

grows plants in north-coastal California, while Adrian Slack was based in a much different climate in England. Accordingly, differing cultivation methods are recommended by the two authors for various plants. (For example, D'Amato ignores entirely Adrian's method of growing *Drosophyllum* in nested pots, a technique my cronies and I often call "slack-potting"!)

The reader should follow the guidance of the author who gives the most sensible advice, considering the reader's home climate.

But perhaps beyond all this, what really sets D'Amato's book apart is his ability to bring across a sense of gothic fun. Plants are shown growing in abalone-shells, gravy-boats, porcelain hearts, swans, and a *U. sandersonii* planter too hideously kitschy to describe. His figure captions are similarly nutty, "Upon entering this doorway, an insect is assured a painful death," "An autopsy on *Sarracenia* proves they are gluttonous pigs," and "The bizarre upper pitchers of *Nepenthes lowii*. Toilet bowls for birds?" If the book were not so completely authoritative on cultivation, these bits of comedy might undermine its credibility. Instead, they reveal the twisted humor of the author.

I am no sycophant—The Savage Garden does have flaws. Some are minor but oddly consistent spelling errors (e.g. "*N. bicalcurata*," "*U. reinformis*," "*U. humboltii*," "thripes," and others). More significant is D'Amato's confusing use of a flurry of unpublished cultivar names. It is hoped these are mended in future editions.

The Savage Garden is informative, accurate, entertaining, and at \$19.95 it is a bargain. An incident which captures its essence occurred when I was first reading it and started laughing raucously at a photo caption (page 250, guess which). My girlfriend came in from another room, "Let me guess, Peter D'Amato's book again?" The Savage Garden reminds me—a hardened old soul—of the magic of carnivorous plants and why I love them.

## LITERATURE REVIEWS

Barthlott, W., Porembski, S., Fischer, E., and Gemmel, B. 1998, First Protozoa-Trapping Plant Found, *Nature*, 392, 447.

The carnivorous natures of *Genlisea aurea*, *G. margaretae*, and *G. violacea* were investigated. By placing ciliate protozoa such as *Blepharisma americana* in a Petri dish with *Genlisea* traps, it was found that protozoa were attracted to and then captured by the traps. Meanwhile, the protozoa were not attracted to roots of *Eriocaulon plumale* (a different wetland plant). It is not described how the investigators parameterised the clustering of protozoa around the *Genlisea* traps, so it is unclear how significant these results are. Furthermore, while protozoa were subsequently found inside the *Genlisea* traps, no statistical estimates are presented of the likelihood that their occurrences in the traps were the results of random exploration by the protozoa. Since the attractive properties of the traps to other possible prey are not discussed, it is hard to justify the authors' claims that *Genlisea* is a "highly specialized protozoan trap." However, their results are evocative, especially since their field studies of *G. stapfii* traps revealed the presence of numerous trapped protozoans (and, presumably, no other prey types). When ciliates marked with the isotope  $^{35}\text{S}$  were trapped by *Genlisea*, the isotope was traceable in rosette leaves, verifying the carnivorous nature of these plants. These are exciting findings and it is hoped that further, more compelling results are published by the authors. (BAMR)

Dress, W.D., Newell, S.J., Nastase, A.J. and Ford, J.C. 1997, Analysis of Amino Acids in Nectar from Pitchers of *Sarracenia purpurea* (Sarraceniaceae), *Am. J. Bot.*, vol. 84, 1701-1706.

The amino acid composition of nectars from the extrafloral nectaries (nectar glands that are not part of flowers) of the pitchers of *Sarracenia purpurea* were analyzed. These nectaries act as lures for prey insects. The amino acids varied so that no single amino acid was found in all thirty-two pitchers examined. Nine amino acids (methionine, valine, cysteine, serine, aspartic acid, glycine, histidine, glutamic acid, hydroxyproline—in order of decreasing abundance) were present in at least twenty of the samples. No other amino acid occurred in more than twelve samples. The possibly significant cost of amino acid secretion is discussed by the authors in terms of being offset by increasing the plant's attractive properties, and therefore also capture of prey insects (a quite obvious phenomenon of nectaries in general). (JS)

Gallie, D.R., and Chang, S.C. 1997, Signal Transduction in the Carnivorous Plant *Sarracenia purpurea*, *Plant Physiol.* 115, pp. 1461-1471.

