but with occasional yellow forms (i.e. *spiralis and tortilis).* Still, it is a useful rule to remember.

Cultivation of this species is easy. It will grow in pure milled Sphagnum or a 2:1 peat-sand mix. I grow mine in moss and my plants flower well. I do not advise live Sphagnum, especially species with coarse and large tufts, because they will overwhelm the Utricularia. As with all my CPs, I use water purified by distillation or reverse osmosis. I keep the water level 2-5 cm beneath the soil surface but some growers raise the water level to the soil surface or even submerge the plants when they become established. I have found this to be a successful method but if you grow your pot of prehensilis in a deep tray of water with other CP pots, stolons from the plant will quickly grow out of the pot and invade the neighboring pots. This plant enjoys warm temperatures but is not picky, 15°-32°C (60°—90°F) is fine. If temperatures are too high, the flower scapes may abort, even if they are more than 30 cm long. I grow my prehensilis in terraria under fluorescent lights and in the greenhouse under 50% shade cloth. Its cultural needs are easily met, so the only challenge the plant offers is when it flowers. Left on its own, the questing scape will quickly find other nearby plants-including other prehensilis scapes-and will wind around them. I forgot about this once and when I checked on the plant a few weeks later, one scape had found my *D. regia* and the other a large clump of *D. binata dichotoma*—when I finished untangling the mess I was thoroughly slimed. The easiest way to restrain the plant is to insert a vertical stick into the pot and let the scapes wind around that. I use chopsticks, and when they reach the top I train them back to the bottom and let them climb up again (Figure 2). Since crawling pests such as wingless aphids use toppled scapes as bridges from one pot to the next, training the scapes can decrease the occasional insect problems that inevitably occur in greenhouses.

In the wild, *U. prehensilis* grows in tropical and South Africa, and in Madagascar. In this range it grows in bogs and often shallow water. It typically flowers during the wet season, but in permanently wet conditions it flowers all year. I keep my plants constantly wet and they flower year round, but most heavily during the late winter and spring.

Growing and studying carnivorous plants is fulfilling for many reasons. We may marvel at their beauty and form, be fascinated by how they fill difficult ecological niches, enjoy the challenges posed by growing them, or even take ghoulish delight in how they devour their prey. But as I watch the curiously probing scapes of *U. prehensilis* thrash around, fitfully searching the air one day and then sliding against a terrarium wall which offers no foot-hold (and I use that term uneasily) the next, I know it is the only carnivorous plant that makes me laugh.

Growing Terrestrial *Genlisea*

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Late in the summer of 1991 I received in trade a plastic bag filled with live Sphagnum. Carefully exploring through the strands I was thrilled to discover that the object of my desire had survived the shipping ordeal, and I finally had an opportunity to grow a *Genlisea*. My new acquisition was smaller than a grain of rice, so I planted it immediately. Some species of Genlisea are aquatics and others are terrestrials. I wasn't sure of my new plant's preferred habit, so to be safe I embedded it in a loose mix of live fluffy Sphagnum just a few cm above the water table. The plant is now thriving and has taught me many things about growing species from this genus.

Despite its reputation as a difficult plant, my first species (*Genlisea hispidula*) is very accommodating. I grow mine in live or unmilled dead *Sphagnum*. A more densely packed medium (such as a peat or sand mix) may not allow tiny aquatic creatures to swim into the traps. I keep the water table near or just below the moss surface. Of course, use only pure water for these plants. I grow mine under 50% shade cloth. The spatulate or cuneiform leaves (up to three cm long each) are arranged in a rosette. The

plant sometimes becomes covered by heads of growing *Sphagnum*. When this happens I pull the strands back to keep the plant from becoming buried. Kept at about 18 °—35°C (65°—95°F) the plant will grow quickly. Cooler than this and its growth slows. I suspect a frost, however light, would be the end of your Genlisea. Fertilizer is not necessary so I have never used it.

When the rosette matured it produced an unbranched scape 20 cm tall with several flowers (Figure 1). As I examined the flowers something kept nagging me—I felt they reminded me of something but it wasn't until I was composing this article that I realized what it was. The arching lid-like upper corolla lip, the strange lower lip, and the sub-conical spur conspire to mimic the lid, peristome, and basin of a Cephalotus pitcher (But I am not suggesting the flower is carnivorous!). Carefully following Peter Taylor's key in CPN 20:1, p22, I was easily able to identify the plant as *G. hispidula*. I was slightly surprised the plant was correctly identified when it was sent to me—a real rarity with the related genus Utricularia!

The carnivorous traps on this genus are produced below ground from the rosette base and are shaped like an inverted "Y" a few to several centimeters in total length. Excellent line drawings of the traps can be found in Lloyd or Slack's first book. Midway between the trap's point of attachment and the bifurcation is a tumerous swelling—the utricle. This digestion chamber is the ultimate destination for wayward rotifers. A tube connects the utricle to the trap bifurcation. Each of the two branches of the trap is tightly twisted into a helix. A slit spiraling along the length of the helix allows free-swimming organisms into the twisted canal. Once inside, the creatures are constrained to swim along the inside of the canal by that old standby in plant carnivory (and something I feel I have read countless times), inward pointing hairs. These hairs allow the creatures to swim only towards the trap's utricle. Occasional columnar structures called prop-cells connect the walls of the canal and keep them spaced at a fixed, optimal separation. There are many unanswered questions regarding the function of the traps. After this article I present an order of magnitude calculation to explore if Genlisea suck water through their traps in order to accentuate their efficiency. But despite our poor understanding of the mechanics of the Genlisea traps they are effective. The utricle of older traps are clearly discolored by the internal accumulation of digested material and detritus.

