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Covers

Front—*Guzmania besseae* H. Luther, native from Ecuador to Bolivia. Grown and photographed by Andrew Flower.

Back—mixed population of *Brocchinia hectioides*, *B. reducta* and hybrids in the Guiana Highlands of Venezuela. Photo by Stewart McPherson.

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Editorial

In this Issue

The plant of *Guzmania bessii* shown on the front cover is a medium-sized green-leaved guzmania, 60cm high in flower, that grows in an un-heated, covered shadehouse behind my potting shed. It is quite hardy in our mild climate, with winter temperatures generally between 2 and 5°C at night, and no frost. The printed photo is 3x life-size, and because depth-of field is so shallow with close-up macro photography I used a computer program to combine 4 photos taken at different focal lengths. After more experience, I will review the program (Helicon Focus) in the Journal.

Also in the editorial section there is a review of the suggested procedures for submitting digital image files for publication.

Scientific

Harry Luther and Karen Norton describe on page 55 a new Colombian guzmania, *G. kressii*, that is allied to *G. squarrosa*. Another new species, this time a puya from Bolivia and NW Argentina, is described on page 58 by Silvia E. Gómez, Alberto C. Slanis & Alfredo Grau who are based in Tucumán.

Thorsten Krömer & Amparo Acebey from the National University of Mexico present a survey of the bromeliad population in the San Martín Tutla Volcano, Veracruz. They found one bromeliad new to Mexican records, *Weraubia nutans* previously only known from Costa Rica, and a number of species not previously recorded in the study area. Included are habitat photos of some popular cultivated species.

Page 68 carries an important notice: a call for applications for the 2007 BSI research Grants program, that offers grants up to \$1,000 US for selected projects. Deadline for submissions is June 1, 2007.

Cultivation

On page 70 we read the strange tale of a plant known for some years as "*Neoregelia ulena*" that does not meet the original description of that species, and has now been re-named in honor of Tom Wolfe in Florida. There is a N. "*uleana*" in the BSI seedbank (p. 90) - whatever the seedlings are, they won't be "*uleana*" or "Tom Wolfe" !!

Ben Sill describes, from long-lost journal notes, his experiences 35 years ago with a Cuban tree frog he named "Fidel," and the frog's behavior in the Sill greenhouse.

General Interest

On page 77 BSI President Joyce Brehm leads off with a review of the BSI membership renewal system, and a notice of our annual meetings next July.

Francisco Oliva-Esteve advises that he has again changed his email address: franciscooliva@cantv.net



Next, Bruce Holst reviews a new book that has been widely publicised around bromeliad societies, *Pitcher plants of the Americas* by Stewart McPherson. The author accepts species from *Brocchinia* and *Catopsis* into the “carnivorous” category, although he is reluctant to fully commit himself on the question, calling them “bromeliad pitcher plants” as distinct from ‘true’ pitcher plants. It is a question of definition: usually, to be considered “carnivorous” a plant needs to meet four criteria:

1. Attract prey.
2. Capture and retain the prey.
3. Kill the captured prey.
4. Digest or assimilate useful substances from the prey.¹

Most tank bromeliads appear to satisfy the first 3 criteria, assuming death by drowning is accepted as a “kill.” It is usually the digestion/assimilation that is controversial. All plants, one way or another, absorb minerals dissolved in water—so passively waiting until a dead insect has decomposed will not do. The plant needs to be actively engaged in the digestive process, producing enzymes that break down the insects’s bodies into absorbable nutrients. It is an interesting point to ponder!

Following Bruce’s review we are fortunate to have an article from Stewart McPherson discussing the bromeliads claimed to be carnivorous, with some wonderful habitat photographs. This is not an excerpt from his book (reviewed on page 78) but a stand-alone article he has written especially for bromeliad societies.

Sharing information between affiliated societies is encouraged, and the Dutch/Belgian Bromeliad Society has sent in a nice article, beginning page 88, describing how their group got started, and how they organize their meetings. Could other affiliates take up the challenge and send the editor a page or two, with a photo or two, describing their own group, how they got started, how they organize activities for their members, and perhaps tips on what they have found to be successful for keeping their members interested, what public shows they put on, and anything else they have tried in their efforts to promote bromeliads (including failures), please. And feel free to tell us any ways in which the BSI could do better in helping you!

Australian Bill Morris has been an Honorary Trustee of the BSI for 45 years, and his compatriot Geoff Lawn outlines Bill’s achievements on page 92.

Sending Digital images to the Editor.

Most modern digital cameras are capable of producing photos suitable for printing in the Journal, so long as you follow a few simple rules. We print from 300 dpi tif files, but you can send us jpg files if that is what your camera produces. The Editor will convert your files into print-ready versions. It is vitally important that you do not use imaging software to re-save, or “down-size” your original files. They may look great on the computer screen, but still be unsuitable for printing. Avoid using “digital zoom” as this reduces quality, so try and get as close as possible and fill the frame with your subject. The table shows how different spec. cameras relate to eventual print size.

¹ Salmon, Bruce *Carnivorous plants of New Zealand* (2001, Auckland, Ecosphere Publications.

original image size	camera needed at highest quality setting	size of print in the Journal	jpg file size assuming no further saving.	Suitability for the Journal.
640 x 480				too small
1280 x 960	1.3 megapixel	4” x 3”	516 KB	smallest acceptable
2048 x 1536	3 megapixel	6.8” x 5”	1 MB	front cover size
2448 x 1632	4 megapixel	8.2” x 5.4”	1.2 MB	nearly full page
2592 x 1944	5 megapixel	8.6” x 6.8”	1.5 MB	full page inside
3000 x 2000	6 megapixel	10” x 6.7”	1.6 MB	full coverage back cover

The “original image size” is the size of the file you download from your camera, eg., a 5 megapixel camera set to highest quality will produce a 2592 x 1944 image file, on its lowest quality setting it might produce a 640 x 480 shot. The jpg file sizes shown are those that should be produced by the camera, and it is these I need for the Journal. I can reduce the print size of image files you send me, but I am very reluctant to try increasing them. These are minimum standards: the higher quality you can send, the better.

Image files can be copied onto a CD and posted to me, or they can be e-mailed. E-mailing images is slow, and some mail providers set a limit on the size of attachment you can send. You can try sending one image per email, or you can contact me and I will tell you how to transfer files over the internet directly from your computer to the BSI website without using email. This way you can send huge files—I send the Journal to the printers by this method, and the file can be 400 megabytes!

Bromeliad Society International. Membership Rates

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Rodney Kline, new BSI Director for California 2007-2009

I am from the San Francisco Bay Area. I grew up here, went to school here, and intend to stay here my whole life. I am interested in a whole variety of plants and spend many weekends visiting local gardens, shows, and displays as much as I can.

I was introduced to bromeliads by accident because I was interested in orchids and they were companion plants to my orchids. I have been growing orchids since my early teen years. Little did I suspect that the bromeliads would take over and the orchids would become the companion plants less than fifteen years later.

I started with a casual *Neoregelia concentrica* "Harvey Kendall" bought from Pamela Koide at the San Francisco Orchid Exposition. I have moved heavily into hybrid billbergias. I have over two hundred different billbergias species and hybrids and am continuously trying to hybridize and make better looking cultivars. I have been working at hybridizing for over five years now with mixed results.

At the San Francisco Bromeliad conference I met Don Beadle and talked to him regarding hybridizing and techniques to use to keep pollen viable longer. I intend to register billbergia hybrids when I am satisfied with the results. I also intend on registering hybrids of unregistered hybrids as I find them and get them to bloom.

I am always attempting to get information regarding bromeliads, with limited results. This all led me to join the Sacramento club. I had attended both Sacramento and San Francisco clubs' shows and sales for well over fifteen years. I had been joining each club on and off many years but was unable to regularly attend their meetings. It was time to join and commit time to my favorite past time, growing bromeliads. I settled on the Sacramento Bromeliad Club because it was easier to get to Sacramento from the East Bay than into San Francisco and because the Sacramento Club had more of a homey, family environment. Keith Smith and Chet Blackburn were an inspiration and fountain of information.

I am interested in becoming a director in the International Bromeliad Society to further expand my knowledge of bromeliads. I am also interested in popularizing them so that they can better be protected in their natural habitat.



Scientific

Guzmania kressii, a New Species from Western Colombia.

Harry E. Luther¹ & Karen F. Norton

This is the first installment of a series of papers to tease out satellite taxa of the extremely widespread and superficially variable *Guzmania squarrosa*.

Guzmania kressii H. Luther & K. Norton, sp. nov.

TYPE: Colombia; Choco, Munic. San Jose del Palmar between Cairo and San Jose del Palmar, elev. ca. 2000 m. 7 Feb. 1989, *W. J. Kress & B. Echeverry* 89-2604. (Holotype: HUA; Isotypes: SEL, US, MO, CHOCO).

A *G. squarrosa* (Mez & Sodiro) L. B. Sm. & Pittendrigh cui affinis sed sepalis longioribus, bracteis florigeris multo excedens differt.

