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Cover photographs. Front: *Neoglaziovia burle-marxii*, a new species, is described by Elton M.C. Leme on pages 101–104. Photo by the author. Back: A hybrid of *Tillandsia streptophylla* and *T. paucifolia* shows distinctive characters inherited from both parents. Text by Mark Dimmitt begins on page 118. Photo by the author.

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NOTICE

Ballots are enclosed for all voting members except those in regions with no directorship vacancies (Australia, Louisiana, and Texas). Please tell the editor if you did not receive your ballot.

Disteganthus basi-lateralis

Harry E. Luther

The genus *Disteganthus* has for many years remained an almost mythical entity to bromeliad collectors. Even the few who were aware of its existence knew little more than that it flowers from the base of the plant and vaguely resembles a large and spiny *Cryptanthus beuckeri*.

The genus *Disteganthus* was established by Lemaire in 1847. The original publication in *Flore de Serres*[1] was illustrated with a beautiful hand-colored plate showing the details of the axillary, basal inflorescences with their pink bracts and yellow petals. That plate was done from a living plant since *Disteganthus basi-lateralis* was in cultivation in Paris at that time. It seems to have disappeared from horticulture soon after that.

In 1960, the genus *Disteganthus* disappeared as well, submerged into the catch-all genus *Aechmea* Ruiz & Pavon. There it remained until 1976 when L.B. Smith and R.W. Read resurrected it to genus level.

The genus *Disteganthus* now contains two species: *D. basi-lateralis* Lem. from French Guiana and the Brazilian *D. calatheoides* (L.B. Smith) L.B. Smith & R.W. Read (first described as *Aechmea calatheoides)*. Neither species is well known. Of *D. calatheoides* there is only the type collection. *D. basi-lateralis* is evidenced by only four collections, the latest two by Dr. John Kress were the first to be introduced into American horticulture through the Marie Selby Botanical Gardens. The first release of plants of *D. basi-lateralis* was made at the 1988 World Bromeliad Conference rare plant auction.

Disteganthus basi-lateralis grows as a terrestrial in dense, wet forests usually in large colonies. Plants have done well in cultivation at Selby Gardens and appear to be prolific in the production of stoloniferous offsets. Our plants are grown in ten-inch bulb pans in a commercial seedling orchid mix kept moist and well fed and always above 62 degrees F. None has yet flowered, perhaps because they have been divided and not allowed to cluster.

The accompanying habitat photos of *Disteganthus basi-lateralis* should be of interest to growers who have acquired (or hope to acquire) this strange and uncommon plant.

M.B. Foster Bromeliad Identification Center
Marie Selby Botanical Gardens, Sarasota, Florida

1. *Flore de Serres et des Jardins de l'Europe.* Vol. 3. Ghent: L. van Houtte; 1847:226–228.

W.J. Kress

W.J. Kress

Fig. 1 and 2
Disteganthus basi-lateralis in French Guiana habitat. This species grows in large colonies as a terrestrial in dense, wet forests. Note in the lower photograph the depth of the base and the presence of two offsets on stolons.

Neoglaziovia burle-marxii, A New Species of Caroá from Brazil

Elton M.C. Leme

Saturday morning. From the spacious terrace of Roberto Burle Marx's home we can see the show of color and forms of several kinds of bromeliads that the master of landscape arranged with his undeniable touch of art. Further on, the view extends; the evergreen mangrove vegetation dominates the scenery. In the background, the water of Guaratiba Bay makes a perfect picture.

We are at Roberto Burle Marx's estate called Santo Antonio da Bica. This retreat is situated on the Piabas Hills near the city of Guaratiba. The exuberance of the plants grown and arranged together by Roberto over the decades, with the unique good taste of the artist, accomplish a perfect marriage. Brazilian bromeliads, as usual, had to be present with all their ornamental power and their arrangement of utmost ability.

E.M.C. Leme

Fig. 3
Neoglaziovia variegata.
A very large plant with leaf blades up to 15 dm long and 15–20 mm wide. Called caroá, it is the source of fibers used for both cordage and textiles.

From time to time we pay a visit to Roberto Burle Marx and identify his bromeliads. We are always surprised at the new and rare species, many of which are little known. At other times Burle Marx draws our attention to a certain group of species that, hidden in the middle of the vegetation of the property, he considers "different." Very often we come across species not yet classified.

Last October, Roberto announced that his *Neoglaziovia variegata* (Arruda da Câmara) Mez were blossoming. Then we went to give a look at such a xerophyte. As we got near the big clump, the intense red of the inflorescences increased its power of attraction on us. It seems to have the same attraction for the local butterflies. We had to take a closer look at those strange bromeliads – and I declared, *'Neoglaziovia,* yes, Roberto, but not *Neoglaziovia variegata,* not even *Neoglaziovia concolor!*

In fact, the leaves as well as the details of the inflorescence were quite different from anything I had seen before. After gathering plenty of material, more detailed studies disclosed a new species. We are glad to pay tribute to its discoverer:

***Neoglaziovia burle-marxii* Leme, sp. nov.**

Ab omnibus speciebus adhuc cognitis inflorescentia dense, bracteis floriferis supernis sepala aequantibus, floribus sessilibus differt.

Plant terrestrial, propagating by underground rhizomes. *Leaves* about 10 in a fasciculate rosette, 1–2 or 3 meters long, suberect, thick, very rigid; *sheaths* narrowly oblong-ovate, entire or sparsely spinose near the apex, 8–10 cm long, about 5 cm wide near the base, on both sides but mainly beneath covered with a white membrane of fused scales, dark brown and corrugate near the base; *blades* linear, about 2.5 cm wide near the base, gradually narrower toward the apex, strongly canaliculate and sometimes with revolute margins, green, delicately nerved and densely white-lepidote beneath, with scales arranged in longitudinal rows, inconspicuously white-lepidote above with scales concentrated on the margins, apex acuminate-caudate, margins laxly serrate with brown antrorse and retrorse spines 2–6 mm long. *Scape* erect, 25–55 cm long, about 8 mm in diameter, greenish or reddish, densely white-flocculose; *scape bracts* about 6, not completely hiding the scape, the lower ones foliaceous, the upper ones narrowly lanceolate, acuminate, suberect, distinctly exceeding the internodes, reddish, densely white-lepidote on both sides, laxly spinose. *Inflorescence* simple, densely racemose, erect, 10–13 cm long, 3–4 cm in diameter, distinctly shorter than the leaves, bearing a small apical coma of sterile bracts; *axis* red, about 8 mm in diamet., white-lepidote or glabrous, inconspicuously verruculose; the lower *floral bracts* resembling the upper scape bracts but smaller, distinctly exceeding the flowers, the upper ones narrowly triangular, acuminate, nerved, entire or lax and irregularly spinulose, glabrous adaxially, densely white-lepidote abaxially, equalling the sepals. *Flowers* 30–40, sessile, subspreading, 20–25 mm long,

polystichous; *sepals* subsymmetric, suborbicular, free, apex obtuse or emarginate, 5–8 mm long, 6–8 mm wide, red, glabrous; *petals* long obovate, apex emarginate, 13–18 mm long, about 7 mm wide, suberect at anthesis, free, purple, bearing 2 small subentire scales on the base and 2 well-developed, longitudinal calli. *Stamens* shorter than the petals; *filaments* the epipetalous 1 mm basally adnate to the petals, the other free; *anthers* sublinear, 5 mm long, base obtuse, apex apiculate, fixed near the middle. *Ovary* subglobose, red, glabrous; *epigynous tube* short; *placentae* apical; *ovules* apiculate.

