants in the wild; from Sumatra deep in the Apalachicola National Forest in Florida, to Sumatra deep in the rugged tropics of Indonesia. For this last example, Jim even tricked Bill into accepting a free trip to accompany him. "Jim called me and said 'I'm in a bind. I paid for (his longtime partner) Donna's trip and now she can't go,'" Bill recalled. "So it's all paid for." In the end, Donna did go – with the two of them.

And together, the pair traveled to South America three times to see *Heliamphora*: Climbing Roraima and Ilu tepuis on two trips, and on the third being stranded in the town of San Francisco de Yuruani for four days by their helicopter pilot and "drinking every beer in the place," said Bill.

I met Jim in 1995 in Virginia, at what would be the last of what was called the East Coast CP get togethers. I was new to the hobby and – like so many before and after – Jim took me under his wing, introducing me to the New Jersey Pinelands (and the overly-suspicious New Jersey Park Police) and offering plants, and advice, and more plants. I visited Jim numerous times at his house in Coney Island, Brooklyn, New York where he tried, repeatedly and unsuccessfully, to get me to accept boxes of cuttings of his favorite *Nepenthes* clones.

While nature has always seemed to be Jim's life, at that time it was also his work, as a New York Parks Department supervisor. After the terrorist attacks of September 11, 2001, Jim was the first person that many of the fleeing survivors saw as they escaped lower Manhattan across the Brooklyn Bridge, offering water and helping them wash the ash from their faces and hands.

After Jim retired, he and Donna moved to Tucson, Arizona where Jim struggled – and ultimately succeeded – in making his corner of the desert bloom. Friends Jason Ksepka and Perry Malouf both enjoyed his company in Arizona, watching the wildlife from his kitchen table: the birds at the feeders (and the rattlesnakes waiting there for a feathered meal) and the javelinas that would come to the door, or wandering through the Saguaro-covered hills just across the street.

"Jim treated me as an equal, even when I was an annoying 15-year-old kid," Jason said. "He treated everybody like this." Jason's fondest memory of Jim is his laugh. "He would turn red in the face, squint his eyes, and bounce like Santa Claus."

Perry made an annual pilgrimage from Maryland to stay with Jim and Donna in Arizona, to talk about their shared passion. "Though Jim didn't have formal training as a botanist, he had such a keen observational sense and such experience in the field that he became very knowledgeable about the cultivation of these plants," Perry said. "We would have discussions about various problems we'd experience: we'd talk about water quality and light and humidity, and we'd take turns trying to troubleshoot each other's challenges. And sometimes we'd just sit in the greenhouse trimming plants."

Tim Krug said "Jim was the co-discoverer of *Heliamphora ionasi* "G" with Bill Baumgartl on Ilu tepui in 1992. When Bill and Jim returned to the U.S. from Venezuela, Bill gave his *H. ionasi* "G" to his mother Marie, who ran Marie's Orchids in Florida. In "Sarraceniaceae of South America", Andreas Wistuba specifically discussed Bill Baumgartl's plant as not being *H. ionasi* "G", but being really *H. arenicola*. Wistuba states that in 1988, he saw the same plants, in the same location, but did not obtain a specimen, or name the plant. So Bill and Jim were the first to introduce *H. arenicola* into cultivation."

Pitchers for the public!
The Meadowview story (Part 1)

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Introduction

In Virginia and the western shore of Maryland, the need for pitcher plant conservation is particularly acute since the total extinction of all native pitcher plant populations is predicted, with high confidence, within the next 30 years (Sheridan 2010, Fig. 1). There are a number of factors causing pitcher plant extirpation such as succession, lack of fire, development, and flooding of habitat by beavers. Fortunately, because of the timely implementation of the Meadowview five step process, many of these threatened and/or extirpated populations have found protection on the Meadowview preserve system.

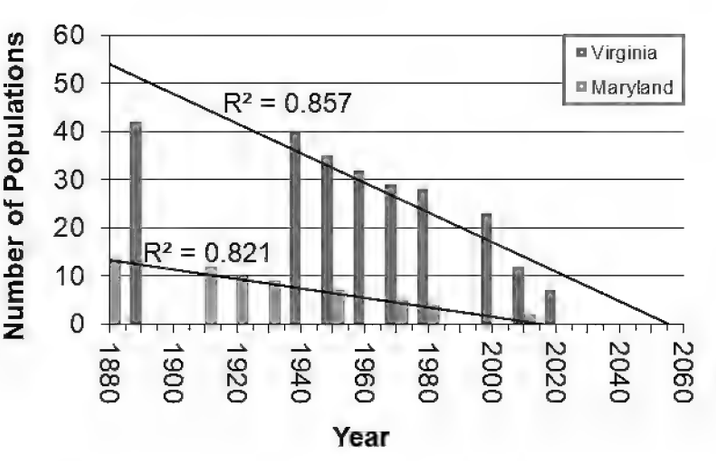

Figure 1: *Sarracenia purpurea* L. regional extirpation prediction for Virginia and the western shore of Maryland.

Meadowview is a non-profit 501(c)(3) conservation organization that was founded in 1995 with a mission of preserving and restoring pitcher plant bogs and associated habitats in Virginia and Maryland utilizing a unique five step process of discovery, propagation, research, reintroduction, and education. Long-term goals are met through the development of a series of nature preserves to protect the resource in perpetuity.