Plant an epiphyte or terrestrial, flowering 0.8 – 1.4 m tall. **Leaves** densely rosulate, spreading, moderately coriaceous, 50 – 75 cm long; **leaf sheaths** elliptic, 16 – 25 x 7 – 10 cm, nerved, densely appressed brown punctate-lepidote especially adaxially, somewhat castaneous especially adaxially; **leaf blades** ligulate, acute, 25 – 45 mm wide, somewhat nerved, sub-densely appressed pale punctate-lepidote, somewhat more so abaxially, bright green or green tinged red. **Scape** erect, 10–20 cm x 10 – 15 mm, fugaciously pale brown stellate-lepidote; **scape bracts** erect to spreading, indistinguishable from the inner leaves. **Inflorescence** erect, bipinnate, 40 – 70 x 30 – 70 cm. with 20 to 30 hemispherical branches; **primary bracts** spreading at ca. 90° from the axis, thin-coriaceous, 5 – 40 cm long with an ovate partially castaneous sheath, 2 – 5 x 3 – 5 cm and with a lingulate acute blade 2 – 4 cm wide; the lowest bright green, the upper pale green proximally, bright pink

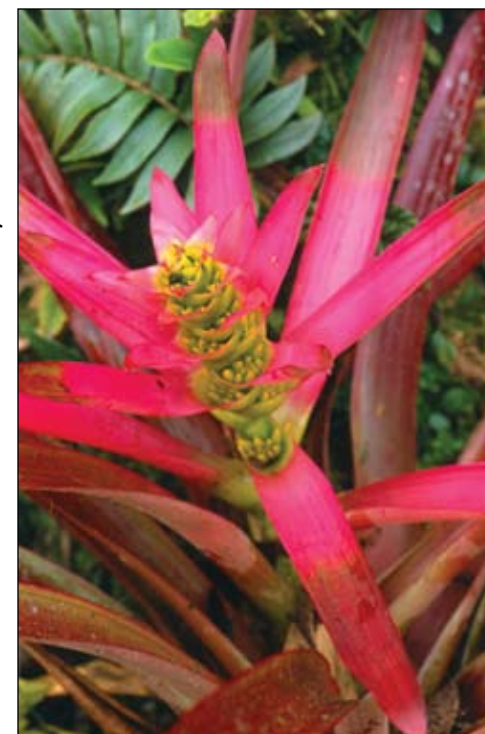


Figure 1. *Guzmania kressii*, young inflorescence of the type plant in the field. Photograph by J.W. Kress.

¹ Mulford B. Foster Bromeliad Identification Center, Marie Selby Botanical Gardens, Sarasota, FL 34236 USA.

distally or entirely bright pink; all appressed punctate-lepidote and nerved; **branches** polystichously arranged, 10 – 12 mm apart, each with a stout 1 – 3 mm long peduncle, spreading at ca. 45° from the axis, 3 – 4 x 2 – 4 cm, polystichously 8 – 20 flowered; **floral bracts** elliptic, broadly acute to rounded, cuculate, 18 – 25 mm long, punctate-lepidote, yellow to yellow-green. **Flowers** with a slender 8 – 15 mm pedicel, opening during the day; **sepals** narrowly elliptic, acute, 22 – 30 mm long connate 10 – 12 mm, coriaceous, nerved, sparsely punctate-lepidote, yellow to yellow-green; **corolla** erect, tubular, spreading only slightly at the apex, only barely exserted from the calyx; **petals** ligulate, acute, 25 – 30 mm long, agglutinated for ca. 20 mm, yellow to orange-yellow. **Fruit** unknown.



Figure 2. Paratype collection of *G. kressii* flowering at the Marie Selby Botanical Gardens. Photograph by K. Norton.

PARATYPE: Colombia. Choco, without specific locality, 2-3000 m elev., seeds field collected by C. Skotak, cultivated by J. Kent; flowered in cultivation at the Marie Selby Botanical Gardens, 12 Dec. 2002, H.E. Luther s.n. (SEL).

This showy new species can be distinguished from *Guzmania squarrosa* by its sepals that much exceed the floral bracts, thereby giving the lateral branches a spiky

appearance. In addition, the corolla is slightly spreading at the apex, but only exserted for 1 – 3 mm at anthesis and mostly not apparent at all in dried specimens. In contrast, the lateral branches of *Guzmania squarrosa* are globose with floral bracts nearly equaling the calyx and a conspicuously exserted (by 8 – 15 mm), tubular corolla with erect, cuculate lobes. *Guzmania kressii* somewhat resembles another pink-bracted taxon related to *Guzmania squarrosa* from N.W. Ecuador, but differs conspicuously on account of its barely exserted erect corolla.

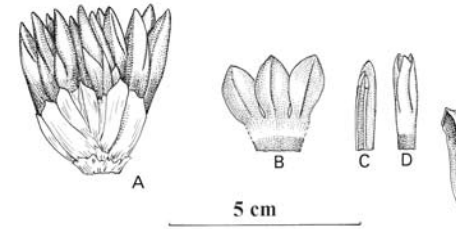


Figure 2. *Guzmania kressii*.

- A. Lateral branch.
- B. Calyx, expanded.
- C. Petal and stamen.
- D. Calyx, natural.
- E. Floral bract.

Drawing by Stig Dalström.

This beautiful new species is named for the collector of the holotype, Dr. John Kress of the Smithsonian Institution, specialist in the “other” monocots (Heliconiaceae, etc.).

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Puya bermejiana (Bromeliaceae, Pitcairnioideae), a New Species from Southern Bolivia and North-western Argentina

Silvia E. Gómez¹, Alberto C. Slanis^{2,1} & Alfredo Grau¹

A main diversification area of *Puya* extends in the Paramo and high Andean grasslands from Colombia to NW Argentina, including species adapted to temperate to cold tropical conditions (Smith and Downs 1974). A second, less explored diversification region involves the subtropical, humid to semiarid forests and valleys of Bolivia and NW Argentina ((Vásquez and Ibisch 2004), which has recently added several new species (e.g. Vásquez and Ibisch 2004, Ibisch and Groß 1998) to the already long list of Bolivian *Puya* species (Krömer, 1999). The purpose of the present paper is to describe a new species found at the border between Bolivia and Argentina belonging to the latter diversification area.

Puya bermejiana Gómez, Slanis & Grau, sp. nov. TYPE: Bolivia. Dpto. Tarija, Provincia Arce, Río Bermejo, frontera Bolivia-Argentina, 3 km al Sur de La Mamora, 1000 m elev., 28 – XII - 2005, Grau, Gómez & Araújo 1575 (Holotype: LIL). Fig.1.

Planta usque ad 3,50 m alta. Folia rosulata, ca. 1 m longa x 3,5 cm lata. Scapo longiori, bracteis scapalibus quam internodia superantibus. Inflorescentia magna, glauca, glabra, ample paniculata, cum 33 vel ultra ramulis lateralibus. Flores pedicellati deflexi, pedicellis gracilibus, ca. 1,2 cm longis, glaucis, glabris. Sepalo oblongo. Petalo lanceolato. Stamina exserta.

Plant flowering over 2.5-3.5 m high. **Leaves** many in a spreading rosette, over 7 dm long; **sheaths** ovate, entire, ca. 8 cm long; **blades** greenish-gray, narrowly triangular, over 1 m long and ca. 4 cm wide, serrate with antrorse curved spines, dark brown to black, ca. 4 mm long and ca. 15 mm apart. **Scape** straight, ca. 1 m long, 2 – 3 cm in diameter, pale green, glabrous, covered by whitish epicuticular wax; **scape bracts** narrowly triangular, acuminate, 12-50 cm long, exceeding the internodes, serrate, lepidote with hairy stellate trichomes on both sides. **Inflorescence** laxly bipinnate, 1.5-2 m long, subpyramidal, rachis glaucous, glabrous, covered by whitish wax as the scape; **primary bracts** triangular, acuminate, up to 5 cm long and ca. 2 cm wide, shorter than the sterile stipes, concave, margin serrate, pubescent on the adaxial side and glabrous on the abaxial side; **primary branches** 25 to 30, straight, 30-50 cm long. **Floral bracts** ovate, apiculate, entire, with hairy stellate trichomes on the adaxial surface and glabrous on the abaxial surface, ca. 1.5 x 1 cm, equaling or exceeding the pedicel

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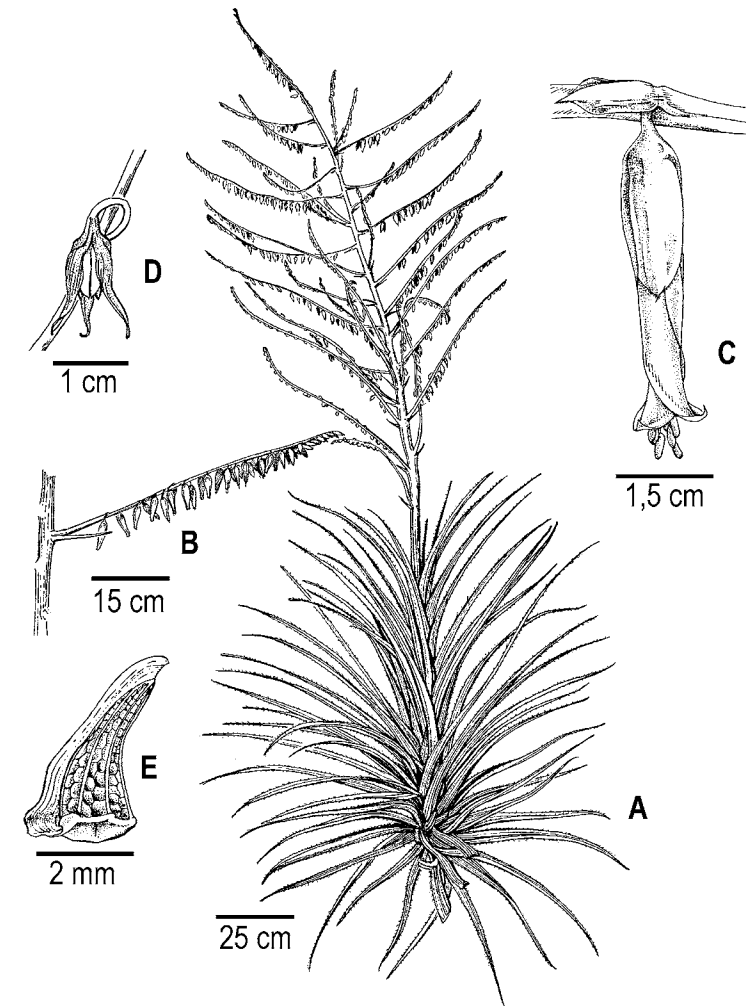


Figure 1. A: Plant. B: Inflorescence lateral branch. C: Flower. D: Capsule. E: Seed. Drawing by Alberto Gutiérrez.

length; **pedicels** glaucous, glabrous, ca. 1.2 cm long. **Sepals** glaucous, broadly elliptic, apiculate, entire, concave, mostly glabrous but with a few hairy stellate trihoms at apex, ca. 2.3 x 1 cm. **Petals** green with a pink or violet margin in the upper part, narrowly elliptic, apiculate, reflexed, ca. 4 x 1 cm. **Stamens** exserted; **filaments** flattened, ca. 3.2 cm long; **anthers** yellow, linear-oblong, ca. 1 x 1 cm. **Ovary** conic, ca. 8 x 3 mm; **style** ca. 2.5 cm long; **stigma** spiraled. **Capsules** ellipsoid, ca. 1 x 0.5 cm, sepals persistent, coriaceous, reflexed. **Seeds** triangular, rugose-reticulate, basally and dorsally winged, ca. 2 cm long, including the wing.



