THE SAVAGE GARDEN:
"BY THE LIGHT OF THE SILVERY MOON"

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Imagine this. You are in southern Alabama. It is a warm night, the sun having set in a dying blaze of orange and red a few hours before. You are standing on a grassy slope overlooking a wet meadow of white trumpet plants, *Sarracenia leucophylla*. It is early October, and the sound of a chorus of crickets and tree frogs reverberates against the stands of longleaf pines (*Pinus palustris*) that surround much of the open meadow. To the east, just over drooping fronds of some scattered cabbage palms (*Sabal palmetto*), hangs the moon. It is full, some call it the harvest moon in early autumn, and it really does look larger than normal, an optical illusion they say, big, bright and silvery. The light is so bright, the cabbage palms and pines form distinctive shadows over the edge of the dense stand of white trumpets - thousands of them bathed in the light of the silvery moon. The trumpets catch the glow. It almost seems as though candles are within each pitcher tube, the whiteness of the pitchers reflecting the moonlight. If you focus your eyes, you can see the dancing movement of tiny black specks and blotches along the mouths and lids of the trumpet plants. They are moths and other nocturnal insects, like bugs fluttering around a light bulb at night.

We will return to our moon-lit meadow of white trumpets momentarily. But first let us talk of other things. Let us ponder some of the more unusual physical adaptations of carnivorous plants, particularly some surprising discoveries in the past one or two decades. While for nearly 140 years carnivorous plants have been known to lure, catch, kill, and feed upon insects by various treacherous traps and trickery, there have been some amazing discoveries made concerning how specialized a few species have become in their quest of nutrients usually absent in the soils in which they grow. Often, these adaptations concerned peculiar physical properties of the plants that were mysterious, yet unexplained.

It was around twenty years ago that Cliff Dodd, a grower in Florida, and I noticed almost simultaneously that our *Nepenthes lowii* plants were doing something unusual. He and I had probably the only sizable plants of this species in cultivation in America at the time. We both noticed an oozy, white, bead-like substance appearing among the bristles that hung from the inner surface of the lid. This surprised us, since we had read that these white clusters had been seen on the plants in the wild. They were assumed to be snail or slug eggs, laid there for the protection of the hopeful offspring, a reasonable assumption at the time. However here it was on Cliff's and my cultivated plants. I nicknamed the stuff "smegmata".

It wasn't until Charles Clark made the astounding revelation in his 1997 "Nepenthes of Borneo" that according to his field observations, this white substance lured small birds that fed on the smegmata, dropping their feces into the wide, flared upper pitchers of *N. lowii*, making the plant a "crapivore", as I have often joked in my lectures, or, more coarsely, "sh**ivorous". *N. ephippeata* has evolved a similar adaptation.

Nepenthes albomarginata was a widely grown plant as the hobby grew in the 1990s, and all of us admired the distinctive white band on the pitcher, just below the peristome. Why was it there? Some visual lure for insects, no doubt.

But it wasn't until the recent turn of the century that ecologists Jonathan Moran, Marlis Merbach and their associates discovered the true nature of this white band. It was covered in minute, hair-like trichomes that a specific species of termite found irresistible. The termites would swarm over the white band eating the hairs, hundreds to thousands of the insects being caught by the pitchers in the course of one night. Most interesting is that the peristome had to be stumbled upon accidentally by one or a few termites, who would then return to the nest to notify the colony of a tasty food source. Remember, this band is bright white. The termites are nocturnal. It was not mentioned by its discoverers if the moon was full.

One drawback to more discoveries of this sort is that one has to be there to observe it, in the wild, where it occurs. We would never have known about the true nature of the white band of

N. albomarginata or the smegmata of *N. lowii* if we had only studied cultivated plants.

Another astounding discovery was by Siegfried and Irmgard Hartmeyer concerning the species of sundew they discovered, named *Drosera hartmeyerorum*. In Stewart McPherson's book "Glistening Carnivores", he offers a detailed report by the Hartmeyers - and amazing photos - of the truly weird tentacles found near the base of the leaves that are topped with bizarre reflective lenses. These lenses catch sunlight and "glow", possibly as a lure to insects. In "Glistening Carnivores" there is even a photo of these reflective lenses illuminated in the dark by a torch or flashlight. Would moonlight reflect in these lenses, visible to nocturnal insects in ways that human eyes could not see?

