EYE TO EYE WITH "CRUISER":

Discovering Victoria's Secrets

by Matthew Johnson
Photos by Matthew and Debra Johnson

The colossal *Victoria* waterlily requires a huge pond to thrive, right? Wrong! In fact, *Victoria* will grow and flower in a space smaller than a bathtub. Learning about *Victoria*, virtually eye-to-eye, in the confined space of my basement has been an exciting and unforgettable quest of her secrets.

For decades, the only hybrid *Victoria* thought possible was 'Longwood Hybrid', produced at Longwood Gardens in Pennsylvania by Patrick Nutt when he pollinated a *cruziana* flower with *amazonica* pollen. The reverse crossing of an *amazonica* flower with *cruziana* pollen was assumed improbable, but it is now known as 'Adventure'.

In the 1998 season, Joe Summers of Missouri Botanical Garden in St. Louis, along with other experts, successfully produced seeds from *Victoria* species crossed back to 'Longwood Hybrid'. Such a crossing had been considered unlikely because of uneven chromosome numbers between the two parents. In 1999, these hybrid seeds successfully germinated. Among them were 'Longwood Hybrid' x *amazonica*, now called 'Discovery', and 'Longwood Hybrid' x *cruziana*, now called 'Challenger'.

(above) "Cruiser" in an outdoor pond during the summer of 2000. Possibly with more than 90% *Victoria cruziana* in the cross, the red tones found in "Cruiser's" leaves still depict its *Victoria amazonica* heritage.

Many other experimental crosses were attempted. One of these crosses, 'Challenger' x *cruziana* would launch my Victoria odyssey – a journey that continues even today.

Initially, the seeds for this hybrid proved hard to start. After many months, a sprout began to grow on March 23, 2000. Already unique as the result of two generations of improbable crossings, I called the new seedling 'Challenger' x *cruziana* for some time before nicknaming it "Cruiser." Because *Victoria* seeds must be started in January in New York State to attain flowering, I held little hope of baby "Cruiser" producing blooms. Nevertheless, "Cruiser" moved into my *Victoria* "nursery" of eight 100-gallon Rubbermaid tubs heated with 300-watt heaters and lighted by fluorescent grow lights, set up in our basement.

A view from above, showing how "Cruiser" has adapted to the less than ideal space available within the confines of its tub.

At first, "Cruiser" barely differed from a pure *cruziana* plant, and it was hard to tell them apart. Soon, however, its baby leaves gave way to pads slightly tinted with red. As the plant grew, this subtle difference became even more apparent with the display of many tones of red. Although "Cruiser" may contain less than ten percent of *amazonica* in the cross, it still retains visible *amazonica* traits.

In mid-June, I placed "Cruiser" outdoors

Like *Victoria cruziana*, "Cruiser's" buds are almost devoid of thorns. The buds, slightly more pointed as compared to *Victoria cruziana*, appear much like a 'Longwood Hybrid,' also a part of "Cruiser's" family tree.

The shape and number of petals in “Cruiser’s” flowers seemed very similar to *Victoria cruziana*. However, the petals seemed longer and more pointed at their tips, but I did not have a *cruziana* flower available for comparison at the time.

with the rest of my collection of 29 *Victoria*. When June of 2000 went on record as the second coldest season in upstate New York, the small *Victoria* suffered from the cold and barely grew. Heavy rainfall also brought aphid infestations. By August, “Cruiser” was dying; only one good pad remained and two others were damaged. Trying to salvage the seedling, I brought it back indoors the second week in August. After thoroughly hosing away the aphids, I fertilized the plant heavily for the first several weeks. “Cruiser” quickly recovered.

Although “Cruiser” had produced small rims on its ten-inch pads outdoors, it stopped producing rims when I brought it back indoors. Initially, I thought a difference in humidity might be the cause. However, a resumption of rim production proved this wrong. To my delight, in spite of bearing only twelve-inch pads, “Cruiser” started to produce buds in late September and early October. None bloomed.