Figure 2. Flower detail.

rigid leaves with a higher spine density, larger flowers and exerted stamens. *Puya pearcei* from Northern Bolivia is also much smaller than *P. bermejiana* and its leaves and inflorescence are white-lepidote.

Geographic distribution and habitat: The new species grows on rocky slopes of the Bermejo River gorge that builds the Bolivia-Argentina frontier, in the Tucumano-Bolivian forest, between 500 and 1,000 m elevation in an area with annual rainfall of 1,500-2,000 mm concentrated in the November-April period.

Acknowledgments

We wish to express sincere thanks to the Mr Alberto Gutiérrez, from the Iconografía Section of the Fundación Miguel Lillo, for the line drawings.

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Figure 3. *Puya bermejiana* in habitat.



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The Bromeliad Flora of the San Martín Tuxtla Volcano, Veracruz, Mexico

Thorsten Krömer & Amparo Acebey¹ photographs by the authors.

Introduction

We conducted botanical sampling of selected plant groups, including aroids, bromeliads, orchids, and ferns along an elevational gradient in the region of Los Tuxtlas (18°05'–18°43'N, 94°35'–95°25'W), in the southeast portion of the Veracruz State, Mexico (Fig. 1). The study area is located within the municipality of San Andrés Tuxtla and rises from 100–1680 m above sea level, encompassing the San Martín Tuxtla volcano and the adjacent Los Tuxtlas Biological Research Station (EBT: Estación de Biología Tropical “Los Tuxtlas”; with a 640 ha reserve), which is operated by the Instituto de Biología, Universidad Nacional Autónoma de México (UNAM). Together, these include ca. 8500 ha old-growth forest, forming one of three core zones of the new Los Tuxtlas Biosphere Reserve that was established in 1998. For a detailed description of Los Tuxtlas see González Soriano, Dirzo et al. (1997) and Guevara, Sánchez et al. (2004).

The dominant vegetation in this region was tropical rain forest, but 80–90% of the original forest extent had been cleared by the year 1990. Currently, the lower slopes of the San Martín Tuxtla volcano are covered by a vegetation mosaic of pastures, small patches of remnant trees, and different types of agricultural fields surrounded by remaining forest fragments. Among the most important tree families (genera) are Fabaceae (*Lonchocarpus* spp.), Moraceae (*Ficus* spp.), and Lauraceae (*Nectandra* spp.). At about 1000–1550 m elevation mostly undisturbed humid montane forest (*bosque mesófilo de montaña*; (Rzedowski 1986)) comprised of up to 45 m tall trees such as *Ulmus mexicana* can be found. The summit is covered by dwarf cloud forest dominated by *Oreopanax xalapensis* and *Clusia salvinii*. In the study area, most of the botanical collections have been carried out in the relatively low elevations of the EBT, and very few botanists have sampled above 900 m. The recorded vascular flora of the EBT includes 943 species in 137 families (González Soriano, Dirzo et al. 1997), whereas for the whole region of Los Tuxtlas more than 3350 species of plants have been recorded (Guevara, Sánchez et al. 2004). The estimated total of approximately 4000 species demonstrates the urgent need for more inventories as plant diversity is threatened by the continuing transformation of natural forest into pastures and plantations.

¹ Estación de Biología Tropical “Los Tuxtlas”, Universidad Nacional Autónoma de México, Apartado Postal 94, San Andrés Tuxtla, Veracruz 95701, México. E-mail: tkroemer@ibiologia.unam.mx

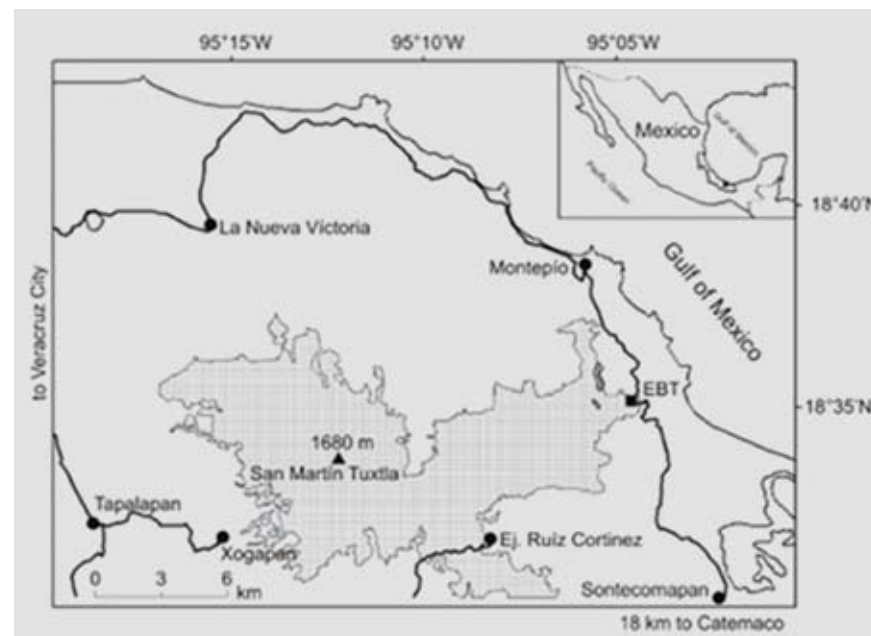


Figure 1: Map of the study area in the north-eastern region of Los Tuxtlas in southern Veracruz, Mexico. The shaded area corresponds to mostly undisturbed old-growth forest in the surroundings of the San Martín Tuxtla volcano and the Los Tuxtlas Biological Research Station (EBT).

Bromeliaceae of Los Tuxtlas

The contribution of Bromeliaceae to species richness in Los Tuxtlas is limited. A preliminary checklist of bromeliads found in the study area, based on personal collections and data from Espejo-Serna, López-Ferrari et al. (2004; Espejo-Serna, López-Ferrari et al. (2005) includes 32 species in 9 genera (Table 1). As expected, *Tillandsia* has the most species (12), while the high species numbers of *Aechmea* (5) and *Werauhia* (5) are somewhat surprising. A total of 25 bromeliads are epiphytes and only seven are terrestrial, amongst the latter are two notable species exploited by humans. One, *Aechmea magdalenae*, known as *ixtle* or *pita* in Mexico, is found in dense clusters in the understory of the lowland rainforest. The long white fibers extracted from the leaves were traditionally utilized by indigenous groups to make rope, fishing nets, and rustic clothes, whereas today it is used for the production of expensive artwork known as *el piteado* (Ticktin 2002). In adjacent Sierra of Santa Marta, also part of the Los Tuxtlas Biosphere Reserve, this species is cultivated in secondary forests for sustainable use as a non-timber forest product. Another species, *Bromelia pinguin* is often cultivated by farmers as “living fence” to delimit cattle pastures.

In Mexico, most bromeliads listed in Table 1 show a wide elevational range of at least 1000 m, whereas most species sampled during this study were only found in one or two elevation zones of 400 m. Only the widespread *Catopsis sessiliflora* occurs along the entire elevational gradient. A total of 13 species show a rather limited distribution



Figure 2. *Aechmea nudicaulis*.

to Mexico and at least to one of the Mesoamerican countries. Seven species are found south to the northern part of South America, including Colombia, Ecuador, Venezuela, and/or the Brazilian Amazon, while another seven species reach as far south as Peru, Bolivia, and/or Argentina. Merely four species, *Greigia juareziana*, *Tillandsia flavobracteata*, *Tillandsia limbata*, and *Werauhia vanhyningii*, are endemic to Mexico. A total of nine species represent new records for the municipality of San Andrés Tuxtla, including *Greigia juareziana*, which is new to the state of Veracruz and was formerly only known from Oaxaca and Chiapas. *Werauhia nutans* is new to Mexico and was formerly only known from Costa Rica (Krömer, Espejo-Serna et al. 2005). This locally abundant species with an inconspicuous green inflorescence is night-blooming and likely pollinated by nectar-feeding bats, similar to other chiropterophilous bromeliads such as the widespread *Werauhia gladioliflora*. (Krömer 2004)



Figure 3. *Tillandsia punctulata*

Establishment of a living collection

All species of bromeliads and orchids collected during this study will be cultivated in a shadehouse (Fig. 4) with the goal to establish a complete living collection of plants from the Los Tuxtlas Biosphere Reserve. For Bromeliaceae we expect to find at least eight additional species (e.g., *Catopsis berteroniana*, *Guzmania nicaraguensis*, *Tillandsia leiboldiana*) that have been documented for the adjacent municipalities of Catemaco, Soteapan, and/or Mecayapan (Espejo-Serna, López-Ferrari et al. 2004; Espejo-Serna, López-Ferrari et al. 2005). Much more diverse is the local orchid flora, which alone for the EBT includes 118 species in 55 genera (González Soriano, Dirzo et al. 1997), many of which are rare and endangered because of illegal harvesting for commerce as well as habitat alteration.