Meadowview owns two nature preserves: the 94-ha Joseph Pines Preserve in Sussex County, Virginia and the 7-ha Central Virginia Preserve in Caroline County. The Joseph Pines Preserve is restoring a longleaf pine/pitcher plant ecosystem while the Central Virginia Preserve is protecting and restoring the northern-most native purple pitcher plant bog in Virginia with state threatened species and a globally rare gravel bog.

The early days and the development of the Meadowview Business Model

Meadowview was initially started as a "private sector initiative" to meet the organization mission. This construct lasted about three years. Bottom line, if you think the private sector (i.e. for profit) is going to perform or fund meaningful rare plant conservation, you are mistaken. Therefore, we incorporated in 1998 and obtained non-profit status in 2000 to become an official charity. Setting up a non-profit is a fairly daunting task, especially if you have never done it before. We were very fortunate to have a great corporate secretary, Linda Davies, who had experience setting up non-profits. Linda had a template for the bylaws and articles of incorporation and was able to quickly put them together for my review and adjustment. Several other carnivorous plant non-profits have since used our bylaws and articles of incorporation as a template to also get started. I'm glad to see we were able to help some other conservation organizations get through this difficult process.

A very important part of setting up our bylaws and articles of incorporation is that we stated our long-term desire to own a series of nature preserves. Little did I know how crucial those few words would be to our future! Years later, as I started applying in competitive grant rounds for land conservation grants, I found out that the applicant had to state in their corporate charter that land conservation was part of their mission. If I hadn't put those words in our charter or had the vision to see that need, Meadowview would not have been able to acquire land for its own preserve system.

I thought the achievement of non-profit status would open the financial doors to achieve our mission. Wrong again! A non-profit generally has to be in existence at least five years before state, federal, or foundation grants will be given. How do you support a non-profit unless someone is going to donate to your cause? Fortunately, I had amassed a large personal pitcher plant collection and had my house paid off to provide a base for non-profit operations. I initially funded the non-profit, for several years, from my income as a teaching assistant. I was also hesitant to sell pitcher plants for fear that this commercial activity might tarnish the reputation of the non-profit. Those fears proved to be unfounded. In fact, I ended up developing a fairly unique business model for a non-profit: a conservation organization funded by horticultural operations and membership fees. It took about five years for horticultural sales to completely sustain operations, a typical scenario for a small business. I then ended up donating my entire plant collection, house, and land to Meadowview over a period of several years. The donations occurred because I wanted to endow the non-profit with the assets for success and also to remove any appearance, or thought, that I might be personally benefitting from the enterprise (a big no-no for a non-profit). I frequently still get asked "Where's your collection?". The answer is I no longer have, nor need, a personal collection and have moved on to the greater effort of preventing the extinction of these plants in the wild. I think an important point here is to show fellow hobbyists you can still love the plants but don't need to own them. In other words, a hobbyist can become a conservationist and the two are not necessarily mutually exclusive.

It's also worth pointing out the value of a spouse or partner in providing emotional and perhaps financial support in this endeavor. I was largely in the "ecological monkhood" during the years working on my bachelors, masters, and Ph.D. As you might imagine, the monkhood involved vows of poverty, chastity, and obedience. Fortunately, I was able to leave the monkhood through marriage to a wonderful and supportive spouse, Margie Sheridan. The days before Margie were trying times and I often wonder if we would have succeeded without her. Margie played a significant role helping out with some key expenses from 2002-2010 and jumpstarted and enabled the purchase of the Joseph Pines Preserve as the anonymous matching donor. I don't even get paid as director and president of Meadowview. Building a non-profit takes time and money and all our revenue either goes back into operations or land conservation. My basic needs are covered by Margie because she supports and values the conservation work Meadowview is doing.

Today, we have a pretty robust business from plant sales, memberships, and land conservation donations. We're also getting increased levels of state and foundation grant support for land conservation and asset purchase. This success, I think, is because we had a clear mission that was possible to accomplish and we didn't quit when times were tough.

Why are pitcher plants important?

A question I'm frequently asked is "Why are pitcher plants important?" If we're going to have an organization dedicated to pitcher plant conservation, we better have a good answer to this question. Here's why I think pitcher plants are important.

1. They are beautiful.
2. They bring limiting nutrients into their environment from their carnivorous habit.
3. They are valuable commercial plants.
4. They are early bloomers and nourish the first pollinators in bogs.
5. In many cases, they are state listed rare, threatened, or endangered species.
6. They are a model organism for study of complex ecosystems. The National Science Foundation has provided ongoing funding to a group of Harvard researchers to develop this model.
7. The pitcher plants are part of 0 order stream systems where water first emerges from the ground. Protection of this habitat, of which pitcher plants are a part, maintains high water quality.
8. The precautionary principle. We shouldn't lose our biota or consciously allow components of an ecosystem to be lost forever. We don't know all the parts an organism plays in an ecosystem or how critical that part might be.
9. Medical use (a complicated and controversial topic).

The Meadowview Preserve System

Our long-term goal was to have a series of nature preserves to protect indigenous pitcher plant populations and their associated ecosystems in Virginia and the western shore of Maryland. These preserves could be owned by us fee simple or the goal could be accomplished by use of proxies (state, federal, or private conservation groups or landowners) owning and managing the preserves.

Initially, since we didn't own any land, reintroduction efforts focused on private property or state land with suitable habitat (VDOT wetland mitigation sites, Figs. 2 & 3) within the historic range

Figure 2: Reintroduced population of native Virginia *S. flava* L. at VDOT Fort Lee wetland mitigation site in 2001.

