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Cover photographs. Front: Peeled fruit of *Bromelia plumieri*. Photograph by Robert Guess. Text on edible *Bromelia* fruit begins on page 51. **Back:** *Neoregelia* 'Hannibal Lector', an unusual new hybrid. Photograph by Chester Skotak.

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Edible Fruits of *Bromelia plumieri* and *Bromelia pinguin* from Chiapas

Virginia Guess and Robert Guess

"¿Quiere probarla?" chants the smiling vendor as she raises her voice to pierce the noise created by the throng of Saturday shoppers. In concert with this invitation to sample her wares, she extends an arm from behind rows of carefully displayed tropical foods. In her hand, she holds a small, glossy, magenta and white fruit encouraging passersby to taste it.

In this bustling, outdoor-market of San Cristóbal de Las Casas, not everyone is familiar with these spindle-shaped *piñuelas*, a seasonal treat that campesinos bring from the lower altitudes of the tierra caliente to Highland Chiapas. Aficionados of bromeliads, however, will recognize these otherwise mysterious-looking morsels as the edible fruits of *Bromelia plumieri* (E. Morren) L.B. Smith, a synonym of *Bromelia karatas* Linnaeus.

Those sold in this market come from the woodlands and savannas of the Central Depression of Chiapas, in the Municipios of Acala and San Lucas where altitudes range from 400 to 460 meters. There, large patches of *B. plumieri* with green leaves over two meters long and armed with sharp spines, nestle in the shade of banana, zapote, and chicozapote trees. Each plant produces a sessile inflorescence, up to thirty centimeters in diameter, surrounded by loosely arranged, scarlet-colored leaves. Approximately one hundred fruits, with an average length of eight centimeters and covered by a woolly layer of brown hairs, develop deep within the tall, spreading rosette. The species occurs in dense aggregates continually enhanced by vegetative offsets, or as single plants from seeds dispersed by small animals that feed on the fruits.

The campesinos from this region do not systematically cultivate *B. plumieri*. Instead, they harvest them opportunistically by searching through clusters of plants near the beginning of the dry season in early December. After carefully cutting away the spiny, exterior leaves to reach the inflorescence, they pluck the ripening fruits, wipe away the hairs to expose the skin, and pack them into wooden crates which are then transported by truck or bus some one hundred kilometers to the market in San Cristóbal. Once there, vendors purchase a full crate or two from these itinerant gatherers, and then resell them in the measure of a *cubeta* (small, plastic bucket holding some twenty to thirty fruits) for five pesos, the equivalent of nearly fifty cents in United States currency. The availability of *piñuelas*, limited to three or four weeks each year, depends entirely on the campesinos who bring them to market.

Piñuela is a derivative of the Spanish word for pineapple, piña (Bennett 2000). This generic epithet, used throughout Mesoamerica, refers to the edible fruits coming from several bromeliads that taste like pineapple, or whose leafy

Figure 1. *Bromelia plumieri* forms an impenetrable property barrier near La Trinitaria, Chiapas (altitude: 1450 meters.)

Robert Guess

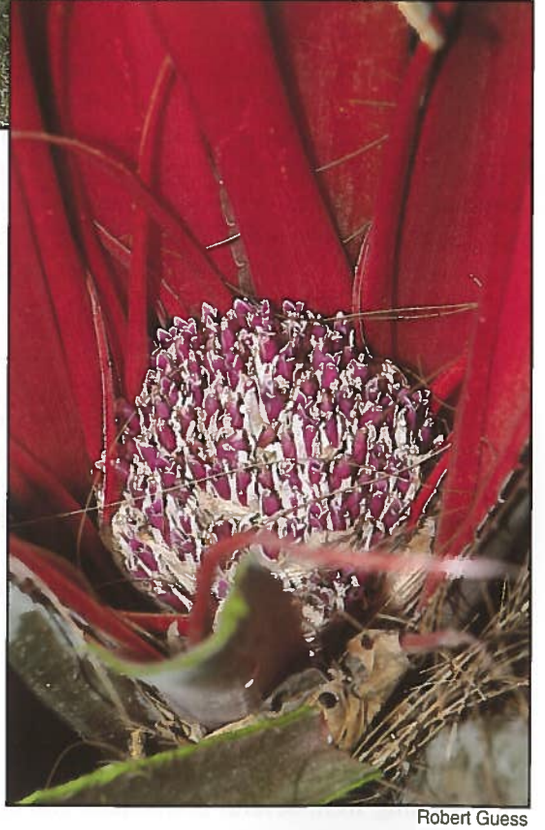

Figure 2. Sessile inflorescence of *Bromelia plumieri*, deep within the plant's spreading rosette.

Robert Guess

Figure 3. Fruits of *Bromelia plumieri* (piñuelas) for sale in the market of San Cristóbal de Las Casas. From top to bottom: guayabas, chicozapotes, zapotes amarillos, piñuelas, and guajes.

Robert Guess

Robert Guess

Figure 4. *Bromelia pinguin* along the highway near Abasolo, Chiapas (altitude: 1325 meters).

structure resembles the spinose-serrate blades of *Ananas comosus*.

The *piñuela* of *B. plumieri*, packed with seventy to a hundred small, hard, black seeds, is rather inconvenient to eat. Those who consider it a delicacy consume the meager amount of pulp and juice in several ways. Most, first gently squeeze it to soften the inner pulp, and then puncture the skin by biting through the surface in order to suck the juice directly through the small aperture. Others peel the fruit like a banana, starting at the stem-end; eat the soft, white pulp; and expectorate the seeds. Some prefer to combine the citrus-like juice with that of other tropical fruits to make a savory punch. All agree, however, that if they consume too many, the acetic juice irritates their tongues and mouths.

Another *piñuela* comes from the erect inflorescence of *Bromelia pinguin* Linnaeus. In contrast to the relatively soft-skinned fruits of *B. plumieri*, these have thick, leathery rinds; are yellow and ovoid-shaped with the longest dimension averaging about four centimeters; and develop on a stalk in numbers of fifteen to thirty. To alleviate the irritation of the mouth, they are frequently roasted or boiled rather than eaten raw. Although the *piñuelas* of *B. pinguin* are used as a vermifuge and sedative, they are not as readily found in markets as those of *B. plumieri*.

The leaf color of *B. pinguin* appears to be extremely variable depending on the growing environs. In Chiapas, this species ranges from sea level along the Pacific Coastal Plain (including the Soconusco region), throughout the Central Depression, and into the lower altitudes of the Central Highlands. The plants observed in the Soconusco have the expected green leaf color often tinged with red. In flowering plants, however, the inner leaves surrounding the inflorescence, like *B. plumieri*, turn a dramatic crimson. Outer leaf coloration intensifies in most plants growing at higher altitudes (1500 meters) where they are exposed to constant, harsh sunlight. Along a well-traveled highway (MEXICO 186) linking San Cristóbal with Palenque, for example, hundreds of *B. pinguin* with brilliant red leaves form stunning hedgerows around houses and fields in the highland community of Abasolo. In sharp contrast, Hallwachs (1983) reports that *B. pinguin* found in densely shaded areas of Costa Rican forests produce more subdued, blue-tinted leaves.

Near estuaries along the Pacific Coast of Chiapas, residents often transplant individual plants of *B. pinguin* among coconut trees at the water's edge to sustain the bank, as well as to demarcate property boundaries. In addition, they use the fiber from the leaves for cordage in making nets, and occasionally decorate churches or shrines with their flowers. According to Spencer's (1981) observations in Puerto Rico, some of the islanders even consume the inflorescence of *B. pinguin* as a vegetable.

Bromelia, as a genus, ranges widely throughout Mexico, Central America, the West Indies, and parts of South America where it typically grows in the understory of tropical deciduous forests. These large terrestrial plants are

noteworthy for their heavily-armored spiny leaves, strong leaf fibers, edible fruits, and purported medicinal properties. Their common use as protective barriers is widely acknowledged (Bennett 2000). Nearly fifty species in this genus are known, but only three grow in Chiapas: *Bromelia hemisphaerica* Lamarck, *B. pinguin*, and *B. plumieri* (Utley and Utley 1994). Of the three, *B. pinguin* and *B. plumieri* are more widespread, often found growing side-by-side in hedgerows.

These two species of *Bromelia*, along with *Ananas comosus*, were among the first bromeliads introduced into Europe from the West Indies in the sixteenth century. However, only the pineapple appealed to European palates, leaving the more exotic fruits of *B. plumieri* and *B. pinguin* to be savored closer to their origins. Today, local residents with acquired tastes for *piñuelas* continue to enjoy them where they thrive in their natural habitat, or wait for their seasonal appearance in the markets.

ACKNOWLEDGMENT

Our thanks to Susanna M. Ekholm for presenting us with our first *cubeta* of *piñuelas* from *B. plumieri* on Christmas Day, and to Dr. Barbara Voorhies for information on the use of *B. pinguin* along the Pacific Coast of Chiapas.

REFERENCES

Bennett, B. 2000. Ethnobotany of Bromeliaceae. In Bromeliaceae: Profile of an Adaptive Radiation, D. H. Benzing. U.K., Cambridge University Press, p. 587-608.

Hallwachs, W. 1983. *Bromelia pinguin* and *B. karatas*. In *Costa Rican Natural History*, edited by D.H. Janzen. Chicago, University of Chicago Press, p. 195-197.

Spencer, M. 1981. Bromeliads: Edible and Therapeutic. J. Bromeliad Soc. 31(4):147-151.

Utley, J.F. and K. Burt-Utley. 1994. *Bromelia*. In flora Mesoamericana, Volumen 6, Alismataceae a Cyperaceae, edited by Gerrit Davidse, et al. México, Universidad Nacional Autónoma de México, p. 148-150.