Apart from the important *ex situ* conservation aspect, this living collection and its associated data base, documenting general information on the cultivated species, will offer students and researchers the possibility to carry out research on subjects such as anatomy and morphology of reproductive organs. Furthermore, an exhibition for the general public of mostly flowering plants with explanations on the systematics and ecology of different groups and families will fulfil the educational commitment of the EBT Research Station.

Bromeliad Species	Life-form	Elev. Zone 1	Elev. Range (m) 2	Distribution in the Neotropics 3
<i>Aechmea bracteata</i> (Sw.) Grieseb.	ep	I, II	0-1100	MEX, MES, COL, VEN
<i>A. lueddemanniana</i> (K. Koch) Mez	ep	I-III	100-1150	MEX-COR
<i>A. magdalenae</i> (André) André ex Baker	ter	I	0-600	MEX, MES, COL, ECU, VEN
<i>A. nudicaulis</i> (L.) Grieseb.	ep	I, II	0-1000	MEX, MES, ANT, BRA, COL, ECU, PER, VEN
<i>A. tillandsioides</i> (Mart. ex Schult. & Schult. f.) Baker	ep	I	0-700	MEX, MES, BOL, BRA, COL, ECU, PER, VEN
<i>Bromelia karatas</i> L.	ter		0-920	MEX, MES, ANT, BRA, COL
<i>B. pinguin</i> L.*	ter	I	0-1550	MEX, MES, ANT, COL, ECU, VEN
<i>Catopsis juncifolia</i> Mez & Wercklé ex Mez*	ep	I	100-450	MEX, MES
<i>C. nutans</i> (Sw.) Grieseb.	ep	I	0-1900	FLO, MEX, MES, ANT, BRA, COL, ECU, VEN
<i>C. sessiliflora</i> (Ruiz & Pav.) Mez	ep	I-IV	0-2250	MEX, MES, ANT, BOL, BRA, COL, ECU, PER, VEN
<i>Fosterella micrantha</i> (Lindl.) L.B. Sm.	ter		150-1200	MEX-SAL
<i>Greigia juareziana</i> L.B. Sm.**	ter	IV	1300-2700	MEX, endemic
<i>Pitcairnia imbricata</i> (Brongn.) Regel	ter	I	50-1700	MEX-NIC
<i>P. recurvata</i> (Scheidw.) K. Koch	ter	I, II	0-1450	MEX-GUA
<i>Tillandsia brachycaulos</i> Schltdl.	ep		0-1200	MEX, MES
<i>T. fasciculata</i> Sw.*	ep	II	0-1860	FLO, MEX, MES, ANT, BRA, COL, VEN
<i>T. festucoides</i> Brogn. ex Mez	ep	I	0-1400	MEX, MES, ANT
<i>T. filifolia</i> Schltdl. & Cham.	ep	I	0-1750	MEX-COR
<i>T. flavobracteata</i> Matuda*	ep	I	150	MEX, endemic
<i>T. limbata</i> Schltdl.	ep	I	0-1200	MEX, endemic
<i>T. punctulata</i> Schltdl. & Cham.	ep	III, IV	200-2200	MEX, MES
<i>T. schiedeana</i> Steud.	ep	I, II	0-2230	MEX, MES, ANT, COL, VEN
<i>T. tricolor</i> Schltdl. & Cham.	ep	I, II	250-1820	MEX, MES
<i>T. usneoides</i> (L.) L.*	ep	II	0-2700	FLO, MEX, MES, ANT, ARG, BOL, BRA, CHI, COL, ECU, PER, VEN
<i>T. variabilis</i> Schltdl.	ep	I	50-1170	FLO, MEX, MES, ANT, BOL, ECU, VEN
<i>T. viridiflora</i> (Beer) Baker	ep	II-IV	670-2260	MEX-NIC

<i>Vriesea heliconioides</i> (Kunth) Hook. ex Walp.	ep	I	80-950	MEX, MES, BOL, BRA, COL, ECU, PER, VEN
<i>Weraubia gladioliflora</i> (H. Wendl.) J.R. Grant	ep	I, II	0-1200	MEX, MES, BOL, BRA, COL, ECU, VEN
<i>W. nocturna</i> (Matuda) J.R. Grant*	ep	IV	1400-1800	MEX-COR
<i>W. nutans</i> (L.B. Sm.) J.R. Grant***	ep	II-IV		MEX-COR
<i>W. vanbyningii</i> (L.B. Sm.) J.R. Grant*	ep	IV	600-2900	MEX, endemic
<i>W. spec.</i> (THO 2207, 2507)	ep	III, IV		

Table 1: Bromeliad species occurring in the study area with notes on life form (LF; ep: epiphytic, ter: terrestrial), occurrence in four elevational zones (I: 100-499 m, II: 500-899 m, III: 900-1299 m, IV: 1300-1680 m), elevational range in Mexico, and distribution in the Neotropics (FLO: Florida, MEX: Mexico, MES: Mesoamerica, COR: Costa Rica, GUA: Guatemala, NIC: Nicaragua, SAL: El Salvador, ANT: Antilles, ARG: Argentina, BOL: Bolivia, BRA: Brazil, CHI: Chile, COL: Colombia, ECU: Ecuador, PER: Peru, VEN: Venezuela). Species marked with one asterisk are new records for the municipality of San Andrés Tuxtla, the species marked with two asterisks is a new record for the state of Veracruz, and the species marked with three asterisks is a new record for Mexico. Data from ¹this study, ²Espejo et al. (2004), ³Utlé & Burt-Utlé (1994).



The display will contain some highly ornamental species such as *Aechmea nudicaulis* (Fig. 2) and *Aechmea tillandsioides* as well as common species such as *Tillandsia punctulata* (Fig. 3) and *Tillandsia viridiflora* or *Aechmea bracteata* (Fig. 5) and *Tillandsia limbata*, which can often be found growing on trees along the roadside.

Figure 4. Los Tuxtlas collection in shadehouse.

Acknowledgments

We thank Rosamond Coates, Adolfo Espejo, Bruce Holst, Ana Rosa López-Ferrari, Bruno Rezende Silva, and Martin Ricker for valuable comments on the manuscript. This study was supported by a postdoctoral grant for TK from the Universidad Nacional Autónoma de México.

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Bromeliad Society International Research Grants Program

The BSI sponsors a small granting program to support research projects dealing with just about any aspect of bromeliads. For instance, recently funded projects have dealt with ecological aspects of bromeliads in Ecuador, an inventory of Bromeliaceae for Cuba, taxonomic studies within Aechmea, and we would like to see more proposals dealing with other topics, such as horticulture, conservation, or breeding. The awards are competitive and generally limited to \$1,000 (U.S.). Applicants need to hold membership in the Society for their proposal to be considered. June 1, 2007 is the deadline for receipt of proposals for the 2007 competition.

General guidelines for proposal preparation are presented below. If you have any questions concerning these guidelines, or wish to discuss the feasibility of project ideas, please contact Greg Brown, Chair of the Research Grants Committee (gkbrown@uwyo.edu).

1. The proposal body has a 5-page limit (single-spaced, 12 pt font, 2.5 cm margins) consisting of title, project description, an itemized budget with justification, a timeline for the project, and a statement that you will submit a manuscript for review, and possible publication, to the Journal of the Bromeliad Society describing results from the funded research. Please note that the BSI Research Grant Program will not pay for institutional overhead (i.e., indirect costs), salary, or travel to attend meetings; all grant funds must be applied directly to the proposed research.

2. Your curriculum vitae.

3. For electronic submission, which is preferred, please submit pdf or Word files to gkbrown@uwyo.edu. For paper copy submission, mail 4 copies to:

Gregory K. Brown, Department of Botany, 1000 East University Ave., University of Wyoming, Laramie, WY 82071, U.S.A.

Once a proposal is received it is sent out for review. Funding decisions are based on reviewer evaluations. Awards will be finalized at the annual Board of Directors meeting in July, and applicants will be notified promptly.



Figure 5. *Aechmea bracteata*.

Bromeliad Named in Honor of Tom Wolfe

Carol Wolfe. Photos by Jay Thurrott

A bromeliad labelled “*Neoregelia ulena*” was sold, probably in the 1990’s, at a monthly meeting of the East Coast Bromeliad Society where Tom Wolfe was the speaker. Tom usually takes some bromeliads for sale that he feels a hobbyist might enjoy, and Frank Cowan of Ormond Beach purchased this plant. When selling bromeliads, Tom tries to keep at least one in his collection but in the early 90’s, the northern winds whipped south on Christmas Eve tearing the plastic from his greenhouse allowing the heat to escape and he lost many bromeliads in his collection, including “*Neoregelia ulena*”, to freezing temperatures.

When Jay Thurrott acquired a pup from the plant and noticed that it did not look like the picture on the FCBS website, he sent a picture of it to Derek Butcher, BSI Registrar. Derek questioned the name, and he doubts the existence of *Neoregelia uleana* at all since it dates back to 1896, so he proposed registering the plant as *Neoregelia* “Tom Wolfe”.

Derek Butcher to Jay Thurrott: “*Neoregelia uleana* is an enigma. It is only known from the type collection which was made in the Rio de Janeiro Botanic gardens in 1896. The photo on FCBS comes from Dennis Cathcart and he is often at Marie Selby trying to get an answer. I do not know how big it is or where he got the plant from in Brazil. In 2003 the Brazilian expert Elton Leme said he did not know what *N. uleana* looked like because he had not found it in the wild. I enclose drawings and herbarium specimen and to my eyes they do not match Dennis’s plant”.