Figure 3: Reintroduced population of native Virginia *S. flava* L. at VDOT Otterdam Swamp wetland mitigation site in 2003. Intern Johnathan Boynton observing pitcher plants.

of the *Sarracenia* genus in Virginia and Maryland (Sheridan & Penick 2002). These efforts, while initially successful, have largely failed due to lack of management. Pitcher plant habitats require management (largely prescribed fire but mechanical clearing is an acceptable substitute) and without that effort reintroduction efforts are futile. If we were to do this kind of reintroduction in the future, we would require a legally binding agreement (e.g. conservation easement) protecting the land in perpetuity with mandated management. These results should not be lost on would-be *Sarracenia* conservationists. Don't waste your time and valuable plant material on projects for which you can't guarantee a future.

While there are a couple nature preserves in Virginia (Zuni and Cherry Orchard) and the western shore of Maryland (Arden or Gumbottom Branch and Piney Branch) that have/had native populations of pitcher plants, their stewardship has been inadequate. This lack of stewardship is especially ironic since these are the "special places" that should be receiving the highest priority for conservation. Especially glaring examples of ineptitude are the complete loss to beaver flooding of the largest native purple pitcher plant site on the western shore of Maryland at the Arden bog in Anne Arundel County, Maryland (a state natural area no less) and collapse of the purple pitcher plant population at the Zuni Pine Barrens in Isle of Wight County, Virginia. In both cases, stewards were warned, with plenty of advance time, of habitat perturbation or colony collapse and either acted too late to prevent extirpation or refuse to institute emergency measures such as *ex-situ* conservation (Sheridan 2010).

Starting the Preserve System

Since proxies obviously aren't and weren't doing the job of protecting and restoring pitcher plant resources in Virginia, it's a good thing we had the vision to establish our own preserve system. This process started back in the 1970's when my friend Bill Scholl and I started combing the state for

native pitcher plants. This field work ultimately bore fruit in the 1980's (Fig. 4) as we honed our botanical skills with some old literature sources provided by Dr. Alton Harvill at Longwood College. We relocated some historic pitcher plant populations and discovered a number of new ones. We were also able to obtain either rhizome divisions or seed from these native populations and safeguard them in our collections. In my case, I was able to do a fair amount of baseline research on the ecology and reproductive biology of these captive plants either on my own, as part of undergraduate and graduate research, or ultimately as Meadowview (Fig. 5). These baseline studies were key to substantiating the validity of our reintroduction program.

We got the chance for our first pitcher plant preserve in a remarkable way. I gave a talk at Three Lakes Nature Center and aquarium in Henrico County, Virginia about bog gardening and our reintroduction efforts. One of the couples attending (Brad and Marsha Whitehead) had a 40-ha property in Sussex County, Virginia and was interested in participating in the reintroduction effort. I evaluated the property and found it had a number of excellent sphagnum seeps including several rare plant associates found in pitcher plant bogs. Therefore, I introduced one population of native yellow pitcher plant (Sappony Creek material) to the Whitehead property (Fig. 6). I checked on these plants annually and they continued to flourish. The Whitehead's had initially planned to build their dream house on the property but abandoned those plans after adopting two children. At that point, they put the property up for sale. Fortunately, during my annual inspection of the pitcher plant introduction, I saw the "for sale" sign and contacted the Whitehead's about purchasing the property. The Whitehead's signed a contract with us to purchase the property. The terms of the contract were extremely favorable to Meadowview and allowed us to lease the property for $12/year while funds were being raised to buy the site at $100,000. The lease also allowed us to commence restoration work. We also

Figure 4: Bill Scholl at new *S. purpurea* population discovered near Wakefield, Virginia in 1985. The population has since been extirpated by beaver flooding but propagules are now protected at our Joseph Pines Preserve.

Figure 5: Phil Sheridan in the early days (1990s) at Meadowview. Native Virginia *S. flava* and *S. purpurea* research beds in background.

Figure 6: Meadowview board members Jim Robinson (left) and Brad Whitehead (right) at Joseph Pines Preserve (ca. 2000).

had a gentleman's agreement that if Brad lost his job, we would secure a loan to purchase the land. We raised a little over $40,000 by the time Brad lost his job and honored our agreement by obtaining a bank loan to purchase the property. Now we could start restoration in earnest.

Peril, what's killing our pitcher plants?

It's hard to imagine that as rare as pitcher plants are in Virginia, and all the work we had done to save them, that we faced the prospect of their loss in *ex-situ* conservation by the actions of a maniac. In 2002, when I got married and was commuting to my Herndon, Virginia home, we started losing plants on the weekends to the mysterious "black streak". I couldn't figure out what the heck was going on since we had never had anything like this before. We were also experiencing a fairly severe drought. Combined with drought and "black streak", the beavers in the pond started eating large pitcher plant clumps on the pond edge. Our collection was getting hit on three sides! I ended up sending plant victims of "black streak" to Dr. Jay Stipes in the plant pathology department at Virginia Tech. Answer: No known plant pathogen can kill the range of plants that you are losing. You need to look elsewhere. Finally, I started to realize from the cumulative evidence that we were being sabotaged (i.e. plants were being sprayed with poison). We called the sheriff and they set up partial video surveillance but the damage continued. The installation of a security fence and system finally stopped the poisoning but the damage was extensive. Hundreds of seedlings crosses were destroyed, valuable location specific material killed or wiped out (e.g. Iredell County, North Carolina *S. flava*), and our propagation program set back ten years.