Santa Barbara, California

Figure 5. Developing inflorescence of *Bromelia pinguin.*

Robert Guess

Figure 6. Portion of a fruit-laden stalk of *Bromelia pinguin.*

Robert Guess

Thoughts on Show Arrangements and Judging

John Arden

The following are some of my thoughts regarding the horticulture section, which is the backbone of any bromeliad show. The S.F. Conference was a great success, but I did hear criticism aimed at the show schedule and judging. I had three entries in the show myself. All received Award of Merit. One of them was chosen as Best in Show - Horticulture. Another was judged Best of Decorative Containers Division, section all Decorative Containers, class Man-made Material. I understand the Best in Show title, but the other award does not make any sense to me at all.

Judging rules for bromeliad shows should be simple and understandable to growers. Presently we have a complicated system understood by only to a few people, mostly the judges that are trained for this. What happened to the simple ways we displayed our plants and judged them before? Lately world shows have had some new changes, but I don't feel the changes were for the better.

All books and catalogs list plants by genus, not by single specimen plant, multiple specimen, etc. If this is considered a good way to group plants, the taxonomists and every body else would be using it.

Present judging rules have been written by a flower judge. These rules do not represent the ways bromeliads should be judged or displayed. Perhaps it would be best to keep judges out of decisions as to how a show should be displayed and arranged. Instead, they should be trained to be able to judge any way a show has been staged and any way the plants are displayed. Simplicity is the answer! All a bromeliad grower should have to know is the name of the plant to enter it in a show.

Awards are presently given in the horticulture division for individual specimen plant, multiple ... and who knows what else. These terms do not make any sense to anyone but the judges. The goal of judging should be to select the best *Tillandsia*, *Vriesea*, *Neoregelia*, or whatever. These are terms that make sense to all bromeliad growers. I like to see plants from one genus assembled at one place and not scattered around all over the showroom, as it is now. I like to compare them against each other and see what one genus has to offer. The Handbook permits placing the plants by genus after judging is completed if so desired. Why not place them by genus, where they belong, before judging and save all this work and confusion later?

I usually enter plants in 2 or 3 local shows a year. These societies use a simple schedule, older than the BSI schedule, and plants are judged and displayed by genus. The members are happy with this arrangement and would

not change for anything else. The BSI system was tried for a year and was dropped because of member dissatisfaction. The only thing these societies use from the BSI Handbook is the point system. The shows are judged mostly by BSI judges. They have no problem judging these shows as they are arranged. Sadly, the judges involved do not receive credit for judging them however, even if they are judged by the BSI point system. There is also a conflict of interest involved. Judges should not be involved in any way when it comes to writing the schedule. Judges should do the judging and nothing but the judging!

There are those who say that we need a standard show schedule. What should this schedule include? Would you accept someone else's views? Or are you one of those who wants a standard schedule, as long as they are the standards you want?

There is nothing standard about a so called Standard BSI Show Schedule. The handbook lists 3 different variations of schedule; A, B and C. The one that bromeliad growers like the most, the one by genus, is not even there. In addition, there are minimal requirements, that can change everything considerably again. Nothing is gained by creating a standard bromeliad show. There is nothing standard about all the bromeliad societies in the world in the first place. Some are big, some are small, some are active, some are not. Also the plants themselves vary from one location to another because of climate and cultural conditions. Different societies have different views, goals and interests. They should have the freedom of choice to do things as they please. If standard shows is such a good idea, every plant society would be using them.

BSI is an international society with affiliates around the world. Most affiliates outside the U.S. were ignored when it came to writing the rules and regulations for shows and judging. Is it fair that we should dictate to the whole world how they write their schedule and arrange their shows, before we have a clear view and universally agreed way of doing this among ourselves? There just is not a standard schedule possible for every one, and quite frankly, nor is one needed. What we need is a standard judging system. It's the point system that determines the winners and the outcome of the judging, regardless of how the show was set up and plants displayed. By allowing bromeliad societies to arrange their annual or local shows any way they wished, there would not be the divisive problems associated with telling anybody how they should go about to set up their own show. Perhaps the world conferences could be an exception.

Pots do not get judged, but there is so much fuss as to what's allowed in the so-called standard container part of the show. It's not fair to force exhibitors to enter in the decorative container division just because of a glazed or somewhat fancier container. The decorative pot division should be for those who *choose* to enter there and have their exhibit prepared for this purpose only. I have heard comments that if decorative pots were allowed in the horticulture division, exhibitors would start using them all the time. What would be wrong with that?

Would not this be wonderful !!! If you go to a cactus and succulent show, you can't help noticing all the nice ceramic pots. They are not required to be entered in some kind of decorative pot section. Pot and plant becomes an exhibit and is judged as such, or the pot can be ignored and plant judged by itself.

Judges seem to have a somewhat different view of the world than most bromeliad growers, perhaps because they have been trained and influenced to see things in a different way. However, it's the growers who are responsible for the success of a show and we should start listening more to what they think and what they have to say.

The first handbook came out in 1982 and was followed by a revised edition in 1987. In addition, changes have been periodically published. Several years ago there was talk about rewriting the handbook again. Different versions have been tried at the world conferences. It's difficult to follow all the changes. I have not noticed any simplification or improvement that they have produced over the years.

I believe the handbook has done more harm than good to the BSI. After 18 years, there is still not universal agreement as to its content. Reasonable suggestions, forwarded to the powers-that-be, never seem to get implemented nor is there any feedback been given as to why they could not be. Whether true or not, the impression created for many is that the people involved are not listening to anyone and not accountable to anyone. They may well be hard-working, dedicated people who believe strongly in what they are doing, but it seems to me that what they have been doing is not working. I can think of no other aspect in which there is such a wide difference of opinion between the BSI and many of its affiliates, and as much of a cause for hard feelings.

I believe we already have everything needed to successfully do a good job. What we seem not to have are people working on the handbook who will listen to alternative ideas and give them fair and impartial consideration. We should no doubt thank those who have put so much time and effort into the handbook, but perhaps that's the root of the problem. It may have become too personal for them. At this stage we would be better served by people who would be more responsive to the affiliate's concerns. I think the time has come to recognize that the BSI Standard Show as currently envisioned is not a "one size fits all" situation and put language in the handbook that would allow affiliates to write their own schedule and allow judges to use the existing point system to judge the shows.

Vista, California

The Bromeliads of Merritt Island

Lynne Fieber

One weekend in mid-January, my husband and I traveled to Brevard County, Florida. It was beautiful 60° F. weather, much warmer than a few weeks prior when several cold fronts in quick succession had resulted in numerous nightly frosts. I spent one day in the Merritt Island National Wildlife Refuge. The refuge's better-known neighbor on Merritt Island is the Kennedy Space Center. The Vehicle Assembly Building serves as a convenient landmark for the region.

Apparently the county commissions just north of Palm Beach County heeded the lessons of unplanned growth in Palm Beach, and lobbied effectively for the creation of protected coastal lands. Merritt Island and the lands surrounding the space center for miles reflect the philosophy of protecting Florida's natural areas, consisting largely of federal, county, or city parklands. Merritt Island contains what was once the last refuge of the dusky seaside sparrow, believed extinct since the mid-1990's. Decades of poor water management practices in the sparrow's formerly far-ranging habitat compromised the population beyond its ability to recover.

The large refuge consists of 140,000 acres. A popular way to enjoy the park is to bird via car, in which a birding devotee drives until they see a creature of interest. They then pull over and hop out with binoculars and birding guide in hand. Using this procedure I was able to add skimmers, a snail kite, ruddy ducks and both white and blue morphs of the reddish egret to my weekend birding list. These birds were just my highlights among the hundreds of birds I saw in the refuge that day.

There are also a couple of worthwhile and easy hiking trails in the refuge, located only a few hundred feet from the Visitors Center. From my car I could see that *Tillandsia usneoides* and *T. recurvata* were prevalent in the branches of mature trees of the wetland-fringing hammock, but it wasn't until I started walking the hammock trails that I was rewarded with the sight of the other conspicuous *Tillandsia* species of Merritt Island: *T. setacea* and *T. utriculata*. Although cocoplum, gumbo limbo and other native trees familiar to South Floridians were present, wild oak trees characterize the hammock.

T. utriculata was in every wild oak, often 10 or more mature or nearly-mature specimens per 40-foot tree. Many sported spent bloom spikes, indicating they had reached maturity and had or were about to disperse seed. Seedlings were even more numerous. To this casual but interested observer (I climbed no trees!) these plants appeared free of the Mexican weevil, *Metamasius callizona*, that is decimating *T. utriculata* populations in the state, including elsewhere within Brevard County and in areas south of Merritt Island's location. I examined as closely as I could each plant that I encountered lying on the ground near the

trail. Trying to examine without damaging the plant, I found that they all appeared intact, without damage to the bases of the leaves. It was likely that the bromeliads had fallen due to their attached branches having fallen from the parent tree.

What is protecting Merritt Island's *T. utriculata* from the weevil? Is it that the refuge is uninhabited and far from the reach of vermin dwelling in the closest private collection? Is it that the weevil has a hard time bridging the gap between the mainland and the island refuge? Is the weevil there, but not yet numerous enough to cause noticeable damage? I don't know if scientists studying the weevil have hard data to support these or any other hypotheses.

Of course, ferns, orchids and the occasional wild hog were also on the agenda that day in the refuge. *T. utriculata* and a couple of my favorite bird species made the trip special for me, but whatever your wildlife interest, Merritt Island has something worthwhile for you to see. Due to the recent lack of rain, the trails are dry and easy to negotiate. The ocean's proximity brings cooling breezes. It's only 4 hours by car from Miami, and there are other interesting attractions in the area. As one of our BSSF (Bromeliad Society of South Florida) members is fond of saying, "time passes". It's an unpleasant thought that *T. utriculata* might go the way of the dusky seaside sparrow in Florida. To ensure that you don't miss a truly beautiful enclave of this stately bromeliad, consider a trip to Merritt Island soon.