Derek: “I feel that the Tom Wolfe plant should be called ‘Tom Wolfe!’ This is what I am thinking of putting on the register using your (Jay Thurrott) photos *Neoregelia* ‘Tom Wolfe’. Add – named by D Butcher, a plant that was sold by this nursery in Tampa, FL, in the late 1990’s as ‘uleana’. This species is little known and of doubtful origin – discovered in a Botanic Garden in 1896! In all probability this is a mis-spelling of ‘olens hybrid’ where it has clear links, photo fcbs.org”

Jay Thurrott says it is a nice looking plant about 12” to 14” across and since Tom no longer has the plant, Jay has promised him a pup. So here it is *Neoregelia* “Tom Wolfe”!



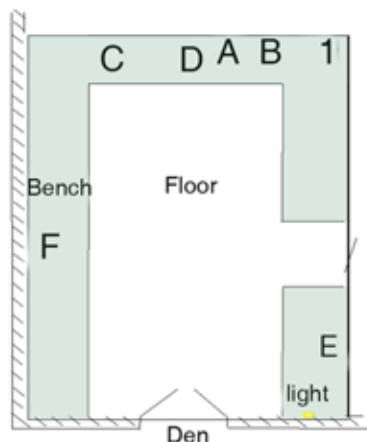
Neoregelia “Tom Wolfe” with pup. Photo by Jay Thurrott.



Bromeliads and a Cuban Treefrog

Ben Sill¹ photographs by the author.

We humans go to elaborate ends to plan, finance, and construct a “house” or “home.” It is difficult to believe that the “lower” animals care at all about where they live, so long as they can “eat but not be eaten.” This short note describes an experience with a treefrog and my bromeliads in 1975 in Charlotte, NC (I only recently found my old, detailed notes on this).



Greenhouse schematic with plant locations

Here is the scene: I had constructed a small greenhouse (about 10 feet by 12 feet) attached to our den, so that you could walk through the double doors directly into the greenhouse. Around the periphery was a two foot wide bench where a wide variety of bromeliads were displayed. The floor was gravel covered with a boardwalk at the same level as the den floor. There was a ledge around the periphery at the top of the glass walls. The ledge also supported a ventilation panel along the entire length of the walls.

My wife, a botanist, worked in a plant nursery which received regular shipments of tropical plants from Florida. On January 16, she found a small treefrog in some of the plants and brought it home (we have always been interested in things natural). It was a Cuban treefrog (*Osteopilus septentrionalis*) and had all the common characteristics of such animals, particularly the suction cups on his feet that allowed him to walk up the glass of the greenhouse without difficulty. After she brought him home, we kept him in a terrarium, but after 3 days he escaped and we saw him no more. That is, until June 6, when my wife heard him calling, and following the sound, she found him in a *Billbergia* “Santa Barbara” (Plant A in the diagram). We immediately named him “Fidel.”

We were elated to find him after such a long absence and were happy that he had made it through the winter when temperatures in the greenhouse had hovered around the 50 degrees Fahrenheit mark. The following comments are excerpts from a daily diary that we kept of Fidel’s movements over a period of the next 21 months.

Chapter 1: Does he recognize his home?

We noticed that he remained in Plant A (see the figure) during the day, and then at night he proceeded up to the ledge and moved around the periphery (clockwise, past the corner labeled 1), past the door and to the area of the green-

¹ Clemson, South Carolina, USA.



Fidel, the Cuban Tree Frog.

house at E, near the incandescent light. Here he perched on the ledge, looking for insects. He continued this habit for June 7, 8, 9, and 10 (and we presume that he had done this for some days prior without our noticing). It is important to note that the vents were open all along the ledge so that he could have escaped at any time.

This situation was too good to pass up. While he was out feeding on the night of June 10, I noticed that adjacent to his Plant A and only six inches away, was a second *Billbergia* Santa Barbara (Plant B) of the same size. I exchanged the position of the two plants.

On the morning of June 11, Fidel was not back in his old home (i.e. Plant A), nor had he gone to bed in Plant B. Instead he had relocated to a *Billbergia euphemiae* (Plant C). That night, while he was out feeding, I switched Plants A and B back to their original locations and again six inches apart. On the morning of June 12, Fidel had not returned to either Plant A, or B, or C. Later that afternoon, I found him in a hanging *Tillandsia xerographica* (Plant D) which was 2 to 3 feet above the plant bench below.

At dark that night, he came out as usual and made his customary trip around the greenhouse and stopped on the ledge just a bit short of the light (at E). On the morning of June 13, he had returned to Plant A, his original home (that was in its original position). Unfortunately for the progress of science, our family was on vacation from June 13 through June 20.



Fidel in his prime, photographed 35 years ago.

Summary Chapter 1 (see Chapter 1 table of locations):

This limited observation period suggests that Fidel “knew” his home. He apparently knew its location and appearance well enough so that when it was exchanged for another virtually identical plant, and his original home was only moved six inches, he decided to use neither.

Chapter 2: How does he handle competition?

Upon our return from vacation, I caught Fidel to make photographs and upon releasing him again in the greenhouse, he crawled through a crack and up onto the outside, top of the greenhouse. When he hadn't returned by 11 p.m., I crawled up on the greenhouse and recaptured him and released him near Plant C. On the morning of June 23, he was back in Plant A. He did not return to the light that night even though everything was the same, choosing instead to remain on that end of the greenhouse in the evening. He continued this behavior for June 24 (Plant A), 25 (Plant A), June 26 (Plant C), June 27 (Plant A), June 28 (Plant A), June 29 (Plant A). For all of these days, he remained on the far end of the greenhouse (furthest away from the den) at night

On June 29, a grey treefrog (*Hyla versicolor*) native to our area was released in the

Tables of locations

DATE	Day Location				ACTIVITY
	A	B	C	D	
June 6					
7					
8					
9					
10					Switched plants A & B
11					Switched A & B back
12					
13					On vacation through 6/20

Chapter 1: does he recognize his home?

DATE	Day Location					ACTIVITY
	A	B	C	F	?	
June 23						
24						
25						
26						
27						
28						
29						Released <i>Hyla versicolor</i>
30						
July 1						
2						
3						
4						
5						
6						
7						

Chapter 2: how does he handle competition?

greenhouse at location E at about 4:00 p.m. On June 30, neither Fidel or the *Hyla versicolor* could be located. On the morning of July 1, Fidel had gone to bed in Plant F (*Billbergia* ‘Muriel Waterman’). The grey treefrog could not be found, although my wife heard him call during the morning.

On the morning of July 2, Fidel was back in Plant A and he remained loyal to this location for July 3, 4, 5, 6, and 7. He wasn't located on July 8 and 9, but was back in Plant A July 10-12.

DATE	Day Location				ACTIVITY
	A	B	G	H	
March 13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					Released another <i>O. sept.</i>
27					
28					
29					
30					
31					
April 1					No two consecutive days in same plant from 4/1-5/1

Chapter 3: how does he react to kin-folks?

Summary Chapter 2:

Apparently Fidel was able to discern that an intruder had been released in his “territory” and reacted by changing his “home” location, at least temporarily.

Chapter 3: How does he react to kin folks?

In early March of 1976 Fidel was happily using the *Billbergia* Santa Barbara's in their usual locations (Plants A and B). Then on March 26, I brought home another Cuban treefrog (which I had captured at the Alberts and Merkel nursery in Florida) and released it into the Greenhouse. It was delighted to be free after such a long plane flight – we named him Will. As we might have expected, Fidel immediately “knew” that another frog was now inhabiting his space. As a result, he didn't return to Plant A, and in fact after 4 days in other plants, he did return to A for one day and then for the next month he never spent the day in A again and in fact, never spent two consecutive days in the same plant. During this time, Will didn't settle on one specific plant for his day time siestas either, but also moved from plant to plant.

Summary Chapter 3:

Even though the greenhouse was not large, it was much larger than a little treefrog. Despite this, it was obvious that Fidel was certainly aware that he was not alone in his former space.

Closure:

In the late summer of 1976, our family moved from Charlotte to Clemson, S.C. and we of course took our plants and frogs along. We had a new greenhouse constructed and released the frogs. They lived happily in their new surroundings until January, 1977 at which time Will died, and Fidel (maybe from a broken heart) died about a month later.



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Did You Know?**Joyce Brehm, BSI President**

BSI membership renewals occur every two months throughout the year. Interestingly, largest number of membership renewals occurs in the months of June and December. The reason for these months containing the most renewals is not known. The reason that renewals occur every two months, no matter what date you paid your dues, is because your renewal date starts with the next issue of the bimonthly publication of the Journal.

The date of your membership renewal is printed on the address label of every Journal of the Bromeliad Society you receive. It is printed in the format YYYYMMDD. About two months before your membership expires the Membership Secretary, Dan Kinnard, will mail a renewal notice.

When you receive the renewal notice the easiest way to renew your membership is by accessing the BSI web site at bsi.org and renewing on the form provided. This is also the least expensive way to renew, saving you and the BSI a postage stamp. You may renew prior to receiving your renewal notice, saving even more BSI postage. Using the internet provides you with almost immediate acknowledgment and receipt of your renewal. You will receive acknowledgement by mail if you choose to renew by mail or do not have an e-mail address.

Your team of BSI Officers and Directors is doing its best to serve all members, both by internet and by surface mail. We understand that not everyone has internet access, so if you have questions and cannot access the internet, where you have the capability to contact any of the BSI Officers and Directors directly, do not hesitate to telephone me at 858-277-1030, or write me at the address printed in the Journal of the Bromeliad Society. I will gladly answer your questions or pass them on to the person who can.

