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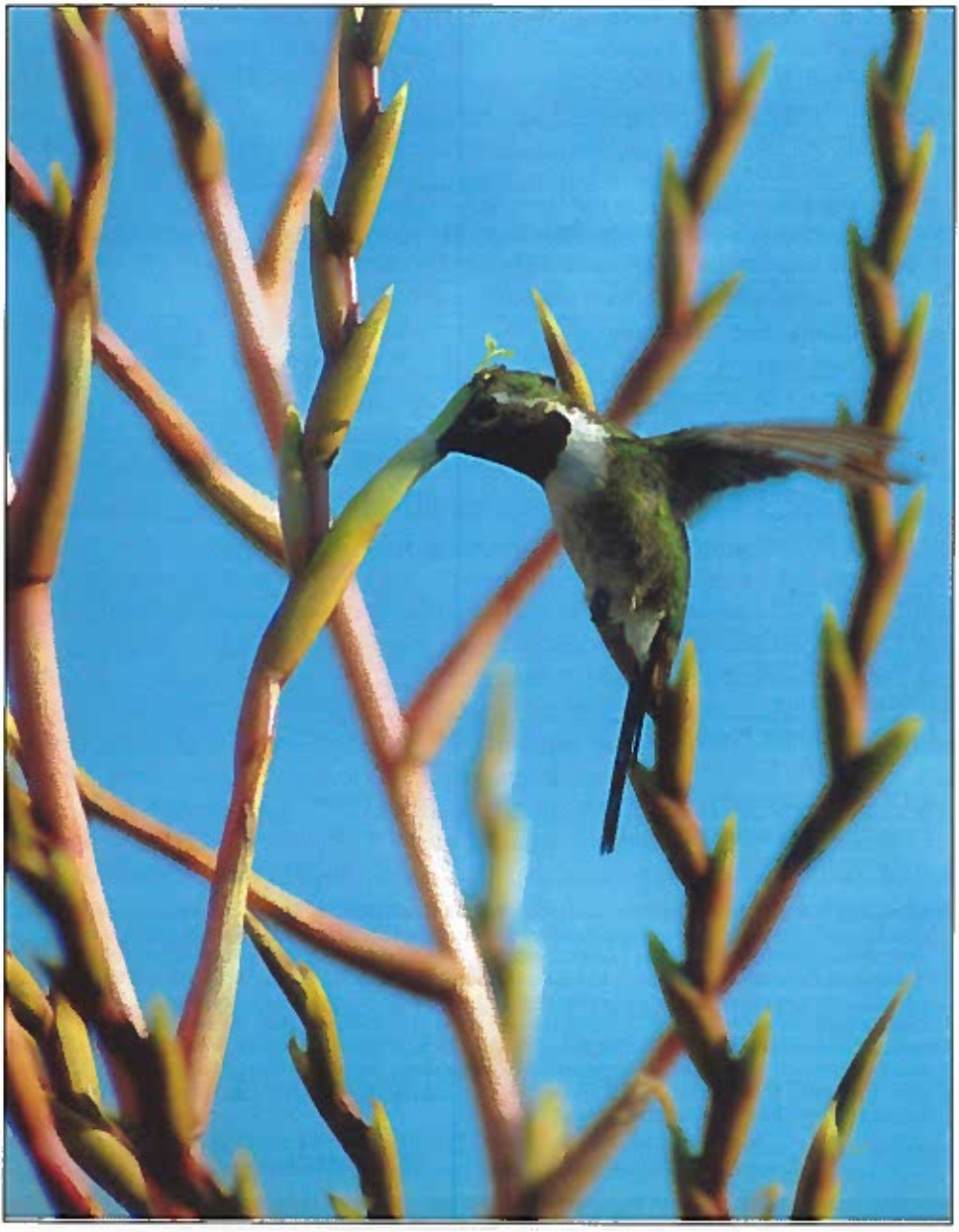

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Cover photographs. Front: The hummingbird *Doricha enicura* (male) pollinating flowers of *Tillandsia dasyliriifolia* in the Yucatán Peninsula Mexico. See the complete story in this issue Photograph by Ivón Ramírez. Back: The bizarre flower spike of *Aechmea perforata* surprised many in Australia when it appeared. Photograph by Derek Butcher.

FEATURE ARTICLES

BROMELIAD SOCIETY BUSINESS AND NEWS

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Puya ibischii (Bromeliaceae), a New Species from Cochabamba, Bolivia

Roberto Vásquez Ch.[1]

Abstract: *Puya ibischii* sp. nov. from Cochabamba, Bolivia is described and illustrated. This species is related to *P. solomonii*, *P. nutans*, and *P. venezuelana* which have nutant inflorescences. It is distinguished by the lanate indument covering the floral parts. It occurs in a high and humid canyon that descends to the montane rain forests of the Yungas region.

Resumen: Se describe e ilustra *Puya ibischii*, una nueva especie de Cochabamba, Bolivia. Roberto Vásquez Ch. Esta especie está relacionada con *P. solomonii*, *P. nutans* y *P. venezuelana* por presentar una inflorescencia nutante. Se diferencia de esas especies por el indumento lanoso que cubre las partes florales. Crece en una quebrada alta y húmeda que desciende a la región de los bosques montano húmedos de los Yungas.

Puya ibischii R. Vásquez, sp. nov. **Type:** Bolivia. Cochabamba: Prov. Chapare: between Corani and the road to Tablas, 3150 m, 17°13'04"S, 65°53'31"W, in steep slopes above cloud forests, 1 May 2002, *R. Vásquez 4457* (HT: LPB; IT: SEL, VASQ). FIGURES 1-4.

Puya solomonii G.S. Varadarajan, *P. nutans* L.B. Sm. et *P. venezuelana* L.B. Sm. similis in scapo nutanti sed indumento lanato alboque bracteas et flores obtegenti, scapo longiore et floribus majoribus differt. A *Puya herzogii* inflorescentia nutante et floribus majoribus viridi-flavisque differt.

Plant aggregated, flowering 2.5-2.8 m high. ***Leaves*** rosulate, forming a dense rosette, to 1.8 m in diameter; sheaths not seen; blades 80-100 cm long, 3-3.5 cm wide, oblong triangular, olive-green, glabrous above, densely cinereous-lepidote beneath; serrate with antrorse light brown, 7-10 mm long spines. ***Scape*** stout, inclined at an angle of 45° in relation to the stem, 1.8-2 m long, 25 mm in diameter, white lanate, becoming glabrous with age. ***Scape-bracts*** reflexed, exceeding the internodes, glabrous, the lower ones with narrow triangular blades, to 15 cm long, laxly serrate; the upper ones shorter and wider. ***Inflorescence*** nutant, simple, if compound only in the lower branches, cylindric, up to 50 cm long, 15 cm in diameter at anthesis, densely white lanate. ***Floral bracts*** broadly ovate, apiculate, obscurely crenate, densely white lanate on both surfaces, exceeding the sepals, up to 9.5 cm long, 4.5 cm wide, dark brown, fleshy at the base. ***Flowers*** nutant, up to 9 cm long. ***Pedicel*** and ***ovary*** obconic, 1.5-2 cm long. ***Sepals*** obovate, apiculate, fleshy at base, 5 cm long, 2.5 cm wide, yellowish green, the apex maroon, densely white lanate on both surfaces. ***Petals*** contorted after anthesis, broadly obovate, obtuse to mucronate, fleshy at base, greenish-yellow towards the apex, to 6.5 cm long, 3.3 cm wide. ***Stamens*** included, white, 50-

[1] Sociedad Boliviana de Botánica. Casilla 3822. Santa Cruz, Bolivia. E-mail: rvasquez@cotas.com.bo.

Photograph by R. Vásquez.

Figure 1. *Puya ibischii* in habitat.

Figure 2. Detail of the inflorescence of *Puya ibischii*.

Photograph by R. Vásquez.

55 mm long including a 25 mm long anther; pollen yellow. ***Pistil*** 6 cm long, white; stigma light green, 5 mm long, slightly contorted. ***Capsule*** and ***seeds*** not seen.

Paratype: Bolivia. Cochabamba: Prov. Chapare: Cumbre de Colomi, on the road from Cochabamba to Chapare, 3300 m, 20 July 1997, *J.R.I. Wood 12499* (BOLV).

This species has been known to botanists for more than 20 years who drove along the new road between Cochabamba and Villa Tunari, without paying major attention - possibly, due to the fact that it can be confused with *Puya herzogii* Wittm. (e.g., Ibisch & Vásquez 2000) because they grow in similar habitats. Both species have a dense and white-lanate indument covering the inflorescence, the bracts, and the sepals. However, *P. ibischii* differs

by having a nutant and simple (not erect and compound) inflorescence, and by the larger flowers with greenish-yellow petals (not greenish-blue). (see photograph of the type population of *P. herzogii* in Herzog 1923, p. 187, see also Kessler 2001)

Puya ibischii is also similar to *P. solomonii* Varad. due to the geniculate or nutant inflorescence, and both grow at the edge of the cloud forests. Other species with the same character are *P. nutans* L.B. Sm. and *P. venezuelana* L.B. Sm. from Ecuador and Venezuela respectively (Smith & Downs 1974, Varadarajan 1989). *Puya ibischii* differs from these three species by being larger and having a densely lanate indument that covers the scape, the inflorescence, the bracts, the rhachis, and the sepals that easily becomes detached. *Puya solomonii* differs additionally by its glabrous, paniculate inflorescence.

Puya ibischii is only known from a narrow canyon that connects Yungas cloud forest habitats with the humid Puna grasslands, between 2900 and 3300 m elevation. The climate is rather humid and cold, and frost occasionally occurs. Another new species, *Puya pizarroana* Vasquez, Ibisch & Beck (Vásquez et al. 2003). was recently found in the same ecoregion, in the department of La Paz department. *Puya ibischii* is sympatric with *P. tristis* L.B. Sm. (3200 m), *P. raimondii* Harms (3200-3600 m), *P. humilis* Mez (3200 m), *P. atra* L.B. Sm. (2500-2900 m), *P. secunda* L.B. Sm. and *P. ferruginea* (Ruiz & Pav.) L.B. Sm. (1800-1850 m).

This new species is dedicated to the German botanist Dr. Pierre L. Ibisch in acknowledgment of his commendable work in the field of botanical research in Bolivia from 1991 to 2003. The new taxon was his first *Puya* to be observed and photographed.

Photograph by P.L. Ibisch.

Figure 3. Detail of the flowers of *Puya ibischii*.

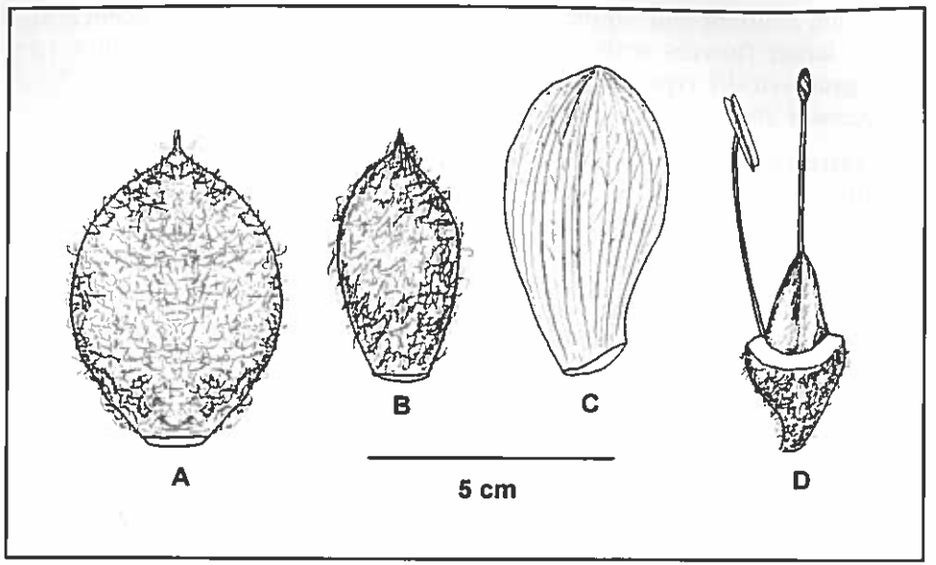

Figure 4. *Puya ibischii*. A. Floral bract. B. Sepal. C. Petal. D. Pistil and stamen. Drawing by R. Vásquez.