This paper on the physiology of *Sarracenia purpurea*, only apparently a well-studied plant, is somewhat unusual among recent publications on this topic by the predominantly experimental (rather than conjectural or traditional) nature of the facts the discussion is based upon. And quite expectedly, very interesting and important new observations are communicated in this article. It is shown by enzymological investigations that proteolytic and other hydrolytic (nuclease, ribonuclease, and phosphatase) activities are secreted by the plant autonomously within the first days after pitcher opening (irrespective of the water content of the pitcher). Later on, these activities decrease in the absence of external stimuli, but the secretion of the enzymes is triggered as soon as chemical stimulants like protein, nucleic acids, or ammonium chloride are added to the pitcher fluid. Microbial contamination is demonstrated not to play any role previous to the second week after pitcher opening, but the secretory behaviour of the plant is essentially independent from microbial action even after months.

*Sarracenia purpurea* subsp. *purpurea*, the plant the experiments have been performed with, is misspelt *S. purpurea* spp. (meaning species, plural) *purpurea* (i.e., p.1462), but this does not cause ambiguity.

This excellent paper, which is not only remarkable for the clearly designed experiments but also by the carefully performed controls, demonstrates for the first time beyond any doubt that *Sarracenia purpurea* does secrete endogenous hydrolytic enzymes, so this species (the only one in the genus for which this has been doubted occasionally) is an autonomously digesting, truly carnivorous plant. Moreover, the ability to regulate enzyme secretion depending on stimulants present in the pitcher fluid is apparently a new (albeit not an entirely surprising) characteristic for the genus, minimizing the risks and costs associated with carnivory as a means to maximize the benefits of extracting nutrients from the prey. (JS)

Heubl, G., and Wistuba, A. 1997, A Cytological Study of the Genus *Nepenthes* L. (Nepenthaceae), *Sendtnera* 4, pp. 169-174.

In this paper the genus *Nepenthes* is demonstrated to be cytologically uniform with  $2n=80$  chromosomes in all 15 species investigated. These counts confirm the preliminary data communicated by Lowrey (*Am. J. Bot.* 78 (6 Suppl.), pp. 200-201,

1991) and likewise contradict the first counts reported by Kondo ( $2n=78$ , Bull. Torr. Bot. Cl. 96, pp. 322-328, 1969). The homogeneity within *Nepenthes* explains why most species hybridize readily. A cytological comparison is made between Nepenthaceae and Droseraceae, several species in the latter having  $2n=20$  chromosomes, and a few polyploid taxa having as much as  $2n=80$  chromosomes. In the light of recent data on the composition of the order Nepenthesales, which includes the families Polygonoaceae, Plumbaginaceae, Nepenthaceae, Droseraceae, Drosophyllaceae, Dioncophyllaceae, Ancistrocladaceae, Frankeniaceae, and Tamaricaceae, the scope should perhaps have been extended also to some of the other families in this order ( $2n=20$  being common e.g. also in *Rumex* and *Polygonum*, Polygonoaceae). (JS)

Jebb, M., and Cheek, M. 1997, A Skeletal Revision of *Nepenthes* (Nepenthaceae), Blumea 42, pp. 1-106

This paper is intended as a precursor for the treatment of Nepenthaceae in Flora Malesiana, the standard flora covering most of the distributional range of *Nepenthes*. Six species are described as new. These are: *N. argentii* from the Philippines (featured already in Carniv. Pl. Newslett. 27, pp. 6-11, 1998), *N. aristolochioides*, a remarkable species from Sumatra with small pitchers that have a vertical peristome, *N. danseri* from Waigeo island west of New Guinea, *N. diatas* from north Sumatra that is closely related to *N. singalana*, *N. lamii*, the species from New Guinea that has formerly been united with the New Caledonian *N. vieillardii*, *N. macrophylla* (specific rank for what was originally described as *N. edwardsiana* subsp. *macrophylla*), and *N. murudensis*, a plant known only from Gunung Murud, Sarawak, Borneo, that has a compelling similarity to *N. tentaculata* but larger pitchers (it has been regarded as a hybrid involving *N. tentaculata* previously).