Notice of Annual Meeting

The Annual Meeting of the Voting Members of the Bromeliad Society International shall be held at the Holiday Inn French Quarter and French Quarter Chateau LeMoyne, 124 Royal Street New Orleans, LA 70130. Direct Phone #: (504) 613-3222 , Direct Fax #: (504) 522-7930 on July 14, 2007

The meeting begins at 0900 with BSI Members business transacted first then followed by the Board of Directors meeting. Any Voting Member of the BSI is welcome to attend. If any member has any business for the board to transact or any proposed business requiring a vote, this should be submitted in writing (email is fine) to the President at President@bsi.org, not less than 60 days before the meeting (May 21, 2007).

Book review

Bruce Holst¹

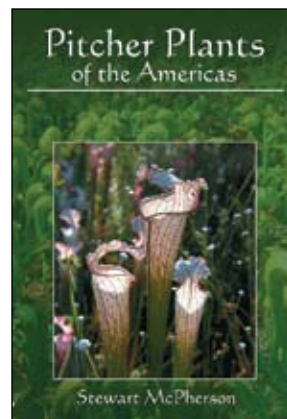
Pitcher Plants of the Americas, Stewart McPherson,
The McDonald & Woodward Publishing Company

Combining the taxonomically diverse, but beautiful and interesting, pitcher-forming carnivorous plants of the Americas into a book was a good idea waiting to happen. Fortunately, author Stewart McPherson was around to make that happen, resulting in a useful reference replete with beautiful photographs.

Five genera of pitcher plants are found in the New World, and are treated with equality in the book; two are bromeliads (*Brocchinia* and *Catopsis*) and three Sarraceniaceae (*Darlingtonia*, *Heliophora*, *Sarracenia*). A very handy synopsis of carnivory in general is presented, with a taxonomic overview table I find myself referring to frequently. Subsequent chapters focus on evolution, detailed descriptions of each genus and species, conservation, and horticulture. A glossary, conversion table, bibliography, and index round out the book.

The text appears aimed at the advanced naturalist/hobbyist but is equally of value to the professional ecologist due to the keen natural history observations by the author who seems to have spent considerable time visiting these plants in the wild. The book does not pretend to be a guide to the cultivation of carnivorous plants in the formal sense, though the brief chapter on cultivation and horticulture includes a few general growing tips along with commercial sources of plants. The content, though, should be very useful to horticulturists through the detailed accounts of plant growing conditions. The author's style is easy to follow and conversational. I enjoyed reading some of the snippets from a few of the original plant discoverers and other centuries-old comments on the natural history.

Graphically, the book is a treat. The photography is mostly excellent with many full-page pictures bled to the edge and a few 2-page full bleeds. There are a few sub-par pictures, though that is likely a result of the rarity of certain species, and they don't detract from the overall luxurious image quality. I would have liked to see more information in the photograph captions, particularly an indication of where exactly the picture was taken, and whether from a cultivated plant or from a location in the wild. Simple, uncluttered distribution maps are provided for each species and provide a useful, at-a-glance view of where the plants are found in the wild. The pen and ink



¹ Marie Selby Botanical Gardens, Sarasota, FL 34236 USA.

drawings are well done and nicely illustrate the key features of each genus.

The Bibliography section is perhaps the weakest part of this book. It fails to include some of the more interesting and significant scientific publications of the past few decades, particularly the works of Tom Givnish et al. (1984) and David Benzing et al. (1980, 1994) on carnivory in Bromeliaceae, Klaus Jaffe et al. (1992) on carnivory in *Heliophora*, and Otto Huber on the ecology and geography of the tepuis (1995). While that makes it more difficult for the reader to delve more deeply into the original literature and may reduce the scientific accuracy to some extent, many classic carnivorous plant works are included, along with a few very up-to-date ones.

The chapter on conservation really brings home the plight of some American pitcher plants, especially *Sarracenia*. A long passage from carnivorous plant documenter Jim Miller, who has first-hand witnessed the vast habitat destruction of the southeastern United States, is especially poignant.

I very much look forward to seeing the authors' forthcoming books on the Lost World area of Venezuela, carnivorous plants of the world, and pitcher plants of the Old World. And my 9-year old son, a keen carnivorous plant enthusiast in his own right, is looking forward to snatching this current book from my hands.

Outside dimension; 6 x 9". 320 pages. 245 Figures. Full color throughout, glossary bibliography, index. Available through Redfern Publications (www.redfernnaturalhistory.com) or McDonald & Woodland Publishing (www.mwpubco.com). Hardcover \$44.95 (0-939923-75-0). Softcover \$34.95 (0-939923-74-2).

Note: A portion of the proceeds from books purchased through Redfern Publications are being used for *Sarracenia* habitat preservation.

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The Carnivorous Bromeliads

Stewart McPherson

It was during Christopher Columbus's second voyage to the New World in 1493 that bromeliads were first collected and described by Europeans. During the five centuries since, at least 3,000 species have been described all of which occur exclusively in the Americas with the exception of one species. When we examine this vast group of plants, we see a startling diversity in the differing shapes, sizes, structures and colours of bromeliads. This wide diversity and adaptability has enabled the Bromeliaceae to emerge as one of the most successful families of New World plants. Bromeliads have mastered terrestrial, epiphytic and even in some cases lithophytic habitats, and within specific ecological niches they can dominate local flora. Yet within this incredible group of plants three particularly interesting species stand alone, for they have evolved the remarkable adaptations that enable the trapping of insects and other animal prey. They are the carnivorous bromeliads.

It may be surprising that just 0.1% of currently known bromeliad species are carnivorous. Carnivory in the plant kingdom is in all incidences extremely rare, however tank bromeliads seem so naturally predisposed towards the trapping of prey that they would appear to be the most likely plants to evolve to become carnivorous – yet this is not so, they are far outnumbered by almost 600 species of non-bromeliad carnivorous plants. Three species of bromeliads belonging to two genera are currently seen to be carnivorous. Two belong to the genus *Brocchinia* (*B. hecetioides* and *B. reducta*) and one belongs to the genus *Catopsis* (*C. berteroniana*). In both cases, each genus consists of around 20 species, the overwhelming majority of which are non-carnivorous regular tank bromeliads. This in itself is unusual since all other genera of carnivorous plants consist exclusively of carnivorous species – perhaps this is an indication of a the recent evolution of carnivory among bromeliads. It is certainly clear that carnivory evolved separately in the two genera after *Brocchinia* and *Catopsis* diversified from an ancient common ancestor, thus carnivory has emerged at least twice in the Bromeliaceae although it has apparently been driven in parallel evolutionary directions.

All three species were first described during the late 19th and early 20th centuries as the botanical exploration of tropical parts of the New World intensified, yet all three have remained obscure and little known until relatively recently. During the 1980s and 1990s, botanists discovered unusual morphological traits in *C. berteroniana* and *B. reducta* which displayed similarity to adaptations of known carnivorous plants. Experiments such as those conducted by Frank et al (1984) demonstrated that *B. reducta*, *B. hecetioides* and *C. berteroniana* caught prey much more readily than regular tank bromeliads, and indeed in the case of *C. berteroniana* 12 times more prey was caught in comparison to



Catopsis berteroniana growing in the cloud forest in Venezuela

regular bromeliad species under identical conditions and circumstances.

It has long been known that all tank bromeliads inherently trap insects which occasionally and randomly fall into the plant's water reservoirs and drown but observations reveal that unlike regular tank bromeliads, *B. hecetioides*, *B. reducta* and *C. berteroniana* possess clear adaptations that actively elevate the rate by which insects are trapped. In essence these three bromeliads possess the ability to attract, retain, digest and absorb insect prey in fundamentally the same ways as other known carnivorous plants.



A landscape dominated by *Brocchinia bectioides* in the Guiana Highland, Venezuela.

B. bectioides, *B. reducta* and *C. berteroniana* produce foliage that collectively forms upright, hollow, water containing leaf rosettes that store a permanent quantity of rainwater which functions as the plant's trap. The foliage in all three species is vividly coloured (bright yellow) and extremely conspicuous. The leaves of all three species are lined with a prominent coating of intensely UV-reflective white powder. In the UV sensitive vision of insects, this powder coating must make the bromeliads stand out brilliantly – perhaps to mimic conspicuous and often similarly shaped flowers. The presence of water and the occurrence of previously trapped dead insect within the leaves act as bait to entice new prey. Sweet secretions akin to nectar occurring within the leaf rosettes of the carnivorous bromeliads have also been noted by botanists and may also act as lures. The result is a brightly colourful and fragrant structure to which flying insects, beetles and ants in particular are drawn.

Perhaps mistaking the foliage for flowers, visiting insects explore the interior of the plants' rosettes perhaps in search of nectar. The surface of the leaves of *B. bectioides*, *B. reducta* and *C. berteroniana* is extremely waxy and very slippery. The UV-reflective white powder that coats the leaves is crumbly and loose and greatly hinders the ability of

insects in securing a firm footing. The slightest movement of the plants in the wind or any falter on the part of the insect causes it to flip and fall into the water filled leaf axils of the bromeliad. Trapped by the surface tension of the liquid contained within, the trapped prey is unable to climb up the slippery leaf, and eventually drowns. It is not clear the degree to which enzymes are secreted by *B. bectioides*, *B. reducta* and *C. berteroniana* however the work of Plachno et al. (2005) demonstrated that at least simple enzymes such as phosphatases are produced directly in the case of *B. reducta*. Bacteria and various micro organisms assist the digestion process and break down the soft remains of trapped prey, releasing nutrients into the liquid contained within the bromeliad's reservoirs. The resultant nutrient soup is absorbed directly by the bromeliads leaves.