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Water Quality Of Some Bromeliad Tanks In Brazil

Dorothy E. Tuthill, Josh Pomeroy and Gregory K. Brown[2]

Approximately half of all Bromeliaceae species collect water in central tanks or in leaf axils. These aquatic systems (called phytotelmata) are ecologically significant, both in quantity of water stored and in number of organisms harbored. The current volume record for a single plant is 45 liters (Benzing 2000), and Fish (1983, cited in Benzing 2000) estimated that bromeliads in a Colombian cloud forest could hold 50,000 liters per hectare. Numerous surveys have documented the varied organisms that occur in bromeliad tank waters, including bacteria, fungi, algae, invertebrates, vertebrates, and vascular and nonvascular plants (e.g., Laessle 1961, Maguire 1971, Frank 1983, Richardson 1999 and citations within).

Fewer studies have been directed toward chemistry of the tank water, which presumably has a direct effect on establishment of phytotelm communities. Laessle (1961) measured water properties in bromeliads in Jamaica and recorded tolerance levels for a number of tank organisms, and Benzing et al. (1972) manipulated tanks of *Aechmea bracteata* in order to elucidate factors controlling water chemistry. Our study was designed to gather information on tank water quality (temperature, pH, conductivity and dissolved oxygen) at a low-elevation, dry site and a higher elevation, wet site, both in southeastern Brazil.

Methods and Materials

Study Sites

The low elevation site was located in the southern portion of Jurubatiba National Park (JNP), near the city of Macaé, Rio de Janeiro State (22°17.7'S, 41°41.0'W, elev. < 3 m; FIGURE 5). The landscape here is a restinga, comprised of sandy coastal plains and beach ridges with poorly developed soil. Patches of dense, drought-tolerant vegetation are dominated by *Clusia hilariana* (Clusiaceae), *Protium icicariba* (Burseraceae) and *Eugenia rotundiflora* (Myrtaceae) (de Araujo et al. 1998). Palms (especially *Allagoptera arenaria*), cacti, ferns, and orchids are also well represented. Prominent bromeliads include epiphytic *Tillandsia stricta* and *Aechmea lingulata* and terrestrial *A. nudicaulis* and *Neoregelia cruenta*. JNP receives approximately 1100 to 1300 mm annual precipitation, and has a mean annual temperature of 22.6° (de Araujo et al. 1998).

The high elevation site was located in the Macaé de Cima Ecological Preserve (MCEP) in the Atlantic Coastal Mountains, near the city of Novo Friburgo, Rio de Janeiro State (22°26.2'S, 42°31.2'W, elev. 1100-1400 m; FIGURE 6). The vegetation consists of highly diverse, secondary growth forest, probably less than 100 years old. No precipitation or temperature data is available for this site, but it is much wetter and cooler than the restinga site.

[2] Department of Botany, Bromeliad Research Lab, University of Wyoming, Laramie, WY 82071

Figure 5. *Aechmea nudicaulis* and associated vegetation at Jurubatiba National Park, Brazil.

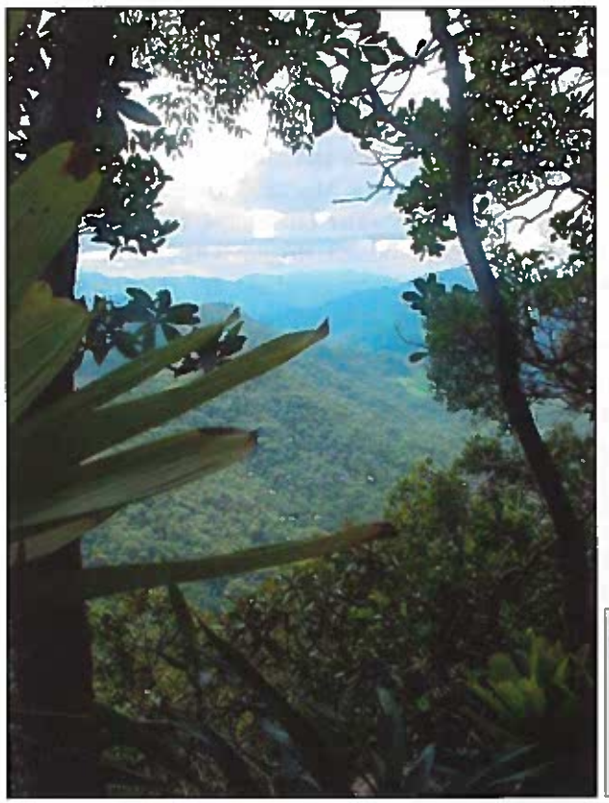

Figure 6. *Vriesea bituminosa* in the diverse, secondary forest at Macaé de Cima Ecological Preserve, Brazil.

Sampling procedures

Sampling was limited to tank-forming species that were within reach of the researchers. At JNP, this included *Aechmea nudicaulis* and *Neoregelia cruenta*, both terrestrial species with relatively large central tanks. At MCEP, *Vriesea* species, mostly *V. bituminosa*, a facultative epiphyte, and a species of *Alcanterea*, terrestrial or saxicolous, were found low enough for sampling. Both of these taxa form open rosettes and lack central tanks.

All pH, conductivity, temperature and dissolved oxygen (DO) measurements were taken with a Hydrolab Quanta®. For the Quanta® to accurately take measurements, a minimum water sample of 150 ml was needed. When there was insufficient water in a plant (as was often the case in the restinga), water from neighboring plants was pooled. Pooling was always done from plants of the same species that were located in close proximity to each other. Sampling at JNP followed transects that were 30 m long and 10 m wide. At MCEP sampling was random: whenever a group of accessible plants was located they were sampled. Due to the heavy rainfall and large plant size at the latter site, most of the plants had enough water to sample individually. Water was removed from the plants with basters or syringes, placed into a graduated cylinder to determine volume, then transferred to the Quanta®. After measurements were obtained, water was returned to the sampled plants.

Data were compiled by species at each site. For each measured property, range and mean were determined. In addition, for the *Aechmea nudicaulis* data (the largest set) Pearson correlations were calculated for all pairwise combinations of properties.

Results

Measured water properties were more variable at the restinga site than in the rainforest (TABLE1). At JNP, pH ranged from very acidic (pH 3) to neutral (pH 7), but was always between 4 and 5 at MCEP. Similarly, at JNP conductivity was sometimes as low as that found at MCEP, but more commonly was much higher. Temperature, although always higher at the restinga site, also had a greater range than at MCEP, while dissolved oxygen was both lower and higher at JNP than at the rainforest site.

Table 1. pH, conductivity, temperature and dissolved oxygen (DO) of tank water sampled from four bromeliad species in two sites. Number of samples given in parentheses.

	pH		Conductivity (mS/cm)		Temperature (°C)		DO (ppm)	
Species	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Restinga								
Ae. nudicaulis (37)	3.06–7.07	4.80[a]	0.011–0.650	0.139[a]	25.4–34.4	30.9[a]	1.82–7.49	4.27[a]
N. cruenta (16)	4.23–7.11	5.65[b]	0.056–0.611	0.240[a]	24.8–31.9	28.5[b]	3.47–5.79	4.42[a]
Rainforest								
Vriesea spp. (9)	4.22–4.66	4.38[c]	0.013–0.032	0.021[b]	20.7–22.9	21.7[c]	3.04–6.52	5.08[b]
Alcanterea sp. (2)	4.75–4.88	4.82[c]	0.018	0.018[b]	21.0–21.5	21.2[c]	6.26–6.69	6.48[b]

[ab] Means in the same column with different superscript letters are significantly different ($p<0.05$)

Several interesting and significant associations were noted between water properties, species and site (TABLE 1). Phytotelmata of *Neoregelia cruenta* were significantly less acidic than those of *Aechmea nudicaulis* or either of the rainforest species' tanks, though the most acidic waters, with pH less than 4, were also found in the restinga site, in the tanks of *A. nudicaulis*. No association of species and conductivity was found, but a significant difference between conductivity of tank water at the two sites was detected. Water temperatures were significantly different for the two species sampled at JNP, and both were much warmer than tank temperatures measured at MCEP. DO content was similar for all species except *Alcanterea*; members of that species had a significantly higher average.

Correlations were low for all pair-wise combinations of properties (TABLE 2). The highest correlation was between pH and conductivity, but conductivity accounted for only 28.4% of the variance in pH. All other correlations were insignificant.

Table 2. r^2 values for all pair-wise combinations of properties measured for Aechmea nudicaulis.

	pH	Conductivity	DO	Temperature
pH	1			
Conductivity	0.284*	1		
DO	0.103	0.012	1	
Temperature	0.021	0.127	0.064	1

* Correlation significant (p=0.01).

Discussion

Tank water properties measured in this study generally fall within ranges detected by previous researchers. Laessle (1961) found pH to range from "much below" 4 to 6 in Jamaican bromeliads, with the highest pH's associated with accumulations of snail shell fragments in the tanks. Richardson (1999) measured pH's of 4.9-5.9 for *Guzmania* and *Vriesea* spp. While these latter measurements fall within the overall range that we found, they are higher than pH's from our rainforest site, the site most comparable to the Puerto Rican forest where Richardson and her colleagues have worked. Unlike previous authors, we noted a difference in pH for tanks of different species at the restinga site. The two species sampled have tanks of different shape, which may be responsible, at least in part, for their differing properties. *Aechmea nudicaulis* is typically an upright, almost tubular plant, with a single, central tank, usually found growing in the open. *Neoregelia cruenta* forms more open rosettes where small pools form in the axils of each leaf in addition to the larger central pool. Also, *N. cruenta* usually grows within or on the margins of vegetation patches, so that it receives less sun and more vegetative debris than *Aechmea nudicaulis*.

Decomposition of organic matter accumulated within tanks is presumed to lead to decreased pH through the accumulation of humic acid, but neither our observations nor those of Laessle (1961) support this assertion.

Laessle (1961) noted that low readings were obtained from reservoirs with little organic debris, while we found that tanks containing considerable debris had respectably high pH's of 5 or greater. Benzing et al. (1972) found that tanks that contained illuminated algae had increased pH's during the daytime, though they became acidic again at night. Although we did not note the algal content of tanks, our finding of increased pH in shaded plants (*Neoregelia cruenta*) rather than sun-exposed plants (*Aechmea nudicaulis*) suggests that the situation is not that simple.

The more consistent pH of rainforest tank water, compared to restinga, may be attributable to regular flushing by rainwater. Complex biotic and chemical pathways responsible for pH must be reset and diluted by rainfall. Our sampling at JNP was done after a period of very little precipitation. The variation observed there suggests that conditions within phytotelmata are highly variable from plant to plant, so that when processes are undisturbed by flushing with fresh water, the outcomes can be quite different between plants. It would be interesting to repeat our sampling procedures after heavy rainfall, to determine if flushing does indeed limit variation.