Miami, Florida

For those who might be interested in seeing Merritt Island while attending the World Bromeliad Conference in St. Petersburg in 2002, Merritt Island is located near Titusville, on the Atlantic Coast of Florida, approximately 145 miles (under 3 hours) from the hotel in St. Petersburg....[CHB}

Some of my Best Friends are Bromeliads

Jack Burton Grubb

One thing about airports. While you're waiting to go to strange places, your mind tends to wander to strange places itself. A few years ago while on my way to speak to the Corpus Christi Bromeliad group I arrived at the airport carrying my morning paper intending to read it during the flight. While waiting in the lobby for my flight to be called, I had placed the newspaper on my seat and had sat down with my carry-on baggage at my feet. A lady sitting across from me looked over and asked, "Excuse me Sir, are you reading that newspaper?" I glanced down at it, looked back at her, and couldn't resist responding, "No Ma'am, that's a trick I haven't learned yet."

Having by now already alienated one fellow passenger, my mind wandered off in another direction. Have you heard that statement that people tend to look like their dogs...or vice versa? I started to think about how some people remind me of their bromeliads. Not that they look like bromeliads, mind you, but how some of the characteristics of bromeliads could be ascribed to different people.

For example, how many "vrieseas" do you know? People who remind me of vrieseas are some of my closest friends. They can be plain and not so colorful most of the time, but when you give them a chance to bloom they can be counted on to be bright and reliable. They never fail, they're there when needed and give us a needed lift at just the right time. Still other "vriesea people" tend to be colorful most of the time, though not necessarily any more colorful in their prime. I'm thankful for the "vriesea people" in my life and their presence makes me smile.

Then there are the "aechmeas". What a diverse group they are. Every imaginable shape and character is present. Some are tall and thin, others short and fat, and still others range just about everywhere in between. Some are colorful, some are plain but all are a bit rough at the edges. When they bloom, some stand proud and erect while others slouch down and seem embarrassed to be noticed. There's a wide range of colors and other characteristics in aechmeas and, like many people, they often have a tough exterior yet can be a lot more delicate than they seem.

Then there are the "tillandsias." Wow! What can you say about tillandsias? I don't think I've ever seen one that hasn't been interesting, fascinating, unpredictable, attractive, curious and yet, just a bit strange. They have so much to offer just as they are, and yet they bloom too. It's always a pleasure to meet a new tillandsia.

And the "billbergias?" Talk about enigmas. They are the backbone of our societies and whether they are pretty or ugly, you just have to love them. In some ways they remind me of my first blind date. You couldn't exactly call her pretty and you wouldn't necessarily say she was ugly. She fell somewhere in between...you might say she was pretty ugly. Still, billbergias are the most dependable of all. They bloom regularly and when needed. They are colorful and consistent. When one fades, there's always another one ready to spring forth and reward us, and they are always ready to propagate.

Have you ever met a *Puya raimondii*? They are tough, aloof, alone and live with their heads in the clouds. They hang around for about 35 years before they finally do something. My wife says she married one.

How about a *Bromelia serra*? Boy they get you coming and going. You reach out and try to help one of them and they grab you. You're the one that usually gets hurt before you can disengage yourself from an encounter with one. But still...gosh they're pretty in flower!

The "neoregelias" of life are really special. They come in many shapes and colors, and there's always a certain dash about them. Even if sometimes unpredictable, the unpredictability usually results in a pleasant experience. They're easy to cultivate as friends and always ready to offer a cup of cheer.

That's the nice thing about bromeliads...and people. There are many kinds, and almost all are a joy to be around, even if you get stuck a few times.

Mandeville, Louisiana

Additional Information on the Cultivar Registry Update

An article by the Cultivar Registrar in volume 51 (1):9, [the January-February 2001 issue] of the Journal informed readers that the update to the Cultivar Registry could be obtained by either downloading it from the BSI Web site or by sending a large, self-addressed, stamped envelope to BSI Publications. The Publications Chairman has informed us that he has been receiving standard-sized business envelopes with 34 cent postage stamps. The update is too large to fit into those envelopes and weighs too much to be sent at that postage rate. Please request the update by contacting the Publications Chairman, George Allaria, at the address shown on page 64 instead of sending an SASE.

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Contact George Allaria, BSI Publications
2265 W. 239th St.
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Pollinators in *Cryptanthus*: a Hypothesis

Ivón M. Ramirez M[1].

Pollination is the transfer of pollen grain to the stigma (Proctor et al. 1995). Subsequent events are related to fertilization such as germination of pollen grain in the stigmatic surface and fertilization of the ovule. The transference of the pollen grain could be carried out by different means: air, water, insects or vertebrates.

In Bromeliaceae, there are several pollinators reported as well as visitors. Johow(1898) reported hummingbirds as pollinators in *Puya* species in Ecuador. Others (Knuth, 1904; Harms, 1930) listed bees, bumble bees, moths, and butterflies as visiting bromeliad flowers. Vogel (1969) has carried out detailed studies of pollination in *Vriesea* and *Encholirium* by bats. Siqueira Filho (1998) reports *Euglossa cordata* and *Melipona scutellaris* as main visitors of *Hohenbergia ridleyi*. Ramirez *et al.* (2000) report *Apis mellifera* as a potential pollinator for Hechtia schottii. No pollination studies have been reported for *Cryptanthus* species.

There are the so-called pollination syndromes, formed by a group of plant characters, mainly floral characteristics upon which pollinators can be predicted. Thus, white odorless or fragrant flowers, with open corolla and exerted anthers and stigma, or small and fragrant flowers, with inserted stigma and anthers, pollen and/or nectar as reward and diurnal anthesis, could be pollinated by bees. *Cryptanthus* flowers fit this syndrome and based on other plant characters, hypotheses are here proposed.

The genus *Cryptanthus Otto* and A. Dietrich, with 45 species, is one of the largest genera in the Bromelioideae, a subfamily composed of 26 genera (sensu Smith and Downs, 1979) and ca. 700 species (Luther and Sieff, 1996). I recognized the same two subgenera first proposed by Mez(1896). The investigation indicates that additional characters involving geography and ecology further distinguish these two subgenera.

Subgenus *Cryptanthus* includes five sections and is defined by andromonoecy, a simple erect stigma with spreading lobes and fimbriate margins, flowers that tend to be odorless, oblong or narrow elliptic, reflexed petals, exerted anthers and stigma, reticulate pollen and relatively few and large seeds per fruit (ca. 8). Members occur from sea level to 700 m elevation, in wet forests, restingas, and caatingas, in the States of Rio de Janeiro, Espirito Santo, Minas Gerais, Bahia, Sergipe, Pernambuco, Paraíba, and Goiás. Leaves feature a succulent central section attributable to a many layered hypodermis.

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Ivón Ramirez

Figure 7. *Cryptanthus warasii* E. Pereira. Close up of foliar surface of a dried leaf.

Ivón Ramirez

Figure 8. *Cryptanthus zonatus* (Vis.) Beer. Transversal bands formed by foliar trichomes.

Ivón Ramirez

Figure 9: *Cryptanthus roberto-kautskyi* Leme in the type locality in the Brazilian State of Espiritu Santo. Notice the transversal abaxial foliar bands formed by the differential organization of trichomes.

Subgenus *Hoplocryptanthus* includes four sections, and is defined by hermaphroditism, simple erect stigmas [with lobes very short and almost connate, that form a truncate stigmatic surface], and usually fragrant flowers. The corolla is campanulate or almost flat, petals are orbicular or wide elliptic, anthers and stigma usually included, pollen with a smooth or finely reticulate surface, and numerous seeds per fruit, sometimes (*C. schwackeanus* Mez) up to 40. Members inhabit wet forests from 700 m up to "the campos rupestres" [high altitude grasslands] at 2000 m, in the States of Minas Gerais and especially Espirito Santo.

With respect to pollination syndromes however, the inflorescences of *Cryptanthus* are nidular, without colored bracts, flowers with white petals, some species with fragrant flowers. In subgenus *Cryptanthus*, the corollas usually have the petals retrorse, exposing the stigma and stamens, and the flowers are not fragrant and have diurnal anthesis. These species occur at low elevations, always in partially to completely shady places; the foliar blades usually have red or purple coloration (if color is present, it is in all the leaves), making the plant look more colorful. In subgenus *Hoplocryptanthus*, the corolla is campanulate, many species have fragrant flowers (sweet smell), diurnal anthesis, leaves never have red or purplish color on foliar blades, and they occur in places at high elevations, on exposed areas. Pollen is also different in both subgenera: in subgenus *Cryptanthus*, the pollen surface is reticulate or fusselate and larger in size compared with that in subgenus *Hoplocryptanthus*, which has a smooth surface and comparatively smaller pollen grains.

In most of the members of Bromeliaceae, pollinator attraction is carried out by petals, sepals, floral and inflorescence bracts, and in several members it is possible that the colored or lepidote leaves may also play an important role. Important experiments carried out by Manning (1956) and Free (1970), where honey bees were tested for the effects of shape, color, nectar guides, and scent. Results indicated the last two as the most important factors driving pattern visits. Regarding color blindness, bees and honeybees seem to be red-blind insects, while honey and bumble bees can perceive blue-green and ultra violet as distinct colors (Frish, 1950, 1954). Most of the white flowers as in *Cryptanthus* species, do not reflect ultra-violet, but bees see them as colored because they do not reflect the complete ultra violet spectrum.

Based on morphological, floral, and ecological differences between the subgenera, performed a series of experiments using a UV light lamp (644 nm) to observe the absorption or reflection on this range of ultraviolet light, in order to estimate potential differences on reflection and/or absorption of UV and to hypothesize if those differences could reaffirm the possibility of different pollinators in both subgenera.