A more recent addition to my CP collection is *G. violacea*. This plant is smaller in all respects than *G. hispidula*, with petiolate elliptical leaves 2 cm in total length. In flower it is much different, and resembles from the front a small *Viola* flower (Figure 2). The flowers are spaced only a few centimeters apart, and are long-lived enough so that several flowers are in full bloom in a lovely spray at all times. It grows well using the same culture as for *G. hispidula*.

These species, especially *G. hispidula*, are easy to propagate. For vegetative propagation use cuttings from leaves or traps. Some even report success using scapes! The cuttings should be partially buried in live Sphagnum. For leaf cuttings, remove as much of the petiole base as possible, and anticipate the new plantlets to develop anywhere on the leaf. Leaves can be cut into pieces for more plantlets. If scape cuttings actually work, I expect the new plants would develop from the peduncle scales. This species will produce viable seed even if not selfed. When the seed capsule matures and splits (see Taylor's figure 1—5, CPN 20:1, p34, for the remarkable details of capsule dehiscence), sprinkle the seed immediately on wet Sphagnum. Germination will occur in a few weeks. Treat cuttings and seed as you would mature plants. The species *G. violacea* is a little more challenging. Selfings don't produce seed, and leaf cuttings have never struck. I owe a thanks to Gordon Snelling who first told me about the success of trap cuttings. In fact when I have examined the traps still attached to a plant I have noticed parts of the traps (especially the tips) may develop adventitious leaves which grow to the soil surface and produce new plants.

I hope I have whetted your appetite for these remarkable little plants. In attention to detail their traps are the most complex of all the carnivorous plants—second

perhaps only to Utricularia. Their flowers are delightful, and when the species discussed here reach flowering size they continually produce scapes all year. And the plants are easy! If you can grow terrestrial Utricularia then you can grow the plants I described here. I have never grown an aquatic Genlisea, and anticipate they may be more exacting in their treatment (as is the case with most aquatic Utricularia). Very recently I have obtained specimens of *G. repens* and a plant which may be *G. pygmaea*. Time will tell how much luck I have with them. Good luck with yours!

Figure 1: Flower of *G. hispidula*

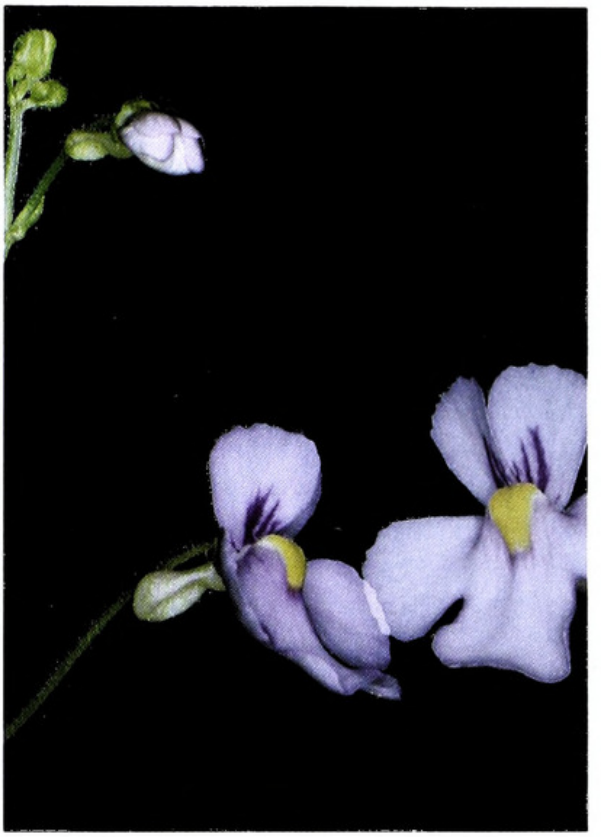

Figure 2: Flower of *G. violacea*

Growing Carnivorous Plants in a Semi-Arid Climate

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I live in Southern California approximately 100 miles (160 KM) east-southeast and inland from the City of Los Angeles. Although this area is not classified as a desert, it has the feel of one in the summer: it is hot and very dry. Technically, with 13 inches of annual precipitation (33 cm) the climate is considered semiarid and is classified as a Mediterranean, dry-summer type; almost all the annual rainfall occurs in the winter months. The daytime high temperatures in July and August average over 100 °F (37.8°C). Maximum temperatures can exceed 110 °F (43.3°C). Rainfall during the summer months is almost nonexistent. The elevation here is 1517 feet above mean sea level (462 meters). Because of the hot, dry air and relentless sun, the climate is very hostile to tender, water-loving plants. In spite of the climatic difficulties I have been growing carnivorous plants (CP) outdoors for the last 15 years. Several of my Sarracenias were obtained as two-year old plants in 1976 and are still flourishing. None of the plants are grown in any kind of shelter; all are grown in pots standing in the direct sun.

I had always read that CP required very high humidity to survive. When I first started growing CP in Southern California I attempted many different methods of maintaining high humidity in and around the plants: I grew some indoors under lights; I grew some outdoors in terrariums and other contraptions designed to retain high relative humidity. The indoor experiments resulted in limited success. The plants would flourish and grow with great vigor for a year or two, then would slowly decline.