The significant difference in conductivity between phytotelmata of the two sites is almost certainly due to the proximity of the ocean at the restinga site. Salt spray from the pounding surf can lead to significant ion deposition on plant and soil surfaces. Reinert et al. (1997), at a similar restinga, found deposition rates of about 3 and 4 mg cm^{-2} day^{-1} of Na^+ and Cl^-, respectively, at distances from the sea similar to that of our sampling area. Variation among individuals can be accounted for by differences in plant size, pool surface area and plant aspect with regard to spray direction, all of which affect the amount of deposition received. Unlike the restinga plants, the rainforest tanks had consistently low conductivities, the consequence of an abundance of fresh water and a lack of atmospheric ion input.

Tank temperature difference among the two sites are easily accounted for by differences in the ambient temperatures at the two sites. In addition, plants at the restinga received abundant insolation, but skies at MCEP were largely clouded. The lower temperature of tank water in *Neoregelia cruenta*, as compared to *Aechmea nudicaulis*, is probably due to *N. cruenta*'s preference for shade. Lopez and Rios (2001) found a significant difference in water temperature between shaded and exposed bromeliads and, moreover, that temperature had a much greater affect on the distribution of phytotelm fauna than did bromeliad species.

The amount of oxygen dissolved in tank water is a measure of biotic activity. Photosynthesis by algae or cyanobacteria leads to an increased amount of oxygen, while respiration causes a decrease in the amount of DO. Therefore, we might have hypothesized that sun-exposed phytotelmata would have the highest DO content, but we would have been wrong. In fact, there was no difference in DO between either of the restinga species or the *Vriesea* spp. encountered in the rainforest. However, water in the two

Alcanterea samples contained significantly more DO, even though these specimens were located in shade and contained considerable amounts of detritus. Furthermore, we expected to find DO values increasing throughout the day as photosynthesis proceeded, but again, we found no evidence of that trend within the restinga data (results not shown). Our findings are in direct contrast to those of Benzing et al. (1972) and Laessle (1961). A high diurnal fluctuation in DO was detected in sun-exposed tanks, and much lower overall DO levels in shaded plants by Laessle (1961). Similarly, Benzing et al. (1972) found a large daytime increase in DO in manipulated tanks that contained algae and lesser amounts of DO when algae were absent. However, tanks that contained algae, debris and insects showed lower amounts of DO (< 3 ppm) at all times (Benzing et al. 1972). These last tanks are no doubt most similar to the natural situation in phytotelmata, and our data supports the hypothesis that oxygen released by photosynthesizers is rapidly used by other organisms in the tank.

Like Laessle (1961), we found a high degree of variation in DO among the tanks, in our case ranging from quite depleted (< 2 ppm) to near saturation (> 7 ppm). This variation, along with high variation in pH, conductivity and temperature, indicates that phytotelmata are complex systems, with many factors leading to variable outcomes. The low or non-existent correlation between the properties indicates that none of the properties that we measured is pushing the system in any particular direction. Other features, perhaps the tank biota, must be primarily responsible for the divergent assemblages of water quality properties in bromeliad tanks.

Acknowledgments

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Events Calendar

Australia

Sept. 11-12, 2004. *Illawarra Bromeliad Society' Show.* Illawarra Bromeliad Society. Uniting Church Hall, Russell Street, Corrimal.

Oct. 14-17, 2005. *Bromeliads XIII - Australian Conference.* The Bromeliad Society of Queensland, Inc. Brisbane, Australia. The conference will include lectures, tours, sales, displays, and an auction and show. For more information, contact Bromeliads XIII Conference Committee, c/o Bromeliad Society of Queensland Inc., PO Box 565, Fortitude Valley, Queensland, 4006 Australia. E-mail: secretary@bsq.org.au. Web site: http://www.bsq.org.au/conference.html.

United States

Sept. 10-12, 2004. *Southwest Bromeliad Guild Standard Bromeliad Show and Sale.* Bromeliad Society Houston. Houston Arboretum and Nature Center, 4501 Woodway, Houston, Texas, USA. Friday Sale 12-5, Saturday Sale 9-5, Show 2-5; Sunday Sale & Show 11-4. Growers and showers from Texas, Louisiana and Florida. For more information, contact Allyn Pearlman - deliboys@houston.rr.com

Oct. 23, 2004. 2004 *Florida Extravaganza.* Florida West Coast Bromeliad Society. Plant Sale at: Florida Botanical Gardens, 12175 125th St N, Largo, FL 33774; Banquet and rare plant auction at: Holiday Inn Select, 3535 Ulmerton Road, Clearwater, FL 33762. Sale 9-4; banquet 6 pm; auction 7:30 pm. For more information, contact For vendor/sales information contact Gary Lund 727-586-5865 or glund@tampabay.rr.com. For rare plant auction donations, Michael Kiehl, 941-488-4011.

Oct. 30-31, 2004. *Bromeliad Sale*, Bromeliad Sale. Caloosahatchee Bromeliad Society. Terry Park, Palm Beach Blvd., Ft. Myers, FL. Oct. 30 9-5, Oct. 31 10-4. For more information, contact Brian Weber 941-355-2847 (brianweber1b@aol.com) Betty Ann Prevatt 239-332-0210 (bprevattbcc@aol.com).

Welcome New Members!

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Gay Austin
Bay of Plenty Bromeliad Soc.
Jolene Bedoya
Tommy J. Blair
Botanic Garden Adelaide
Justin A. Bragg
Jane Brown
Kathy Burdick
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Portraits of Bromeliaceae from the Mexican Yucatan Peninsula-IV: *Tillandsia dasyliriifolia* Baker: Taxonomy and Reproductive Biology

Ivón M. Ramírez-Morillo[3], Germán Carnevali Fernández-Concha[3] & Francisco Chi May[3] **Photographs by Ivón Ramírez**

Abstract. The circumscription and distribution of *Tillandsia dasyliriifolia* are here clarified, as well as the differences with other species in what we refer to as the *Tillandsia utriculata* (L.) L. complex in Mexico. Aspects of reproductive biology, including pollinators of natural populations of *Tillandsia dasyliriifolia* in northern Yucatan State, indicate that the populations of the species in the study site are not presently in danger due to the large reproductive capacity of the species through sexual reproduction and vegetative growth.

Introduction

In the following we provide an overview and circumscription of *Tillandsia utriculata* (L.) L. species complex where we place *T. dasyliriifolia* along with other species. A complete morphological description of *T. dasyliriifolia*, its geographical distribution, and characteristics to distinguish it from the other species in the complex, are included. Reproductive biology data are presented, as well as photographs of the species.

Tillandsia dasyliriifolia belongs to a group of species here referred to as the *Tillandsia utriculata* (L.)L. alliance. This alliance is characterized by epiphytic or subterrestrial rosettes, a monocarpic or polycarpic habit, leaves somewhat triangular, acute, never ligulate, with terminal, erect inflorescences, which are rarely racemes but more commonly 1-2 pinnate panicles, with flexuous and/or geniculate (bent like a knee), sessile flowers, with exerted stamens and stigma from a tubular corolla. The following species have been included in this complex: *T. limbata* Schltdl., *T. makoyana* Baker, *T. pringlei* S. Watson, *T. simplexa* Matuda, *T. swartzii* Baker, and *T. dasyliriifolia* Baker.

Most of the species related to *Tillandsia dasyliriifolia*, and thus in the *T. utriculata* complex, fall into Group II in Sue Gardner's proposed classification of the genus *Tillandsia* (Gardner 1986). This group corresponds to subgenus *Tillandsia* (sensu Smith & Downs 1977) which occurs from southern Florida throughout the Caribbean, from central Mexico to Central America, and along the northern and northwestern parts of South America (Gardner 1986). Gardner's Group II contains 19 taxa, nine of which occur in Mexico. Gardner characterized the group by the presence of filaments of unequal length, round in cross section for their entire length, petal apex erect or recurved, and an open corolla throat.

[3] Herbario CICY, Centro de Investigación Científica de Yucatán, A. C., A. P. 87, Cordemex, Mérida 97310, Yucatán, México. Telephone (999) 981-39-23; facsimile (999) 9813900. E-mails: ramirez@cicy.mx, carneval@cicy.mx, frankcm@cicy.mx

A morphologically similar group, especially in floral characters (flexuous and /or geniculate flowers) is that comprised of such taxa as *Tillandsia albida* Mez & Purpus, *T. flexuosa* Sw., *T. calcicola* L.B. Sm. & G.R. Proctor, *T. cucaensis* Wittm., *T. fresnilloensis* W. Weber & Ehlers, and *T. karwinskyana* Schult. f. This group is excluded from this discussion since several relevant vegetative characters (rosette shape and size, indument, inflorescence position) as well as geographical distribution set them apart from populations identified or confused with *T. dasyliriifolia*. We lack phylogenetic data to ascertain the relative positions of these two groups of taxa. Thus, it is not clear at this time whether the similarities in inflorescence structure are due to most recent common descent or to convergence.

Tillandsia dasyliriifolia was described by Baker in 1887 based on a collection by S. Gaumer from Mexico, Yucatan Peninsula, State of Quintana Roo, from a locality called Holbox Island "Bay of Honduras". This was once mistakenly referred to as Honduras by Smith (1938) but is actually located north of the Quintana Roo State (FIGURE 7).

In the original description Baker mentioned that the species has violet petals, but extensive field work in the Yucatan Peninsula has failed to reveal any populations of taxa in this complex with violet petals. Instead, all members of this complex in the area have chartreuse petals. Perhaps the violet or reddish color was intended to describe the floral bracts, because petals are not violet in this species (FIGURE 8). This inaccuracy in the original description caused many of the misidentifications in the species complex.

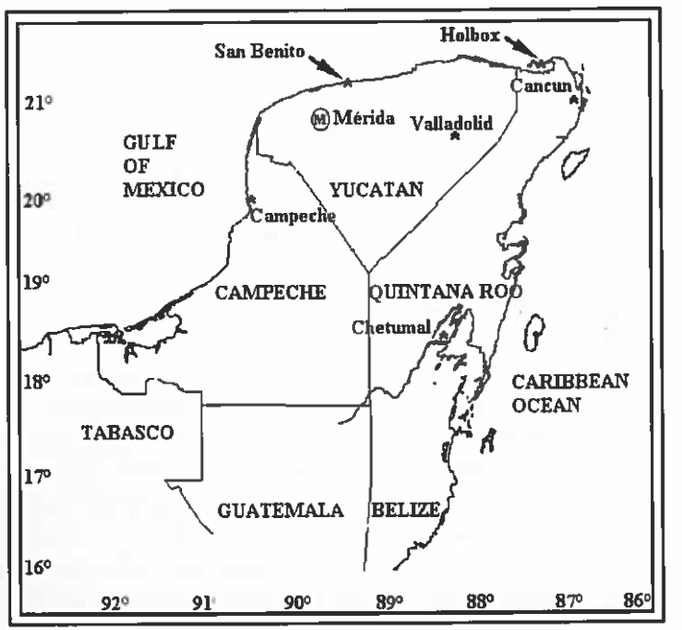

Figure 7. Type locality of *Tillandsia dasyliriifolia* (Holbox Island), and study site (San Benito).

Figure 8. Flower of *Tillandsia dasyliriifolia.*

Figure 9. Plant of *Tillandsia dasyliriifolia.*

The name *Tillandsia dasyliriifolia* has been applied to a large number of populations of *Tillandsia* across Mexico and Mesoamerica including populations in Colombia (Providence Island) (Smith & Downs 1977, among others), inhabiting such diverse vegetation types as shrubby vegetation in sand dunes, oak-pine forests, low inundated forests, etc. As a consequence, the distribution of *T. dasyliriifolia* has been interpreted until recently as extending from Jalisco (NW Mexico) to northern Colombia, and from sea level up to 2300 m elevation.

