



Why Are There So Many Heliconia Hybrids In Puerto Rico?

By Paul Yoshioka, Past President HSPR

Members of the HSPR often report on new heliconia hybrids appearing in their gardens. Examples include Sherry Ballester's 'Coral Surprise', a possible hybrid between *Heliconia champneiana* and *H. librata*, and the various hybrids between varieties of *H. bihai* developed by Judy Nelson. The appearance of hybrids are especially interesting because Berry and Kress (1991) list only 10 hybrids among the 89 species in their book. This raises the question, "Why are heliconia hybrids so rare in nature but relatively common in the gardens in Puerto Rico?" Are environmental conditions in Puerto Rico especially advantageous for hybridization? One way to address these questions is to examine barriers to hybridization, and how such barriers are affected by the Puerto Rican environment.

Barriers to hybridization between plants can be placed into two general categories; (1) "pre-zygotic" factors involving cross pollination between species, and (2) "post-zygotic" factors relating to the germination and growth of hybrid seeds and seedlings. Although post-zygotic factors are undoubtedly important (e.g., the care that

HSPR members give to their seeds and seedlings), I will only discuss pre-zygotic influences in this report.

There are several pre-zygotic barriers preventing hybridization between heliconia species. Pollen of some species may not fertilize the ovules of other species because of biochemical incompatibility (Berry and Kress, 1991). Also, many heliconias flower in different seasons. For instance, hybridization between *H. angusta* 'Holiday' and *H. caribaea* is improbable because *H. angusta* flowers around Christmas while *H. caribaea* flowers in spring/summer. The opportunity for hybridization may be even further reduced because differences in flowering seasons may not be random but staggered (i.e. more separated compared to random expectation) as demonstrated by Stiles (1977).

Because hummingbirds are the only known cross pollinators of heliconias in the Americas, the biology of hummingbirds greatly affect hybridization between heliconias. Some hummingbird species (or sexes) have long curved bills while others have short straight bills. For example, females of the purple throated carib hummingbird of

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Dates to Remember

- HSPR Meeting, 9:30 am, Sunday, September 7, 2003. Hacienda La Delfina, Mariacao, PR.
- Heliconia Society International Conference, August 3-7, 2004, San Juan, PR.

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St. Lucia have long curved bills while males have short straight bills (Temeles et al., 2000). In correspondence, the 'Emerald Forest' variety of *H. bihai* has long curved flowers while *H. caribaea* in St. Lucia has short straight flowers. Hybridization is thus prevented because female and male birds feed only on *H. bihai* and *H. caribaea*,

respectively. The situation is even more complicated in areas of St. Lucia where only *H. bihai* occurs. In such areas another (unnamed) *H. bihai* variety with short



The author showing different forms of *Heliconia caribaea* with Judy Nelson watching.

straight flowers is found, and is pollinated by male hummingbirds (Temeles & Kress, 2003). A parallel situation occurs in Dominica where the red varieties of *H. caribaea* (e.g., 'Black magic') have long curved flowers, while the yellow (e.g., 'Cream') varieties have short straight flowers. As a result, differences in flower shape may prevent cross pollination by hummingbirds even between varieties of the same heliconia species. Differences in hummingbird feeding behavior can also affect hybridization. Some hummingbird species (or sexes) are territorial, feeding only on flowers of a single plant, while others are "trapliners" going from plant to plant (Stiles, 1979). Territorial and traplining hummingbirds would then decrease and increase chances for hybridization, respectively.

Finally, hybridization cannot occur if heliconias are not growing together. Berry and Kress (1991) downplay this possibility, stating that "the sparsity of natural hybrids exists in spite of the large number of species that grow together in the same habitats and share the same pollinators". Kress et al. (1999) estimate that about 220 heliconia species exist. However, the more relevant information involves the number of species that actually "grow together" in nature.