Type: Brazil. State of Bahia: without exact place of collection. Leg. *Roberto Burle-Marx, s.n.* Flowered in cultivation in October–November 1988. **Holotype** HB; isotype: RB.

Material used for comparison: *N. variegata* (Arruda da Câmara) Mez **Brazil. Bahia:** Joazeiro, *Zehntner 728,* Nov. 1913 (R); ibid., Itumirim, *Campos Porto s/n,* Dec. 19, 1922 (RS); Mucugê, road to Contendas do Sincorá, *G. Martinelli 5464 et al.,* Oct. 29, 1978 (RB); Cafarnaum, *E. Pereira 2153,* Sept. 12, 1956 (RB); Santo Inácio, road to Gentio do Ouro, *A. Furlan s/n et al.,* Dec. 2, 1980 (RB); Itaité, *A. Araujo 97,* Nov. 23, 1979 (RB); road to Iracê, near Angical, *E. de Oliveira 189,* Oct. 8, 1980 (RB, EPABA); Quedas de Paulo Afonso – Terenoabo, *Castellanos 21885,* Jan. 31, 1958 (R); Morro da Lapa, *Zehntner 570,* Nov. 15, 1912 (R).
Minas Gerais: Itinga, *A. de Mattos Filho 1643 et C. Toledo Rizzini,* Oct. 13, 1984 (RB).
Ceará: Aurora, *Löfgren s/n,* May, 1912 (R).
N. concolor. C.H. Wright. Brazil. Bahia. *D. Sucre 10792 RB);* Bom Jesus da Lapa, District of Cameleira da Lapa, Mangel Farm, *P. Carauta 1023,* Jan. 28, 1970 (RB).

Burle Marx collected *Neoglaziovia burle-marxii* Leme many years ago in the State of Bahia, but, unfortunately, he has forgotten exactly where he found it. It differs from the two known species of *Neoglaziovia* especially in the densely flowered inflorescence, in the upper floral bracts, which equal the length of the sepals, and in the sessile flowers. It is interesting to observe that using the key for genera worked out by Smith & Downs (1979) this new species fits near *Quesnelia* just because sessile flowers had not yet been reported for *Neoglaziovia.*

Generally speaking, the different *Neoglaziovia* species are terrestrial plants growing very often in stony ground under intense sunlight and xerophytic conditions, occurring in great concentrations of population in the northeast of Brazil. In the sixteenth century the colonizer in Brazil mentioned the use of the fibers of the *N. variegata*, the common *caroá,* for cordage.

It is the native northeasterner who does the picking of the *caroá* leaves (fig. 4). Such work is done at the time of drought as it can be used to more

Luiz Claudio Marigo

Fig. 4
A typical native northeasterner, called *Nordestino*, collecting caroá leaves in Caatinga vegetation.

advantage, producting a better product. For hundreds of years the fibers of *N. variegata* were used by local people. At the beginning of this century it achieved great success in the textile industry.

We know a great deal about the economic uses of *N. variegata*, but practically nothing about *N. burle-marxii*. Although this new species possesses longer leaves than the species already known, the spines are proportionally more developed. That fact may discourage people from gathering it for manufacturing purposes. Yet, only new collections with more complete data will clear many obscure aspects of this new caroá.

References:

Foster, M.B. 1958. Collecting in caroá country. Brom. Soc. Bull. 8:30–31.

Mez, C. 1934. Das Pflanzenreich IV.32:1–667.

Smith, L.B. 1958. Caroá, Nature's gift to the Nordestino. Brom. Soc. Bull. 8:28–30.

Smith, L.B.; Downs, R.J. 1979. Bromelioideae. Flora Neotropica, v. 14, pt. 3:2036–2037.

Zavataro, T. de B.B. 1988. Tipos brasileiros, II. Calendário de Souza Cruz.

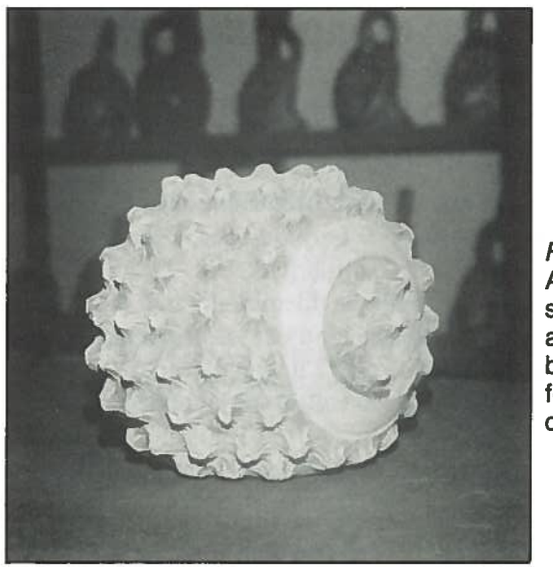
Rio de Janeiro

Bromeliads in Peruvian Pre-Columbian Art

Klaus von Bismark

Archeology is not one of my favorite hobbies, but I do know something about it. For many years I have lived near the Amino Textile Museum in Lima, Peru, and have taken many guests and friends to see this small, well laid out, and well-organized museum. After several visits you know what there is to see and recently, while taking friends around, I was bored so I was looking at some huacos (pre-Columbian terra cotta pots) to pass the time when suddenly I noticed on a huaco dating from the Mochica Culture (200 A.D. to 700 A.D.) a chasqui, or the equivalent of a postman in those days, followed by a dog. Nothing new in that, but there were plants in the desert, definitely not cacti. They could only be bromeliads as there are no other plants of that shape in the Mochica area which stretched from Chimbote to Piura. There was only one pot with bromeliads that I could find in the Amino Museum and no similar designs on any of the materials dating from different cultures.

I searched through various other museums and libraries trying to find bromeliads but finally in the Larco Herrera Museum, where by kind permission of Mrs. Isolina de Larco and her daughter Chabuca, I was allowed to photograph, I came across a huaco shaped like a pineapple belonging to the Mochica Culture (fig. 5). I have searched but have not been able to find a single example of bromeliads on huacos, materials, or jewelry from any other Peruvian Culture, which does not mean to say that they do not exist, but it would take an enormous amount of time to search through all the material available.



Author

Fig. 5
A huaco of the Mochica culture shaped like a pineapple. The author suggests that other bromeliad designs may be found in other artifacts of that culture.

Author

Fig. 6
A huaco design showing warriors and possible tillandsia plants (taken from the pot shown in the upper right corner).

The museums with Mochica huacos show bromeliads on numerous pots. The bromeliad on the huaco in the Amino Museum is almost definitely a *Tillandsia latifolia* var. *divaricata*, a very common plant, but one with two inflorescences. It is an unknown variety, artistic license on the part of the Mochica artist, or an extinct variety? In a private collection, I noticed for the first time that tillandsias other than just the *T. latifolia* appeared but which they are I do not know. Then I found in Reiss and Stubel (1880) Book 3[1] an archeological drawing, but the archeologist was more interested in the different uniforms rather than the plants depicted (fig. 6).

The October 1988 *National Geographic Magazine* includes an article about the excavation of a Mochica high priest's grave showing how highly developed the Mochica Culture was. This gives an idea of the Mochica Culture if anyone is interested in finding out more about the tillandsia artists.