I based my preliminary hypothesis on the fact of the differences of leaf colors and flower shape, scent and fruit setting (based on observations in the field, herbarium and cultivated specimens). My hypothesis is that in those plants in subgenus *Hoplocryptanthus* each individual flower is the pollinator's target while in plants in subgenus *Cryptanthus* (usually reddish colored leaves) each individual rosette was the insect's target and that pollinators should be different in each group. Since the patterns of UV reflectance could be observed in herbarium specimens (Eisner et al. 1973), I studied sterile and flowering rosettes in several species of *Cryptanthus* and several in *Orthophytum*, to compare changes of possible patterns of UV reflectance and/or absorbance. I only observed changes on ventral surfaces (and dorsal on caulescent plants) of the leaves and flowers, since those have more chance to be seen by the pollinator. Variations in results depend upon whether: (1) flat or funnelform rosettes have a dense cover of white trichomes; (2) flat or funnelform rosettes have a glabrous foliar surface; (3) flat rosettes have cross wavy white bands on brown to maroon leaves; or (4) plants with colored inflorescence bracts (as in *Orthophytum*).

Those plants with a white covering of trichomes (section *Xerophyticae* of subgenus *Hoplocryptanthus*) do not absorb or reflect light in the indicated UV spectrum, they reflect all light and plants look white, especially on areas of high trichome density. If trichomes are organized on alternating bands of different densities, under UV light the rosette looks with broken or discontinuous concentric white rings (e.g., *Cryptanthus warasii* - figure 1). Plants with flat rosettes and lower trichome density look white-purplish, indicating some absorption of the UV spectrum (e.g. *C. whitmanii*). Plants in Section *Zonatae* (subgenus *Cryptanthus*) with dark maroon or brown leaves, with white wavy

cross bands of trichomes, appeared dark purple and the trichomes are brown, indicating some absorption by the trichomes in the UV spectrum, compared with those in the rest of the genera (see above).

Plants of Section *Cryptanthus* (subgenus *Cryptanthus*) with colored leaves and odorless flowers, do not show any pattern of UV reflectance. Some of the specimens show some absorbency, and in a few cases the petals absorbed some of the wavelength, but no pattern was found.

Species of *Orthophytum* (e.g., *0. vagans*), where the sepals have a high density of trichomes, have high UV reflectance. In those with colored inflorescence bracts (e.g., *0. sucrei*), there is high reflectance in the center of the rosette, at the base of the scape, around this area, the leaves are colored (dark brown) and here there is more absorption of UV, making the plant resemble two concentric rings when seen from above. This pattern is repeated at the top of the scapose inflorescence. If both sets of concentric rings are placed together, the plant looks like a four concentric-rings target. 0. sucrei has green flowers (petals and stigma), the corolla is tubular, and no smell has been detected. The pollination syndrome indicated pollination by birds, probably hummingbirds, which has been reported previously in the family (Johow, 1898).

Plants of *Cryptanthus* show differences in patterns of absorbance/reflectance of UV light that is related to the density of trichomes on leaves or other vegetative structures, such as inflorescence and floral bracts, and sepals.

All morphological, UV patterns reflectance, ecological, and altitudinal characters involved in the pollinator's attraction in both subgenera suggest that the members of the two subgenera could have different groups of pollinators, possibly different groups of bees. Also, fruit setting is different in both subgenera. Plants of subgenus *Cryptanthus* have lower fruit setting, fewer seeds and larger per fruit, whereas plants of subgenus *Hoplocryptanthus* have higher fruit setting, smaller and more numerous seeds per fruit. These correlations suggest that studies on pollination biology in the genus *Cryptanthus* promise interesting results. These results could partially shed light into the origin of andromonoecious breeding systems in this bromelioid group.

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LITERATURE CITED

Eisner, T., M. Eisner, P. A. Hypio, D. Aneshansley, and R E. Silberglied. 1973. Plant taxonomy: ultraviolet patterns of flowers visible as fluorescent patterns in pressed herbarium specimens. *Science* 179(4072): 486-487.

Free, J. B, 1970. Effect of floral shapes and nectar guides on the behavior of foraging honeybees. *Behavior* 37: 269-285.

Frish, K von. 1950. Bees, their vision, chemical senses and language. Cornell University Press, Uthaca, N. Y.

- - - - - . 1954. The dancing bees. Methuen, London.

Harms, H. 1930. Bromeliaceae. In Engler & Prantl, *Die Naturlichen Pflanzenfamilien* ed. 2, 15a: 65-159.

Johow, F, 1898. Ueber Ornithophilie in der Chilenischen Flora. Sitzungsber Akademie und Berlin 28: 338-341.

Knuth, P. 1904, Handbuch der Blütenbiologie. Leipzig, Verlag von Wilhem Engelman.

Luther, H,E. and E. Sieff. 1996. An alphabetical list of bromeliad binomials. Fifth Edition. Bromeliad Society Inc.

Manning, A. 1955. The effect of honeyguides. *Behavior* 9: 114-139.

Mez, C. 1896. Bromeliaceae. En: A. de Candolle (ed.), Monographie Phanerogamarum 9: 1-990. G. Masson, Paris.

Ramirez, I. 1998. A systematic revision of Cryptanthus: major results. J. Bromeliad Soc. 48(2):55-59.

Ramirez, I., F. Chi-May, G. Carnevali, F. May-Pat & G. Chuc-Puc. 2000. Portraits of Bromeliaceae from the Mexican Yucatan Peninsula-I: *Hechtia schottii* Baker ex Hemsley (Pitcairnioideae). J. Bromeliad Soc. 50(1): 20-24.

Siqueirta Filho, J. A. 1998. Biologia floral de *Hohenbergia ridleyi* (Baker) Mez. Bromélia 5(1-4): 3-13.

Smith, L. B. & R J. Downs. 1979. Bromelioideae. Flora Neotropica 14: 1493--2142.

Vogel, S. 1969. Chiropterofilie in der neotropischen Flora. *Flora* 158: 289-323.

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An Unusual new Species of *Pepinia* from Southeastern Peru

Harry E. Luther[1]

Pepinia holstii H. Luther, sp. nov. TYPE: Peru. Dept. Cuzco: Prov. La Convención. Cordillera de Vilcabamba, , 11°46'47"S, 73°20'27"W, 950–1000 m, seed from herbarium voucher *Holst & Beltran 6541*, flowered in cultivation at SEL (1999-181), 4 January 2001, B. *Holst & H. Luther 7277* (Holotype: SEL; Isotype: USM).

A *Pepinia neglecta* H. Luther, cui affinis sed inflorescentia perlongioribus, bracteis florigeris dimorphis et sepalis et petalis brevioribus differt.

Vern Sawyer

Figure 10. *Pepinia holtsii* flowering for the first time at the Marie Selby Botanical Gardens.

Plant nearly stemless, clustering, flowering to 90 cm tall. **Leaves** essentially monomorphic, rosulate, spreading, ca. 12 in number, 60-100 cm long. **Leaf sheaths** elliptic to triangular, 4–10 × 3–5 cm, entire, nerved, castaneous, densely brown-lepidote abaxially, nearly glabrous adaxially. **Leaf blades** with a 8–20 cm × 10–15 mm entire or very laxly serrulate, channeled, reddish pseudopetiole; the upper portion of the blade narrowly elliptic, attenuate, 3–8 cm wide, undulate, channeled, densely pale-lepidote abaxially, nearly glabrous adaxially, green tinged reddish. **Scape** erect, 25 × 1 cm, brown-floccose. **Scape bracts** erect, densely imbricate, narrowly elliptic, the lowest with attenuate blades, the uppermost acute, entire, nerved, punctate-lepidote, reddish brown. **Inflorescence** simple, cylindric, 65–75 × 4–5 cm. **Floral bracts** dimorphic; the lowest fertile, erect, densely imbricate, acute, 4–7 × 1–2 cm, thin-coriaceous, nerved, the margins crispate, subdensely punctate-

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lepidote, brown; the upper mostly sterile, spreading then incurving, acute, 2–3 cm × 5–12 mm, very thin-coriaceous, nerved, pale stellate-lepidote, bright red rapidly turning black. **Flowers** subsessile, spreading at ca. 30° from the axis at anthesis, 70–75 mm long. **Sepals** subtriangular, acute, 20–25 mm long, subcoriaceous, brown-lepidote, greenish, the adaxial pair obtusely carinate. **Corolla** erect, zygomorphic. **Petals** ligulate, broadly acute, 60–70 × 10–13 mm, each with a 12–14 mm long subtriangular basal appendage, orange-yellow. **Ovary** ca. 3/4 superior. **Fruit** a dry capsule to 2 cm long. Seeds triangular, winged, 1.5 × 1 mm.

This new species differs from the related **Pepinia neglecta** by having a much longer inflorescence (65–75 vs. 15–27 cm) with dimorphic floral bracts and shorter sepals (20–25 vs. 27–31 mm) and shorter petals (60–70 vs. 75–85 mm).

Similar dimorphism of the floral bracts occurs with the unrelated *Pitcairnia simulans* var. *ornata* H. Luther from N.W. Ecuador. The brightly colored corollas of both taxa are especially conspicuous against dark fertile bracts and the red sterile apex of the inflorescence is visible for a long distance.

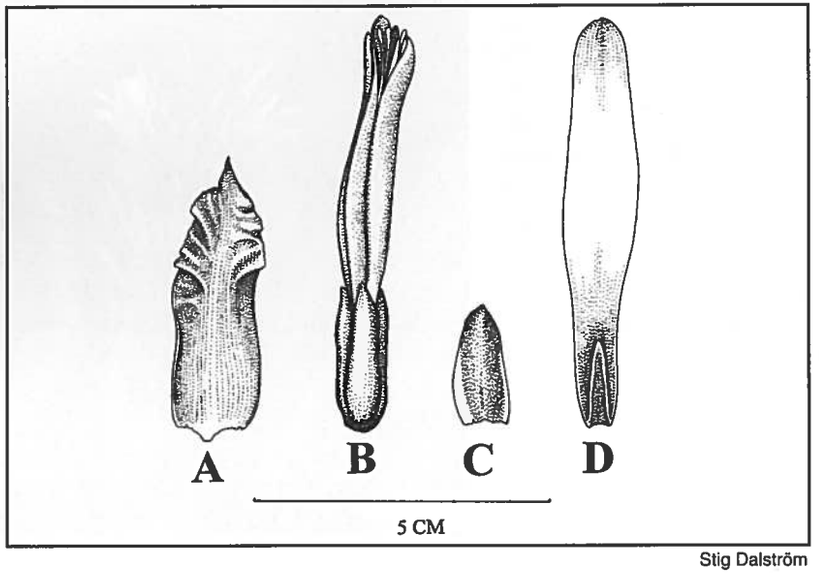

Figure 11. *Pepinia holstii* H. Luther: A) floral bract; B) flower; C) sepal; D) petal.