The same basic structure is consistent in the traps of all three tank bromeliads. The foliage is arranged in a compact water tight rosette that is capable of retaining water either centrally or in the plant's leaf axils. The foliage of *C. berteroniana* forms a relatively broad rosette which contains water predominantly in the plants' leaf axils whereas the foliage of *B. reducta* is arranged in a tightly tubular rosette which offers

little or no space for axil reservoirs but a large central reservoir in the middle of the leaves. *B. hechtoides* is midway between the two extremes. It produces a loosely arranged leaf rosette with large leaf axil reservoirs but also a large central reservoir. The differences in the trap structures perhaps reflect differences in the ecology and habitats of the plants. *C. berteroniana* grows epiphytically and therefore requires small, compact, relatively streamlined foliage that is less likely to overturn and spill while the much more tubular upright foliage of *B. hechtoides* and *B. reducta* are always anchored to the ground as these plants grow terrestrially.



The entrance to the tubular leaf rosette of *Brocchinia reducta* - the interior of the rosette is extremely waxy - it is very easy for an insect to fall into the depths of the rosette, but very difficult for it to escape.

Of the three carnivorous bromeliads, the foliage of *B. reducta* appears to be the most specialized towards carnivory and indeed it generally catches the largest amounts of prey. It is reasonable to suggest that insects may escape more readily from the leaf axil reservoirs of *B. hechtoides* and *C. berteroniana* than the deep, tubular, tight rosettes of *B. reducta*. Yet to achieve this efficiency, *B. reducta* has evidently compromised the efficiency by which it can photosynthesize. Its tightly arranged foliage forms an effective trap but since the leaves are positioned upright and overlap one another, far less sunlight is caught than by the more widely spread foliage of *B. hechtoides* and *C. berteroniana*.

This trade off appears to afford *B. reducta* a number of very significant advantages, since it reduced dependence on the local availability of nutrients and enables the plant to flourish in the most marginal areas of habitat where barren and inhospitable conditions reduce competition. In such areas a reduced rate of photosynthesis is likely little disadvantage. Consequently on the desolate summits of the tablelands of Venezuela, *B. reducta* is especially prevalent and frequently represents the overwhelmingly dominant species of large plant.

The ability of the carnivorous brocchinia to acquire nutrients through carnivory is apparently so significant that both *B. hechtoides* and *B. reducta* are able to grow rooted directly to bare rock – their modified leaves provide a permanent and stable supply of water and a constant source of essential nutrients in the form of trapped insects.

The mechanisms and processes by which *B. hechtoides*, *B. reducta* and *C. berteroniana* trap insects are essentially exactly the same as those employed by the genera of pitcher



Colonies of *Brocchinia reducta* growing on bare rock in the Guiana Highlands, Venezuela.

plants *cephalotus*, *darlingtonia*, *heliophora*, *nepenthes* and *sarracenia*. Insects are lured through various forms of bait, encouraged to fall into reservoirs of water that the plants' leaves hold, and then are prevented from escaping and eventually digested so that nutrients can be absorbed by the plant. The only significant difference between the carnivorous bromeliads and the conventional pitcher plants lies in that the trap of the carnivorous bromeliads consists of several leaves rather than a just one. On this basis, I handle the carnivorous brocchinia and catopsis as 'bromeliad pitcher plants' and refer to the five conventional genera as 'true pitcher plants' (McPherson 2006).

The fundamental morphological similarities between the 'bromeliad pitcher plants' and members of the 'true' pitcher plants are often extraordinary. The clearest example is the similarities of the structure of the trap of *Brocchinia reducta* and *Sarracenia flava*. Both plants produce traps that are narrow, tubular, and approximately of similar heights. In both, the ratio of width to height is roughly the same, probably reflecting the most efficient balance for the retaining of prey. Both are highly UV-reflective and both are bright yellow and contrast conspicuously with surrounding vegetation. Both plants are lined with vertical veins and the uppermost parts in both are often infundibular. If the sweet bait of *B. reducta* is confirmed, then both will essentially possess exactly the same lures to attract prey. Although the two plants have evolved completely separately, they appear to have evolved in direct parallel with one another.

Arguably the simplicity of the traps of *B. reducta* offer significant advantages over the Sarraceniaceae including the *heliophora* – a genus of pitcher plants that

*Brocchinia reducta* in the lowlands of Venezuela*Sarracenia flava* in Florida, USA.

are closely related to *Sarracenia*. Whereas the traps of *S. flava* last only a few months and die back every winter, the collective trap of *B. reducta* is maintained through the combined effort of several individual leaves and is therefore more durable and lasts the entire length of an individual plant. Since *brocchinia* occur in tropical areas, the lack of cold winter temperatures allows continual growth year round so that the plants 'pitcher' is permanently maintained as older leaves die back. Prey that is trapped by *B. reducta* may therefore be digested over a longer period and perhaps nutrient extraction per prey is more efficient. On the other hand, the *Sarraceniaceae* consist of several leaf traps and the combined total of prey which each plant catches may therefore be greater than that of *B. reducta*. These variations of the pitcher plant theme arise from differences in climatic and environmental conditions as well as evolutionary and ecological history, yet the fact that evolution can yield such essentially comparable results is extremely interesting.

At the start of the 21st century, large blanks remain in our understanding of even the basic ecology and taxonomy of the carnivorous bromeliads. Fundamental details of the floral structure and reproductive traits of these plants, especially the *brocchinia*, remain unclear and indeed even the boundaries between each of the species of *brocchinia* remains very unclear. There are at least two other taxa of *brocchinia* which do not fit into any currently described *brocchinia* sp. yet at the same time, these

undescribed variants show very clear affinity to *B. hecetioides* and *B. reducta*.

One is a much larger version of *B. hecetioides* which consists of three times as many leaves, each of which are up to 100 cm tall. It differs from all currently known *brocchinia* sp. in that its rosette is upright, compact and forms an essentially tubular vessel similar to *B. reducta* and *B. hecetioides* yet it is considerably larger than both. A second variant is more similar to *B. reducta* and possesses a tightly tubular rosette that is much shorter, but considerably stouter so that the result is almost triangular in cross section. Both undescribed variants appear to display all of the characteristics towards carnivory that *B. hecetioides* and *B. reducta* display – perhaps there are more than two species of carnivorous *Brocchinia* after all.



The stout *brocchinia* that does not fit into the current descriptions of either *B. hecetioides* or *B. reducta*.

It will certainly be many years until we fully understand these remarkable plants and their extraordinary abilities to trap insects and other small animals.

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Introduction to the activities of the Dutch/Belgian Bromeliad Society

John Coenen, Jeroen van der Steen, Cees Fransen and Uwe Scharf



Visiting BCG group members at the nurseries of Corn. Bak B.V.

Introduction

Recently Dutch and Belgian hobbyists of bromeliads and associated plant nurseries celebrated the 10 year anniversary of the combined Dutch-Belgian Bromeliad Society. Amazingly in a country like The Netherlands, with many hobbyists of all kinds of indoor and garden plants, one would expect a longer history for a society on exciting popular plants such as Bromeliaceae.

Moreover, Europe, The Netherlands as well as Belgium are

well-known for commercial nurseries of bromeliad plants and widespread sales. For instance very close to the capital of Amsterdam we find the company Cornelis Bak B.V. It is one of the largest nurseries of bromeliad plants and seedlings in Europe, if not worldwide. Large professional nurseries exist as well in Flanders, Belgium.

The start

The initiative for the foundation of the Dutch-Belgian Bromeliad Society was taken around 1995 by two Dutch individuals. One of these pioneers is John Coenen from the village Benthuisen (close to The Hague). John is fascinated by the colourful blooming of bromeliad species such as Vriesea, Aechmea and Tillandsia. At the time he could not find any good society specializing in these plants and tried unsuccessfully to form a liaison with the Bromeliad Society UK. Finally he became a member of the Dutch Orchid Society and a Paludarium (land-water) Society in The Hague in the hope of finding more information on bromeliads. The other pioneer is Jeroen van der Steen from the city of s'Gravenzande who has his roots in the amphibian and reptilian community. He is keen on special bromeliad species such as Tillandsia, Dyckia's and Abromeitiella's. Accidentally in 1996, during their search for splendid animals and decorative plants, Jeroen and John met during an exhibition event organized by the aquarium society "Minor" down town in The Hague. Representing the Paludarium society, John stood behind a small counter nicely decorated with tillandsia and bromeliads. While talking

about the frogs and reptilians soon their discussion diverted to their true love "bromeliad and tillandsia plants". This turned out to be a happy and stimulating flash of recognition.

First steps

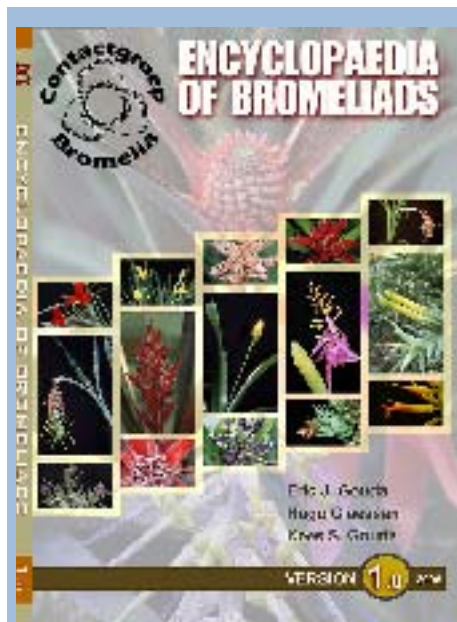
Jeroen and John decided to organize something to benefit the hobbyists of these plants since no organized group was present to actively support hobbyists growing Bromeliads in either The Netherlands or the neighbouring country Belgium. After a few visits to their respective plant collections they decided to search for people with similar interests and to explore the possibility of founding a new group fully dedicated to Bromeliads. This should be an informal "Bromeliad Contact Group" (BCG) an unofficial society, just to meet and talk on plant growing issues and eventually exchange plants, seeds and siblings. Persons who made an interesting voyage to tropical rain forests abroad could be invited to present their slides for showing bromeliads in their native habitat.