Several taxa are redefined, the Sumatran taxa *N. pectinata*, *N. eustachya*, and *N. sumatrana* are considered distinct from the Javanese *N. gymnamphora*, the Philippine *N. alata*, and the New Guinean *N. treubiana*, respectively. On the Malayan peninsula, *N. ramispina* is split from *N. gracillima*, on Borneo *N. hispida* is split from *N. hirsuta* (with which *N. leptochila* is united). *N. carunculata* is included in *N. bongso*, a decision which is justified if the specimens identified as *N. bongso* by Danser do belong to the taxon described by Korthals originally. In this case, *N. talangensis* cannot be included in *N. bongso* like it is quite surprisingly done in the present paper. *N. fallax* is included in *N. stenophylla*, although a specimen is selected as the lectotype of the latter that does not belong to the same taxon as *N. fallax*, so essentially Danser's misconception is perpetuated. A better solution must be found soon if further confusion should be avoided.

All new species and several of the redefined ones are illustrated by line drawings and described in detailed English descriptions. *N. deaniana*, *N. junghuhnii*, *N. melamphora* var. *lucida*, *N. neglecta*, and *N. smilesii* are treated as little known taxa, *N. cincta*, *N. cristata*, and *N. lindleyana* are excluded.

The paper is a must for all interested seriously in the taxonomy of *Nepenthes*, and it is another important step towards an improvement of Danser's classical treatment. However, several debatable points have to be clarified previous to the completion of the Flora Malesiana account. (JS)

Lowrie, A. 1998, A New Species of *Utricularia* (Lentibulariaceae) from the South-West of Western Australia, Nuytsia, vol. 12, 37-41.

A plant reportedly considered a variant of *Utricularia dichotoma* (a widespread

and fairly variable species) by Peter Taylor (Kew Bull. Add. Ser., vol. 14, 108-113, 1989; the specimens described here are, however, not mentioned in this context) is described under the name *U. paulinae* (recte: *paulinae*). The distinguishing features are the lemon yellow (rather than violet) upper corolla lip, spur longer than corolla lower lip (shorter in *U. dichotoma*), and capsule shorter than calyx (longer in *U. d.*). Peter Taylor is mentioned in the acknowledgements, but unfortunately nothing is mentioned about his opinion on the new taxon. (JS)

Lowrie, A. and Conran, J.G. 1998, A Taxonomic Revision of the Genus *Byblis* (Byblidaceae) in Northern Australia, *Nuytsia* 12, 59-74.

Botanist, adventurer, and author Allen Lowrie is well known to readers of Carnivorous Plant Newsletter. In this paper, coauthored by John Conran, he adds three new species to the genus *Byblis*, which previously only contained *B. gigantea* and *B. liniflora*. The three new species are *B. aquatica*, *B. filifolia*, and *B. rorida* (actually, *B. filifolia* is a name resurrected from an 1848 description). The new species are all similar to *B. liniflora*—indeed *B. filifolia* is what was recently named *B. liniflora* subsp. *occidentalis*. The four species, *B. aquatica*, *B. filifolia*, *B. liniflora*, and *B. rorida* can be distinguished from each other by a number of characteristics. These will be discussed in a future article in Carnivorous Plant Newsletter, but diagnostic characters are: 1) *B. liniflora* has anthers shorter than its filaments, seeds 0.8 mm long or smaller, and pedicels as long as or longer than the leaves; 2) *B. aquatica* has anthers shorter than its filaments, seeds 1.0 mm long or longer, and pedicels as long as or shorter than the leaves; 3) *B. rorida* has anthers as long as or longer than its filaments and has glandular hairs 0.7-1.5 mm long on its sepals; 4) *B. filifolia* also has anthers as long as or longer than its filaments but the glandular hairs on the sepals are only 0.3-0.5 mm long. In addition to the name *B. liniflora* subsp. *occidentalis*, *B. filifolia* has been known to horticulturists as *B. aff. liniflora* “Kununurra,” while *B. aquatica* has been known as *B. aff. liniflora* “Darwin.” Range maps are included for all four species. Only time will tell if the division of *B. liniflora* into four species is maintained, but the characteristics outlined in this paper are compelling. (BAMR)

Newell, S.J., and Nastase, A.J. 1998, Efficiency of Insect Capture by *Sarracenia purpurea* (Sarraceniaceae), the Northern Pitcher Plant, *Am. J. Bot.*, vol. 85, 88-91.