As best we can determine, a neighbor was apparently upset by our rodent (e.g squirrel) control and retaliated against our plant collection. As many carnivorous plant hobbyists know, squirrels can cause extensive damage to a plant collection and sometimes require control. The Virginia *S. flava* that had been so carefully preserved in beds at Meadowview narrowly escaped complete annihilation. While we were experiencing "black streak", and still didn't know what it was, I made the decision to move all the Virginia *S. flava* to the Joseph Pines Preserve. I thought that if we did have a pathogen, the best control for the disease would be provided by natural habitat. Looking back, this might seem like a rather risky proposition biologically (if indeed it was a pathogen) but the decision saved the day and prevented the complete loss of our Virginia *S. flava* to a crazy person. The lunatic, however, was apparently watching my movements and did succeed in landing a poison blow in the last bed bound for the preserve (Gary's Church). While there was some damage to the Gary's Church plants, it was not a lethal hit and those plants are now thriving on Joseph Pines Preserve. In any case, a close brush with extinction for Virginia pitcher plants.

Part 2 will include: restoration, reintroduction, issues with reintroduction, tools of the trade, and sustainability of the preserve system.

Donations. For the various categories you can donate to the Meadowview Biological Research Station, please see http://www.pitcherplant.org/donate.html.

References

Sheridan, P. 2010. Ecological and genetic status of the purple pitcher plant, *Sarracenia purpurea* L., in Maryland and Virginia. Ph.D. dissertation. Old Dominion University. Norfolk, Virginia. 194pp.

Sheridan, P., and Penick, N. 2002. Highway rights-of-way as rare plant restoration habitat in coastal Virginia. In: Goodrich-Mahoney, J.W., Mutrie, D.F., and Guild, C.A. (eds). The 7th International Symposium on Environmental Concerns in Rights-of-way Management; 2000 September 9-13; Calgary, Canada. Elsevier Science, Oxford, England. pp. 185-191.

Growing a magnificent sundew: Germination and cultivation of *Drosera magnifica* from seed

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Drosera magnifica was discovered after photos were posted on Facebook (hence the nickname "Facebook sundew") in October 2012. This resulted in a fieldtrip in September 2013 and the publication in 2015 by Gonella, Rivadavia, and Fleischmann describing this new species (Gonella *et al*. 2015). Due to its unusual discovery, this species was featured in newspapers as well as TV news stating it to be one of, if not the first plant discovered via social media (e.g., Anon. 2015; Hall 2015; Lewis 2015; Natzer 2015).

Drosera magnifica only grows on Pico do Padre Ângelo, Minas Gerais state, Brazil at the top of the mountain. The Type location is recorded at 1530 m asl. It is one of the largest *Drosera* of the world, rivaling with the south African *D. regia* and the south western Australian *D. gigantea*. The plants can reach a total height of 1.5 m. It resembles in many aspects the closely related *D. spiralis* and *D. graminifolia*, both also from Minas Gerais. Based on an assessment following the criteria for the IUCN Red List (IUCN 2001) it is Critically Endangered (CR B1ab(iii) + B2ab(iii)).

Early in 2017, we were amongst several experienced growers of *Drosera* that were contacted, asking if we would try to germinate and grow *Drosera magnifica* from seed with the goal of finding out how to grow this species and get it in general cultivation. Seeds were distributed to people that have the ability and knowledge to grow them *in vitro* as well. The first of these plants were recently offered at the annual European Exchange and Exhibition of Carnivorous Plants (EEE) meeting in Bonn. So, it has become time to share our experiences.

The intention of this article is not to present a perfect instruction text. We are just describing what we tried, what worked, and what didn't work in our conditions. Also, we include some information received from other participants in this project.

Growing by Marcel

Setup 1A

The initial information about the natural soil painted a picture of a plant in a well-drained soil that needed its large roots to reach water.

A mix that was tried was therefore a well-draining mix of 50% 2-3 mm crushed stone, 25% coarse sand, and 25% milled peat. The plants seem to like this mixture as the seeds germinate and grow well in it. Failure to germinate or grow can be attributed to watering conditions—this is a confirmed problem with other growers using various soil mixtures.

The soil mix was placed in an aquarium tank with ventilation slits in the top. As South American *Drosera* tend to need large amounts of light to thrive, lighting is provided by two 6800 K 24W LED bars.

Seeds where placed in 9×9×11 cm plastic pots sitting in 3-5 mm of water that was refilled once a week, resulting in the pots standing dry for about two days every week. Germination took place after about 28 days. The germination rate was about 80%.

Plants were grown at average day temperatures of 22-25°C, night temperatures were a little cooler at about 16-20°C.

The plants did well in these conditions, though growth is slow. Slow growth is also reported by other growers and it is therefore likely that this is indeed a slow growing species.

Setup 1B

This setup uses an identical soil mix and pot size as setup 1A, but there is only one LED bar and watering was by misting for several minutes 8 times in 24 hours instead of the pot sitting in water.

Heliamphora, *Brochinnia*, *Drosera ultramafica*, *Drosera schizandra*, and several *Utricularia* grow well in these conditions. However, *Drosera magnifica* does not. Germination was at a similar rate and slightly faster at 24 days, but after 2 weeks the seedlings started to fall behind compared to setup 1A. Eventually most seedlings died, and the survivors were rescued and transferred to setup 1A.