Throughout autumn, “Cruiser” continued to grow well indoors. The rims grew higher, and the pad sizes increased. Once displaying six pads in its tub, it could now hold only three without overlapping, even as another leaf crawled up the tub to stand nine inches out of water. Buds continued to form, but the plant aborted all. “Cruiser” was not happy enough to bloom.

A rare glimpse of a yellow phase displayed the morning after the first-night flower opened. The cause of this yellow cast still needs to be determined.

Since “Cruiser’s” tub was only four feet long by two-and-a-half feet wide, I removed older pads to make room for the new. However, after hearing from other *Victoria* growers that *Victoria* may stop budding with extensive pad removal, I stopped removing the pads. This made sense since I knew that my outdoor *Victoria* did their best with all their pads, regardless of pad condition. For over a month, “Cruiser’s” pads piled up in the tub. Noticing a slight drying of the rims, I then discovered a layer of leaves had formed that kept new leaves from touching the water correctly. With no sign of flowering, I risked a cut-back. During the cut-back, I added soil to the top of “Cruiser’s” pot, fertilized the plant, and turned the pot around. Two days later, the largest bud to date appeared, but it aborted.

In January of 2001, ten-month-old “Cruiser” had aborted nearly two-dozen buds. I gave up hope for flowers in the house. As “Cruiser” produced pads, rarely exceeding 24 inches across, the rims grew higher, the largest extending upward nearly seven inches. It seemed that the plant would grow up if it could not grow out. I continued to leave all pads on the plant. When a new pad developed under an existing pad, I cut a hole in the existing pad large enough to allow the new one to come up over it. Then “Cruiser” surprised me: it maintained four pads without overlapping and only two others that were overlapped. Still, I removed overlapped pads only when they turned yellow and started to rot.

“Cruiser’s” flower turned pink as it began its change into a second-night flower.

On January 6, 2001, during a routine check of my *Victoria*, I found the largest bud yet produced by “Cruiser”. Excited but cautious, since the bud was not completely out of the sheath, I told very few people. Two days later, as the bud continued to grow and inch its way from the sheath, my excitement grew. Finally, sure that the bud was going to continue, I sent an e-mail to the *Victoria* mailing list.

Only one sign of a viable bud was missing: it did not turn red as normally would be expected, perhaps because little light could reach the bud under the thick layer of pads. As the bud grew to peer out from beneath the pads, it began turning red. Plump with few spines on the sepals, the bud differed little from that of a *cruziana*. However, one difference noted was a small white spot at the very tip of the bud. Apparent throughout the grow-

During “Cruiser’s” second-night color transformation, the flower took on a lavender cast.

The flower center shows the color of the stamenoids as they assumed second-night coloration.

ing process, the spot appeared to be part of the sepals, although *Victoria* sepals are green.

Since the bud stretched above the water for several days, I misted it with warm water to prevent drying. For five days, it continued to grow upward. On the day before opening, it grew yet another four inches from 3:00 p.m. to 10:00 p.m. to a height of eight inches from the base of the bud and twelve inches from its tip to the water's surface. This extraordinary height seemed to be "Cruiser's" way of thrusting its bud above the seven-inch-tall pad rims.

On the night of January 16, 2001, "Cruiser's" long awaited bud began to crack. Waiting until 11:00 p.m., I turned off the three light fixtures at fifteen-minute intervals to mimic natural conditions in preparation for the flower. Finally, opening with snowy white petals, "Cruiser" filled our basement with the delicately sweet, tropical aroma of *Victoria*. Perhaps due to our three-month-long hiatus of *Victoria* blooms, "Cruiser's" aroma seemed sweeter, although not as strong, as most *Victoria* fragrances.

