

An Adventure in Paradise: New Developments in the Raising of Cultivars of the Giant Waterlily, *Victoria* Schomb.

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Abstract

Since the two species and hybrids of *Victoria* are thought to be annual, *V.* 'Longwood Hybrid' has to be re-created every season yet its morphological features remain distinct and uniform. This paper describes how the reverse cross, *V.* 'Adventure' was made in 1998 by a small number of *Victoria* enthusiasts working independently. This and subsequent back-crosses, thought not to be possible on account of ill-matched chromosomes, made through controlled pollination between a parent species and its hybrid progeny are all recognizably distinct from each other. A number of distinctive cultivars have been named and are distributed annually to specialist collections all over the world. This presentation illustrates the history and continuing development of *Victoria* hybrid cultivars and demonstrates what can be achieved by a group of co-operating enthusiasts who are determined to show that the "impossible" can be achieved through careful planning and experimentation.

INTRODUCTION

I'm a trainer of Lipizzan dressage horses from Cocoa Beach, Florida, and my husband Ben is a family physician. Our home is located directly on the Atlantic ocean-front. We're hobbyist gardeners with absolutely no background in horticulture or botany. Our garden is mostly (fresh) water and the ponds are filled with tropical waterlilies.

Our interest in the giant water platter *Victoria* is Ben's fault. He thought it would be fun to grow one and we built a pond especially for it. We obtained those we grew the first few years from a catalog. They were supposed to be *Victoria cruziana* but proved to be "mutts".

In the genus *Victoria* there are only two species, *V. amazonica*, from the equatorial countries of South America, and *V. cruziana*, from the cooler, more southerly countries of South America. It is easy to tell the two species apart. The pads of *amazonica* are maroon/bronze/green with low rims. *Cruziana* pads are bright green with high rims. *Amazonica* buds are maroon, squat and thorny. *Cruziana* buds are pinkish green, pointed and have few if any thorns on the sepals. *Amazonica*'s first night flowers are nearly pure white. Second night flowers are deep red. *Cruziana*'s first night flowers are creamy white, then pale pink the second night.

Though we are not convinced of this, *Victoria* is generally regarded as an annual. It must be remade and regrown from seed each year. It attains its giant size in a matter of months, flowers, fruits, declines and dies as cold or flood might dictate. *Victoria* is a night bloomer with a delicious fragrance much like crushed pineapple the afternoon before it opens and the first evening, white or cream the first night and second morning, closing for a few hours to open pink to red the second night. It does not reopen. The plant is heavily armed with huge thorns on all but the top surface of the leaf. The leaf structure is an engineering marvel, able to hold great weight and to shed water quickly.

THE FIRST HYBRID

Until the last few years, *Victoria* was cultivated almost exclusively at a few major botanical gardens, among them Kew, Missouri and Longwood Gardens. In 1961 Patrick Nutt of Longwood made the first attempt at crossing the two species. The result was the

famed 'Longwood Hybrid' with *V. cruziana* the pod parent and *V. amazonica* the pollen parent, combining the best attributes of both species and proving easier to grow than either one. For some reason, the reciprocal cross was "considered impossible" and this thought was not challenged. Wrapped in a mist of exclusivity, none of the myths about *Victoria* were challenged.

We entered the picture when a friend, Rich Sacher, (who was in touch with the tiny group of *Victoria* growers) learned that we always had seeds from our one *Victoria* without doing anything to make it happen. Myth number one exploded, that *Victoria* is protogynous, female only on the first night and male only the second night. *Victoria* self-pollinates very easily the second night in our conditions, with or without help from us.

It seems that producing seeds, especially 'Longwood Hybrid' F1, was becoming increasingly difficult for the botanical gardens and Rich suggested we give it a try. In 1998, with a *V. amazonica* from him, sprouted seeds from another source and a few tiny plants we started from seed ourselves, we embarked on our "Adventure with *Victoria*", building our large, dune-side "Reflection" pond especially for it.

At that time, little had been written about *Victoria* (and much of that was wrong) but we read what we could find. We basically just bumbled our way along, fortunate that *Victoria* loves our conditions. We didn't have a clue which flower parts were which and had to learn, not easy when different botanical authorities used different terminology. We stuck with Dr. Ed Schneider's "Floral Anatomy of *Victoria* Schomb.". With some information and moral support from the largely non-scientist International Waterlily Society e-mail group, we started making selfs of the species and crosses for "the" hybrid, 'Longwood Hybrid', in a clumsy old fashioned way.