Most of the confusion with the delimitation of taxa in this complex characterized by inflorescences with flexuous rachis and /or geniculate flowers is due to the lack of good types (herbarium specimens), incomplete locality data (most of them come from such vague localities as "Mexico without exact locality"), misinterpretations in the description of petal color (previously mentioned in Baker, 1889) or the apparent hybridization between several species. In addition, some of the types are based on illustrations (i.e., *Tillandsia makoyana* Baker, *T. pulvinata* E. Morren ex Baker, *Tillandsia geniculata* Baker, all based on Professor Morren's plates), which makes some important characters impossible to study (drawings are impossible to dissect!). However, a more serious problem is that most herbarium specimens of the species in the *T. utriculata* complex look alike since most of the important diagnostic characters (color, symmetry, textures, etc.) are lost

when the plant is dried. Furthermore, being such large plants, many herbarium specimens are incomplete, i.e., lacking either portions of the inflorescences or of the rosette. Moreover, critical morphological characters are either ignored in the field descriptions provided in the labels by the collectors, or completely misinterpreted.

Following is a complete description of *Tillandsia dasyliriifolia*, which is based on herbarium specimens from the United States (F, MO, SEL), Mexico (CICY, CIQRO, MEXU, UAMIZ, UADY), and Central America (INBIO, TEFH). The circumscription of this species, as well as those of the other taxa in the complex, were ascertained with the aid of herbarium and cultivated material from several localities in the Yucatan Peninsula and Mexico.

Recent fieldwork in many localities in Mexico, including several type localities (Espejo-Serna & López-Ferrari 1994), a detailed observation of population variation in the field, cultivation of several species, and a more complete documentation through herbarium material, photographs, and pickled material, greatly aided in the understanding of the *Tillandsia utriculata* complex.

Tillandsia dasyliriifolia Baker, J. Bot. 25: 304, 1887. **Type:** Mexico: Quintana Roo: Hab. Holbox Island, "Bay of Honduras". Received from F. Godman, F.R.S. in VIII-1886, *G. Gaumer s.n.* (K). FIGURES 8, 9.

Epiphytic ***rosettes***, often rupicolous or sub terrestrial (on sandy soils or low inundated forests), (0.5-)0.7-1.7(-3) m tall, sometimes producing offsets ("keikis") on the inflorescence (especially populations from shrubby vegetation on sand dunes or in large, robust plants). ***Leaves*** forming a funnel

Figure 10. Small rosettes ("keikis") produced on the inflorescence of *Tillandsia dasyliriifolia.*

form rosette, (23)70-90(95) cm long, 2.1-2.7(3.6) cm wide; ***foliar sheaths*** dark castaneous, densely adpressed to subadpressed white-lepidote, widely elliptic, gradually merging into the triangular lamina, 6-7 cm long, 3.5-4 cm wide; ***lamina*** narrowly triangular, white-lepidote abaxially, green adaxially, sparsely white lepidote adaxially, usually with the mid longitudinal area of the leaf thicker, (-24)29-30 cm long. ***Inflorescence*** usually a 1-2 pinnate panicle, 50-58 cm or much longer up to 3 m long or much reduced in small depauperate plants to a raceme 30 cm tall, erect to arcuate, usually the peduncle much longer than the leaves, especially in plants growing in shady, humid places; ***peduncle*** 0.7-1.8(2) cm diameter at base, (30-)66-100 cm long, usually longer than the rosette, rarely as long as the rosette, scape bracts 3.5-5.5 cm long, with a long, acuminate apex, erect, longer than internodes at the base of the peduncle but as long to shorter than internodes toward the apex of the inflorescence, margins of scape bracts adnate by 1 cm long on those at the base of peduncle, widely triangular, acute; ***branches*** (1-3)7-12(-22) per inflorescence, 16-20 cm long; sterile portion of branches to 6 cm long, fertile portion 35-46 (67) cm long, 6-7 flowers per each 10 cm of rachis length on branches; ***rachis*** 2-5 mm diameter, naked or covered by floral bracts, usually red or dark pink; primary bracts 2-3 at base of each branch, 3.5-5.5 cm long, (0.8-) 1.5-2 cm wide, wide elliptic, acute, imbricate, margins hyaline. ***Flowers*** (3.9-)4.2-5.2 cm long, 70-100 flowers on well developed inflorescences, actinomorphic at first but becoming zygomorphic after anthesis and pollinator visit when stamens and stigma get pushed toward the adaxial portion of the corolla tube and this is distorted and becomes curved, sessile or subsessile at base. ***Floral bracts*** widely ovate to wide triangular, obtuse to acute, covering the rachis with their bases, as long as or shorter than the sepals, deeply concave, non imbricate, ecarinate, smooth or apically veined on the adaxial surface, glabrous, coriaceous, 2-2.4 x (1.4)-1.9 mm, drying roseate or sometimes the apical half maroon, red when fresh as well as the rachis and peduncle, (13)19-22 x 13-15 (21) mm. ***Sepals*** 15-22 (25) x 7-8 mm, narrowly elliptic to elliptic or elliptic-obovate, acute to obtuse, green, white-lepidote inside, the sepals opposite to the rachis are connate by 3 mm of their length. ***Petals*** 28-33 (37) x 4-6 mm, with a constriction caused by the apex of the sepaline tube at 17-20(25) mm from base, elliptic to oblong, acute to obtuse, concave, pale chartreuse to almost white. ***Stamens*** exerted, filaments pale green or white, 3.6(-5) cm long; anthers black, 4-5 mm long. Stigma exerted, longer than stamens, with three long, expanded lobes, pale chartreuse. ***Ovary*** elliptic, (6.5-)8.5-9 mm long, 2.5-3 mm wide. ***Capsules*** 5-6 cm long, 5-8 mm diameter; ***seeds*** 2.7-4.2 cm long, including the hairy appendages.

Tillandsia dasylirifolia inhabits xerophytic shrub lands on coastal dunes, deciduous forest, mangroves, low inundated forests, and evergreen forest, from 0-250 m above sea level.

Geographical distribution: México (Yucatán, Quintana Roo, Campeche, Tabasco); Belize (Districts of Belize, Toledo).

Phenology: Plants have been recorded with flowers in April, May, June, and October; fruits in February, May, August, September, November, and December. Our knowledge of the phenology of the species in likely incomplete and will improve as more collections are incorporated into herbaria.

Diagnostic characters: We have carried out studies to estimate the variation among populations of several vegetative and floral traits in *Tillandsia dasylirifolia*, particularly comparing plants from the low inundated forests and the shrubby vegetation on sand dunes associated with the coasts in the Yucatan Peninsula. There is variation in size of vegetative and floral traits—plants from the coastal shrubby vegetation are taller, with larger inflorescences and higher fruit set are compared to those in low inundated forests. We suggest that larger-sized plants are correlated with the humidity received from the sea, and the differences in fruit set is probably due to fewer visits by pollinators in the tintales, and not necessarily due to fewer pollinators. This might be due to a more restricted flower "menu" in the coastal dune compared to the tintales, thus forcing the pollinators to use more efficiently what is available in the season.

Another variant of this taxon was observed in populations from more humid and/or shady places south of the Peninsula of Yucatán. In tall evergreen forests in Quintana Roo, the plants tend to have softer, longer leaves and longer peduncles on inflorescences and branches located toward the apex. Although the species was described as having violet petals (Baker 1887), none of the populations from the type locality and vicinities present this feature. This mistake on the floral description was noted by several authors whose interpretations of the species were distorted by this claim (Smith & Downs 1977, McVaugh 1989, Utley & Utley 1994).

Tillandsia dasylirifolia can be identified by the presence of a funnelform rosette, and is mostly epiphytic or sometimes subterrestrial on sandy soils. In most cases the leaves are straight, but sometimes they curve downwards (especially in plants from humid, shady places), white lepidote abaxially, dark green adaxially, narrowly triangular, with a wide base that becomes castaneous upon drying; the peduncle, rachis, primary and floral bracts are red, the sepals are dark green and petals are light chartreuse. Flowers are initially actinomorphic but eventually become zygomorphic after visits of the pollinating hummingbirds, *Doricha eliza* and *Amazilia yucatanensis*.

How to recognize the species from herbarium specimens? Leaves tend to dry light brown, the foliar sheaths are castaneous, inflorescences only rarely are racemes, usually 1-2 pinnate panicles, the floral bracts covering the rachis, the rachis flexuous, the flowers geniculate, the floral bracts shorter than to rarely equal to the sepals, the rachis and floral bracts red, the sepals green, petals light chartreuse. *Tillandsia dasylirifolia* is known from all three states in the Yucatan Peninsula (Campeche, Quintana Roo, and Yucatan), the state of Tabasco, Petén of Guatemala and Belize. There is another species similar to *Tillandsia dasylirifolia* in these states, such as *T. utric-*

ulata, with rachis, floral bracts and sepals green, petals white with an asymmetric corolla, leaves shiny green above, slightly white lepidote abaxially, forming a utriculate rosette, inflorescences are larger (with a proportionally shorter peduncle) and less dense (fewer flowers per branch) and slightly flexuous rachis and slightly geniculate flowers. Both species produce new branches if a portion of the inflorescence is damaged, a character absent in other related species such as *T. limbata* and *T. makoyana*. *T. utriculata* and relatives, however, are almost always monocarpic plants as opposed to the usually serially monocarpic plants of *T. dasyliriifolia*.

The species was also reported for Guatemala by L.B. Smith (1958) who mentioned that the flowers are pedunculate (5 mm long) and with green or violet petals. Thus, if Smith was right about the floral characters, he must have been referring to an entirely different taxon and the Guatemalan plants in question are neither *Tillandsia dasyliriifolia* nor any other of its relatives since the flowers in the *T. utriculata* complex are nearly sessile.

McVaugh in Flora Novo Galiciana (1989) reported the species from several states in Mexico (Nayarit, Jalisco, Michoacán, Guerrero, Mexico, Morelos, Puebla, Quintana Roo). This cited distribution indicates a disjunction, from the Pacific Coast to the Caribbean Coast of Quintana Roo, and from high elevations to sea level. Our studies indicate that there are more than one species in the Pacific Coast in this complex. Gardner (1984) correctly stated (and we agree) that many of the specimens from that geographical area previously identified as *Tillandsia dasyliriifolia* actually represent *T. limbata*, which occurs in moist forests, with thinner and less coriaceous leaves, and is known from the states of Veracruz, Puebla, and Chiapas, and south to at least Honduras.

In the group of taxa with violet petals, several are involved. Some of the morphospecies fit the *Tillandsia makoyana* concept. Another entity with violet petals, flexuous rachis and geniculate flowers, rosette with triangular, erect leaves, that inhabits mostly oak-pine forest above 1000 m above sea level, is probably new to science; while a third one with geniculate, green flowers and a flexuous rachis, from lower elevations in the state of Oaxaca is also undescribed.

Reproductive Aspects of Tillandsia dasyliriifolia

In order to determine the breeding system of the species, we conducted a series of controlled crosses in the field-a shrubby vegetation area, north of the Yucatan state, in the San Benito area (FIGURE 7). We used 60 plants and 1662 flowers in order to perform the following crosses: agamospermy (fruit production without pollination by removing anthers and thus pollen from flowers - a process called emasculation); manual selfing (pollinating the flower with its own pollen); unassisted selfing (by bagging the flowers and observing fruit formation through pollination by one's own pollen); cross pollination (pollinating flowers with exogenous pollen); anemophily (bagging the emasculated flowers with a material able to let pollen through but not animal pollen vectors); and natural pollination (leaving flowers unprotected and observing pollination). The percentages of fruit set for each controlled cross is shown on TABLE 1.