Seedlings of this species were distributed to Marie Selby Botanical Gardens members in the fall of 1999 as "Pitcairnia species 99-05".

Marie Selby Botanical Gardens,
Sarasota, Florida

Hybridization and Reproductive Isolation Between Four *Pitcairnia* Species in Brazilian Rocky Outcrops

Tânia Wendt[1]

Bromeliad species hybridize easily when manipulated by hand (Beadle, 1998), but reported cases of natural hybridization are rare (Luther, 1984; Gardner, 1984). Natural hybridization in plants is a widespread phenomenon, and it has been the focus of various studies over the past several decades (Arnold, 1997). Reproductive isolation mechanisms present substantial barriers that must be overcome if natural hybridization is to occur (Grant, 1981). The reproductive biology of most bromeliad species is unknown. The few studies that have dealt with floral events and pollinator behavior did not determine whether the bromeliads were reproductively isolated, or if there was hybridization between species.

Sympatric populations of closely related bromeliad species are very common and this may facilitate interspecific crosses. I studied hybridization and reproductive isolation of four taxa: *Pitcairnia albiflos* Herbert, *P. staminea* Loddiges, *P. flammea* Lindley and *P. corcovadensis* Wawra (Wendt, 1999). Sympatric populations of these taxa are found on Corcovado Mountain and Pão de Açúcar Mountain. These mountains are situated in the heart of Rio de Janeiro, surrounded by urban development. They are the most famous tourist attractions in the city, and are still covered by native vegetation, rich in endemic species.

The geographic distribution of these taxa is restricted to a few rocky outcrops in the state of Rio de Janeiro, except for *P. flammea* (figure 16) which is wide-ranging, and one of the most morphologically variable Brazilian *Pitcairnia* species; it has seven varieties (Wendt, 1994). Smith (1943) reduced *P. corcovadensis* described by Wawra in the last century, to a variety of *P. flammea*. *Pitcairnia corcovadensis* (figure 18), is known from a few localities, always co-occurring with *P. flammea*. It is widely advocated that the variety should be used to designate geographic variation of ordinary species, so allopatric distribution of different varieties is to be expected (Hamilton & Reichard, 1992). Despite their very similar flower form and color, *P. corcovadensis* differs from *P. flammea* in plant size, and the plants can be clearly distinguished based on information such as scape length and number of flowers. For this reason, *P. corcovadensis* was recently re-established at the species level (Wendt et al. 2000).

Pitcairnia flammea and *P. corcovadensis* grow together with *P. albiflos* (figure 12) on Corcovado Mountain. Observations during two flowering seasons showed that despite different peaks, flowering of these species overlaps in April.

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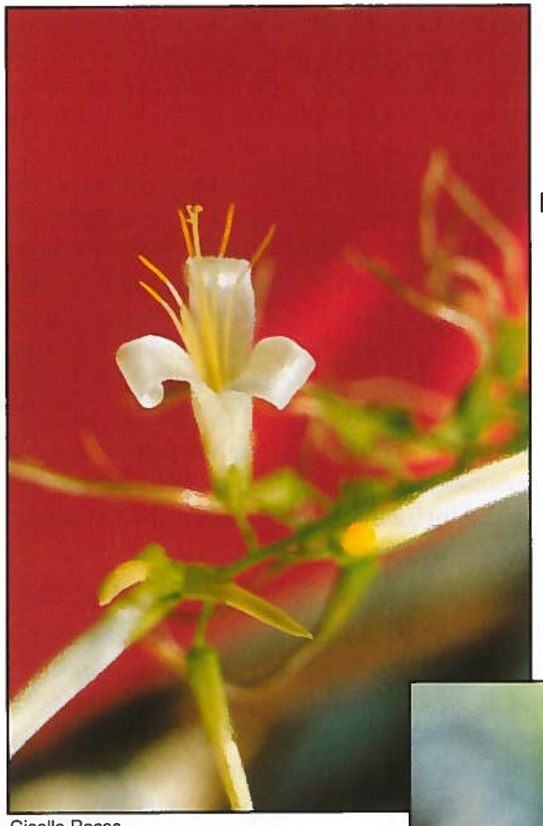

Figure 12. *Pitcairnia albiflos*

Giselle Roças

Figure 13. *Pitcairnia corcovadensis*

Giselle Roças

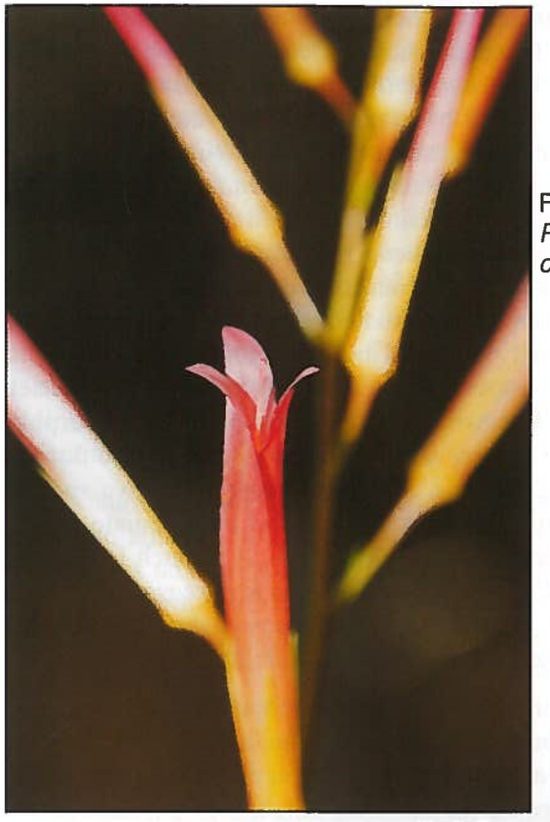

Figure 14. Hybrid between *Pitcairnia albiflos* and *P. corcovadensis*

Giselle Roças

Tânia Wendt

Figure 15. The white flower (left) is *Pitcairnia albiflos*, and the red flower (right) is *Pitcairnia staminea*. The four flowers in the center are natural hybrids between these species.

They grow in mixed clumps that may facilitate promiscuous pollination, but hybrids were absent in the field. These taxa have different floral signals and do not share the same pollinators. *Pitcairnia albiflos* is visited diurnally by bees. *Pitcairnia flammea* is regularly visited by hummingbirds, which suck nectar from different flowers of the same inflorescence before moving on to another plant, thus facilitating self-pollination. Although *P. corcovadensis* is similar in flower shape to *P. flammea*, practically no visitors appeared at the flowers of the former, probably because it has very low nectar production. The absence of a pollinator did not interfere with high fruit production under natural conditions, because this species has autonomous self-pollination. However, these species are interfertile and hybrids were easily obtained by hand-pollination on plants harvested in nature and grown in a greenhouse. This was true even for species with different flower structure. *Pitcairnia albiflos* has white, actinomorphic flowers with spiraled petals, while *P. corcovadensis* has red, zygomorphic flowers whose petals remain erect during anthesis. A cross between these two species produced an artificial hybrid with dark-pink flowers and intermediate flower shape (Fig. 14). Hybrid pollen viability is less than 10 %; it is much lower than that of parental species (87%). *Pitcairnia flammea* and *P. corcovadensis* have similar flower structure, but differ in plant size. The artificial hybrid of these two species is intermediate in plant size, with lower pollen viability (43%).

On Pão de Açúcar Mountain, we found another population of *P. albiflos* occurring together with *P. staminea*. In this mixed population natural hybrids were identified by morphometric analysis (Wendt et al. in press). Although these natural hybrids are naturally sympatric on this rocky slope, their populations are separated due to distinct habit preferences. *P. albiflos* forms small patches on sunny rock surfaces, while *P. staminea* occurs in large thickets associated with shrubs and trees, and the putative hybrids are frequently found at disturbed sites invaded by weeds. These species are easily recognized in the field by flower color, which is white in *P. albiflos* and red in *P. staminea*; the putative hybrids show a broad range of intermediate pink colors (Fig. 15). There was a long period of flowering overlap of these species and their hybrids during three consecutive years of observation. The showy flowers offer pollen and nectar that attract many kinds of visitors such as bees, butterflies, hawkmoths, bats and rarely birds. *Pitcairnia albiflos* is pollinated at night by bats and hawkmoths. *Pitcairnia staminea* is pollinated diurnally by butterflies. Although parental species have different pollination syndromes, they are indiscriminately and intensely visited by trigonid bees throughout the day. Reciprocal hand pollination between parental species and hybrids yielded high fruit set with viable seeds. Measurements of fitness components of hybrids and parental individuals allowed direct comparison of fruit set, seed set, germination and pollen viability. These showed that the hybrid was equal in fitness to the parent species, except for a significant decrease in pollen viability (64%) when compared to the parental species, *P. albiflos* (90 %) and *P. staminea* (86%).

Although hybrids were easily obtained by hand pollination between these

taxa, natural hybrids were only found between *P. albiflos* and *P. staminea*. Floral characteristics that attract specific groups of pollinators can act as a major barrier to gene flow between closely related taxa (Grant, 1981). These species showed different pollination syndromes that contributed to limiting hybrid formation in the wild. However, these species are interfertile and interspecific hybridization may also occur eventually due to a non-specific pollinator, as happened on Pão de Açúcar. The incorporation of self-compatibility, following autogamy, into the breeding system has a pronounced effect on gene flow and restricts hybridization (Grant, 1981). All these species are self-compatible and can perform spontaneous self-fertilization, except for *P. albiflos* that depends on pollination even for selfing. These self-breeding systems are important in assuring some reproductive isolation; since they have neither geographic, ecological, nor temporal isolation mechanisms, neither do they have postmating isolation.