HYBRIDIZATION IN PUERTO RICO

How are the preceding considerations affected by conditions in Puerto Rico? Biochemical incompatibility between pollen and ovules is probably unaffected. Although chemicals produced by plants are known to vary with environmental conditions (e.g. the induction of chemical defenses to deter insect pests), I am unaware of examples involving pollination. Although flowering seasonality may be affected by conditions in Puerto Rico, this effect is probably minor. For instance, *H. angusta* and *H. caribaea* probably flower around Christmas and spring/summer, respectively, whether they are grown in Puerto Rico, Costa Rica, or Hawaii. Without question, the hummingbird pollinators of Puerto Rico differ from those in Central/South America and several other islands of the Caribbean. Thus, it is possible that heliconias not sharing the same pollinator elsewhere (e.g., Costa Rica) may have the same pollinator here in Puerto Rico. Given the lack of knowledge about hummingbird-heliconia interactions in Puerto Rico, it is impossible to evaluate this effect, at least directly. Finally, the greater number of heliconia hybrids appearing in Puerto Rico may reflect the larger number of species growing together in Puerto Rican gardens compared to natural situations. For instance, the parents of Sherry Ballester's 'Coral Surprise', *H. librata* and *H. champneiana*, do not grow together in nature (Central Mexico versus Belize, Honduras, and Guatemala, respectively).

Species lists of heliconias for various countries provide estimates of the maximum of species that may grow together. Among values available in the literature are Costa Rica: 37 species (Daniels & Stiles, 1979), and Colombia: 99 species (Kress et al., 1999). However, the number of species actually growing together in these countries is considerably less.

Daniels and Stiles (1979)



'Maya Sunrise', a new hybrid of *Heliconia champneiana* discovered by President Sherry Ballester.

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found an average of about 5 species growing together in a given area in Costa Rica. I used distributional maps in Kress et al. (1999) to estimate the number of heliconia species growing together in Colombia. Numbers of co-occurring species averaged 15.3 and ranged up to 49 (*H. hirsuta*). These values are easily surpassed in Puerto Rican gardens. Kelly Brooks, Germán Charrón and several other HSPR members have more than 100 species, and most members probably have more than 15 heliconia species in their gardens. Thus, there is undoubtedly a greater chance of hybridization in Puerto Rican gardens compared to natural areas in Colombia or elsewhere.

The effect of the greater number of heliconia species growing together in Puerto Rico on hybridization should not be underestimated. The following example illustrates the magnitude of this effect. Assume that 1 hybrid results from 10 species growing together in nature compared to 15 hybrids from 50 species in a Puerto Rican garden. At first glance hybridization rates appear higher in Puerto Rico (15/50 or 30% compared to 1/10 or 10% in nature), suggesting that "something different" is increasing hybridization in Puerto Rico. This is an erroneous conclusion. The correct way of assessing hybridization rates is the number of hybrids relative to the potential number of hybrids (not the number of species). As shown in Table 1, the number of potential hybrids increase disproportionately to the number of species. For example, with 2 species (e.g., species A and species B) there is 1 possible hybrid, AxB (equivalent to BxA). When the number of species is doubled (to 4 species), the number of possible hybrids increases six fold (AxB, AxC, AxD, BxC, BxD, and CxD). Thus, 1 hybrid from 10 species gives a hybridization rate of 1/45 or 2.22%, while 15 hybrids from 50 species gives a rate of 15/1225, or 1.22%. In other words hybridization rates in Puerto Rico may be lower than natural rates. This effect is simply overwhelmed by the greater number of species growing together in gardens of Puerto Rico. Thus, there is no evidence to indicate that the pollinators of Puerto Rico (or other factors) are more effective in the hybridization of heliconias compared to natural situations.