TABLE 1: Controlled crosses, number of plants used, total number of flowers used for each cross, number of fruits produced, and fruiting percentage in *Tillandsia dasyliriifolia*.

Controlled cross	# Plants	# Flowers	# Fruits	% Fruiting
Agamospermy	10	42	0	0
Manual Selfing	9	110	102	92.7
Unassisted selfing	9	617	574	93
Manual cross pollination	15	42	38	90.5
Anemophyly	9	42	0	0
Natural pollination	8	809	707	87.4

A first approach to know the breeding system of a species is to get results from controlled crosses. According to our results:

1. An absence of fruits by agamospermy indicates that the flowers will produce fruits by pollination only.

2. The absence of fruits in anemophily indicates that in order for pollination to occur, the pollen must be moved by a vector other than wind or water (such as insects, birds, etc).

3. The species is self-compatible since we obtained 92.7% of fruit setting by selfing, but also a similar result by cross pollination (90.5% of fruit setting). The plant will produce fruits by pollination with its own pollen and exogenous pollen.

4. The species also produced fruits by pollinating itself, since protected flowers produced fruits without pollinator assistance (unassisted selfing with 93% or fruit setting). This indicates that even though anthers release pollen before the stigma is receptive, there is a moment when both are functional and pollination occurs (flowers are not dychogamous) and both structures, anthers and stigma touch each other at some time (flowers are not herkogamous).

5. A high percentage (87.4%) of fruit setting was also obtained by natural pollination. Usually when we record lower percentages of fruit setting in natural pollination compared with selfing or cross pollination, it suggests a lack of pollinators or some sort of pollinator's inefficiency. The differences in percentage between natural pollination and the other crosses with fruit set are very small for this species suggesting that pollinators are very efficient moving pollen from one flower to another.

A more accurate way to determine the breeding system is to observe seed formation; an even more accurate method is to observe viable seeds. In other words, fruit can be formed but with few or no seeds, and seeds can be formed but some of them may not be viable, indicating inbreeding depressions and /or hybrid vigor, as many plant growers are familiar with.

In accordance with this idea, when we observed results based on seed numbers, the data tendency is similar to the results based on fruit setting (TABLE 1). Thus, we have the same story told by both data sets.

A statistical test, ANOVA, was performed in order to determine whether there are significant differences between the number of seeds produced among all controlled crosses, [$F(3,354)=16.23$; $p<0.0001^*$]. Once this result was determined from this ANOVA; we wanted to know in which of the controlled crosses the number of seeds was the higher and so on. For this, we proceeded to perform a second statistical test, LSD, a comparison of medias. Results indicated that the major amount of seeds produced occurred in manual cross pollination (letter a), this value being much higher than the other treatments. Manual selfing rendered the second largest amount of seeds (letter b); third was natural pollination, and the lowest value was for unassisted selfing (letter d) (TABLE 2). Since manual cross pollination produced the largest number of seeds, we suggest that there is some sort of hybrid vigor, as well as an inbreeding depression or defective pollination as suggested by the lowest amount of seeds in selfing.

TABLE 2: Average seed number and aborted seed number on each individual controlled cross performed in *Tillandsia dasyliriifolia*

Controlled cross	Seed number
Manual selfing	164.1 ± 10.3^b
Unassisted selfing	154.8 ± 16.4^d
Cross pollination	188.1 ± 15.9^a
Natural pollination	159.7 ± 11.0^c

Viable seeds provide more information about possible effects of selfing (inbreeding), out crossing (hybrid vigor), etc. We selected seeds from each fruit type (from selfing, out crossing, etc.) and germinated seeds in the lab on Petri dishes with a filter paper and controlling humidity, light, and temperature. A statistical test called Xi^2 was applied in order to detect differences among the results (TABLE 3). According to these results, there are no differences among number of viable seeds among the crosses (all have same literal, a), suggesting no inbreeding depression and/or hybrid vigor at this level. Results of germination of seeds suggest that all seeds will be equally successful in germinating, an important advantage for the species.

TABLE 3: Seed germination percentage for each individual controlled cross performed in populations of *Tillandsia dasyliriifolia*. A Xi^2 test was performed in order to detect differences.

Species/Cross	Selfing	Unassisted Selfing	Cross pollination	Natural Pollination
T. dasyliriifolia	96.00^a	96.00^a	97.30^a	96.30^a

We recorded several flower visitors, bees and birds, some of them being the pollinators, such as the hummingbird *Doricha enicura* male (COVER), which takes nectar from the flowers and gathers pollen on the forehead, pollinating other flowers in successive visits. This hummingbird usually visits several flowers in the same inflorescence before moving to the next plant, but geitonogamy (pollination among flowers of the same inflorescence or genet) is minimized by the fact that only a few flowers per inflorescence open each day, increasing the rate of cross pollination.

Populations of *Tillandsia dasyliriifolia* in the Yucatan peninsula, and specifically in the study site, have very high reproductive values. They are able to set fruit without pollinators assistance, as well as with pollination by hummingbirds; it is a self compatible species. Moreover, they produce new rosettes in the inflorescences ("keikis", FIGURE 10) and the genet is polycarpic. All these factors added to the fact that the species grow in coastal shrub lands, low caducifolious, forest, tall evergreen forest and low inundated forest, indicate that the species, thus far, is not in danger.

Acknowledgments

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Charles Coolbaugh, a Hybridizing Artist

H. Alton Lee[4]

Charles (Chuck) Coolbaugh was well into middle age when he first became aware of bromeliads. His life was forever changed as well as the lives of all who have come to know and love his many hybrids.

The bromeliad that initially dazzled Coolbaugh is one that has mesmerized many before and after him: *Billbergia pyramadalis*. But unlike some who come to bromeliads for a time and then, fade away, Charles was completely hooked and absorbed. He became obsessed with this legendary plant family and they remained a passion for him for the rest of his long life.

Coolbaugh was born in Iowa in 1911 and his family settled in Illinois when he was still a small child. The Midwest is not exactly a Mecca for tropical plants, but it certainly has plenty there of horticultural interest. Even from childhood, Coolbaugh liked all kinds of plants.

His wife, Bernice, remembers that after they were married and still living in the North, Charles was always interested in gardening and worked hard to see that their landscape was in the best possible shape.

Those who knew Coolbaugh know that his interests were extensive and that he was never a person predisposed to do things in a halfhearted way. If he was interested in something, he was REALLY interested in it and gave it his all. Though physically small, Coolbaugh had enormous energy. His restless, "constantly into something" nature stayed with him till the very end of his days.

At an early age, Coolbaugh had an illness which affected his hearing and speech. Bernice remembers that doctors later thought problems might have been caused by an early bout with Diphtheria.

But no impairments ever slowed Coolbaugh down for a minute. Early on, he studied art and eventually became a professional sign painter with a thriving business. It was in this way that he met Bernice, who owned a local beauty shop and employed Charles to paint signs. The rest as she says was sixty-one years of wonderful history. They were married in September, 1939.

During the war, the Coolbaughs relocated to Mississippi where Chuck joined the civil service, since his hearing difficulties kept him out of the military. His profession served him well though, for he ended up lettering planes that would soon fly overseas.

When the war ended, the Coolbaughs determined that they'd had enough of Northern winters and decided to stay in the South. They were now the parents of one daughter and had a second girl in the early 50s.

[4] 5813 19 Ave. S., Gulfport, FL 33707-4023

Florida became the location of choice, but where in Florida proved more problematic. The Coolbaughs explored a number of places between Orlando (then a very sleepy, Disneyless little town) and Miami. They settled on Lakeland, a truly tiny place in the 40s.

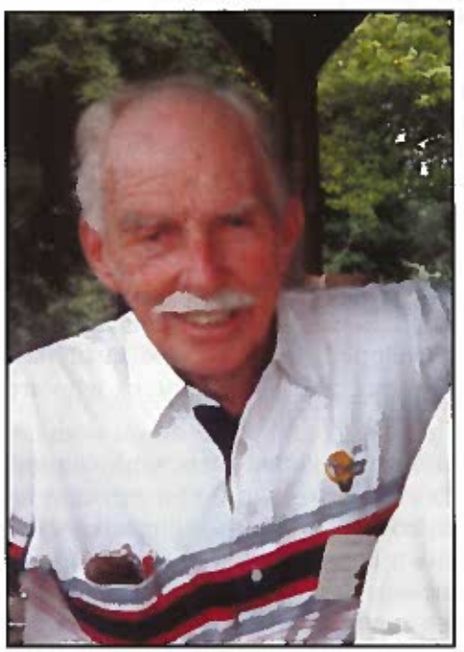
The Coolbaughs purchased two lots on what would become Valencia Street. Bernice remembers they paid $500. And handyman, Charles built their house where they would live for decades.

According to Bernice, they were not within city limits, so they raised chickens and ducks and opened a small nursery called Orchid Dell. Coolbaugh also ran a sign painting business. Plants, initially, were just a hobby-obsession.

But then came that sultry charmer, *Billbergia pyramadalis*. Coolbaugh was seeing the plant all over Lakeland and becoming more and more curious and very interested. He started reading everything he could find about bromeliads. The more he read, the more he wanted to know.

Chuck also set out to meet anyone else as obsessed by bromeliads as he was becoming. Eventually, he met most of the bromeliad stars of their day, the Fosters, Julian Nally, Ed Ensign, the Morris Dexters and the Irvin Wurthmanns, among many others.

As time progressed and Coolbaugh's bromeliad collection grew, it soon occurred to him to start a business with his hobby. The mail order business, Exotic Bromeliads, flourished. Coolbaugh eventually retired from his sign painting profession, though Bernice says he had a steady hand for freehand lettering till nearly the end of his life. He also continued to take on the occasional sign-painting job for some longtime customers and did the work in his garage amid the bromeliad shipping.



Photograph by Bernice Coolbaugh.

Figure 11. Charles Coolbaugh, late in life.

During their alleged retirement years, the Coolbaughs were always traveling and collecting plants, and Chuck had also become interested in hybridizing. He would eventually register 54 hybrids, mostly neoregelias, and the work started with *Neoregelia* 'Alpha' in 1969. It was immediately in much demand by collectors as was the soon following

Neoregelia 'Beta'. 'Alpha' was always Coolbaugh's very favorite of his hybrids, but Bernice says she was especially fond of 'Beta'. Bromeliad Journal editor, Victoria Padilla, who visited the Coolbaughs, wrote about these two hybrids in 1979. Not surprisingly, after a picture of 'Beta' appeared in the journal, the Coolbaughs were hard-pressed to keep up with requests for the plant. Happily, it is reasonably generous with offsets, though not an especially fast grower.

Coolbaugh eventually sold his mail order business and hybrids stock to Michael Kiehl, who still gets many admirers and purchasers of the sought after neoregelias. The Coolbaughs relocated to Auburndale on an acre of property to be nearer to their children and grandchildren. The greenhouse moved with them, and as Bernice points out Chuck certainly did NOT stop growing or selling plants. Although less focused on hybridizing in his later years, his plant interests expanded again—not only in bromeliads, but orchids and aroids among many others.