Natural hybridization has often been considered a key phenomenon in plant evolution since it results in much genetic recombination, thus enabling the founding of new evolutionary lineages (Arnold 1997). The presence of natural vigorous hybrids and the facility of obtaining hybrids from artificial crosses suggest that ancient hybridization could have contributed to the formation of bromeliad species. This needs to be taken into account in systematic studies.

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LITERATURE CITED

ARNOLD, M. L. 1997. *Natural hybridization and evolution*. Oxford University Press, New York, NY.

BEADLE, D. A. 1998. *The Bromeliad Cultivar Registry*. Compiled for the Bromeliad Society, International.

GARDNER, C. S. 1984. Natural hybridization in *Tillandsia* subgenus *Tillandsia* (Bromeliaceae). *Selbyana* 7: 380-393.

GRANT, V. 1981. *Plant speciation*. Columbia University Press, New York, NY.

HAMILTON, C. W. AND S. H. REICHARD. 1992. Current practice in the use of subspecies, variety, and forma in the classification of wild plants. Taxon 41: 485-498.

LUTHER, H. E. 1984. A hybrid *Pitcairnia* from Western Ecuador. *Journal of Bromeliad Society* 34: 272-274.

WENDT, T. 1994. *Pitcairnia* L'Héritier (Bromeliaceae) of Rio de Janeiro State. *Selbyana* 15: 66-78.

_____ . 1999. Hibridização e isolamento reprodutivo em *Pitcairnia* (Bromeliaceae). Tese de Doutorado, Programa de Pós-Graduação em Ecologia - UFRJ, Rio de Janeiro.

Giselle Roças

Figure 16. *Pitcairnia flammea*

Giselle Roças

Figure 17. *Pitcairnia corcovadensis*

Giselle Roças

Figure 18. Hybrid between *Pitcairnia flammea* and *P. corcovadensis*

_____, M. B. F. CANELA, J. E. MORREY-JONES, A. B. HENRIQUES AND R. I. RIOS. 2000. Recognition of *Pitcairnia corcovadensis* (Bromeliaceae) at the species level. *Systematic Botany* 25: 389-398.

_____, N. P. L. PAZ AND R. I. RIOS (in press). A morphometric analysis of a putative hybrid between *Pitcairnia albiflos* and *Pitcairnia staminea* (Bromeliaceae). *Selbyana* 21: 000-000.

Rio de Janeiro

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Bromeliad Micropropagation in a Temporary Immersion System

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Abstract

Bromeliads are ornamental plants prized for their beautiful foliage and flowers. Within this group of plants, the genera *Aechmea*, *Neoregelia* and *Cryptanthus* are particular favorites among plant collectors. As a means of reproduction, seeds and axillary buds were established to in vitro. The multiplication of *Aechmea fasciata*, *Aechmea kertezii*, *Aechmea blumenavii*, *Neo-regelia carolina*, *Cryptanthus bromelioides* and *Ananas nanus* was achieved in MS liquid medium supplemented with 2.0 mg/L BAP and 0.3 mg/L NAA. A procedure for the mass propagation of bromeliad plants using a temporary immersion technique is described. This procedure involved two distinct phases in the automated temporary immersion system: sprouting and elongation. To establish this protocol, *in vitro* shoots obtained from established liquid culture were used as starting materials. Temporary immersion increased multiplication rate after 45 days. Paclobutrazol promoted formation of compact bud clusters with limited leaf development. The highest multiplication rate was found when explants were cultured in a sprouting medium (MS + 2.0 mg/L BAP + 0.3 mg/L NAA) supplemented with 0.12 mg/L PBZ for six weeks. The highest number of competent and uniform plants was achieved when bud clusters were cultured for three weeks in a medium supplemented with 0.1 mg/L IBA and 0.3 mg/L NAA.

Abbreviations used:

Abbreviations used in the text below are as follows: BAP, 6-benzylaminopurine; IBA, indolil butiric acid; NAA, naphthaleneacetic acid; PBZ, paclobutrazol; [(2RS,3RS)-1-4-chlorofenyl 4,4-dimethyl-2-(1H-1,2, 4-triazol-1-yL)pentan-3-ol,].

Introduction:

The family Bromeliaceae contains about 2500 species native to tropical and subtropical North and South America. The subfamily Bromelioideae presents the greatest variety of bromeliad forms (Mercier and Kerbauy,1997). The genera *Aechmea, Ananas*, *Billbergia*, *Cryptanthus*, *Neoregelia* and *Nidularium* are the best know horticulturally, being used as both indoor and outdoor plants. They are increasingly being used as ornamental plants.

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Bromeliad plants can be propagated through sexual and asexual processes. However, sexual propagation has been demonstrated to have disadvantages, one of the most limiting being the availability of seed. On the other hand, the main disadvantage of asexual reproduction is that it is not capable of producing the large numbers of plants needed in commercial nurseries.

Some species of *Bromeliaceae* have been propagated with the application of growth regulators, such as with *Aechmea fasciata* in using Paclobutrazol and Chlormequat (Ziv et al, 1986) and in species of the genus *Tillandsia* using the cytokinin BAP (Bessler, 1997).

Micropropagation of bromeliads is in high demand because of the superior quality of the plantlets when compared to seedlings, programmable flowering, and uniformity. However it is difficult to establish bromeliad cultures from shoot axillary buds excised from field collected adults plants.

From 300 to 400 million plant seedlings are biofabricated *in vitro* per year world-wide. A fraction of these are bromeliads, produced traditionally in Belgium, The Netherlands, The United States and Japan (Zorning, 1996). Several genera of Bromeliaceae are becoming popular as pot plants. However many Brazilian bromeliads on sale are of wild origin (Mercier y Kerbauy, 1993). The aim of this study was to evaluate the temporary immersion systems as a means of finding a more efficient method for clonal propagation of these plants.

Materials and Methods:

Bromeliad plants were obtained from established liquid cultures grown on a sprouting medium, which consisted of MS salts supplemented with 2.0 mg/l BAP and 0.3 mg/l NAA, as recommended by Daquinta and Benega (1997). The cultures were grown under cool white fluorescent lamps providing 80 µmol. m^{-2}. s^{-1} photons, with a 16-h photoperiod at 25 °C.

The temporary immersion system consisted of two containers; one for growing plants and a reservoir for the liquid medium. The two containers were connected by silicone and glass tubes. In each case, the airflow was sterilized by passage through 0.2- µm hydrophobic filters. Air pressure from an air compressor pushed the medium from one container to the other to immerse the plants completely. The airflow was reversed to withdraw the medium from the culture container. Electronic timers controlled the frequency and length of the immersion period. Three-way solenoid valves provided on/off operation.

Effect of paclobutrazol on shoot multiplication:

Temporary immersion systems were compared in combination with paclobutrazol at 0.0, 0.12 or 0.25 mg/l added in the sprouting medium. The culture vessel dimension for conventional micropropagation was the same as described above. Two 10 L vessels constituted the temporary immersion system.

The culture medium reservoir included 5 L of medium. Five explants were also cultured in each vessel. For the temporary immersion system, shoots were immersed for 2 min every three hours. Cultures were incubated at 25°C under cool white fluorescent tubes (80 µmol . m^{-2} . s^{-1}). The multiplication rate was evaluated after 45 d of culture.

Shoot elongation in temporary immersion system:

For this experiment, a 10 L culture was used. The sprouting medium contained paclobutrazol (step 1). The medium was sterilized at 120°C, at a pressure of 1 Kg/cm^2 for 45 min. After shoot-multiplication periods of 6 weeks, the medium was removed and changed with MS medium supplemented with 0.1 mg/L IBA + 0.3 mg/L NAA (Firoozabady et al. 1997) or 0.5 mg/l BAP + 1 mg/l GA_3 (step 2). After 21 d, the shoots were *ex vitro* rooting.

Ex-vitro rooting and acclimatisation of the cultured plants:

Elongated shoots taken from the temporary immersion system were transplanted into a substrate consisting of zeolita mixed in a 1:1 ratio with sugarcane filter. The trays were placed in a greenhouse under humidity tents to prevent desiccation during the first 10 days. Survival was evaluated after 30 days.

Results and Discussion:

An automated system, functioning on the principle of temporary immersion, was designed for large-scale pineapple propagation (Firoozabady *et al.* 1997, Escalona *et al*, 1998). This micropropagation system enabled a constant supply of nutrients and aeration to plants without use of sophisticated technology.

The temporary immersion culture combines the advantages of solid and liquid mediums. Solid cultures allow aeration, but do not provide full contact with nutrient media. Liquid culture medium permits an efficient nutrient uptake, but hyperhydricity is often present. However, hyperhydricity has been never reported in bromeliad liquid cultures.

The combination of temporary immersion systems with paclobutrazol (0.12 mg/l) greatly increased the pineapple multiplication rate (Tables 1 and 2). A strong interaction was observed between the culture system and paclobutrazol concentration. Growth retardants and inhibitors of gibberellin biosynthesis are used extensively in agriculture and ornamental horticulture to control plant growth and structure, but until recently only to a limited extent in micropropagation. The positive effect of paclobutrazol on pineapple micropropagation was previously described by Daquinta *et al.* (1994) and are confirmed here. Paclobutrazol controlled shoot growth and induced axillary bud

proliferation. In the temporary immersion system, the use of paclobutrazol for bromeliad micropropagation promoted formation of compact bud clusters with limited leaf development, avoiding unnecessary leaf growth during the shoot formation stage.