THE SECOND HYBRID

Ignorance can be bliss. We saw no reason not to attempt the cross reciprocal to 'Longwood Hybrid' and got seeds – plenty of them! It was suggested that we name the hybrid even before we were sure the seeds were viable "just in case". We could only call it 'Adventure'. The same year, completely independently of us, the same cross produced seeds for Joe Summers at Missouri Botanical Garden and the Stylers in Colorado. We asked them if they would join us in the naming and they accepted. 'Adventure' seeds proved viable and it was first grown and displayed in 1999.

In side-by-side comparisons of plants with exact reciprocal parents and of the approximate same age, 'Adventure' is slightly larger than 'Longwood Hybrid', has slightly lower rims and has a redder undertone to the leaves. 'Adventure's flowers are slightly larger and have more petals. The second night flowers are somewhat deeper in color.

These primary hybrids are intermediate in their characteristics between the two species, each tending slightly toward its pod parent. Rims are sharply upturned like *cruziana* but are always red on the outside like *V. amazonica* and between the species in height. 'Adventure' and 'Longwood Hybrid' buds split the difference as well, in shape and number of thorns on the sepals. Flowers are neither as deep pink the second night as *V. amazonica* nor as pale as *V. cruziana*.

BACK-CROSSING

Also in 1998, because the 'Longwood Hybrid' that Rich Sacher had "thrown in" for us to grow had no real job in seed producing we decided to experiment with it and try back-crosses. These were considered even more impossible than 'Adventure' because the result would have an uneven chromosome count.

Reported chromosomes

V. amazonica – 20

V. cruziana – 24

Presumed chromosomes

V. ‘Longwood Hybrid’ – 22

V. ‘Adventure’ – 22

Back-cross ‘Longwood Hybrid’ × *V. amazonica* – 21

Back-cross ‘Longwood Hybrid’ × *V. cruziana* – 23

When seeds were produced and made plants we thought we might wind up with the Downes Syndrome children of *Victoria* but they proved to be perfectly normal appearing three-quarter species plants.

‘Longwood Hybrid’ by *V. cruziana* was named ‘Challenger’. ‘Longwood Hybrid’ by *V. amazonica*, also originated by Joe Summers in the same year that we made it, was named ‘Discovery’. In 1999, we made similar back-crosses using ‘Adventure’ as pod parent, calling the cross with *V. cruziana*, ‘Columbia’. The ‘Adventure’ cross with *V. amazonica*, and our favorite of these, is ‘Atlantis’. The ‘Adventure’ back-crosses are slightly more *V. amazonica*-like than the Longwood Hybrid back-crosses. These four are named for the fleet of Space Shuttles that usually live in our “side yard” (Kennedy Space Center at Cape Canaveral).

Though we have since satisfied ourselves that any *Victoria* will cross with any *Victoria*, we will not name any further hybrids because they begin to blur together. We also do not promote propagation of F2 or subsequent generations of the hybrids because they are inconsistent in their characteristics. Those seeds are only suitable for salad sprouts or popping. They actually make tasty popcorn.

As people learned of our serious interest in *Victoria*, they sent us more and more information, including an unpublished paper by Pat Nutt from 1961. It seems that he did attempt the cross *V. amazonica* × *V. cruziana* and obtained seeds which did not sprout. He assumed them sterile and abandoned further attempts.

GERMINATION

Other than ‘Longwood Hybrid’ which germinates fairly easily, *Victoria* seeds can be quite difficult to get to sprout. In an offhand comment about this to several friends of ours, Dr. Ed Schneider mentioned the operculum on the seed (which we had never noticed) and that removing it might improve germination. Having plenty of seeds to spare (they were no longer as rare as diamonds once we started producing them) we cut some open and – lo and behold – the embryo was right underneath the operculum! All that spontaneously sprouted through this door.

“Popping the top” has improved germination dramatically and also allows convenient timing of sprouting relative to the desired date of installation of plants. Most sprouts occur in 3-7 days from “nicking”. Random scarification is not effective. Our technique is quite necessary to germinate ‘Adventure’, ‘Challenger’ and ‘Columbia’. Though we have far larger numbers of ‘Adventure’ seeds to work with than Pat Nutt did, we too might have presumed these seeds sterile without this method.