Growing by Christian

I received my seeds in early March 2017. As I have been told that this plant likely does not like heat, I split them up and tried two ways to germinate and grow them. In both cases, I have used the same medium, which is 60% sand and 40% peat in 5×5×7 cm pots (Fig. 1).

Figure 1: *Drosera magnifica* 18-month-old seedling in a 5×5×7 cm pot

Setup 2A

The first setup I tried was a small indoor tank (which is an aquarium) in the basement of my house. The temperatures usually do not get above 25°C in summer and can go down to 12°C in winter. I use two 24-Watt T5 light bulbs for a 40×60 cm tank. The tank is not closed, the light bulbs are just laying on top of the opened tank. The photoperiod I use is 14 hrs/day year-round. There is no misting or spraying. I refill some centimeters of water regularly, but allow the tank to dry out between each watering. In this setup, I mainly grow highland *Drosera* like *D. arenicola*, *D. hirticalyx*, and *D. roraimae*.

The seeds germinated after about 4-5 weeks. I did not count them, but I think, most of them germinated, my estimation is something around 90%. The plants are growing very slowly since then and have so far only produced 2-3 new leaves. This might also be just because I still haven't repotted them. The plants are still in the 5×5×7 cm pot in which I had placed the seeds. I tried to feed them with small crushed blood worms, but this did not have any effect for me, although I know others have had good results with feeding them. Aside from the slow growth, there haven't been any problems. I have not lost any plant in this setup, so I am confident that they will continue to be unproblematic. I will have to repot them soon, which might cause a space problem, as my indoor growing space is very limited.

Setup 2B

The other half of the seeds were placed in my greenhouse in March 2017. My greenhouse is about 10 m^2 in size and about 2.5 m high. In winter it is heated up to 5°C and I also install some T5 light

bulbs from October to March to use for my winter growing *Drosera*. The lights are switched on at 4:00 in the afternoon and are running about 5 hrs each day. In summer, the temperatures can go up to 40°C on hot days, I normally do not use any shading. Some of the more sensitive plants are placed under the greenhouse table during the hotter days. There is usually always water in the trays where my plants are during summer. In winter, I try to keep them a bit drier, so I allow the trays to dry out between watering.

The seeds germinated without any problems. I have chosen a place in my greenhouse that only gets direct sun in the morning to prevent them from overheating in summer. Apparently, that did not do the trick and they got too warm nevertheless. I lost some of them in summer. The rest got repotted last year and have grown well. They have been as slow as the plants in my indoor setup, I could not see any difference between the two setups. They have made it very well through winter in the greenhouse. I have chosen a place under my artificial lights for them.

Unfortunately, an extreme heat wave hit my area of Germany while I was on holiday in July 2018. When I came back home, I saw that most of my *D. magnifica* in the greenhouse died. I think, this happened just because of the heat as I have no indication of other reasons. Right now, there is only one plant left.

In my experience, this is a very slow growing plant that does not like heat. My advice would be to use a cool place for it. It seems to do best at the temperature range for highland plants like *Heliamphora* and Venezuelan highland *Drosera*. As others have had good results with feeding them, I think it can't do any harm to try this as well.

Some general information we have learned (the hard way).

Growth improvement

As stated, this species is a slow grower. Transplanting the seedlings into individual pots when they reached about 1 cm in height did speed up growth a little. But growth was best when, after the first drops of glue appeared, the plants were fed dried *Daphnia* ground to a powder.

Experiment with windowsill growing

Plants grown in setup 1A were placed in a sunny windowsill in The Netherlands to see how this species grows in these conditions.

Plants did surprisingly well, though growth is much slower under less light. The plants that stayed in setup 1A nearly doubled their size in 6 months, while the windowsill plants have hardly grown. Problems arose when an unusual period of hot weather hit Western Europe.

Experiment in storage

Several growers that received their seeds late have reported little or no germination. This was probably caused by long shipments and time in storage without refrigeration.

As a test, a portion of seeds was stored for 1 year (almost to the day) in a kitchen refrigerator and sown in setup 1A. Germination rate was about the same as the original batch, though this took about two weeks longer at nearly six weeks.

Temperature extremes

With the unusual hot summer in Western Europe this year, plants in setup 1A started to show burns at the tip of their leaves when day temperatures of around 28°C were reached. Plants in the windowsill trial died at temperatures of around 34°C near the window even after being placed about 30 cm back as a precaution.

Marcos Ono from Brazil reported fatalities under glass at about 30°C (pers. comm. Marcos Ono, Flora Marcos Ono, Brazil).

Cool temperatures seem to be less of a problem, though growth does slow down at some point. Greg Bourke reports plants surviving multiple days of 3°C and even a day as low as 0°C (pers. comm. Greg Bourke, Curator, The Blue Mountains Botanical Garden, Mount Tomah, Australia).

References

Anon. 2015. Riesen-Sonnentau Neue fleischfressende Pflanze auf Facebook entdeckt. Spiegel Online. http://www.spiegel.de/wissenschaft/natur/d-magnifica-fleischfressender-riesen-sonnentau-auf-facebook-entdeckt-a-1045261.html. Accessed 15 October 2018.

Gonella, P.M., Rivadavia, F., and Fleischmann, A. 2015. *Drosera magnifica* (Droseraceae): the largest New World sundew, discovered on Facebook. Phytotaxa 220(3): 257-267.