Not all of the above examples pertain to moonlight in particular, such as the smegmata on *N. lowii*, although it is opaque to white in color. My point is that there are some curious physical adaptations of some carnivorous plants that are unexplained and should arouse our curiosity and study.

One example is the unusual "eye spots" found in most - but not all - *N. reinwardtiana* pitchers. These two small circular spots are typically on the inner back wall of the interior of the pitcher. Similar spots are sometimes found in other species, such as *N. mikei*, *sanguinea*, and *tobaica*. These eye spots lack the wax of the rest of the pitcher interior. Do they have a specific purpose? Experience with such oddities suggests that they probably do.

However *N. khasiana* usually has a distinctive red band below its peristome, but since red is produced by anthocyanin, known to cause color appealing to the ultraviolet spectrum of light that insect eyes are particularly adapted to, we may assume the color is a typical visual lure, hinting to insects where the nectar is to be found. Insect eyes are very different than ours and many plants, especially their flowers, control insect behavior by color patterns as well as scents.

But let us return to our meadow of white trumpets under the harvest moon.

Don Schnell, in his book "Carnivorous Plants of the United States and Canada", points out something we all now commonly know. *Sarracenia leucophylla* produces its largest, most robust trumpets late in the season, in late summer and autumn, "as though the growing season were starting again, but, of course, the time for frost is nearly at hand." He also states: "...this flush of late summer pitchers is peculiar to *S. leucophylla*."

Could it be merely coincidence that this beautiful species, nearly pure white, produces its best leaves during the haunting brightness of the harvest moon?

This idea did not originate with me. In 1997, I gave a presentation at the North Carolina Botanical Gardens, and one fellow told me a fascinating story. He was in a stand of white trumpets during the bright autumn moon. He said they seemed to glow in the dark. He was especially impressed with the observation that they were catching an abundant quantity of moths. He believed the moths were of one species, and even suspected they were of a particular sex. He wondered if the sweet, musty odor the pitchers produced imitated pheromones that lured either one sex of the moth or the other.

Even though I have kept a daily journal of my life for 38 years, and recorded many details of that trip and the people I met there, I neglected to record the name of the person who told me that story! However, I recently contacted long-time *Sarracenia* enthusiast Randy Troup, who I met at that presentation. He told me the late Rob Gardiner, director of the North Carolina Botanical Gardens for many years, and for a while a co-editor of this newsletter, used to talk about white trumpets and moonlight to him. Since I went on a memorable field trip on that visit with Rob and Larry Mellichamp, it's quite likely Rob was the source of this idea.

Although moonlight has only 1/50,000 the intensity of the sun, many plants have adaptations to the light of the moon. Some flowers bloom only in moonlight. Some plants "block" moonlight so it doesn't interfere with normal photoperiodism of the sun. Lunar biorhythms affect not only animals but plants. Some people grow "moon gardens", which contain plants that have leaves that are white or pale in color. A Google search under "plants moonlight" will bring up a vast array of information.

If *S. leucophylla* has adapted to make use of the light of the silvery moon, then what about the light windows of *S. minor* or *Darlingtonia californica*? Obviously they are most effective in the sun. But since so many insects are nocturnal, could they also "work" in moonlight?

What about the *Nepenthes*, most often richly colored in reds and purples in their lower pitchers, while the upper pitchers, climbing into the sunlight or moonlight, are most often pale green, and some, like *N. muluensis*, having bright white lids?

Patrick Hollingsworth, a friend and volunteer at California Carnivores, has been taking incredible photographs of *Utricularia* traps using a high-powered microscope. He says many of the tiny traps of aquatic species reflect light and "shine", even when dimly lit by a nearby table lamp.

And what about the glittering leaves of sundews? To the eyes of nocturnal insects, might they be called....moondews?

One thing we must remember. Moonlight is sunlight, reflected by our lunar companion. Although night time varies on our earth according to latitude and seasons, plants live in moonlight as much as the direct rays of the sun. That some carnivorous plants may take advantage of the moon's silvery glow is not out of the realm of possibilities.

2009 Index of Contributors

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Front Cover: *Sarracenia leucophylla* seem to glow in the moonlight. Photo by Barry Rice. Article on page 28.

Back Cover: *Heliamphora sarraceniodes* grown under lights in a terrarium Photo by Brian Barnes. Article on page 26.

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