KEEPING RECORDS

Relatively little study has been done on *V. amazonica* in the wild over any period of time and almost none has been done on *V. cruziana* in the wild. Very little information has been collected by growers of cultivated plants. For us they are like house pets. In order to answer our own questions about *Victoria*, we have collected extensive data both daily and weekly as required year-round.

<i>Year</i>	<i>Plants</i>	<i>Flowers</i>	<i>Seeds</i>
1998	7	208	18,575
1999	13	230	14,719
2000	14	188	7,722
2001	18	247	28,499
2002 (through August 26)	16	94	3,236

We track each seed that germinates through every phase of development in multiple databases. As young plants graduate, they move to different databases. Though we still struggle with growing seedlings, we can now usually predict the “behavior” of adults. There are still a few individual plants that baffle us.

For baby plants, we record details of: (a) Seed storage temperatures, (b) Method of starting, (c) Germination date, (d) Planting date, (e) Planting medium, (f) Each floating leaf date, (g) Fertilizer used, (h) Increase in pot size, (i) Location, and (j) Water temperature.

For adult plants, we record weekly: (a) Pad size, (b) Rim height, (c) Number of pads, (d) Water temperatures. As required we also record (e) Other weather events, (f) Bloom number and date, (g) Date and time of pollination, (h) From whom and to whom (so we can crosscheck viability), (i) Days to pod rupture, (j) Seed count, and (k) Pollen quality and storage.

POLLINATION

Victoria pollen is uniquely tetrad. We have found a simple way to germinate the pollen in vitro, and it often makes helical pollen tubes rather than straight ones. When incubated at 90F, the pollen germinates in about an hour and is finished in another hour.

The seed pods are like spiny grapefruit. Pod “behavior” is consistent through the ripening cycle, first “crooking” the stem, then lowering to the bottom, rising to the surface a few days before rupture. At rupture the stem descends back to the bottom very quickly, floating the seeds away from the parent in buoyant arils.

We have learned that pollen is present in the early evening of the second night, even though the stamenoids and stamens have not yet flared. This allows us to make self-pollinations and collect pollen while it’s still daylight. No more tripping through the *Victoria* thorns in the dark after several glasses of wine.

This caused us to wonder exactly how early the pollen dehisced and was viable. The answer is late afternoon; none dehisces before that. These experiments, though, led us to an idea/discovery that has virtually doubled our production of primary hybrid seeds or crossed species seeds. We had originally been limited in making crosses by the fact that we had to self the pollen donor while collecting pollen for the pod parent. Selves of the species are easy to make at times when the two are not in synch for making hybrids and there is a much greater need for hybrid seeds.

While the first night flower is still open the second morning, we remove the entire stamen assembly of stamenoids, stamens and paracarpels along with part of the carpellary appendages (a perfect emasculation). For lack of a better term we call this the “ring”. Stored for the day at 80F or more, the pollen dehisces just as if the ring was on the flower and is no less viable. Rings harvested earlier than the second morning will not ripen. Using the ring technique we are able to reciprocate pollen from the rings, making each flower both the pod and pollen parent in the crosses.

Using our original technique

V. amazonica pollen (2nd night) to self and to *V. cruziana* emasculated 1st night (pollinated 1st or 2nd night) = *V. amazonica* self and ‘Longwood Hybrid’

Using the ring technique

V. amazonica ring pollen (removed 2nd morning) to 2nd night *V. cruziana* flower (ring removed 2nd morning) = ‘Longwood Hybrid’ and *V. cruziana* ring pollen (removed 2nd morning) to 2nd night *V. amazonica* flower (ring removed 2nd morning) = ‘Adventure’

Pollen can be stored in the refrigerator for as many as five days with gradual reduction of viability. “Ripe” rings or anthers can also be shipped to other growers and will remain viable.

AFTERCARE

Over last year's high season, we developed a special nutrient package for *Victoria* which combines the usual inorganic aquatic fertilizer tablets with biostimulants and organic nutrients, with very good results. This year we are seeing all our previous growth, size and bloom records broken, having used the package from the first floating leaf stage onward. We also think we see a greater viability of seeds produced by plants well established on this program last year, so one of our primary interests for 2002 is "How important is prenatal care of *Victoria* parents?"

CONCLUSION

Where will *Victoria* take us next? Who knows! To follow our journey, join us at <http://www.victoria-adventure.org>