I should like to suggest that the Bromeliad Society start a collection of tillandsia designs, which at a later date could be exhibited. There are numerous Mochica huacos in museums and private collections. The idea would be to see what plants existed then and what plants exist today. Were they used just as decoration, which is all I have been able to discover so far from the little I have seen, or were they perhaps used for medicinal purposes? I know that the goats don't like them; they bite the center out only to spit it out, especially *T. purpurea* and *T. latifolia*. The collected material would then be shown to specialists like Prof. Dr. Rauh who knows all the areas and plants so they could be identified, and then to an archeologist who could advise on the significance and use of bromeliads in the culture: the start of Archeological-Bromeliad-Botany? It would need the cooperation of a lot of members and associated societies to collect the amount of information needed.

Apartado 18-0321, Miraflores, Lima, Peru

1. *Wilhelm Reiss and A. Stubel.* The necropolis of Ancon; a contribution to our knowledge of the culture and industries of the empire of the Incas. . . *tr. by A.H. Keans---Berlin: A. Asker & Co., 1880–1887. 3 v.*

A list of museums having pre-Columbian collections follows. It was taken from the reference book Museums of the World, *3rd rev. ed. K.G. Saur, New York, 1981. There may be other significant collections known to society members such as the Amino Textile Museum and the Larco Herrera Museum in Lima, Peru. Please send drawings, and museum postcards of your findings to the editor. Objects in museum cases are difficult to photograph (even if permitted) because of the reflection of the camera flash. —Ed.*

ARGENTINA

Rosario
Museo Historico Provincial de Rosario 'Dr. Julio Marc'. Parc Independencia.

San Ignacio
Museo Jesuitico Numismatico 'Domingo F. Sarmiento', Av. Sarmiento s/no.

FRANCE

Cannes
Musée de la Castre, Le Suquet, F-06400.

Dieppe
Château Musée de Dieppe, Château Musée, rue de Chastes, F-76200.

JAPAN

Hiki
Toyama Art Museum, Toyama Kenekan Foundation, Shiroi-numa 675, Kawajima-machi, Saitama 350-01.

Tokyo
Bridgestone Museum of Art, 1-1 Kyobashi, Chuo-ku.

PERU

Cuzco
Museo Historico Regional del Cuzco, Calle Helanderos.

Lima
Museo de Arqueologia y Etnologia Azangaro 931.

SPAIN

Madrid
Coleccion de Arqueologia y Etnografia Américana. Faculdad de Filosofia y Letras. Depto. de Anthropologie de América, Ciudad Uiversitaria.

Mahon
Museo de Bellas Artes. Plaza de la Conquista, Mahon, Menorca, Baleares.

Valladolid
Museo Misional (Filipinas, China y America del Sur). Paseo de Filipinos 7.

SWITZERLAND

Geneva
Musée Barbier-Muller. 4, rue de Ecole-de-Chimie, CH-1205.

Zurich
Museum Rietberg. Gablerstr. 15, CH-8002.

THE UNITED STATES

Alabama
Birmingham. Birmingham Museum of Art. 2000 8th Ave. N. 30503.

Mobile. The Fine Arts Museum of the South at Mobile. Langan Park 36608.

California
Fresno. Fresno Arts Center. 3033 E. Yale Ave. 93703.

Santa Barbara. University Art Museum, Univ. of California. 93106.

Connecticut
New Haven. Yale Univ. Art Gallery. 1111 Chapel St. 06520.

District of Columbia
Washington, D.C. Dumbarton Oaks Research Library and Collection. 1703 32nd St., NW 20007.

Florida
Coral Gables. Metropolitan Museum of Art Centers, Inc. 1212 Anastasia. 33134.

St. Petersburg. Museum of Fine Arts of St. Petersburg, FL, Inc. 255 Beach Dr. N. 33701.

Tampa. Tampa Museum. 600 Doyle Carlton Dr. 33602.

Illinois
Champaign. Kraunert Art Museum, Univ. of Illinois. 500 Peabody Dr. 61820.

Chicago. The Art Institute of Chicago. Michigan Ave. and Adams St. 60603.

Jacksonville. David Strawn Art Gallery. 331 W. College Ave. 62650.

Indiana
Notre Dame. The Suite Museum of Art, Univ. of Notre Dame. O'Shaughnessy Hall. 46556.

Iowa
Iowa City. Univ. of Iowa Museum of Art. Riverside Dr. 52242.

Louisiana
New Orleans. New Orleans Museum of Art. Lelong Ave., City Park. P.O.B. 19123. 70179.

Minnesota
Minneapolis. The Minneapolis Institute of Arts. 2400 Third Ave. S. 55404.
Moorhead. Plains Art Museum. 521 Main Ave. P.O. B. 56560.
Rochester. Meadow Brook Art Gallery, Oakland Univ. 48063.

New Jersey
South Orange. Seton Hall Univ. Museum. S. Orange Ave. 07079.

New York
Canton. Richard F. Brush Art Gallery of St. Lawrence Univ., Romoda Dr. 13617.
Hamilton. The Picker Art Gallery. Charles A. Dana Creative Arts Center, Colgate Univ. 13346.
New Paltz. College Art Gallery, State Univ. College. 12562.
Syracuse. Joe and Emily Lowe Art Gallery. Syracuse Univ. 13210.

North Carolina
Durham. Duke Univ. Museum of Art. College Station. P.O.B. 6877. 27708.

Ohio
Columbus. Ohio Historical Center. Interstate 71 and 17th Ave. 43211.
Dayton. Dayton Art Institute. Forest and Riverview Avenues. 45401.

Pennsylvania
University Park. Museum of Art, The Pennsylvania State Univ. 16802.

Texas
Dallas. Dallas Museum of Fine Arts. Fair Park. 75226.
Fort Worth. Kimbell Art Museum. Will Rogers Road. P.O.B. 9440. 76107.
Kingsville. John E. Conner Museum, Texas A & I Univ. 78363.

Vermont
Burlington. Robert Hull Fleming Museum. Colchester Ave. 05401.

Virginia
Norfolk. Chrysler Museum at Norfolk. Olney Rd. and Mowbray Arch. 23510.

Washington
Seattle. Seattle Art Museum. Volunteer Park. 98112.

Helgard Schnable, Burgholzstrasse 25, Neubrandenburg 2000, DDR (East Germany) writes that she is now allowed to make personal contact with plant hobbyists and asks for tillandsia plants and seeds. She has a small collection grown from seed. She explains that she has no source of materials in her country. The editor has suggested that the German Bromeliad Society (DBG) consider helping hobbyists in East Germany as they have already done in Czechosolovakia, but you might find a new and grateful friend by your own efforts in Helgard Schnabel. To my knowledge, you can send plant materials to West Germany without difficulty. The same conditions may apply to East Germany. Why not write to her and find out?—TUL

Racine Foster is at home after having spent several days in the hospital. She would welcome cards and notes from her many friends. Her address is: 7123 Foster Lane, Orlando, FL 32818.

Genetic Variation in Three Species of Florida *Tillandsia* (concluded)

W. John Kress, Harry E. Luther, and Cheryl S. Roesel

Continued from March-April 1990.

DISCUSSION

Results of the present investigation and that of Soltis et al. (1987) show that enzyme electrophoresis provides valuable information on the genetics and taxonomy of *Tillandsia* and most likely other bromeliad genera. Additional trials are warranted on the four enzymes examined and others. These experiments are now underway (Kress, unpubl.).

In order to confirm the genetic basis of the banding patterns observed by electrophoresis, progeny studies (comparisons of genetic patterns in maternal parents and offspring) are required. In this investigation no such studies were carried out and we can only infer genetic interpretations by comparing the banding patterns observed with those reported by others, and with those expected as a result of the substructure of the enzyme examined.