He was forever tinkering and experimenting and learning how to grow things, some of them far from easy. Several visiting Aroid experts admired Coolbaugh's way with the frequently difficult *Anthurium veitchii* and *A. warocqueanum*, which chugged along seemingly happy among other aroids, bromeliads and orchids. And Charles also devoted much time and expertise to tropical landscape plants. His garden had a little bit of everything from hibiscus and ferns to daylilies and gingers. The property also, of course, included many specimen bromeliads.

Anyone who grows a wide variety of plants knows there are always so many factors involved, some of them out of a grower's control and most gardeners are never quite satisfied with their results, which keeps the gardening process challenging and ever interesting. Coolbaugh was no exception. Many of his bromeliads never completely pleased him. He confessed to the writer that he always felt he should be able to grow Cryptanthus larger and felt the same about two favored aechmeas, *A. nudicaulis* and *A. fasciata*, the albo-marginated forms.

Very near the end of his life, Coolbaugh began to suffer the many woes that come with old age. He gradually developed dementia, and in his last months had to turn everything over to Bernice and his daughters, who are still attempting to maintain the landscape and plants he so loved.

One of the great things about and for artists is that their work can live on long beyond them inspiring and giving joy to many who never even knew them. Such is true even of plant hybridists. Charles Coolbaugh and so many others have thrown down a gauntlet. There is a big challenge for all those who come under the spell of bromeliads to work diligently to save and spread the wonderful new creations so many hybridists have given the bromeliad world. The BSI and the individual collector-grower clearly have their work schedule sharply defined for them.

Flower Biology and Fertilization of *Aechmea fasciata*

Maurice P. de Proft & Ine Vervaeke[1]

Summary

The study of plants began many years ago with botanists such as Linnaeus and Dodonaeus, with the collection, description and classification of plant material. As knowledge progressed of how all the different plant forms developed, plant classification became increasingly based on evolution.

The ability to cross two plant species is one of the actual criteria, besides others, on which two plants are classified within one genus. Making successful crosses between genera has been a challenge for many breeders. In the bromeliad family many intergeneric crosses exist today (Beadle, 1998), but there are limits, expressed with the term incongruity (cross-incompatibility). If we want to overcome these crossing barriers we need to understand the cause of this incongruity. To do so we have to start with the flower biology of bromeliads. How does a bromeliad species protect itself against mixing of its genes with those of other bromeliad species?

We have studied the flower biology of *Aechmea fasciata*. It became clear that the style tissue plays an important role in the prevention of fertilization. The germination of pollen, the pollen tube growth within the style, the spermiogenesis (division of the generative nucleus) and finally the fertilization has been studied by using staining techniques and microscopic evaluations. We will present the results obtained thus far.

One thing is clear, we still have much to learn about the flower physiology of bromeliads. We think that within the near future *in vitro* fertilization of bromeliads will be possible. This will enable us to a transfer potential plant characteristics without using molecular techniques. This type of research will also help breeders to improve their success rate. We are convinced that the limits of "classical" breeding are not yet reached.

Introduction

In breeding ornamentals, interspecific and intergeneric hybridization is the most important source of phenotypic variation. However, desirable sexual crosses often are not successful due to genetic barriers. In nature, environmental or geographical barriers further prevent species from mixing. Understanding the nature of fertilization barriers is a key element before manipulations can be designed to achieve hybridization. Incongruity or cross-incompatibility occurs in interspecific crosses as a result of a lack of genetic information in both parent plants which is necessary to complete pre- and postfertilization processes (Hogenboom, 1973). Prefertilization barriers

[1] Plant Production Laboratory, Kuleuven, W. de Croylaan 42, B-3001 Leuven, Belgium, fax +32 16 32 29 66, tel +32 16 32 26 61. E-mails: maurice.deproft@agr.kuleuven.ac.be, ine.vervaeke@agr.kuleuven.ac.be

between different bromeliads are often confined within the style (Vervaeke et al. 2001). A range of techniques, such as cut style pollination, placental and placental grafted style pollination have been applied to overcome prefertilization barriers (Vervaeke et al. 2002a; 2002b). Different intergeneric hybrids, *Vriesea* x *Tillandsia* and *Vriesea* x *Guzmania* were created by pollination after removing a part of the style ('cut style' pollination) (Vervaeke et al. 2004 in press). In the following we present an overview of our research on flower biology and *in vitro* pollination and fertilization in Bromeliaceae.

Flower Biology

Vervaeke et al.. (2003a) presented morphometric data of different floral features and *in vitro* pollen germination of six bromeliad cultivars. Two important floral characteristics for plant breeding are pollen germination and style length. In describing the pathway followed by the pollen tube after compatible pollination Vervaeke et al. (2003b) found that pollen grains germinated on the papillate stigma and grew down in the style across stylar canal cells. Fertilization occurred porogamous (FIGURE 12A); this means they penetrate the ovule via the micropyle. The first pollen tubes reached the ovary of *Aechmea fasciata* 14 hours after pollination for plants kept at normal greenhouse conditions in Belgium. In interspecific crosses the inhibition of the pollen tube growth was indicated by a lower number of pollen tubes growing through the style and inhibition of the pollen tubes in the style. Furthermore, the pollen tube morphology was often abnormal; e.g. callose deposition was irregular, pollen tubes were curling or even grew backwards (Vervaeke et al. 2001).

Placental Pollination

To overcome incongruity we attempted placental pollination *in vitro*. Placental pollination involves removal of the stigma, style and ovary wall, pollination of ovules on the placenta, and culturing of the ovule mass on a suitable *in vitro* medium. The main significance of this alternative pollination technique is that it provides means for bypassing the pollen-stigma and pollen-style rejection responses seen in incongruent crosses. However, following placental pollination, fewer or no interactions are built up during the progamic phase. This results in a very low fertilization percentage because pollen tubes are not guided to the ovule micropyle, as was demonstrated for *Aechmea fasciata* (Vervaeke et al. 2002b) (FIGURE 12B). Grafting a style with active growing pollen tubes (placental grafted style pollination) resulted in a higher fertilization percentage. Therefore we concluded that pollen tube growth through the style is a prerequisite for successful fertilization (Vervaeke et al. 2002b). In order to learn more about the guidance of pollen tubes toward the ovule micropyle we studied the difference between pollen tubes *in vitro* (cultured on artificial media) and pollen tubes *in vivo* (grown through a compatible style).

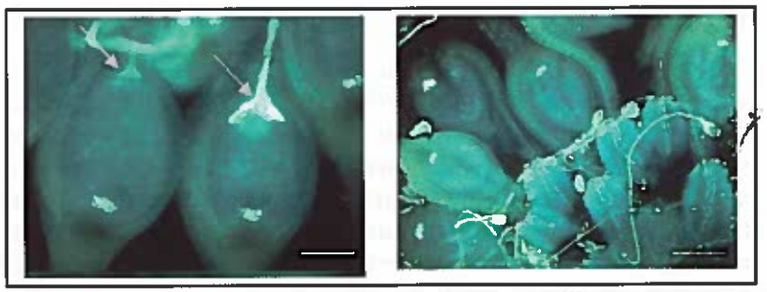


Figure 12. A(left). Pollen tube penetrates the micropyle of the *Aechmea fasciata* ovule: fertilization (20x10, bar = 100µm), B(right). Pollen tubes are not guided to ovule micropyle after placental pollination of *Aechmea fasciata* with compatible pollen (10x10, bar = 200µm)

Difference Between *in vitro* and *in vivo* Pollen Tube Growth

Bromeliads generally show pollen tube growth *in vitro* that is logarithmic with a maximal growth rate of 0.2 mm/h for *Aechmea fasciata* (Parton et al. 2002). In vivo pollen tubes of *A. fasciata* grow 2 mm/h (Vervaeke et al. 2003b), or ten times faster. Bromeliad pollen is binucleate at maturity (Brewbaker, 1967). A second mitotic division of the generative nucleus (resulting in two sperm cells) occurs during pollen tube growth in the stylar tissue. In binucleate pollen, this division has been related to an acceleration of pollen tube growth in the style. Callose plug deposition starts at the same time (Mulcahy & Mulcahy, 1988). Only occasionally has sperm cell production been reported for tubes cultured in vitro from bicellular pollen grains (Read et al. 1993). Individual amino acids as arginine and methionine were able to improve the division of the generative nucleus in cultured pollen tubes of *Aechmea fasciata* (FIGURE 13A and 14, Vervaeke et al. 2004a). The division of the generative cell to produce two sperm cells is required for subsequent double fertilization in higher plants. After placental pollination of ovules with pollen grains, a subsequent penetration of the micropyle by pollen tubes does not occur in *Aechmea fasciata* (Vervaeke et al. 2002b) due to the absence of sperm cell formation in pollen tubes cultured in vitro (Vervaeke et al. 2004a; 2004b).

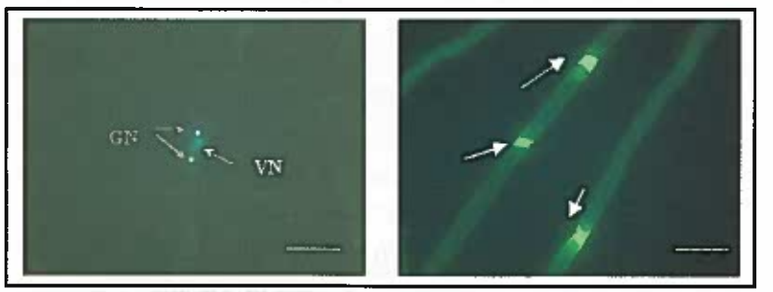


Figure 13. A(left). Pollen tube of *Aechmea fasciata* cultured in vitro with two generative nuclei (GN) and one vegetative nucleus (VN) visualized after staining with DAPI (40x10, bar = 50 µm), B(right). Callose plugs in pollen tubes of *Aechmea fasciata* (40x10, bar = 50µm)

Another striking difference between pollen tubes cultured *in vitro* and those growing through a style is that the former produce few or no callose plugs whereas in the latter callose plugs are deposited at regular intervals (± 300 µm) during pollen tube growth through the style (FIGURE 13B). Pollen tubes extend by a tip growth process, and at regular intervals during tube elongation, callose plugs are formed, which separate the living and growing part from the rest of the pollen tube. Callose is a cell wall polysaccharide composed generally of 1,3-β glucans and can be visualized by the aniline blue fluorescence method. We found that the formation of callose plugs in pollen tubes cultured *in vitro* is influenced by the concentration of sucrose (a lower sucrose concentration results in more plugs) and is positively influenced with the addition of arginine to the medium (Vervaeke 2004, unpublished results).

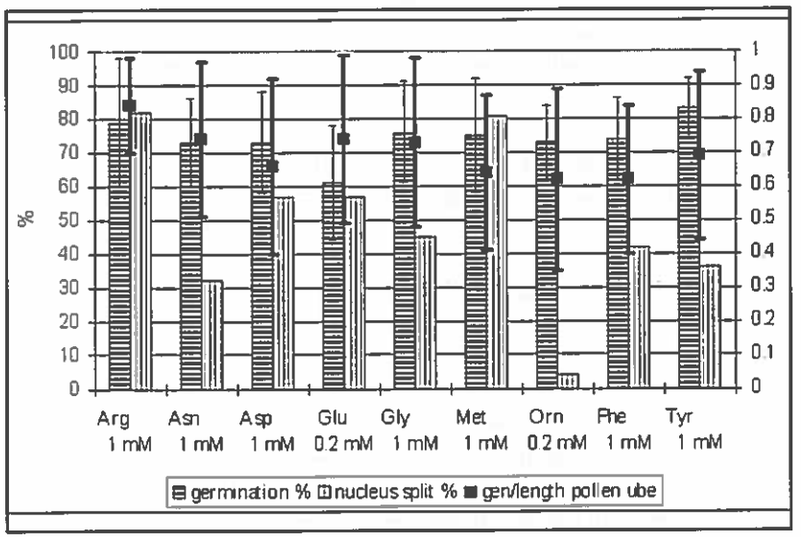


Figure 14. *In vitro* pollen germination (%), division of the generative nucleus (%) and ratio of distance journeyed by the generative nucleus (nuclei) and pollen tube length (■) of *Aechmea fasciata* in relation to Arg: arginine, Asn: asparagine, Asp: aspartic acid, Glu: glutamic acid, Gly: glycine, Met: methionine, Orn: ornithine, Phe: phenylalanine, Tyr: tyrosine (error bars: SE of means) (adapted from Vervaeke et al. 2004a).