Hall, M. 2015. New plant species 'discovered on Facebook'. The Telegraph. Telegraph Media Group Limited. https://www.telegraph.co.uk/news/worldnews/southamerica/brazil/11762745/New-plant-species-discovered-on-Facebook.html. Accessed 15 October 2018.

IUCN. 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Lewis, D. 2015. No one knew this plant existed until it was posted to Facebook. Smithsonian.com. https://www.smithsonianmag.com/smart-news/no-one-knew-plant-existed-until-it-was-posted-facebook-180956084/#aegrum66Z0EbJfSm.99. Accessed 15 October 2018.

Natzer, E-M. 2015. Größter fleischfressender Sonnentau Amerikas auf Facebook entdeckt. Innovations Report. Forum für Wissenschaft, Industrie und Wirtschaft. https://www.innovations-report.de/html/berichte/biowissenschaften-chemie/groesster-fleischfressender-sonnentau-amerikas-auf-facebook-entdeckt.html. Accessed 15 October 2018.

In the aftermath of Hurricane Michael

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On Wednesday, 10 October 2018, just after 7 a.m. local time, Hurricane Michael slammed into the Florida Panhandle between Panama City Beach and Mexico Beach packing maximum sustained winds of 250 km/h, just under the wind speed that would have designated it as a Category 5 hurricane (Fig. 1). It will go down in history as one of the strongest and most devastating storms ever to make landfall in the United States, and the worst hurricane ever to impact the Florida Panhandle.

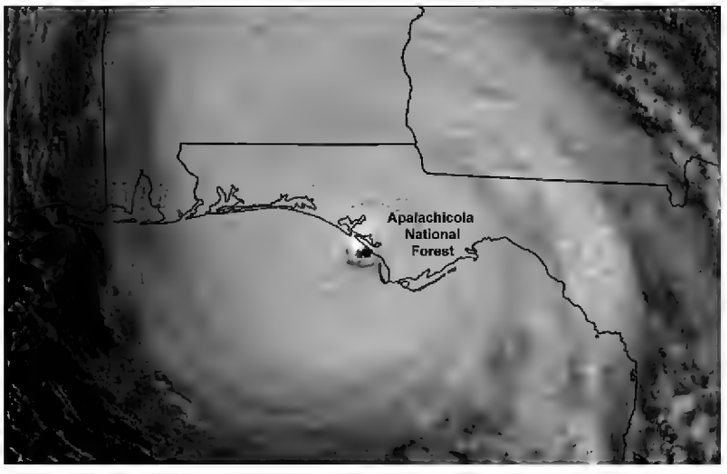

Figure 1: The eye of Hurricane Michael makes landfall just west of the Apalachicola National Forest. Image from NOAA.

The country was still reeling from the record-breaking rains and subsequent flooding from Hurricane Florence, a slow-moving Category 4 storm that caused severe damage in the Carolinas and dumped a total of 913 mm of rain in Elizabethtown, North Carolina in September. Perhaps the nearly non-stop news coverage of Florence led to a kind of media overload, because many people in the western states were not even aware of Hurricane Michael's landfall, or its terrible path of destruction, despite the nearly $12 billion in damages and 54 fatalities.

If there was a bright spot to be found in the story of Hurricane Michael, it was that the storm moved quickly inland into Georgia, and within 12 hours after making landfall, it had already been downgraded to a tropical storm. In Tallahassee, where I live, we were told the sustained winds would remain under 80 km/h with possible gusts of up to 113 km/h. We had survived worse than that during previous hurricanes, so my wife and I were shocked when at about 4 p.m. local time, a sustained wind gust shook our house, toppled a massive 25-m oak tree and demolished my greenhouse as we watched. Minutes later we lost power.

With the storm passing so close to the Apalachicola National Forest, I decided to drive out and inspect the damage on Sunday, 14 October. However, so many trees were down that the Forest was officially closed, and we had to wait until the following Sunday to reach the sites I was most familiar with. Though fallen trees had been cleared from the highway, many more — mostly pines — had snapped like matchsticks, while others had been stripped of their bark (Fig. 2). Although we had been warned of possible flooding as the storm approached, I was shocked at just how little rain we actually got. The water levels in many of the ponds I regularly visit were actually lower than the last time I had been there in September. Despite a NASA satellite that indicated rainfall in the 15 to 25 cm range, my own rain gauge registered less than 5 cm, a far cry from previous hurricanes and even many strong summer thunderstorms.

Back roads throughout the Apalachicola Forest were still impassible due to downed trees and in places, thick piles of debris, but I was able to visit most of my usual stops. *Sarracenia flava* was, as best as I could tell, the only carnivorous plant that sustained significant damage from the storm (Fig. 3). I can just imagine the pitchers being whipped around by the gusty winds and hit by flying debris. Though wet leaves and branches covered much of the area, making it difficult to walk safely — I

Figure 2: Apalachicola National Forest after the hurricane on 21 October 2018.

Figure 3: *Sarracenia flava* in September before (left) and after the hurricane on 21 October 2018.

did take several spills that day, though none were too serious — several sites where large colonies of *S. rosea* and *S. psittacina* are found appeared to be relatively unharmed, though the difficulty of traversing the debris field meant I could only do a spot check. Our native *Pinguicula* also appeared to be in fine condition. The single colony of *S. minor* I often visit was unreachable, but the plants are surrounded by tall grasses which should have offered at least some protection.