Now fully open, "Cruiser" was one of the few *Victoria* to bloom under artificial light, as well as the first of its particular crossing to bloom. With long and pointed petals, slightly crinkled at their edges, the bloom appeared very full and displayed some red in the wide-open center. After taking pictures, my parents and I stood in awed wonder of a very special *Victoria* in bloom.

On the second day around 12:00 noon, "Cruiser's" flower, which had not closed, took on a yellow cast. According to Nancy Styler of the *Victoria* Conservancy, people have reported yellow flowers before, but documentation has been minimal. By 3:00 p.m., the flower had lost the yellow cast and begun turning pink. At 5:00 p.m., the petals began to turn down into the typical second-night shape. It was not going to wait for lights-off to become a second-night flower. By 11:00 p.m., all lights were off, and the only flower part not open was the center, which still covered the anthers. The flower turned a shade of lavender. Finally at 2:00 a.m., the center opened but with no apparent shedding of pollen.

On the second night, the exposed anthers in the flower's center were fully open and red, possibly another hint of "Cruiser's" *amazonica* ancestry.

The first-night bloom of "Cruiser's" second flower in the basement

On the morning of January 18, the flower turned a dark pink and began sinking, still apparently without shedding pollen. Since first flowers on *cruziana* and its hybrids may not shed pollen, and if they do, still do not produce seed, I propped the flower above the water to see if pollen would shed. At 3:00 p.m., the anthers were, in fact, shedding pollen, although not as much as usual. I decided to try pollinating it.

While we were entranced with the events of the first flower, "Cruiser" created a second bud. Although rather small, the bud quickly grew to a size only slightly smaller than the first. Even though the pot-bound "Cruiser" would start failing soon without

repotting, I decided to wait for the second bloom. On January 22 and 23, we enjoyed a second *Victoria* flower from "Cruiser".

Besides growing in a small container and blooming under lights, these blooms were all the more special to me for the presumed improbability of the crossings from which they resulted. Sparking my continued interest are questions of the number of chromosomes, which differ among the parentage and, in "Cruiser's" unique back-crossing, comprise a yet unknown gene pool. This has already led to initial chromosome counting expeditions with Dr. Cheryld Emmons, the Assistant Biology professor at Alfred University in Alfred, New York, where I will attend college this fall. Armed with the results of DNA tests on "Cruiser", I anticipate further discoveries of *Victoria*'s secrets. I would like to thank Nancy Styler for her knowledge and her willingness to share information about *Victoria.* I would also like to send a special thanks to Dr. Cheryld Emmons for sharing her time, lab facilities, extensive knowledge, and expertise.

Matt is 18 years old and a recent graduate of Wayland-Cohocton Central School. He began growing Victoria when he was 15. Matt will attend Alfred University this fall and major in biology.

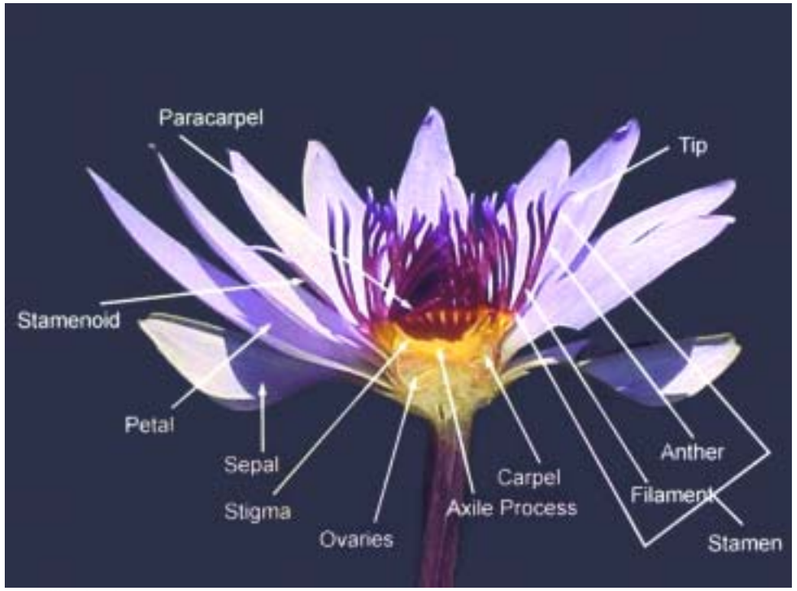
Make Your Own New Cultivar !