They wrote a first invitation letter (dated December 15 1995). Through January 4, 1996 in total some 30 letters were written and paid from their own pockets just because they were convinced of the need for such a Bromeliad Society. Of course some voices were raised telling that this was a no go.

However they succeeded in making a start and gradually the BCG expanded to some 25 members in the first year. Also folks from the neighbouring country of Belgium joined the BCG, which was then baptised as Dutch-Belgian BCG. Gratefully they received support by professional growers such as Jaap Rip Co. (Pijnacker) and Cornelis Bak B.V. (Assendelft). The first informal meeting took place on September 29, 1996 in Tilburg in a restaurant named "De Oliemeulen". This was a good meeting with lectures from senior bromeliad hobbyists Jan Meere and Wim van de Berg. Soon the number of members of BCG increased to 40 people. The second meeting was hosted by Peter Bak, being director of the bromeliad nurseries of Corn. Bak BV. in Assendelft. The third, on June 7, 1997, hosted Willem van de Broek's in "Blijdorp Zoo" in the city of Rotterdam followed by the first meeting organized in the Botanic Gardens of the Academic University Utrecht on October 5, 1997.



Peter Bak, member of our BCG group, shows a nice Bromeliad species to the visiting group of the Dutch/Belgian BCG during their recent visit to the nurseries of Corn. Bak B.V. in Oct. 2005



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Acanthostachys strobilacea.

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Alcantarea imperialis (green) • *Billbergia brasiliensis* • *borrida* • *zebrina*. *Catopsis juncifolia* *Guzmania bollinense* • *zabnii*. *Hohenbergia stellata*. *Neoregelia babiana* • *carolinae* 'Marechalii' • *concentrica* • *concentrica* 'Plutonis' • *fluminensis* • *johannis* • *magdalenae* • *morrisoniana* • 'Mastroeueus?' • *uleana*.

Nidularium marechallii (probably *Neoregelia carolinae*). *Pepinia beachiae*. *Pitcairnia atrorubens* • *brittoniana* • *spicata*. *Portea leptantha*. *Puya mirabilis*.

Tillandsia capillaris 'Hieronymi' • *fasciculata* • *ionochroma* • *jalisco-monticola* • *triticea* (maybe *spiculosa*) • *singularis* • *utriculata*. *Vriesea procera* • *saundersii* • *Weraubia gladioliflora*

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Formal foundation of the Society

The informal BCG was quickly guided by a formal board under the professional leadership of Eric Gouda as chairman. For personal reasons John Coenen stepped back to membership and in his place came Cees Fransen from Noordwijk. In a short time the bromeliad contact group was institutionalized as an official society under Dutch legislation in November 2000.

By seeking connection to the Bromeliad Society International (BSI) as "affiliate society" in June 2000 the BCG increased its official profile to the outside world. However all members appreciated, and still do, that BCG keeps its informal character as a group of enthusiastic number of people willing to put effort into their common hobby. Ever since then the group has kept regular meetings, organized visits to nurseries and invited speakers to give appealing presentations on bromeliads and visits abroad. Currently during each society meeting there is a plant review session chaired by Eric Gouda explaining the origin and characteristics of plants brought by members on a scientific as well as on a popular basis. Also we do have a lottery of plants, kindly donated by Peter Bak and usually some slide presentations at the end. In October 2005 in the Botanical Gardens in Utrecht we reflected on the 10 year old history of our Dutch-Belgian Bromeliad Contact Group and honoured Eric Gouda for his efforts in keeping the group going.

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BSI Honorary Trustee: William (Bill) O. Morris

Geoff Lawn

Hobbyist Bill Morris became a BSI Honorary Trustee in 1962 and has been involved in bromeliads for over 50 years, but his commitment and many achievements have been little known outside Australia. Bill lives in rural Medowie (near Newcastle), New South Wales and began growing bromeliads about 1953, joining the BSI in 1957. He was a prolific correspondent with early pioneers Mulford Foster, Frank Overton, David Barry, Charles Lancaster, Fred Gerber, Adda Abendroth, Charles Hodgson, Muriel Waterman, Richard Oeser, Ervin Wurthmann, Julian Nally, Doering & Eipper in Brazil and later Elton Leme.

In total Bill raised and introduced into Australia over 150 bromeliad species with seed supplied mainly by Barry, Lancaster and Abendroth. Bill traded cycad seed for bromeliad seed with Foster and they had a friendly rivalry on hybrids, Bill producing his first bigeneric (X *Neobergia* 'Noddy') in 1960, before Foster. When the BSI conducted a world-wide collection census in the early 1960s Bill had one of the most varied with over 450 species and hybrids. At that time species forms grown generally outnumbered hybrids. Such was his enquiring mind on correct names, Bill is the only Aussie who has a collection reference in the Smith & Downs Bromelioideae Monograph (1979), referring to *Aechmea gigantea*, page 1799.

By 1962 rising bromeliad interest in Australia warranted organising formal gatherings. Bill became a founding member and first Vice President (1963-65) of the Bromeliad Society of Australia based in Sydney. A second term as Vice President was in 1988-90, during which he was appointed relieving President in 1988-89. Frequent guest speaker, show judge, committee member for many years and Bromeleetter articles writer were other voluntary duties Bill undertook. Life membership was awarded in 1983.

The establishing of Aussie bromeliad societies and study groups in most States by the late 1970s initiated the concept of biennial national Conferences to unite growers regularly and to share knowledge on a wider scale. Furthering the cause, Bill became an Australian Conferences speaker on the following topics in Sydney (1983): "The Early Days of the Bromeliad Society of Australia"; Brisbane 1985: "Tillandsias and the Australian Climate" and in Adelaide (1987): "Billbergias".

Nurturing local regional interest in bromeliads, Bill founded and was first President of Hunter District Bromeliad Society in 1985-86. He was a regular presenter and discussion leader on many subjects, including identification, at meetings. The Vice-Presidency Bill held in 1987-93. Life membership was awarded in 1989.

All the while, on the home front Bill bred 57 hybrids, mainly neoregelias, billbergias, plus a few vrieseas and bigenerics. Cultivars he produced in the 1960-93 period include *Aechmea* 'Terrace Red Sunset', *Billbergia* 'Bill's Baby', 'Bill's Bonanza', *Neoregelia* 'Black Beauty', 'Stormy Forest', X *Aechopsis* 'Newk' and *Vriesea* 'Plain Lubberly'. Bill raised many Brazilian species from seed in the 1960-1970 period. In 1958 Bill developed from

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his variegated seedling the famous Aussie marginated clone of *Neoregelia concentrica*, only recently registered (Jan. 2007) as *N.* 'Bill Morris'. Hybridists are seldom forthcoming in detail on paper about their breeding methods or programs but Bill outlined the basics in his articles and invariably had written technical discussions on the finer points with Derek Butcher in Bromeleetter.



Bill Morris in 1987. Photo by Derek Butcher.

Always active, Bill joined the Bromeliad Society of New South Wales in 1983. He was "grandfathered in" as a very experienced judge and conducted several judging schools in 1994-97. Guest-speaker and show judge were roles in which he excelled. In 1998 life membership was bestowed upon him.

A fourth group Bill became involved in was as a charter member of Central Coast N.S.W. Bromeliad Society (1982); guest speaker and show judge were again his particular forte. Life membership was granted in 1992.

In the past decade Bill's horticultural interests have diverted more into begonias, clivias and breeding terete *Aeridovanda* orchids for cool conditions, indicative of his life-long passion for specialising in various exotic plants. What a devoted long-time leading ambassador for the bromeliad field he has embraced and served.

Acknowledgements: many thanks to Bill Morris, Derek Butcher, Peter Franklin and Alice Williams for information and photos.

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EVENTS CALENDAR

Australia

May 5-6, 2007. Bromeliad Society of Australia Autumn Show, Burwood RSL Club.

September 6-9, 2007. Central Coast Bromelid Society Show, Mt. Penang Parklands at Kariong, N.S.W.

September 8-9th, Illawarra Bromeliad Society Spring Show, Corrimal

September 21-23, 2007 14th Australian Bromeliad Conference. Rydges resort Hotel, Port Macquarie. Enquiries to 47 Boden Street, Edge Hill QLD 4870 or lynnie@ledanet.com.au

October 13-14, 2007 Bromeliad Society of Australia Spring Show, Burwood RSL Club.

October 27-28, 2007. Bromeliad Society of NSW Spring Show, Wellbank Street, Concord.

June 24-29, 2008, BSI World Conference in Cairns (Australia.) Enquiries to Lynn Hudson, 47 Boden Street, Edge Hill QLD 4870 or lynnie@ledanet.com.au

New Zealand

October 9-15, 2007. Bromeliad Society of New Zealand Spring Display & Plant Sale. Milford Shopping Mall, Auckland. Contact Alan Cliffe 09-479-1451.

United States of America

August 18-19, 2007. Seminole Bromeliad and Tropical Plant Society & Floridiana East Coast Bromeliad Society Show and Sale. The garden Club of Sanford, 17-92 and Fairmont drive. Contact 321-363-7351.

August 31-Sept. 2, 2007. 10th International Cryptanthus Show and Southwest Bromeliad Guild Show, Beaumont Texas. Contact 239-997-2237 or 409-753-3652.

September 29, 2007. Florida Council of Bromeliad Societies 2007 Bromeliad Extravaganza. Hosted by Bromeliad Society of Broward County (see advertisement on page 90).

November 30-Dec. 2, 2007. Caloosahatchee Bromeliad Society Sale and Show. Terry Park, 3410 Palm Beach Blvd (SR80), Fort Myers. Contact Steve Hoppin at SteveandLarry@comcast.net or 239-997-2237.

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.

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