Future Perspectives

The addition of arginine to the *in vitro* medium and a sucrose content of 137 g/l resulted in a fertilization percentage of 3% after placental pollination, whereas with the standard Nitsch medium no fertilization was found for a compatible pollination of *Aechmea fasciata*. Pollen tubes better reach the ovule micropyle because they resemble more *in vivo* grown pollen tubes and are able to understand the ovular signals.

Acknowledgements

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Is Your March - April Issue Missing Pages?

We have received a few emails regarding missing (pp.57-60 and 85-88) and duplicated (pp.61-64 and 81-84) pages in Volume 54(2). If this mistake affected only a small portion of the batch, it would be wasteful to print and mail a whole new set. Fidelity Press would like to correct this situation, but we need to know the scope of the problem. Therefore, please let the editors know by email or postcard if your issue is defective. We apologize for the inconvenience, and if anyone needs the missing pages immediately, we can send a photocopy for the time being.

Cultivar Corner

Derek Butcher, BSI Cultivar Registrar

The International Society for Horticultural Science has just issued the 7th edition of the ICNCP (International Code of Nomenclature for Cultivated Plants) 2004. If you want your own copy of this, check www.actahort.org/books/647

There are few changes from the 6th edition and the main ones relate to the inclusion of the Orchidaceae who still base their names on the "grex" system. The Bromeliaceae is included with the rest of the plant kingdom using the "cultivar" system.

This new edition changes the name of "Cultivar Group" to "Group" with minor changes as to what constitutes a Group. A Group is a collection of cultivars that look similar irrespective of parentage.

In the 1998 Register these were shown, for example, as 'Aechmea chantinii Cultivars', 'Neoregelia carolinae Cultivars', etc. Future publications of the BCR will show these as *Aechmea* Chantinii Group, *Neoregelia* Carolinae Group etc., if a particular cultivar has been added to such a group. This is much easier to trace on our on-line data base under Cultivar Corner on www.bsi.org. All you need to do is search on the name of the Group and the response will show all cultivars allotted to this Group.

I have had problems trying to think up a Group name for the many variegated neoregelias because of the involvement of both *N. carolinae* and *N. concentrica*. These cultivar names can be easily checked just by entering 'Skotak' in the hybridist name section and you will get most of them, but not all!

Mulford Foster (1953) described and named *Neoregelia carolinae* var. *tricolor* which became *N. carolinae* forma *tricolor* (Smith 1967). It was not included in "An Alphabetical list of Bromeliad Binomials" (Luther 2002) but was mentioned in an "Update to the BSI Bromeliad Binomial list " dated 26 July 2002. There is doubt as to whether this plant should be treated under the ICBN (International Code of Botanical Nomenclature) rules which basically deals with plants found in the wild. It is interesting that this taxon (or is it a culton?) originated under cultivation, has never been linked to the wild and in the 1950's had a Nurserymen's name of 'Nidularium Tricolor'. Because of this doubt I decided to include *Neoregelia* 'Tricolor' in the Cultivar Register. This means there are two names you can use - either *Neoregelia carolinae* forma *tricolor* or Neoregelia 'Tricolor'.

Regrettably, I do not have a good coloured photo of this plant and if anybody has one, please contact me. This was the first reference to a tricolored *Neoregelia* where a basically green leaved plant had white stripes with added overtones of red, especially at flowering. Another to emerge with this 'Tricolor' name was 'Tricolor Perfecta' which should have been known as

'Perfecta Tricolor' - see notes in the Bromeliad Cultivar Register 1998. The name 'tricolor' does not necessarily mean green, white, and, red but can be a combination of any three colours. Because of the popularity and the volume of such *Neoregelia* hybrids, they need a group name which will be *Neoregelia* Tricolor Group to link them all in the Register.

I did have a problem in grouping all those vrieseas that are grown for their leaf markings and not their floral attributes! I refer to the hybrids using *Vriesea fosteriana*, *V. hieroglyphica*, *V. gigantea*, etc., as parents. After several good suggestions I decided on *Vriesea* Glyph Group which Helga Tarver tells me is apt because 'glyphein' is a Greek verb meaning 'to engrave.' Eventually, I hope every bromeliad grower will know what we are talking about when we talk about 'Glyphs'!

By the way, when you are visiting the Cultivar Corner website, have a look at 'ICNCP - It started in 1952, or did it?' It makes interesting reading.

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BSI Website Members-Only Area

Ken Marks, BSI Webmaster

The Members-Only section of the BSI website has been around for nearly two years. It originally grew out of the need to restrict access to the BSI Membership Directory which is available online. To protect this information from perusal by the general public, it was placed in a protected area and was only available to active BSI members who contacted the Membership Secretary for a username and password to grant access. Since that time, other perks were made available and the Members-Only area took shape. The latest version of the bromeliad binomial list and a companion document listing synonyms were soon added. Last year, an online form of the BSI 50-Year Journal Index was added which provides keyword search capability to the index.

Journal Back Issues Online

The latest addition to the Members-Only area leverages one of the most significant assets of the BSI (the 300+ issues of the Journal) by making it available online. As a side project to running the BSI website, I have been scanning the pages from a complete set of BSI Journals which were graciously lent to me by Polly Pascal, Nat Deleon and others. From these scans I have been able to extract the text contained in these Journals using the latest Optical Character Recognition (OCR) software. Though the OCR software is by no means perfect in its recognition (especially so in the early, faded issues), with proper proofing, it was possible to slowly and methodically convert the contents of the Journals to digital form. Once that step was complete, web pages for each Journal issue were created by hand and the images from each Journal were inserted as the articles were reformatted for viewing using a web browser.

When I had a few years of the Journal converted to web pages, I turned my attention to development of a search engine capable of finding Journal articles matching the supplied search terms. It was not possible to use public search engines (like Google) since the web pages were going to be located in a private, password-protected section of the website. All the articles within each issue of the Journal are included in a single web page, so some special indexing down to the article level would also be required by the search engine. Some research into the current state of the technology in the area of information retrieval provided the basis for a workable algorithm. Additional functionality and refinements over the past months have resulted in a speedy and effective tool for searching through the online Journal articles and providing well ranked results.

I have finally completed the conversion and indexing of the first 12 years of the Journal and I felt this resource was ready for inclusion in the Members-Only area. Additional years of the Journal will be scanned, converted, formatted, indexed and then added to the website as I have time. It is

hoped that this online resource will allow a wider audience to have access to the information contained in these scarce early issues of the Journal.

With the increase in content available in the Members-Only area, more and more requests for usernames and passwords (and re-requests for lost passwords) have been made to the Membership Secretary creating an ever-increasing burden. To alleviate this burden, access control to this protected section of the BSI website is being replaced with a system that is simpler to administer.

New Password System

The new system will use a common username and password combination for use by all BSI members instead of the personal usernames and passwords previously distributed. The existing username/passwords will be phased out as the new system takes effect. **The new combination to be used for accessing the Members-Only section of the BSI website will be printed in the inside back cover at the bottom of the page of each issue of the Journal.** The web page entrance to the Members-Only section will direct BSI members where to look in the Journal to find the latest valid password information. This information will be changed initially every other issue and the previous combination will remain active for enough time to to ensure that the new Journal is received by all members.

Most mainstream browsers (e.g. Netscape, Internet Explorer, Mozilla, etc.) provide a method for permitting the browser to save the username and password for a particular website. This is usually accomplished by checking the box next to the text resembling the phrase "Remember my password" in the username/password popup box. Using this feature of the browsers will free the user from having to remember this information each time they visit the Members-Only area. When the currently stored password has expired, a quick check of the LATEST Journal will provide the necessary information to continue access to this online benefit of membership.

Moving?

If your address is changing, even if your move is a temporary or seasonal one, you should notify the BSI Membership Secretary four to six weeks in advance. Even when you are temporarily away, your bulk mail is either discarded by the Post Office or, as in the case of your JOURNAL issue, is returned to us at a postage due cost of .99 cents within the USA.

If you are moving, or have recently moved, please send your name, the old andnew addresses, and the effective date to: John Atlee, BSI Membership Secretary, 1608 Cardenas Dr. NE, Albuquerque, NM 87110 or by e-mail to membership@bsi.org.

Book Review: Bromeliads for the Contemporary Garden

Bob Reilly[6]

Andrew Steens grows bromeliads in New Zealand. Not surprisingly, his new book reflects this perspective. Thus elements of the book, for example the author's comments on the sun-hardiness of particular bromeliads, need to be treated with caution, given the significant climatic differences between warmer sub-tropical/tropical areas and New Zealand. (However, this may not be as significant an issue for growers in more temperate regions).

The book is a comprehensive introduction to growing bromeliads. In my view, it is one of the best books available on this topic today. Experienced growers will also find much of interest in it.

Bromeliads for the Contemporary Garden has 198 pages and 300 high quality photographs. A high standard of accuracy in matters such as plant names and descriptions has been achieved. In the first chapter, an overview is given of the bromeliad family, and their native habitats. An informative chapter on landscaping with bromeliads then follows.

The bulk of the book is a listing of 24 commonly encountered genera and four bi-genera. Over 200 species and hybrids are described in non-technical language. Many of these plants are illustrated with colour photographs. Most of these bromeliads are available in Australia. Of particular interest to myself, is the description (and photographs) of species from some of the genera, for example *Fasicularia, Ochagavia,* and *Puya*; which do not always flower well in sub-tropical coastal Queensland where I live.

The next chapter deals with bromeliad cultivation. Caution is needed before applying some of this chapter's recommendations, given the different climatic conditions under which bromeliads are grown around the world. However, most of the material is applicable. All of the major topics relevant to growing bromeliads, for example, watering schedules, pest/disease recognition and control, and fertilising; are well covered in non-technical language. The book concludes with a short chapter on bromeliad propagation and a comprehensive index.

Bromeliads for the Contemporary Garden is excellent value for money. The photographs alone are worth the purchase price. However, this book is much more than a compilation of photographs. Overall, it is highly recommended. It can be purchased from the Bromeliad Society International online store as well as many other distributors.

Hardcover. 198 pp. 8.5 x 10.25 in (260 x 215 mm). 290 color photos, 4 tables. 2003 Timber Press, Portland, Oregon. ISBN:0-88192-604-3.

[6] E-mail: bob.reilly@nrm.qld.gov.au

The University of Adelaide Library Celebrates the Life of Marie Robinson

Ray Choate[7] **Photographs by the Author**

Marie Robinson was a member of staff of the Barr Smith Library for 38 years until her untimely death on 6 September 1998. On 19 February 2003, past and present members of the library staff met to remember her and celebrate her life. The meeting was held in the magnificent reading room of the Barr Smith Library, and was attended also by members of Marie's family and others.

On display at the meeting were a photograph of Marie and a painting of one of her beloved bromeliads, and these will shortly be located to the foyer of the Library together with a descriptive note.