by Kit and Ben Knotts

Part of the fun of growing waterlilies is doing a little hybridizing yourself! It's really pretty simple and might just produce a wonderful new cultivar that you can name and register. It requires some basic knowledge of the structure of the flower, a minimum of equipment, and the time to observe your flowers. Don't feel intimidated by the "mystique" of the past. Try it!

We began our hybridizing with *Victoria*, our beloved giant water platter, but our interest soon expanded to waterlilies. We were inspired, encouraged, and instructed by the legendary Bill Frase of Orlando, Florida. The method described herein is a traditional one, although alternative approaches are used by Rich Sacher in New Orleans (nicknamed by us, the "King Bee") and others.

The first step in creating a new hybrid is to decide what you want to make. Some (like us) have specific goals in mind and limit the number of cross-pollinations attempted to those that might yield the desired result. Others, like Rich, make lots of crosses, enjoying all the results, especially the greater opportunity for something spectacular. Your particular growing conditions and tastes may dictate your decisions. Someone with a small pond, for example, would think about compact parents, whereas one with lots of space can think big.



Waterlily Floral Anatomy


Left to right, first-day flower of 'Amethyst Splash', second-day flowers of 'Bill Frase', its smoky, maroon-mottled pad upper left, and third-day flower of 'Floyd Wolfarth'.

It is generally accepted that hybrids between members of the different subgenera within the waterlily genus *Nymphaea* cannot be made. Our attempts certainly have been unsuccessful, though we will never say never. The subgenera are *Brachyceras*, most of the day blooming tropcals; *Lotos*, most of the tropical night bloomers; *Nymphaea*, all of the hardies; *Hydrocallis*, night-blooming tropicals rarely found in cultivation; and *Aneophya*, day-bloming tropicals from Australia and the East Indies.

We love tropical lilies, especially large ones and those that are very cold tolerant. This has led us to concentrate on the big, beautiful, and very tough offspring of *N. ampla*. Our *ampla* was a gift from Bill Frase and is the same as he used in creating 'Floyd Wolfarth,' 'Bill Yohn' and 'Lou Pignolet.' Our examples are from this type of *Brachyceras*, although the techniques apply to all subgenera. *Ampla* itself is not especially large and has a simple white flower with interestingly ranked stamens and bronze pads that look more like night-bloomer pads than the usual day bloomers. *Ampla* is a great parent, not only setting seed easily, but also stamping itself on progeny with large flowers, a leathery quality to pads, and a cold tolerance.

It should be mentioned at this point that here in Florida or in greenhouses, breeding can take place almost year round. This is less and less the case the farther north you go, with the breeding season limited to early fall in the most northern outdoor ponds. Viability of both male (pollen) and female (stigma) flower parts is greatly affected by weather. Certain ones can also be persnickety, producing viable pollen or setting seed only at certain times.

Some of the terminology of hybridizing used offhandedly and interchangeably can also be confusing. Some of the terms that refer to Mom are pod parent and seed parent with female parts referred to as stigma and stigmatic cup. Dad is known as pollen parent and his male

N. 'Bill Frase' is the resulting cultivar of crossing *N. ampla* and *N.* 'Indian Goddess.'

parts are stamens, a part of which is the anther (the pollen bearing portion of the stamen).