A functional enzyme is constructed of one or more polypeptide chains or subunits, the sequence of which is determined genetically. A monomeric enzyme is functional as a single polypeptide chain, a dimeric enzyme is constructed of two chains, and so on. The subunits of a multimeric enzyme for a heterozygous individual interact at a locus to form hybrid bands between the primary bands of an isozyme in a predictable pattern.

The patterns observed for IDH and 6PGD closely fit the expected for a two-locus dimeric enzyme system (Gottlieb, 1981; Goodman & Stuber, 1983).

For PGM, a monomeric enzyme, three distinct zones (Fig. 7) of staining found in all three species suggest that three isozymes are present in *Tillandsia.* Soltis et al. (1987) reported similar observations for two of the same species studied here *(T. recurvata* and *T. usneoides).*

Interpretation of the banding patterns in PGI was difficult. Isozymes of this system are normally dimeric and encoded by two loci (Gottlieb, 1981); two loci were observed in all tillandsias. The more anodal locus in general stained too faintly to read; in contrast the cathodal locus showed distinct multiple-banded patterns (Fig. 6). Both *Tillandsia utriculata* and *T. recurvata* were fixed at this locus for a four- to five-banded pattern suggesting a gene duplication. However, it is unlikely that the same duplication would arise in two unrelated species unless it arose in a common ancestor of the three taxa and has been uniquely lost or silenced

in *T. usneoides*. Further studies are needed to resolve this question. In the polymorphic *T. usneoides* the various one-, two- and three-banded patterns in the cathodal locus appear to be typical of a dimeric enzyme with both homozygotes and heterozygotes present.

The incomplete genetic interpretations for the few isozyme loci obtained in this study do not warrant the calculation of any of the standard statistics for characterizing population structure. However, the results indicate that the frequency of occurance of different alleles varies between the three species investigated. *Tillandsia usneoides* showed the greatest number of variable loci, the greatest observed amount of heterozygosity and the largest number of alleles per population, all indicative of greater genetic variation in this species than in the other two.

It has been shown in a number of plant groups that a correlation exists between the amount of genetic variation revealed by electrophoresis and the degree of outcrossing (Hamrick et al., 1979). The electrophoretic data presented here suggest that *T. usneoides* exhibits a greater level of outcrossing than either *T. utriculata* or *T. recurvata*. This result supports our prediction based on floral structure that *T. recurvata* should be more inbred than *T. usneoides* but is contrary to our expectation of greater outcrossing in *T. utriculata*. In the latter species we suspect that the reduced genetic variation is due to the close proximity of the exserted anthers and stigma, which leads to frequent self-pollination. The data on flower-to-fruit ratios are in general agreement with the electrophoretic results, i.e., autogamy in *T. recurvata* and *T. utriculata;* xenogamy in *T. usneoides*. Additional observations on floral biology and tests for self-incompatibility are needed to understand more fully the breeding systems in *Tillandsia* (Gardner, 1986).

The second goal of this study was to find out if enzyme characters had any taxonomic significance in *Tillandsia*. Electrophoretic banding patterns could be used to separate the species in all four of the enzymes examined and were especially useful in loci monomorphic for a single allele (IDH, PGI, PGM) (Fig. 4). In addition to taxon identification, the potential exists for recognizing relationships among species by comparing shared alleles. For example, at 6PGD three alleles were detected in the three species: one was found only in *T. utriculata* and could be used to identify that species; a second allele was found in *T. recurvata* and *T. usneoides*, but not in *T. utriculata*, hence indicating the possible relationship between the former two species; the third allele was shared in common by all three of the species. When sufficient data on allele distribution at numerous loci are available, more rigorous hypotheses on evolutionary relationships between species can be formulated and tested.

In conclusion, this investigation has demonstrated that enzyme electrophoresis can provide important insights into the systematics of at least some

members of Bromeliaceae. We have plans to continue the present study on Florida tillandsias with the hopes of understanding the distribution and origin of the North American species. We also are planning to experiment with other genera in the family using the methods that have proven useful in *Tillandsia*. During the last several decades much progress has been made in our comprehension of the evolution and taxonomy of the bromeliad family. We anticipate that the methods described here may prove important in furthering our understanding of this family.

ACKNOWLEDGEMENTS

We would especially like to thank Terrence Walters, whose enthusiasm and expertise in electrophoresis helped us develop our methods. We are grateful to the Florida Council of Bromeliad Societies, South Eastern Michigan Bromeliad Society, Bromeliad Society of Australia, Bromeliad Society of Houston, Bromeliad Society of Central Florida, Golden Triangle Bromeliad Society, and the Bromeliad Society Inc. for financial support to complete this study. This investigation was funded in part also by NSF Grant BSR-8706524 to W.J. Kress.

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Notes on the Genus *Hechtia*

Kathleen Burt-Utley and John F. Utley

Hechtia Klotzsch in the subfamily Pitcairnioideae is a genus of approximately 50 species distributed from southern Texas to northern Nicaragua. Most of the species are endemic to Mexico, occurring in seasonally dry, frequently calcareous regions through the country where they often form large, local populations that may represent a major element of the vegetation. Only five species in the genus are known to occur outside of Mexico. Three of these are from Central America (*H. dichroantha* J.D. Smith, *H. guatemalensis* Mez, and *H. malvernii* Gilmartin) and have not been found in Mexico. The other two are *H. glomerata* Zuccarini and *H. texensis* S. Watson, which occur in both southern Texas and Mexico. Within Mexico, the greatest diversity of species occurs from the central region to the southernmost state, Chiapas.

Like most other members of Pitcairnioideae, species of *Hechtia* are characteristically terrestrial or occasionally epilithic, growing on rocks or establishing in crevices between rocks. *Hechtia,* however, is easily distinguished from all other genera in the subfamily by its dioecy, a condition in which separate male (staminate) and female (pistillate) plants are produced. Aside from *Hechtia,* in Central America only, *Androlepis, Aechmea mariae-reginae,* and certain species of *Catopsis* are dioecious. In contrast, most bromeliads have perfect flowers in which both male (stamens) and female (pistil) parts are present and functional. The male and female plants of *Hechtia* species are also sexually dimorphic for inflorescence and floral characters. In sexual dimorphism, males differ in appearance from females. Smith (1937) was the first to recognize this fact and proposed that separate keys were "necessary" for the identification of male and female individuals. In his treatments for the North American Flora (Smith, 1938) and Flora Neotropica (Smith & Downs 1974), Smith attempted to key males and females of several species separately; however, a large percentage of those species were known from only one sex. Until we began our field research, most *Hechtia* species were known only from the type collection and often from a single sex. This is a reflection of the fact that hechtias were very poorly collected, perhaps in part because of the areas where they grow, coupled with their usually aggressively spiny leaves and often large size. Moreover, when species were described from one sex, it was most frequently from female individuals because female inflorescence lasts longer and becomes more conspicuous as the capsules mature.

In addition to petal shape, which Smith (1937) reported, we have noticed significant differences in inflorescence form, sepal shape and floral bract shape and size between sexes (Burt-Utley & Utley, 1987; 1988). *Hechtia carlsoniae* Burt-Utley & Utley provides a striking example of this dimorphism since it

characteristically produces unusual, simple (unbranched) female inflorescences unlike those of any other members of the genus but has bipinnate or occasionally tripinnate male inflorescences. Another example involves *H. melanocarpa* L.B. Smith that has a typically bipinnate female inflorescence while the male inflorescence is tripinnate. From our research to date, we believe inflorescence dimorphism between the sexes is common among the species of *Hechtia.* When inflorescence differences are coupled with differences in sepals and floral bracts, if a species is known from only one sex, it is difficult if not impossible to identify correctly collections of the opposite sex using available literature.