One of the big surprises was seeing some sites where the wind actually created new clearings where shallow water had collected. One of these was just south of the famous radio tower site (Fig 4). There I saw large populations of *Utricularia* flowers swaying in the breeze. I am not an expert on Utrics, but I believe these to be *U. cornuta* or *U. juncea*. I can say with certainty that I have never seen these in flower at this particular site. At the edges of ponds and ditches, the purplish flowers of *U. resupinata* seemed extraordinarily abundant.

I managed to save a large box turtle whose shell indicated he'd had an unpleasant encounter with an automobile sometime in the past and was fortunate enough to see a rare river otter crossing the road. Otherwise, we mainly encountered a wide assortment of butterflies and several groups of turkey vultures. Oddly, the Forest was not filled with the typical wide range of bird calls and songs. Perhaps they had moved to safer ground and had not yet returned.

Figure 4: The wind created new clearings with *Utricularia* growing in shallow water.

If I had to sum it all up, considering the size and strength of Hurricane Michael, things could have been far worse. Though we were not allowed to get close to Mexico Beach, it's clear that the coastline has been forever changed and it will take years or even decades for these communities to look like they did before Hurricane Michael. From experience, I know the Forest will recover quickly and though there are bound to be some changes, by next year all the plants, not just CP, will have a fresh start.

For me, I lost the best shade tree and worse, most of my CP collection (though I was able to locate about 45 of 200+ *Sarracenia* in among the debris piled in our yard, as well as that of our neighbors). Due to the extreme damage to the pitchers, it will be 2019 before I even know exactly what I was able to recover. According to our insurance, we suffered over $10,500 in damages — and our deductible for hurricanes is $5,800! It will take many years for our home (and the homes of our neighbors) to even begin to return to normal. It is very hard not to become overwhelmed by the clean-up and repair tasks that lie ahead, or to be depressed by the number of plants I lost. I just repeat to myself, "This could have been so much worse." Then I try my hardest to actually accept that.

It is up to people far smarter than me to determine whether the recent storms that have caused so much damage are a symptom of natural or man-made climate change. To me, the weather has definitely changed in Tallahassee since I lived here in the 1970s and 1980s, with more droughts, less summer rainstorms, more hurricanes, and warmer winters (when we have a winter at all). For the sake of the planet, future populations and the plants we love, I can only hope that we all choose to do the right thing and protect our global environment.

New Cultivars

Keywords: cultivar, *Sarracenia* 'Eyes', *Sarracenia* 'Dunes', *Sarracenia* 'Shakra du Coeur', *Sarracenia* 'Sergeant Hartman', *Sarracenia purpurea* subsp. *purpurea* 'Merlot', *Sarracenia* 'Lunchbox'.

Sarracenia 'Eyes'

Submitted: 16 September 2018

I bought some seedlings of *Sarracenia leucophylla* × 'Adrian Slack' from Miroslav Srba at the June 2014 Italian Meeting in Tradate. After several years, I identified one of these seedlings with good potential. The mature pitchers are nearly 70-80 cm tall. In Autumn you can see the best pitchers with the cultivar's characteristics. The pitcher is white with green veins similar to a *S. leucophylla* and has two red spots in the throat (Fig. 1). I have named this plant *Sarracenia* 'Eyes' because in the throat of the pitchers there are spots that recall human eyes.

Sarracenia 'Eyes' should be reproduced only by vegetative means to ensure that the unique characteristics are maintained.

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Figure 1: *Sarracenia* 'Eyes' pitcher.

Sarracenia 'Dunes'

Submitted: 26 October 2018

Sarracenia 'Dunes' is a *S. moorei* from the cross between *Sarracenia leucophylla* and a *Sarracenia flava* circulated by the unestablished name "Goldie". The flowers are yellow. Spring pitchers are the tallest, with 98 cm measured for this clone. Pitchers are first a green color then they become very quickly yellow. The throat is very slightly colored red at the opening of the pitcher and then the spot increases in size and darkens becoming dark red or almost black (Fig. 2).

The very yellow color of this *S. moorei* made me think of the desert when I started searching for a name and the name 'Dunes' seemed to me quite adequate for this plant. It can also be a wink to the monstrous worm that appears in "Dune", the 1984 film by David Lynch.

This cultivar must be only propagated by rhizome cutting or division.

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Figure 2: *Sarracenia* 'Dunes' pitchers.

Sarracenia 'Shakra du Coeur'

Submitted: 28 October 2018

Sarracenia 'Shakra du Coeur' is a *S. moorei* from the same cross as *Sarracenia* 'Dunes', namely *Sarracenia leucophylla* and a *Sarracenia flava* circulated by the unestablished name "Goldie".

It is a pretty plant, 80 cm tall, which has the peculiarity of having pitchers that are not very colorful at the opening (Fig. 3 left), but the tube has gentle veining while the throat and the underside of the cap is pink. As the summer progresses, the pink coloration becomes more and more intense (Fig. 3 center and right). The top of the cap is white, lightly veined with green. The flowers are pale yellow.

Like many *S. moorei*, the plant produces very beautiful traps in the spring with a break in summer, then it has a second phase of production during the fall with less impressive but always colorful pitchers.

Shakra is a 5,000-year-old science that comes from the ancient Rishis of India. The word meant a disc of metal symbolizing the power of a Râja said Chakravarti: the one who turns the wheel of destiny of men, who holds their life in his hands, but also, perhaps, the one who is at the picture of Surya, the sun. The Shakras are distinguished by associations of color and the pink, white, and green colors that characterize the heart (French: coeur) shakra are the same colors that can be found on this *Sarracenia*.