The "Code" (ICNCP) allows for listing parents alphabetically when expressing crosses, but it also permits giving the pod parent first and the pollen parent second, the method we prefer and always use. An example would be *N. ampla* (Mom) x *N.* 'Indian Goddess' (Dad) = *N.* 'Bill Frase.' The name of the hybridizer sometimes follows the cultivar name.

The Pollination Process

Most waterlilies open for three days in succession. In the first-day tropical flower, the stamens stand straight up and display fluid (nectar) in the stigmatic cup. This new, first-day flower is the most receptive to breeding, even though its own anthers (the part that contains the pollen bed) rarely produce pollen on the first day. On the second day, the outer stamens lean outward and produce some pollen. By the third day, the middle rank of stamens flare outward with the inner stamens sometimes leaning inward. All produce LOTS of pollen, even though the stigma is less receptive as the days pass.

We select a first-day flower to be the mother and emasculate it so that its own pollen doesn't affect our cross. Emasculation requires the complete removal of the stamens by plucking them with fingers, tweezers, or scissors. Perform this as close to the stigma as possible without damaging it so that you are sure the anther portion of the stamen is removed. No pieces should be left in the stigma or nestled in the petals because the pollen can, in rare cases, continue to develop from the cut first-day anther and corrupt the cross. Some hybridizers even emasculate the day *before* the flower's first opening.

If we have been smart, we have already

Removing the stamens from the pod parent, *N. ampla.*

The pod parent emasculated.

sought out a second- or third-day flower to be the pollen donor. Sometimes both second- and third-day flowers are open on the same plant, so we harvest from both. If the pollen is not visible, we check for its presence by rolling a few stamens between thumb and finger, hoping to see pollen on the fingertip and feel its distinctive "talcum powder" texture. Anthers are plucked with fingers, tweezers, or scissors and can be placed in a small container, although the palm of the hand serves for us. In some flowers, the anthers are lower on the stamen assembly than in others, so we are careful to collect the right part.

Returning to the prepared prospective pod parent, we drop the anthers into the stigma and poke them well into the nectar. Pollen can be extracted from the donor anthers or the anther tips can be removed to increase pollen concentration, possibly improving the success rate, but this is time consuming and we skip the step. We close the flower, cover it with cheesecloth, secure it with a rubber band, and tag the stem

(inset) Checking the male parent for pollen.
(above) Pollen on anthers.

Removing stamens from pollen donor ‘Cherry Bombe’.

Taking the stamens to the pod parent.

Poking the stamens into the stigma.

with the cross information. Old pantyhose also make a great cover.

Once in the stigma, the germinating, individual grains of pollen make a tube, which makes its way down through the stigmatic surface to an individual ovule within the ovaries. With the union of the pollen tube and ovule, the ovule is fertilized and becomes an infant seed. The term “seed set” refers to the successful fertilization of ovules. Waterlily carpels, appearing very similar to the sections of an orange, encase the ovaries and their soon-to-be seeds.

Happy Accidents

There are times that Mother Nature takes care of the process for us. Self-pollination

Closing and covering the flower with cheesecloth.

Securing the cheesecloth with a rubber band and tagging.

A recently set pod, stem “crooked” at neck.

A pod reaching maturity, petals and sepals removed.

occurs easily in some plants. Bees and other insects introduce pollen from other flowers for natural cross-pollination. A wonderful example of this is the result from several huge pods on ‘Enid Frase’ Frase (‘Castali Flora’ x ‘Orchid Star’), an electric medium pink, just too beautiful not to bag and collect. Although we had nothing to do with the process, we get to take credit for the resulting “chance seedlings.” Many of the nicest cultivars offered in the trade were originally chance seedlings.

From Enid’s volunteer pods have resulted some nice pinks, likely self-pollinations of Enid, including ‘Cherry Bombe,’ a deep cherry red and the pollen parent in our illustrations. Also in the batch are some lovely medium blues, probably the result of cross-pollination with the plant adjacent to Enid, ‘Laura Frase’ Frase (‘Blue Beauty’ x ‘Panama Pacific’), a perfect delphinium blue.