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Number of Species	Potential Number of Hybrids
1 (e.g., A)	No hybrids possible
2 (e.g., A, B)	1 (AxB)
3 (e.g., A, B, C)	3 (AxB, AxC, BxC)
4 (e.g., A, B, C, D)	6 (AxB, AxC, AxD, BxC, BxD, CxD)
5 (Costa Rica average)	10
10	45
11 (Costa Rica max)	55
15 (Colombia average)	105
49 (Colombia max)	1,176
50	1,225
100 (Gardens of Puerto Rico)	4,950

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HSPR

*Promoting Zingiberales in
Puerto Rico since 1996.*



The Heliconia Society of Puerto Rico, Inc. was founded in 1996. The objectives of the society are to stimulate and promote the enjoyment and understanding of Heliconia and related plants of the order Zingiberales through education, research and communication, and to interact with the Heliconia Society International and other institutions which share similar interests, purposes or objectives.

From Our Last Meeting

Visitors to our last meeting included Professor Salvador Alemañy from the UPR-Cayey, Mr. Crafton Clift, a plant expert from Florida and new neighbor of the Brunner's in Maricao, Mrs. Carmen Iris Ruíz, florist and cut flower producer, and Dr. Gilberto Santana and Mr. Luis Bonilla, both with interest in heliconias.

The President reminded all members to please make sure their membership payments are current, and brought an updated list so that we could check our status. We were also reminded to donate pendant heliconias for plantings at the Mayaguez Zoo and the UPR-Cayey Campus.

The President presented a new heliconia cultivar, 'Maya Sunrise', which she grew from seed. It is possibly a natural *H. champneiana* hybrid, and has yellow-orange bracts which become reddish with age (see picture on page 2).

The possibility of producing a website for the Heliconia Society of Puerto Rico was discussed, and members were very receptive to the idea. An estimated cost of \$1,000 was given for the project, and a Website Committee was selected. The committee consists of Dr. Salvador Alemañy, Mr. Héctor Méndez Caratini, Dr. Bryan Brunner and Mrs. Delia Pescador.

Dr. Salvador Alemañy mentioned that there is interest in publishing information about our society in the section "Por Dentro" of El Nuevo Día, and requested a summary about the HSPR for use in an article. Mr. Héctor Méndez Caratini offered to communicate with a member of the press to invite them to one of our meetings.

The meeting ended with a delicious lunch and a tour of a truly outstanding collection of heliconias in a beautiful natural setting.

President's Corner

Our June 2003 meeting was in Jayuya, at the farm of Dr. Sergio Tejedor. There we were given a tour of one of the biggest heliconia collections in Puerto Rico. There was, for example, a hill completely planted with *Heliconia chartacea* 'Sexy Pink', most of them in bloom, and another with two forms of *H. griggsiana*. Plants whose flowers I had seen only in pictures were there in full bloom, like the beautiful *Etilingera venusta* and the milky white form of *E. elatior*. There were also different cultivars of *H. caribaea*, and some rare heliconias from Colombia and Ecuador. Although we did not have a formal lecture at this meeting, the tour was very educational for all of us. We are very, very thankful to Dr. Tejedor and his wife Nancy for their time and generosity, and for the incredible, delicious feast at lunchtime.

Our next meeting will be Sunday, September 7, in Maricao. It will be hosted by Guillermo Oliver and his daughter María Adela at their Hacienda La Delfina, home of 'Orquídeas Delfina'. We hope to start at 9:30 am. A map is included for those who have never visited La Delfina before. Our lecturer will be Arnaldo Astacio, and he will educate us all on the new laws and regulations of the Department of Agriculture concerning ornamentals.

We are planning "pot luck" lunch this time, where everyone can bring something to share with the rest. Whether it is a salad or refreshments or a dessert of some type, anything is welcome. Give me a call (827-3121) with suggestions. We also suggest you bring your own chair if you can, and good walking shoes and maybe...rainwear. Remember: it's rainy season in Maricao. Our last plant raffle was a big success. Let's repeat it! Please donate at least one plant for the raffle. Remember: we need some extra funds for our website.