Table 1. Effect of different paclobutrazol concentrations on *Aechmea sp.* sprouting with 0.1 mg/L IBA and 0.3 mg/L NAA as elongation medium.

Paclobutrazol concentrations (mg/L)	Multiplication rates
0.0	24.6
0.12	32.4
0.25	22.9

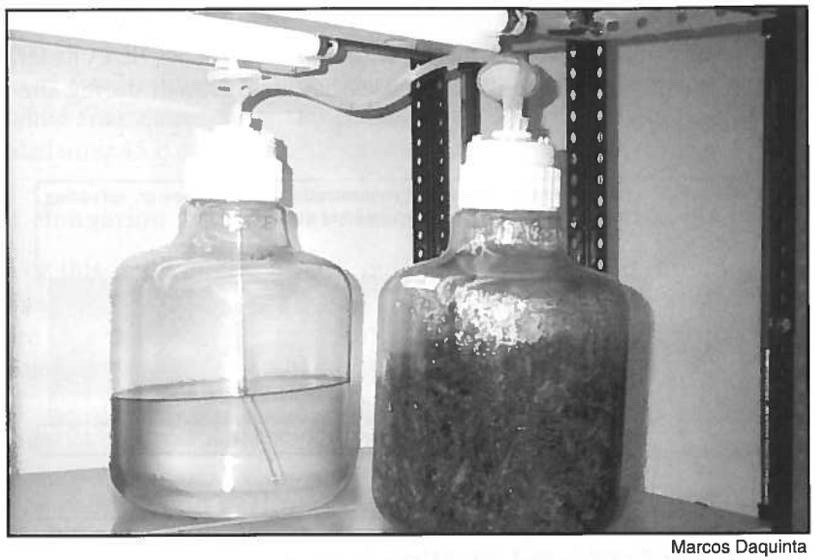
Table 2. Effect of different paclobutrazol concentrations on *Aechmea sp.* sprouting with 0.5 mg/L BA and 0.5 mg/L GA_3 as elongation medium.

Paclobutrazol concentrations (mg/L)	Multiplication rates
0.0	21.5
0.12	24.9
0.25	12.1

Shoots are not adequate for direct *ex vitro* rooting and acclimatisation because of their small size. Such shoots need further elongation. Due to the high propagation rate, this further elongation does not increase production cost. The reason for the efficiency of a temporary immersion culture system is probably the ability of the system to aerate plant tissue and provide contact between entire explants and the liquid medium. These two features are usually not combined in a classic liquid culture procedure (Alvard *et al.* 1993).

In these results there are several considerations: higher proliferation rates are associated with pH around the equilibrium point, which might facilitate the availability of some ions. One of the advantages of temporary immersion culture on *in vitro* nutrition can be that temporary immersion limits the movement of ions associated with pH change out of the plants.

A six week interval resulted in the best multiplication rate, but the plant container was not large enough to allow shoot elongation. The use of MS medium with IBA + NAA and MS medium with BAP + GA_3 were the strategy used to elongate bud clusters from the temporary immersion system. The combination of IBA and NAA 21 days provided for the best shoot elongation and plant uniformity.



Marcos Daquinta

Figure 19. Temporary immersion system used with *Aechmea sp.*

New methods for pineapple micropropagation have been developed to reduce the cost for commercial applications (Firoozabady *et al.* 1997, Escalona *et al*, 1998). The use of paclobutrazol to increase axillary multiplication rate during shooting stage in temporary immersion system, resulting in enhanced multiplication, shoot elongation is carried out in the same container and shoot were separated from clusters and placed directly on substrate for *ex vitro* rooting and acclimatisation over a period of four months.

Micropropagation should find a ready application in the ornamental bromeliad industry as well as in the production of desired hybrids of bromeliads. Only the temporary immersion system will permit a rapid increment in the number of bromeliads. Vegetative multiplication of individual plants remains as a promising possibility for the production of homogeneous planting material and for substantial improvement in plant homogeneity.

REFERENCES

Alvard, D., Cote, F., Teisson, C. 1993. Comparison of methods of liquid medium cultures for banana micropropagation. Effect of temporary immersion of explants. Plant Cell, Tissue and Organ Culture 32: 55-60.

Bessler, B. 1997. The use of 6- Benzylaminopurine for rapid multiplication of tillandsias. HortScience. 32(2): 256-258.

Daquinta, M., Benegas, R. 1994. Estimulación del ahijamiento en vitro plantas de piña con paclobutrazol. Centro Agrícola 21(2): 75-82.

- - - - - - - - 1997. Brief review of tissue culture of pineapple. Pineapple News. 3: 7-9.

Firoozabady, E., Nicholas, J., Gutterson, N. 1997. *In vitro* plant regeneration and advanced propagation methods for pineapple. Acta Horticulturae 425.

Mercier, H.; Kerbauy, G.. 1993. Micropropagation of *Dyckia macedoi*-an endangered endemic Brazilian bromeliad. Botanical Gardens Micropropagation News 1(6): 70-72.

- - - - - - - - -. 1997. Micropropagation of Ornamental Bromeliads (Bromeliacae). In: Y. P. S. Bajaj (ed). Biotechnology in Agriculture and Forestry, Vol. 40. High-Tech and Micropropagation VI. Springer Verlag. 43-57.

Murashige, T.; Skoog, F. 1962. A revised medium for rapid growth an bioassays with tobacco tissue cultures. Physiologia Plantarum, 15:473-497.

Zornig, R. 1996. Micropropagation of Bromeliads. Bromelia. 3(3): 3-8.

Ciego de Avila, Cuba

World Conference Notes
Hattie Lou Smith

Registration fees for the world bromeliad conference in 2002 in St. Petersburg will change after June 30, 2001. Registering between now and June 30 will save $10 per registration. Currently it is $120 for BSI members and $135 for non-members.

Nearly all bromeliad lovers and likers, especially from Florida, will be in St. Pete for this wonderful conference. Don't miss out on the fun!

Registration at the Hilton Hotel may begin after June 1, 2001. The hotel is $99 per night with a maximum of 4 people to a room. Bed tax and sales tax raise the total cost to approximately $110. There is a $4 a day charge to keep your car in the hotel parking lot. Please use the number 1-888-843-6929 to call for reservations and tell them that you are with the world bromeliad conference. This goes through the sales office [open 8 a.m. to 5 p.m. EST, Monday through Friday].

This will be an experience of a lifetime. Don't delay in registering.

Guzmania loraxiana, a New Species From Panama

Jason R. Grant[1]

Abstract. A new cryptic species related to *Guzmania filiorum* L.B. Sm., *G. patula* Mez & Wercklé, *G. subcorymbosa* L.B. Sm., and *G. virescens* (Hook.f.) Mez var. *laxior* L.B. Sm., is described from Panama as *Guzmania loraxiana* J.R. Grant, sp. nov.

***Guzmania loraxiana* J.R. Grant, sp. nov.** (Figures 21-22)

Type. Panama: CHIRIQUI: Reserva Forestal Fortuna, roadside forest 66 km north of Chiriqui, 8° 46' 333" N, 82° 11' 016" W, 28 December 1997, *Grant 97-02660 & Rundell* (holotype US).

Plants short caulescent to acaulescent, found terrestrial, but also likely epiphytic, flowering to 70 cm tall. **Leaves** 30–45 cm long; sheaths elliptic, 7–9 cm long × 3–4 cm wide, elliptical, bright green streaked with prominent reddish-maroon vertical striations on both the upper and lower surfaces, especially on the lowermost leaves of the rosette; blades linear-long, attenuate, 21–38 cm long × 1.0–(1.3–2.3)–3.5 cm wide, bright green. **Scape** erect, to 50 cm long; **scape bracts** acuminate to linear-long, 3.0–22 cm long, the lower ones foliose, green with vertical maroon-red striations. **Inflorescence** to 10 cm long, bipinnate compound with 2–(3–6) spikes (rarely simple); spikes fasciculate, 6–15 flowered. **Primary bract** (the single bract that subtends the inflorescence), green to yellowish-tan yet tinged with vertical maroon-red striations (like the scape bracts), triangular, apiculate, 19–24 mm long, 14 mm wide (when pressed to one dimension), usually slightly exceeding the length of the floral bract of the first flower of the inflorescence, but not longer that the sepal of that flower. **Flowers** diurnal, non-fragrant, sessile. **Floral bract** green to yellowish-tan, triangular, obtuse to acute, margin reddish, nerves dotted reddish, 7 mm long × 6 mm wide (when pressed to one dimension), shorter than the calyx. **Sepals** green to yellowish-tan, narrowly-triangular in outline, acuminate, firm, pungent, glabrous, free, thickly-carinate, 15–17 mm long, navicular, 3 mm wide (yet 5 mm wide when pressed to one dimension). **Corolla** actinomorphic at anthesis, becoming zygomorphic while fading where the exserted portion one petal remains erect, while other two reflex downward. **Petals** white-hyaline, ovate, apically acute to retuse, glabrous, unappendaged, 24–25 mm long, 2/3 connate, the portion included within the calyx 2–3 mm wide; the exserted petal lobes 8–9 mm long, 5–6 mm wide at broadest, involute, reflexed at anthesis. **Stamens** white-hyaline, exserted, spreading laterally in a star-like fashion, 24–25 mm long, the exserted portion 6–7.5 mm long, diplostemonous (that is, with two series of stamens, the outer series opposite the stamens, the inner opposite the petals, and twice as many as the petals, [i.e. 6); filaments 22.0–22.5 mm long,

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0.25 mm wide, the exserted portion 4–5 mm long; anthers linear, 2.0–2.5 mm long, 1 mm wide, basifixed. **Pollen** white. **Pistil** 23–24 mm long, exserted to 7 mm; ovary green, ovate, superior, 3–4 mm long, 2 mm wide at anthesis; style white-hyaline, 21 mm long, 0.5 mm wide; stigma 0.5 mm long, 1.0–1.5 mm wide.