Both Mulford Foster (1965, 1988) and Smith and Downs (1974) characterized the *Hechtia* inflorescence as usually being lateral, but the 30 to 36 species we have observed thus far during our research have terminal or "central" inflorescences. Although curvature of the scape and the presence or absence of basal flattening have been used to infer inflorescence origin, we have found that these characters are unreliable. A plant growing on a steep hillside often will have a scape that is curved and somewhat flattened in appearance even though it is terminal. It is, at times, difficult or even impossible to determine whether the flowering or fruiting inflorescences of certain species are terminal or lateral without having observed the development of the inflorescence over time. Some *Hechtia* species initiate inflorescence formation six or more months before the emergence or elongation of the inflorescence from the rosette. Most hechtias with terminal inflorescences will then produce one or more pups from the axils of upper rosette leaves. A pup grows rapidly and by the time the inflorescence emerges, the pup appears to represent the apex of the plant while the inflorescence now appears to have arisen from the axil of a lower rosette leaf and would be interpreted as being lateral. Lateral inflorescences appear to be restricted to a small group of about seven species including *H. glomerata* and the closely related *H. argentea* Baker, *H. elliptica* L.B. Smith, *H. mexicana* L.B. Smith, *H. schottii* Baker ex Hemsley, *H. texensis,* and *H. zacatacae* L.B. Smith.

Our ongoing research with *Hechtia* is directed at producing a revision of the genus based on extensive field research in Mexico and Central America. This goal requires that we collect both male and female individuals of all members of the genus and make sufficient herbarium collections to enable us to determine variability of *Hechtia* species. We are also collecting living material of the different species for future study and also so that we may introduce more of the hechtias into cultivation. We will use the data drawn from our collections and field observations, in addition to available herbarium specimens, to elucidate relationships among the species. Part of any revision entails recognizing new species and reevaluating previously described species. During the past several years we have collected and described several interesting new species (Burt-Utley & Utley 1987; 1988). We believe that both our *H. lyman-smithii* Burt-Utley & Utley and *H. pumila* Burt-Utley & Utley will be popular in cultivation, in part because of their small size. Mature, flowering rosettes of both species can be only four to eight inches in diameter, although we have seen and collected larger plants of both.

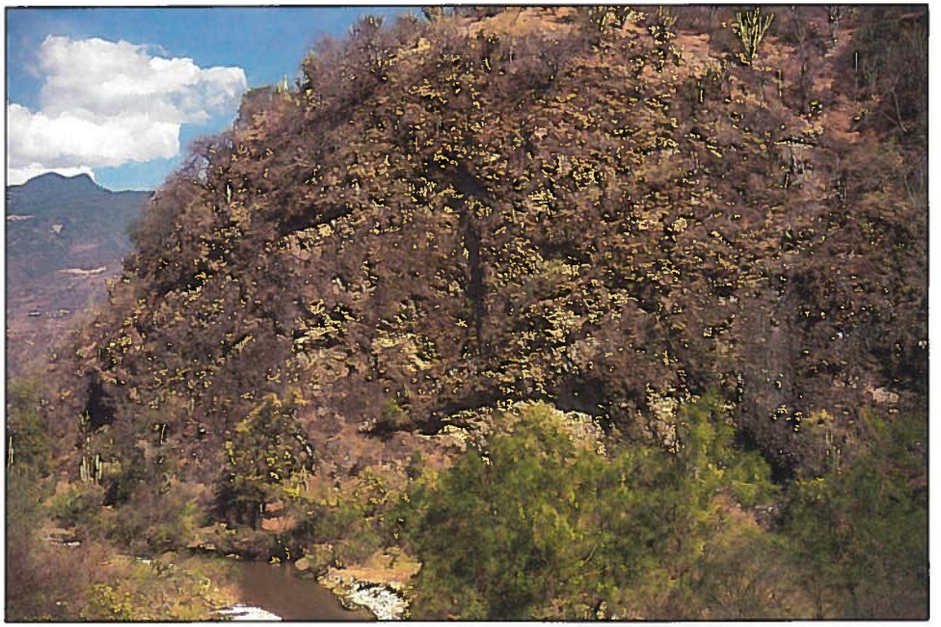


Fig. 7

Steep, dry, chalky hills with thorn-scrub vegetation and cacti in Oaxaca, Mexico, with colonies of *Hechtia lyman-smithii.*

Photos by the authors

Fig. 8.

A clump of *Hechtia lyman-smithii.*

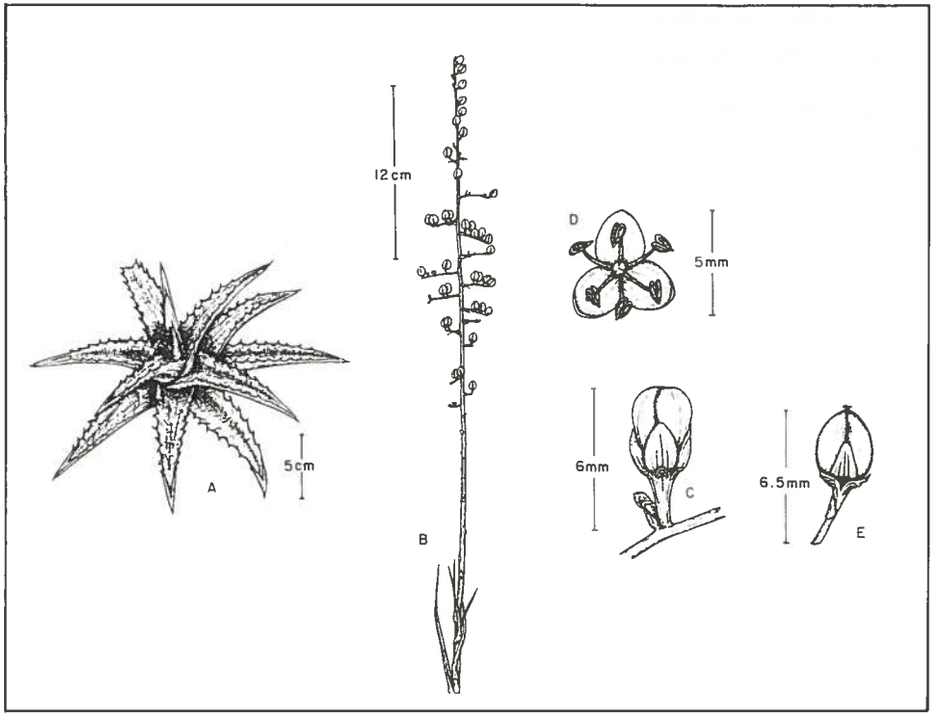
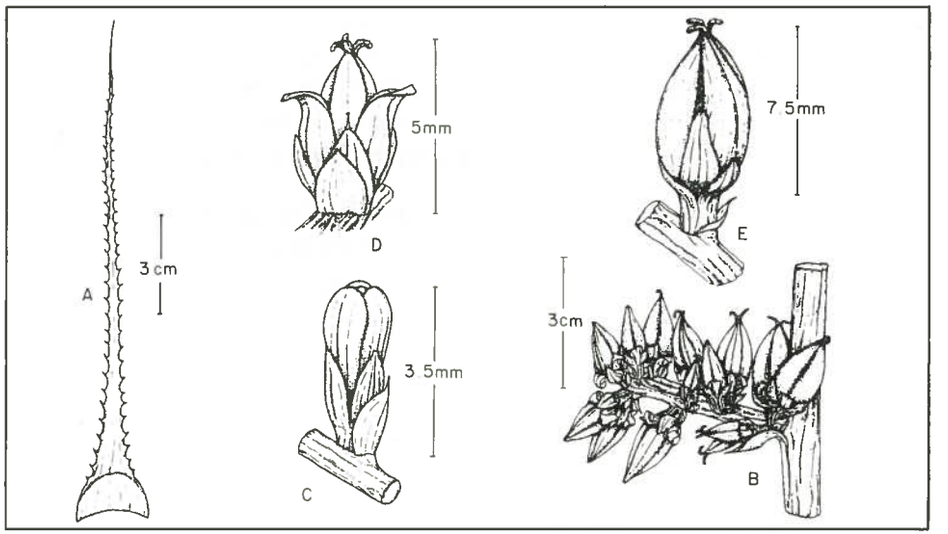