This cultivar must be only propagated by rhizome cutting or division.

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Figure 3: *Sarracenia* 'Shakra du Coeur' pitchers: early spring (left) and mid-summer (center and right).

Sarracenia 'Sergeant Hartman'

Submitted: 26 October 2018

Sarracenia 'Sergeant Hartman' is a *S.* × *moorei* sold by the Gent Botanical Garden during the annual European Exchange and Exhibition of Carnivorous Plants (EEE) meeting in September 2009. It was a Belgian collector and friend, Julien Gillot, who noticed it among a lot of plants that gardeners brought in a wheelbarrow. While I was chatting with him, I saw him practically jump in this wheelbarrow to reserve a plant. When I saw the plant he had reserved, I did not believe my eyes. The plant was beautiful and I stayed stuck for a long time.

Once back home, Julien was kind enough to give me one little spare piece, and thankfully, because the following winter was extremely cold in Belgium, with negative temperatures close to -25°C for several weeks. In spring his mother plant was dead.

So, I took care of my plant in order to multiply it and spread it in collections, but it was then that I realized this *Saracenia* had a rather unique character. Indeed, it is the most demanding *Sarracenia* I have ever had in cultivation. It produces only between 1 to 3 pitchers per year maximum and if the growing conditions are not at best, it can very well produce only phyllodes.

Sarracenia 'Sergeant Hartman' is a very colorful plant, richly veined with very beautiful dark red lips becoming almost black as the pitcher ages. The cap remains white and the pitcher's throat is either slightly green or it takes a beautiful yellow hue with light veins. When the pitchers open, they are barely colored (Fig. 4 left). The color shades come in a few days (Fig. 4 center) and then increase throughout the summer season (Fig. 4 right). Pitchers on a mature plant can reach 1 m in height and pitcher openings almost 10 cm in diameter.

Sergeant Hartman is one of the main characters of the movie "Full Metal Jacket". An extremely demanding personality, he does not leave a single moment of repentance to his young recruits and leaves no breach unpunished. I find this character fits perfectly with what the plant in culture requires to be at the top. This name is therefore totally appropriate.

This cultivar must be only propagated by rhizome cutting or division.

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Figure 4: *Sarracenia* 'Sergeant Hartman', from left, early season, mid-summer, late summer.

Sarracenia purpurea subsp. *purpurea* 'Merlot'

Submitted: 27 November 2018

During summer 2011, I met Bill Smith and Jason Austin who were coworkers at a plant nursery in New Jersey. Bill is commonly known by his self-given nickname of "Bogman". While visiting his home for the first time, Bill showed me a lovely *Sarracenia purpurea* that was completely red and patternless (Fig. 5). Bill and Jason had received seed from plants in Massachusetts, USA. Of all the plants the seed produced, this one was a patternless red plant. Bill subsequently gave me a division, which I am growing in my own bog garden, also in New Jersey. Bill and Jason said that they named the plant 'Merlot' but had not registered the name. I asked Bill if I could register the plant name and was given permission.

This clone has glabrous pitcher surfaces and exhibits the typical form and growth vigor of *Sarracenia purpurea* subsp. *purpurea*, as one would expect in a plant from New England. The color and the fact that it is patternless, or nearly so, makes this plant distinct from other registered cultivars. The color is present in the crown and the earliest growth stage of each pitcher, as opposed to developing later as the pitcher matures. The color of young pitchers is a distinct pink, rather than dark red-purple. It is my belief that in addition to the extra anthocyanin giving it a much redder color, that this plant is also a veinless plant as published by Carl Mazur and Jay Lechtman (2005). In their article, they discuss the veinless trait appearing to have a cline from purely veinless, to plants that have very faint veins. In *S.* 'Merlot' I see this trait under some circumstances. I expect that *S.* 'Merlot' would produce seed offspring that are very similar. However, in order maintain the characteristics of *S.* 'Merlot', a plant must be a clone, that is, a division or rooted leaf pulling. *S.* 'Merlot' may indeed prove to be an interesting plant to cross with other *Sarracenia* for those interested in such crosses.

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Reference

Mazur, C.J., and Lechtman, J. 2005. A veinless form of *Sarracenia purpurea* subsp. *purpurea* discovered in Ontario, Canada. Carnivorous Plant Newsletter 34(3): 79-84.

Figure 5: *Sarracenia purpurea* subsp. *purpurea* 'Merlot' growing in Bill Smith's yard in Warren Grove, New Jersey in 2011.

Submitted: 12 December 2018

We traced the origin of this clone to Brooks Garcia, the originator of *Sarracenia* 'Leah Wilkerson'. Sometime in the early 2000s, the plant was sold by Brooks to a small nursery in North Carolina mis-labeled *S.* 'Leah Wilkerson'. Flytrap King nursery purchased a division of the plant in 2009. After a significant amount of deliberation, we concluded that it is a distinct clone of high merit that is worthy of a cultivar name.

Spring pitchers are approximately 60 cm tall, 4-5 cm diameter, bright white with red venation on the top (Fig. 6). August pitchers are 50 cm tall, 6.5 cm diameter, and more rigid. Peristomes mature to red when grown in bright light. Hood columns are narrow, often resulting in the lid touching in the back. Established plants typically produce two leaves per growth point in the spring, followed by summer phylodia. In August, plants typically produce two more leaves per growth point.

Plants should be reproduced by vegetative means.

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Figure 6: *Sarracenia* 'Lunchbox'.