Paratypes. Panama: CHIRIQUI: Reserva Forestal Fortuna, 58-64 km north of Chiriqui, primary forest surrounding Lago Fortuna, 18 March 1996, *Grant 96-02423 & Rundell* (US); Reserva Forestal Fortuna, roadside forest 59 km north of Chiriqui, 8° 45' 803" N, 82° 12' 757" W, 13 August 1997, *Grant 97-02836 & Rundell* (US). COLÓN: Near Peluca, km 25.6 from Transisthmian Highway on the road to Nombre de Dios, upstream on tributary to Río Boqueron, 25 February 1973, *Kennedy 2664* (US). PANAMÁ: Gatun Station, S. Hayes 340 (NY); 6 miles above Goofy Lake on road to Cerro Jefe, 3 July 1971, *Croat 15202* (US). VERAGUAS: Valley of Rio Dos Bocas on road between Alto Piedra (above Santa Fé) and Calovebora, primary forest along road, 350-400 m, 29 August 1974, *Croat 27393* (US).

This cryptic species has affinities to *Guzmania filiorum* L.B. Sm., *G. patula* Mez & Wercklé, *G. subcorymbosa* L.B. Sm., and *G. virescens* (Hook.f.) Mez var. laxior L.B. Sm., with which several herbarium collections have been confused, and to which the latter may be contaxonomic. The type of *G. virescens* var. *laxior* , formerly at the U.S. Army Summit Herbarium Canal Zone, has since been transferred to STRI in Panama City, Panama. From its photo at US, it appears to be similar to *G. loraxiana*, yet there are significant differences in the lengths of the floral bracts and sepals. Should the two be recognized as the same entity in the future, the name *Guzmania loraxiana* has priority at the species rank.

Other bromeliads collected at or within 15 km of the holotype include the following 34 species: *Catopsis nutans* (Swartz) Grisebach (96-02644), *Guzmania angustifolia* (Baker) Wittm. (96-02436), *G. calamifolia* André ex Mez (97-02820), *G. circinnalis* Rauh (96-02665, 00-3682), *G. donnell-smithii* Mez ex Donnell Smith (96-02647, 96-02659, 00-3697), *G. plicatifolia* L.B. Sm. (96-02416, 00-3681), *G. rosea* L.B. Sm. (96-02417, 00-3695), *G. spectabilis* (Mez & Wercklé) Utley (96-02646, 96-02661), *Pitcairnia arcuata* (André) André (00-3696), *P. geotropa* J.R. Grant (96-02645, 97-02816, 00-3684), *P. lyman-smithiana* Luther (97-02819), *P. nigra* (Carrière) André, *P. rundelliana* J.R. Grant (96-02643, 96-02648, 97-02821, 97-02822), *P. valerioi* Standley (96-02408, 00-3685, 00-3703), *P. wendlandii* Baker (96-02666, 97-02837), *Tillandsia insignis* (Mez) L.B. Smith & Pittendrigh (96-02407, 96-02418, 96-02656, 00-3680), *T. singularis* Mez & Wercklé (96-02418, 96-02657), *Werauhia attenuata* (L.B. Sm. & Pittendrigh) J.R. Grant (00-3694), *W. comata* (Mez & Wercklé) J.R. Grant (00-3693), *W. gladioliflora* (Wendland) J.R. Grant (96-02662, 96-02667, 00-3690), *W. greenbergii* (Utley) J.R. Grant (96-02654, 97-02814), *W. hygrometrica* (André) J.R. Grant (96-02411, 96-02445, 96-02655, 00-3692), *W. kupperiana* (Suessenguth) J.R. Grant (96-02422, 96-02663), *W. latissima* (Mez & Wercklé)

J.R. Grant (96-02446, 97-02817, 00-3689), *W. notata* (L.B. Sm. & Pittendrigh) J.R. Grant (96-02410, 97-02815, 97-02835, 00-3683), *W. sanguinolenta* (Linden ex Cogniaux & Marchal) J.R. Grant (96-02664), *W. cf. singuliflora* (Mez & Wercklé) J.R. Grant (00-3702), *W. cf. viridiflora* (Regel) J.R. Grant (96-02658, 00-3699), *W. vittata* (Mez & Wercklé) J.R. Grant (00-3700), *W. umbrosa* (Utley) J.R. Grant (00-3701), *W.* sp. A (3686), *W.* sp. B (3687), *W.* sp. C (3691), and *W.* sp. D (3698).

Key *Guzmania loraxiana* and related species in Panama based on herbarium specimens:

A Inflorescence simple, sepals connate; leaves 25 cm long x 2.5-3.0 cm wide; sepals 14-16 mm long; floral bracts 15-30 mm long; capsules 40-45 mm long.....***G. filiorum***

A Inflorescence typically compound, rarely simple, sepals free.....**B**

B Spikes in a dense congested cluster at the apex of the spike, always overlapping another, if all perhaps appearing to originate at the same place in a "sub-umbel"; sepals 9-15 mm long, floral bract 5-12 mm long, capsules 15-25 mm.....***G. subcorymbosa***

B Spikes remote with long internodes, rarely ever overlapping another, never appearing as a "sub-umbell".....**C**

C Spikes 1-3, flowers loosely positioned in the spike, each typically spreading to horizontal or slightly erect; sepals 9-16, floral bracts 9-15 mm long, capsules 25-32 mm long.....***G. patula***

C Spikes 1-6, flowers tightly compacted, always erect, never horizontal; sepals 12-15 mm long (15-17 mm fresh), floral bracts 9-12 mm long, capsules 21-25 mm long.....***G. loraxiana***
Eponymy: This species is named for the character 'the Lorax' of the same title by Dr. Seuss (Theodor Seuss Geisel). The Lorax (first published in 1971) a classic children's book, is renowned for its lesson of deforestation, habitat preservation and biodiversity. The Lorax represents a moral voice for the forest, whose notable line is: "I am the Lorax. I speak for the trees. I speak for the trees, for the trees have no tongues."

Deforestation is a serious threat to the survival of such rare and delicate species, many still unknown to science. If the forests disappear, who knows what fascinating organisms may be lost forever?

ACKNOWLEDGMENTS:

I thank the staffs of NY and US for their hospitality during visits to examine herbarium specimens, and the greenhouse staff at the 'Jardin Botanique de l'Université et de la Ville de Neuchâtel, Switzerland' for their excellent care of my living bromeliad collection.

Neuchâtel, Switzerland

Jason Grant

Figure 20. *Guzmania loraxiana.* habit

Jason Grant

Figure 21. *Guzmania loraxiana.* Closeup of inflorescence.

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BROMELIADS

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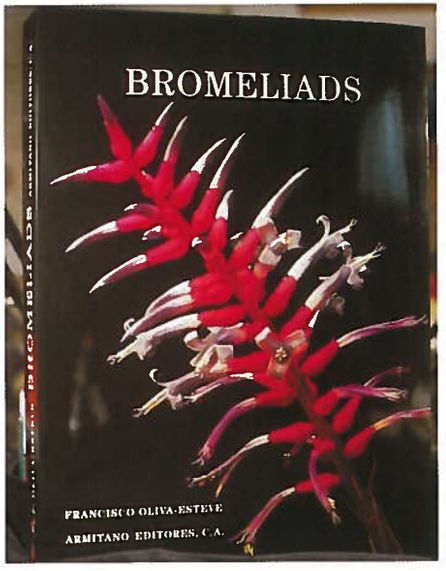

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The Bromeliad Society International

The purpose of this nonprofit corporation is to promote and maintain public and scientific interest in the research, development, preservation, and distribution of bromeliads, both natural and hybrid, throughout the world. You are invited to join.

Photograph by Chester Skotak

Neoregelia 'Hannibal Lector', an unusual new *Neoregelia* hybrid by Chester Skotak. The cross is between *Neoregelia punctatissima*, a dark form received from Roberto Menescal, and a *Neoregelia* tentatively (and perhaps temporarily) known as *N. carcharodon* 'Tiger' that Chester received from Pedro Nahoum. It may be the first medium-large hybrid that does not need sun to show its bands.

Calendar

28-29 Jul	The Sacramento Bromeliad Society will hold its annual show and sale at the Shepard Garden and Arts Center, 3330 McKinley Blvd in Sacramento. Hours are 10 a.m. to 5 p.m. on both days. Contact: Michael Hussey at 916-722-8420.
4-5 Aug	The South Bay Bromeliad Associates will hold their annual show and sale at Rainforest Flora's new nursery location at 19121 Hawthorne Blvd., Torrance, CA 90503. Show hours are noon to 4:30 p.m. on Saturday and 10 a.m. to 4:30 p.m. on Sunday. Plant sales are from 10 a.m. to 4 p.m. on both days. Contact: Bryan Chan, 818-366-1858 or by e-mail at bcbrome@aol.com
11-12 Aug	The North County and Saddleback Valley Bromeliad Societies will hold a combined standard show and sale at the Bird Rock Tropicals Nursery, 6587 Black Rail Road, Carlsbad, CA 92009. Contact: Dan Kinnard 760-414-9636 or Pam Koide 760-483-9393.
24-26 Aug	The Bromeliad Society of Greater Chicago will hold its 16th annual standard bromeliad show at the Chicago Botanical Garden, Glencoe, IL. Contact: Ardie or Jack Reilly at 217-486-5874 or by e-mail at jar56@one-eleven.net
12-15 Oct	11th Australian Bromeliad Conference 'Brom-A-Warra' at Wollongong, New South Wales, Australia. Contact: Graham Bevan, 25 Tallwong Cres., Dapto 2530 or e-mail Eileen Killingley at john.killingley@det.csiro.au
3 Nov	The Bromeliad Society of Central Florida will host the 2001 Extravaganza of the Florida Council of Bromeliad Societies at Harry P. Leu Gardens, 1920 Forest Ave., Orlando, FL. Hours are 9 a.m. to 5 p.m. Contact: Eloise Beach, 407-886-8892, e-mail floridapro@aol.com.