Never one for formality, Marie was famous for her humanity and good nature, her rapid-fire conversation, and her aversion to writing things down. If it was necessary to write something, for Marie it was always on the smallest possible scrap of paper, a trait she learned from William Cowan, University Librarian at the time of Marie's appointment to the Library in 1961. The fact that paper was plentiful and relatively cheap were ideas that just never caught on! Marie studied mathematics at Queens University, Belfast, and was able to do calculations in her head at about the speed that she could talk; she left non-arithmeticians far behind during discussions about budgets and other financial matters. On the few occasions when Marie was required to write down her calculations, the results were miniscule and incomprehensible. Yet somehow the accounting of the Library's multi-million dollar materials budget, for much of which Marie had responsibility, was usually exact to the finest of margins.

At the function, Ken Robinson spoke about his life with Marie, Marie as a mother, and Marie's life outside the Library, as well as how much a part of the lives of all the family, the Barr Smith Library came to play over the years. Ken presented the Library with a portrait photograph of Marie, putting a permanent face to Marie's collection of books on Bromeliads, which the family had donated previously.

On display for the first time was a new painting of the Tillandsia 'Marie Robinson', bred by Marie and painted by Melbourne botanical artist Mary Gregory. The painting was commissioned by the Library in memory of Marie. Marie's friend, Len Colgan, President of the Bromeliad Society of South Australia, spoke about his work with Marie in the Society of which she was Treasurer for 16 years.

Members of the Society are warmly invited to the Library to view Marie's portrait, the painting, and the fine, historic Barr Smith Library Reading Room.

[7] Barr Smith Library, Adelaide University, Adelaide, South Australia 5005, Australia

Figure 15. Marie Robinson.

Figure 16. Tillandsia 'Marie Robinson', bred by Marie and painted by Melbourne botanical artist Mary Gregory.

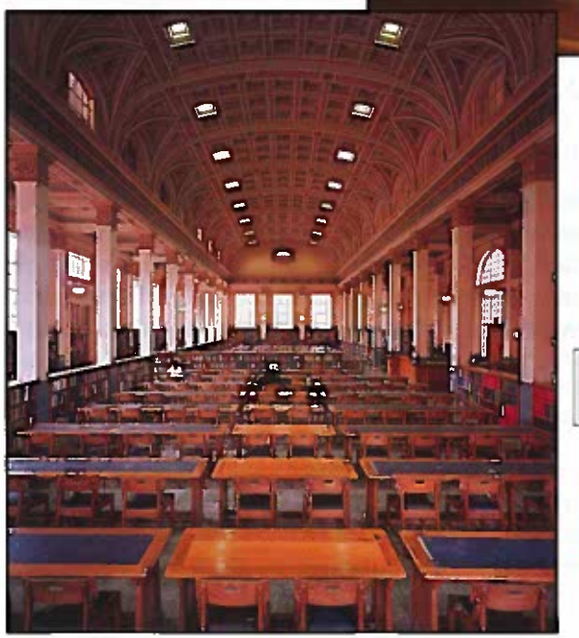


Figure 17. Barr Smith Library reading room.

Not All Ideas Are Golden

Tammy Marks[*]

If you're reading this article you're probably already a member of a bromeliad society, and you're also probably a member of some other garden and plant societies as well. You will also be aware of the never-ending task of recruiting new members into our societies.

Come to think of it, I'm not sure why we need to recruit so frequently, as we're happy with the friends and cohorts we have now. Nevertheless, in our holy grail to entice the whole world into loving our plants, we participate in community garden sales, we give talks, we sell plants, and we have educational seminars.

After a while, it gets very entertaining watching the passersby at these sales. Some will not make eye contact with you whatever you do. No eye contact means no need to turn you down when you try to strike up a conversation. Others will talk with you but won't step into your booth. They just hover on the boundary of no commitment.

Others with more fortitude will browse and talk and have a grand time. But these are the rarities, and most people need to be invited in, coerced in. Americans must just be shy introverted types. So here we are with the same problem as everyone else: How do you get someone interested so you can get their contact information to invite them to your society meeting? We had one of those moments when the sparks fly, the light bulb goes on and an idea pops into your head like the invention of Velcro. It's astounding in its simplicity: Let's have a raffle.

Everyone loves getting something for nothing. Place a few beautiful Guzmanias around the table and people will be throwing themselves at you with their home phone numbers and addresses in hopes of winning them. As chance would have it, a garden show was scheduled to take place a mere block from where we hold our society meetings; and it was only weeks away. What better venue and timing could we ask for?

It was the first year that this garden sale was being held. From past experience we knew that not many people attend first year events due to lack of advertising and knowledge of the event. Then the sparks really flew out of Ken's ears (not as painful as it sounds) because it was definitely him that came up with, "What if we tell everyone who signs up for the drawing that they won?" That means everyone will come to our meeting to pick up their free plant. They will stay for the meeting, find out what a great society we have and join up as life members!

I have to admit that we all thought it was pretty slick. We invest a few dollars in plants and get lots of new members. We even planned a great speaker for that month: Nat DeLeon from DeLeon Bromeliads (and long time BSI member.) Of course, Nat always brings beautiful plants to show, and does a great presentation. We called all the winners, told them they have to pick up their bromeliads at the meeting, and gave them the time, date, and location.

Soon enough our meeting date arrives, and the stage is set. We've got the table set up with the free "drawing" plants. Nat's there and he has show plants for his talk. Our raffle table is loaded with plants from our members. We are all ready as people start to arrive. The initial trickle of winners was ok. Most people were confused; they were told they won a plant; what do they need to do; what is it; where is it? Normal stuff.

Austin Powers showed up. No really, he showed up with his dad and younger sister. Turns out Austin Powers is a twelve-year old kid from Boca Raton. Unfortunately, mom was in the van with the engine running, sis needs to go to bed and they'll just pick up the free bromeliad and leave. Meanwhile, more winners have come in and milling about the free table but eyeing the raffle table instead. Well we tell people that they can pick up their plants after the presentation but of course some people won't listen. They start picking out the plants they want.

Well, I had convinced Ms. Lotta that she should wait for her plant. Ms. Lotta had come in a bit earlier to see what she's won. She had just settled down when some people started picking up the free plants to take with them to their seats. So she became convinced all the good plants will be gone by the end of the talk. The meeting is starting, and to quiet her down I find a nice bromeliad to give to her. Our president is trying to get the meeting in order, and get everyone to sit down. Nat is introduced and he's doing a great presentation on hybrids with wonderful slides.

Out of the corner of my eye, I see Ms. Lotta is not really paying attention. She's looking at her plant and looking at the remaining plants. Then she's eyeing Nat's plants. She leans over and whispers, "is my plant like his?" Well come on - whose plants are like Nat's? Trying not to disturb the meeting, I shake my head.

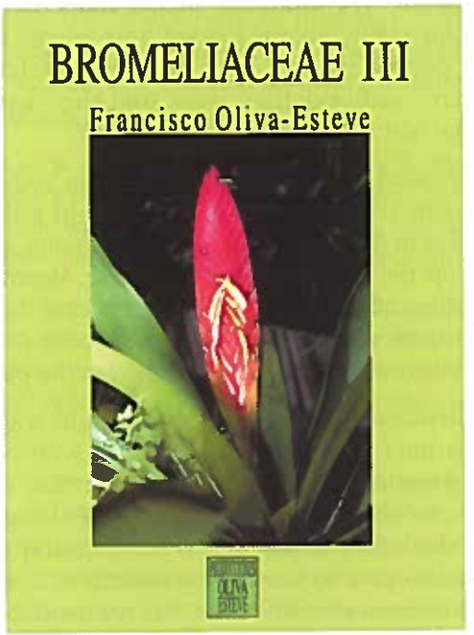
Honest—we didn't plan this, but Ken and I couldn't stay for the entire meeting. We stayed as long as we could and we left. Boy, did we hear the whole story afterwards. A melee practically broke out as people grabbed the free bromeliads at the end of the meeting. Our treasurer, Sally, caught an elderly lady with four free bromeliads trying to get them into her car. Now Sally is definitely not the shy retiring type. I'm not sure what any of us would have done but I doubt we would have caused a scene, thinking it well worth the bromeliads to get rid of this moocher. Not Sally.

Sally approaches Ms. Lotta, because it was, of course, none other than Ms. Lotta, and reads her the riot act. Sally actually manages to get some of the bromeliads back from Ms. Lotta before sending her on her way. As we are licking our wounds, we ponder what went wrong. It sounded like a wonderful idea in theory but perhaps people who want plants just because they are free are not necessarily plant people. Although we would like to see our membership grow, we want quality over quantity - people who really love bromeliads as we do. So now we just need to think of another (better) scheme for next year.

[*] 22690 Lemon Tree Ln., Boca Raton, FL 33428-5514.

"Bromeliaceae III"

By: Francisco Oliva-Esteve



This handsome new book on bromeliads, published by Producciones Oliva-Esteve in Venezuela, is richly illustrated and printed on high-quality coated paper. 9 1/4 x 13 inches (32 x 25 cm). Photos, 564 in color. Hard Cover. 275 pp. English and Spanish editions available. ISBN 980-07-7310-X.

The opening chapter,"A Short Venezuelan Historical Review of the First Explorers," is followed by text and color photographs describing 29 genera. Among these are 108 species of *Tillandsia*, 38 of *Guzmania*, 34 of *Aechmea*, 17 *Pitcairnia*, and 15 *Vriesea*. This books adds new species to those covered in Oliva-Esteve's previous works.

Bromeliaceae III is priced $95 plus shipping and handling and applicable sales tax (Florida 7%). To order a copy, send check in US Dollars and made to SBG Press to:

Selby Botanical Gardens Press
811 South Palm Avenue
Sarasota, Florida 34236-7726

Orders may also be placed by submitting credit card information by e-mail to sbgpress@selby.org, or by telephone (941-366-5731 x 264) or fax (941-951-1474). A secure online order form is available through the Selby Botanical Gardens web site (www.selby.org).

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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Editors . . . . . Bruce Holst & Susan Murphy, Marie Selby Botanical Gardens, 811 South Palm Ave., Sarasota, FL 34236-7726. editor@bsi.org.
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Aechmea perforata L.B. Sm.

Derek Butcher, BSI Cultivar Registrar

Elton Leme, in 1989 on one of his many expeditions into the wilds of Brazil looking for Bromeliads, collected seed of *Aechmea multiflora*, *A. castanea*, and *A. perforata*. He sent some to me in Australia with the laconic note 'Only for those with large shadehouses'! If you know anything about the subgenus *Chevaliera* you will realise that we were in for a prickly experience with large plants. The seed was distributed some keen growers in Australia with the request to let me know when flowering occurred. It was a long wait!

In February, 2004 in Adelaide I was astounded to get a telephone call that one was coming into flower. The call was from Len Cork who was surprised that his plant was doing something after so many years and he had never seen a Bromeliad like it! A white ball had burst through the centre leaves and what he took for scape bracts were a pale brown colour. The ball elongated and a week later blue flowers started to emerge from this cone in sharp contrast to the white. These flowers continued to emerge at regular intervals for weeks and Len was able to take the plant into our Annual Show. Needless to say, it was put in a corner well away from hands and feet of inquisitive onlookers. We still do not know what triggered the flowering but Len had recently removed the offsets and repotted 'Mother' in well fertilised soil mix. It could even have been the extra hot summer. The flowering plant was some 2 metres in diameter but this is small compared to the size they attain in the wild if we refer to Lyman Smith's description!

Photograph by Derek Butcher.

Figure 18. *Aechmea perforata*.