Fig. 9

Hechtia lyman-smithii. A. habit of rosette; B. pistillate inflorescence with capsules. C and D. staminate flower; E. capsule.



Drawings by the authors

Fig. 10.

Hechtia pumila. A. leaf; B. lateral branch of pistillate inflorescence; C. staminate flower, side view; E. capsule.

Hechtia lyman-smithii is an attractive, small species that grows on steep, chalky hillsides in Oaxaca where it forms large clumps or mounds of rosettes ranging from several to many (fig. 7 and 8). It is the only species in the genus that we have observed so far with this growth habit. Its leaves are silvery above as well as below (because of their trichome cover) and are often suffused pink to maroon. The inflorescence of *H. lyman-smithii* is terminal and bipinnate on both staminate and pistillate plants and bears small, greenish white flowers.

Early collections of *H. pumila* from Guerrero, Mexico, were identified as *H. glomerata* probably because of their short, densely flowered, lateral branches that superficially resemble those observed occasionally on *H. glomerata. H. pumila,* however, produces terminal, glabrous inflorescences and flowers while those of *H. glomerata* are lateral and conspicuously pubescent. *H. pumila* often grows on limestone outcrops where it establishes in small crevices or pockets that have accumulated detritis. There it forms diminutive rosettes that are the smallest we have seen among members of the genus. Our plants in cultivation have borne inflorescences on rosettes as small as 4 inches (10 cm) in diameter. Its often short, slender leaves appear green throughout or occasionally have broad, longitudinal, rust-colored bands along the leaf margins. Like *H. lyman-smithii,* its inflorescences are terminal and bipinnate in both sexes. Flowers of this species are small and green.

Hechtia texensis and *H. scariosa* were treated as distinct species in Texas, separated by sepal size and nervation as well as inflorescence density (Correll & Johnston, 1970). Smith (1937, 1938; Smith & Downs, 1974) consistently distinguished these two species and potentially related species on the basis of sepal length and width. However, some researchers working with the floras of Texas and northern Mexico had problems distinguishing them. Our own research leads us to conclude that *H. texensis* and *H. scariosa* are the same species. Since *H. texensis* was the name first used, it has priority and is to be used.

The only known herbarium collection of *H. texensis* was the type collection (Smith & Downs, 1974) from the Great Bend of the Rio Grande. It consists of parts of a pistillate inflorescence with flowers and fragments of capsular material. More recent collections from the vicinity of the Big Bend National Park in Texas were identified as *H. scariosa.* When Smith (1937) described *H. scariosa,* the only specimens available to him consisted of parts of staminate inflorescences in which the sepals were much longer than broad, or elliptic as he characterized them. The shape of these male sepals differs from those observed on sepals of female flowers from *H. texensis.* However, other specimens from the type series of *H. scariosa* that were unavailable to Smith also contain fragments of a female inflorescence with very broadly ovate sepals like those observed on the type of *H. texensis,* in addition to parts of a male inflorescence. It is impossible to distinguish female flowers of *H. texensis* from those of *H. scariosa* using sepal

shape or other floral or vegetative characters. Based on this determination we synonymized *H. scariosa* with *H. texensis* (Burt-Utley & Utley, 1987).

Because of the relatively few collections of hechtias available for study and the sexual dimorphism observed in the genus, our revisionary project with *Hechtia* is an interesting but, at the same time, challenging undertaking that will need several more years of field and laboratory work. In addition to unraveling taxonomic problems and preparing a revisionary treatment, we will be sending living collections and seed material to The Marie Selby Botanical Gardens in Sarasota, Florida, and The Huntington Botanical Gardens in San Marino, California, so that the various species can become established in cultivation.

ACKNOWLEDGEMENTS:

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Bradea, the bulletin of Herbarium Bradeanum, Rio de Janeiro, is frequently cited in this journal as a publication of record. A recent issue consisting of 22 pages on quality paper stock includes descriptions and analytical drawings by E.M.C. Leme of 10 bromeliads under the title, "Novas Bromeliáceas Nativas do Brasil—VI." Both the Bromeliad Society of South Australia, Inc. and Alvim Seidel of Orquidario Catarinense have contributed to the support of this bulletin and your organization might be interested in helping also. The address is: In Care of Sr. E.M.C. Leme, Rua São Joaquim, 83, Apto. 403, BL. 1, Cachambi, Rio de Janeiro - RJ, 20.780, Brazil.

Additional Notes on Breeding Superior Tillandsias

Mark A. Dimmit

This discussion continues my article on selecting superior tillandsia forms for hybridization purposes that appeared in *Journal of the Bromeliad Society,* volume 35, pages 101–103, and 130–132.

Selecting Superior Parents

Nearly all the characteristics you can see in a plant are inheritable. Thus, superior parents tend to produce superior offspring and vice versa. If you want to develop high quality plants, don't just cross any two plants that happen to be in bloom at the same time. Know the range of variability within a species, and choose parents that exhibit the traits you consider desirable.

Whether you are creating hybrids or just increasing a species, decide on a goal before you begin breeding. If you want to maximize certain traits such as bract color, spike length, or blooming season, select only one variable at a time and stick to it. Genetic inheritance obeys mathematical laws, and one such law is that you cannot maximize two or more variables simultaneously. If you want to combine desirable traits found in different clones, work on two at a time; getting three or more traits into a single offspring in one generation is mathematically unlikely. The following example illustrates these principles.

Suppose you have 100 specimens of *Tillandsia stricta.* There will be considerable variation among the plants, especially if they came from different populations within the large range of this species (fig. 11). You will most likely have one or two plants with spikes much larger than average, and a few with small spikes but deep red bracts. Some clones will consistently bloom earlier or later than the rest. Some will have unusually large flowers, and/or of deeper blue color. There are many choices for "improving" this species using the traits named:

1 – Increase spike size;
2 – Select for deeper colored bracts;
3-4 – Select for earlier or later blooming season;
5 – Increase flower size;
6 – Deepen flower color;
7-16 – Combine any two of the above traits (10 possibilities).

There are thus 16 possible breeding strategies using the six named traits.

Suppose you have chosen to try for a large spike with deep red bracts. Since these two superior traits are rare, it is unlikely that one of your 100 plants has both already. Therefore, you need to cross the plant with the biggest spikes with

M. Dimmitt

Fig. 11

Variation on *Tillandsia stricta.* Left to right: a very large spike with greenish bracts; a rich pink-bracted clone; a clone with small spikes but deep red bracts; and a clone with very large spikes. Crossing the two on the right would eventually yield plants with giant red-bracted spikes.