Letting flowers “self” or be crossed incidentally can yield wonderful surprise packages. The drawback is that the parentage can only be guessed. As in the example above, selfs and

A pod of *ampla* near maturity.

A bagged pod right at rupture, seeds floating to the top of the bag.

Seeds and the carpels that contain them from the newly ruptured pod. Most are unfertilized or immature.

Viable seeds of *ampla* x 'Cherry Bombe'.

Sprouted seeds, these of *gigantea*, so more than twice the size of the usual tropical seeds.

crosses can occur in the same pod unless the selfed flower is closed and covered to prevent further crossing by accident.

The Pod

Now we watch and wait. Within a week or so, the stem of a fertilized pod develops a distinct "crook" or coiling, setting the pod face up. The stem and its pod-laden, spent flower sink to the bottom where the pod safely develops. Maturation can take as little as 15 days and as much as eight weeks, dependent mainly on water temperature. The pod swells markedly. Unset pods soon rot off, often part way along the stem.

Once the pod has sunk well down into the water, we remove the cheesecloth and place a plastic bag perforated with tiny holes, over it, sealing it loosely around the stem. The holes allow for some exchange of gasses but won't let any seeds escape. As the pod nears maturity, we carefully remove the bag briefly to remove rotting petals and sepals so that less debris will be mixed with the seeds.

When the pod ruptures, seeds and often the whole carpel assembly float to the surface. If the pod is not bagged, the seeds float freely for a brief time and then disperse, lost to our efforts. With the pod enclosed in the perforated bag, we easily collect the bag and dump its contents into a small bucket, rinsing the bag several times to be sure we have removed all the seeds.

The tiny white, tan, or light gray seeds have not been fertilized and are not viable. Small reddish or purplish seeds are immature and are not viable. Larger dark seeds, however, which can be black, gray, brown or green, sometimes within the same pod, *are* viable. In the first day or two after collection, they float by means of a thin gelatinous coating called an aril. Soon the aril rots off and the good seeds sink to the bottom of the container. The debris can then be "decanted" by swirling and pouring off the water several times, stopping short of pouring out the heavier, viable seeds. A fine strainer is helpful to prevent accidental loss of seeds.

It is possible for pods to remain on the plant to full term, rupture normally, and not contain viable seeds. Sometimes this is seasonal, and sometimes it can be that the pod parent is essentially sterile. Some plants that are sterile as female parents make viable pollen, allowing them to act as dads.

Using *N.* 'Indian Goddess' as the pollen parent with *N. ampla* (shown on the opposite page), a crossing was made.

At this point, seeds can be planted or dried for storage. Once thoroughly dry, they can be kept for years in the refrigerator. If we will plant them, we try to do it before they sprout in water since the tiny first leaf makes them slightly buoyant and hard to anchor in soil. Michael Duff, however, hybridizer of 'Deva,' a crossing of *tetragona* species, often "sorts" out his sprouted, entangled seedlings from their clear, water-filled jars with a toothpick. Laying the individual sprout upon the soil's surface, he separates the tender root from the initial leaf with the toothpick. Using an eyedropper or water dripping from a pencil, a drop of water anchors the seedling in place for a very light sprinkling of sand over the root. Michael likes to plant each seedling in its own small margarine tub.

We plant each of the different crosses in individual containers, their size depending on the number of seeds planted therein. Often, we use a dishpan with a few inches of soil in the bottom and then filled to the top with water. We distribute the seeds, which usually sink to the soil, and dribble a thin layer of white sand over them. Water is added to the container very carefully to avoid dislodging the seeds or seedlings. When the seedlings present floating leaves, we pot them individually and fertilize lightly. The wait for the first bloom, which can be within the year, is agonizing as it just might be your very own, spectacular, new cultivar!

Kit and Ben Knotts live in Cocoa Beach, Florida.