By videotaping pitchers, the insect capture efficiency of *Sarracenia purpurea* was found to be low. Ants may deprive the plants of more nutrients (nectar) than they provide as prey. (JS)

Schulze, W.E., Schulze, E.D., Pate, J.S., and Gillison, A.N. 1997, The Nitrogen Supply from Soils and Insects During Growth of the Pitcher Plants *Nepenthes mirabilis*, *Cephalotus follicularis* and *Darlingtonia californica*, *Oecologia*, vol. 112, 464-471.

The distribution of nitrogen derived from sources outside the plant (prey) has been studied in several different pitcher plants by comparisons of the relative abundance of the two stable nitrogen isotopes  $^{14}\text{N}$  and  $^{15}\text{N}$  that are present in different amounts in different natural sources. The authors confuse the pitcher lid of *Nepenthes* with the leaf tip (on their Fig. 1), although this was shown by Hooker in 1858 to be the dorsal spur at the lid base. Nevertheless, the fundamentally different anatomical nature of the traps of *Nepenthes*, *Darlingtonia*, and *Cephalotus* is

recognized. Comparisons of the characteristic nitrogen isotope ratios of prey, non-carnivorous plants growing at the same sites as the pitcher plants investigated, and different parts of the pitcher plants showed an increase of apparently prey-derived nitrogen in the younger, pitcherless parts of the pitcher plants. This leads the authors to the conclusion that prey derived (nitrogen-rich) nutrients are actively transported towards the young, actively growing (but not yet carnivorous) tissues of the plants. One major logical problem is the fact that in some samples (young parts of *Nepenthes mirabilis*) the nitrogen isotope pattern is shifted farther from the typical plant ratio to the insect side than in the insects themselves, which would necessitate an isotope-selective concentration process in the plant. If such processes were in operation, however, the whole method would be entirely meaningless for the question addressed. (JS)

Zamudio, S. 1997, Redescubrimiento de *Pinguicula clivorum* Standl. et Steyerl. (Lentibulariaceae), Una Especie Rara de Guatemala y Mexico, Acta Bot. Mex., vol. 39, 61-65. (Spanish with English abstract)

In 1944 Standley and Steyerl described *Pinguicula clivorum*, a Mexican species with a markedly zygomorphic flower and a homophyllous rosette of obovate leaves. Casper and others later concluded this plant was probably synonymous with *Pinguicula lilacina* Schldl. et Cham. By studying the herbarium isotype and holotype, Zamudio concludes the specific name *P. clivorum* was justified. Furthermore, the species *P. barbata* Zamudio et Rzedowski is found to be a synonym of *P. clivorum* (the latter name of course having publication precedence). Of the Mexican *Pinguicula* of subgenus *Themnoceras*, *P. clivorum* can be identified by the following: 1) its corolla lobes are entire (eliminating *P. crenatiloba* and *P. emarginata*, which have irregularly incised margins); 2) its rosettes are 3.5-10 cm in diameter, and are homophyllous (*P. immaculata* and *P. gracilis* have tiny 1-2 cm, heterophyllous rosettes). *P. clivorum* is known only from Chiapas (Mexico) and Guatemala. (BAMR)

Zamudio, S. 1997, Una Especie Nueva de *Pinguicula* (Lentibulariaceae) de Centroamerica. Acta Bot. Mex., vol. 40, 65-69. (Spanish with English abstract)

*Pinguicula mesophytica* is described as a new species. It belongs to sect. *Orcheosanthus* and is very similar to *P. moranensis*, but the smaller corolla lobes are rounded rather than cuneate, the leaves have ciliate petioles, and the plant is epiphytic or rupicolous. These plants from Guatemala, Honduras, and El Salvador have been identified with the Mexican *P. moranensis* in the past. (JS)

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