Fig. 12

Crossing two similar species often results in hybrid vigor and thus superior offspring. *Tillandsia* × Houston 'Cotton Candy' is flanked by its parents, *T. meridionalis* (left, past bloom) and *T. stricta* 'Fire and Ice'. Both the plant and spikes of the hybrid are much larger than those of either parent; bract color is also superior in this selection from about 100 clones of Houston flowered to date.

the one with the reddest bracts. If one of these plants has another desirable characteristic, so much the better. But don't choose, for example, a plant with smaller spikes just because it has bluer flowers; you'd be compromising your stated goal. Inheritance is random and thus similar to flipping coins. Flipping two at a time, two heads happen fairly often, but just try getting five coins to come up all heads!

If you want to obtain the desired result in one generation, be prepared to grow several thousand seedlings. These traits are almost certainly controlled by several genes each, so the probability of all the desirable genes winding up in a single offspring is very small. Chances are that the best progeny of the first generation will have larger than average spikes and deep pink bracts. Then you will have to cross the best of the first generation to produce a second generation, some of which, you hope, will have giant spikes and red bracts.

Once you achieve your goal (success is subjective; you can keep increasing size and deepening color for many generations), then and only then think about adding a third trait to your best plants, deeper blue flowers for example. Of course, the deep-blue parent will probably dilute your big red spikes, so it may take several generations to develop all three traits to your satisfaction.

Selecting Parents for Hybrid Crosses

Choosing which two species will make an interesting hybrid is more difficult than improving a species. It takes experience to learn which traits of a given species will be manifested in hybrid offspring. In general, choose two species with very different growth forms if you want to create a distinctive new plant; choose similar species if you want to improve an already good form with hybrid vigor. For example, *T. brachycaulos* and *T. capitata* are similar in appearance; a hybrid between the two may even be difficult to recognize unless done under controlled conditions. But it may have hybrid vigor, and be larger or develop more intense leaf color at maturity. This is what happened with the hybrid between *T. stricta* and *T. meridionalis: Tillandsia* × Houston is much larger and more vigorous than either parent and could be described as a giant, gray-leafed *T. stricta* (fig. 12). On the other hand, *T. pseudobaileyi* is quite different from *T. streptophylla.* A hybrid between these two could create a new and very striking life form if the most distinctive traits of each species come through. Not much of *T. streptophylla* is visible, though; the hybrids look like a giant *T. pseudobaileyi.* In contrast, *T. streptophylla* and *T. paucifolia* both contributed some of their distinctive traits to their hybrid. The result could be described as an elongated *T. streptophylla,* or a many-leafed *T. paucifolia* with twisted leaves and a large inflorescence.[1]

Behavior of *Tillandsia* Species in Hybrid Crosses

After making several crosses with a particular species, it is often possible to recognize that it tends to contribute certain traits to its progeny. Following is an account of my evaluations of several species as parents of hybrids.

1. These crosses will be published soon.

• *Tillandsia albida* has a caulescent habit that does not show up in hybrids with acaulescent species, but its very long, thin inflorescence is dominant. Its hybrids have not been winners, but the one with *T. streptophylla* is interesting. It looks like a giant, acaulescent *T. albida* (or a white-leafed, non-curly *T. streptophylla)* with a very tall, branched, narrow inflorescence with reddish bracts and pale blue flowers.

• *Tillandsia brachycaulos* contributes soft, green leaves. It also greatly shortens or usually completely suppresses the elongated spike of another parent. The bright red leaves at maturity do not come through well unless the other parent has the same trait (e.g., × Victoria).

• *Tillandsia bulbosa* with its bulbous base and twisted, awl-shaped leaves is extremely dominant. Nearly all of its hybrids look mostly like it, to the extent that it is difficult to recognize the other parent. It tends to dwarf the inflorescence of hybrids. The trait of red upper leaves at flowering does not come through well.

• *Tillandsia concolor* is an excellent parent. It transmits stiff leaves and good symmetry of the rosette. The branched spikes and their bright red and/or chartreuse bracts are transmitted to offspring very well. Its progeny bloom over an extended period, and the bracts stay colorful for about three months.

• *Tillandsia didisticha* greatly slows the growth of its hybrids, even with *T. stricta;* none are even close to flowering at four years of age. I hope that it will contribute a branched, long-blooming inflorescence. Its small, white flowers will probably be dominant if similar crosses are indicative.

Tillandsia duratii is a giant, but its hybrids are closer to the other parent in size. It does contribute stiff, succulent, heavily lepidote leaves. Its green primary and flower bracts are quite dominant in the progeny. In two crosses with species in other subgenera *(T. meridionalis* and *T. gardneri)* the plants have been very beautiful, but the inflorescences have been abortive and without flowers. Hybrids with *T. stricta* produce usually small, few-branched spikes with some color in the flower bracts, and small, dark blue flowers. A few clones have very large, many-branched inflorescences with small but deep purple flower bracts. A cross with *T. cacticola* looks like a giant, succulent *cacticola;* the first spikes are appearing and are very large.

• *Tillandsia ionantha* dwarfs the size of its hybrids and greatly shortens or, more often, eliminates the elongated spike of the other parent. The red leaves at maturity do not come through unless the other parent has the same trait.

• *Tillandsia ixioides* contributes stiff, lepidote leaves. The green flower bract color is very dominant. The yellow flower color is transmitted if the other parent has white flowers. Crossed with blue flowers, the result is dirty-brown flowers (i.e., with *T. stricta).*

M.A. Dimmitt

Fig. 13

Tillandsia seedlings at 2 and 4½ years age, showing differentiation of characters with maturity and influence of other species in hybrids with *Tillandsia streptophylla: T. streptophylla* (left) and hybrids with (second from left to right) *T. paucifolia, T. seleriana,* and *T. pseudobaileyi.* The upper seedlings are within two years of maturity. The differences among the hybrids became even more dramatic at maturity. These and other hybrids will be described and published soon.

• *Tillandsia meridionalis* contributes stiff, lepidote leaves and fairly vigorous growth, though not as fast as *T. stricta.* The white flower color dilutes the color of the other parent in hybrid progeny.

• *Tillandsia paucifolia* transmits its elongated form and smaller number of leaves to most of its hybrids, creating some intriguing plants. When the proliferating form is used, the viviparous habit has usually not come through (so far only in some of the progeny with *T. albida).*

• *Tillandsia pseudobaileyi,* like *T. bulbosa,* is heavily dominant. Hybrids have bulbous bases, twisted, awl-shaped leaves, and frequently faint striations on the foliage. It contributes a large, branched inflorescence.

Tillandsia streptophylla is an excellent parent. It transmits its large size and very large, well-branched spike to almost all of its hybrids. Some hybrid progeny also have the twisted leaves, as does the one with *T. streptophylla.*

• *Tillandsia stricta* contributes its rapid growth more than anything else, including its short-lived blooming habit. The pink flower bracts and blue flower color are greatly suppressed when crossed with green-bracted or white flowered species. The other parent should, therefore, have a good inflorescence.

• *Tillandsia xiphioides* usually transmits its very slow growth rate. The only hybrids yet to flower has been with *T. stricta.* The green flower bracts washed out the pink of the other parent. The large flower size did not come through well; the hybrid's flowers were about twice the size of *T. stricta* and less than one-quarter the size of *T. xiphioides.* No other hybrids have yet flowered at five to seven years of age.

Selecting and Culling for Further Breeding or Space Needs

If you have been successful, even a couple of seed capsules will result in 100 or more plants, probably more than you have room for. Plants obey the gas laws—they quickly expand to fill any available space. If you don't cull your collection, you will eventually have a huge number of overcrowded, unhealthy plants. It's preferable to have a few good plants than a bunch of crummy ones. As seedlings flower, evaluate them relative to their parents and to each other, and label them. Then get rid of the inferior plants. Save the few very best for further crossing, give away or sell the rest of the top third or so, and throw out the inferior ones. (Don't give away your culls because you can't bear to kill a plant; it's bad for your reputation as a horticulturist!)

The Arizona-Sonora Desert Museum
Tucson, Arizona

We thank The San Diego Bromeliad Society and the Bromeliad Guild of Tampa Bay for their generous gifts to the *Journal* color fund. As we keep saying, this kind of gift is an indication of both interest and willingness to participate. The BSI operates basically on income from membership fees supplemented by the advertising fees.—ED.

Notice of Annual Meetings

The annual meeting of the membership of The Bromeliad Society, Inc. will be held at 9:00 a.m., June 6, 1990 at the Wyndham Greenspoint hotel in Houston, Texas. It will be followed immediately by the annual BSI Board meeting. Members are invited to forward matters for consideration at either meeting to the president before the meeting date.

On Bromeliad Growing

Len Trotman

One of the reasons that I got into growing bromeliads was the fact that I had a glasshouse on my property. When it was first erected about twenty years ago, I was growing chrysanthemums, but these fell out of favour and the house was used as a storage for some time. After looking at the many ways of utilizing it, I finally decided to try bromeliads. This was about seven years ago when my collection amounted to six plants, which were given to me as curios.

My collection grew and space began to diminish rapidly, but this is a story so often heard from bromeliad collectors. The problem was what to do about the situation. I figured that if I could get x number of plants on the floor of the glasshouse I should be able to get three times x if I had three tiers.

Since I was going to refit the house, I also decided to replace the glass with "Nova roofing," a corrugated plastic sheeting that comes in several colours including natural, which I chose to use. Taking the glass off was quite a big job since a lot of it had become fused to the frame and some of it was quite brittle. After removal of the glass the frame was repainted white to reflect as much light as possible. The house is sixty feet long and twenty feet wide, with a gable roof (fig. 15). Side walls are five feet high from the top of the reinforced concrete base. The top of the gable is twelve from the base. The main frame is constructed of 3″ × 2″ treated pine timber,[1] which is rabbetted to accommodate the glass. There is a galvanised steel section running lengthwise on each side of the structure to support the roof trusses. The house runs east to west on the property, which is contrary to good light diffusion, hence there is a bright side and a dull side. Originally only two-thirds of the house was converted to growing area.

After the sheathing and painting were finished, came time to erect the shelving. First, a shelf 24″ from the floor was erected around the outer walls, and then another shelf 27″ above that. After this, a console of shelves in the middle area was constructed and the distance between these was increased because of the extra height of the roof in this area. All shelving was painted white and covered with clear plastic to stop any drips or foreign matter from dropping on the plants underneath.

The idea of three tiers follows the sequence of bromeliads in their natural environment except that I do not keep any tillandsias in the house as I find that they do much better out of doors. They are mostly grown on the south side of the glasshouse—which in our latitude is the cool side. They get some sun during the summer months only and are open to all other elements. We do not get any frost in this area and the temperature range is between 8 and 24 degrees centigrade.

1. *It appears that the author did not use wood treated with a copper-based preservative. Such preservatives are death to plants.*

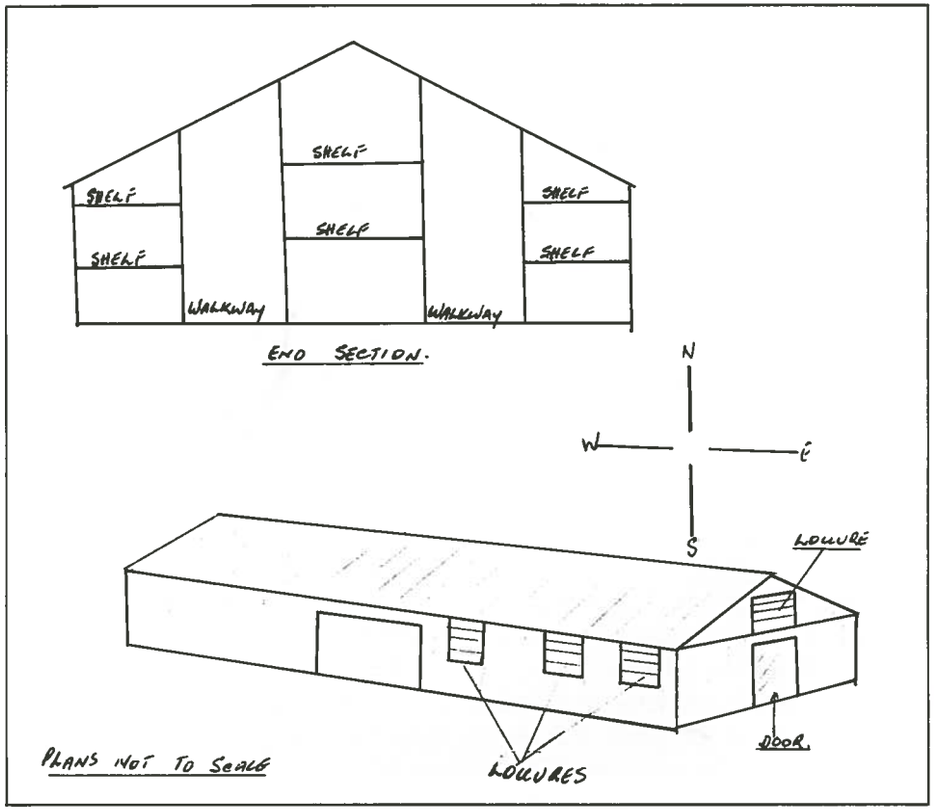
Fig. 14

Author

Interior of Mr. Trotman's greenhouse with three levels emulating the light levels to be found in nature. Almost all of the interior is painted white for light reflection, the shelves are covered to keep water and foreign matter from the lower shelves, and all of the plants are potted. Here is a meticulous hobbyist.

Inside the house, plants such as neoregelias, some aechmeas, and billbergias that need bright light reside at the top of the house and those requiring less light on the middle shelves. Plants such as vriesea, nidularium, and seedlings on the lower level are on the side with the least light.

I find that the arrangement works very well provided I can keep a balance of high light and low light plants. As all my plants are grown in pots they can also be moved around if need be. There is also a lot of room for hanging baskets over the aisles and along some of the shelves. The natural-coloured sheathing was painted with a sunshield paint when it was first put on and since then it has not been necessary to do any more shading as this material tends to turn slightly opaque. The last section of the house was covered with a blue sheathing, which, unfortunately, was the only colour I could obtain at the time. This color filters out too much sunlight particularly in the winter and does not colour the broms as much as the natural shade of this material.



Author

Fig. 15

Drawings by the author of his three-tiered greenhouse showing (above) the end view and (below) the three-dimensional plan.

Auckland, New Zealand

One Mo' Time.

We invite 2—4 line ads on any bromeliad subject. Line length and type face same as this notice. Rate: $3.75 per line per issue. Due date for September-October 1990 *Journal* is 1 July. Send to: BSI Editor, 1508 Lake Shore Dr., Orlando, FL 32803.

Regional Reflections

In Defense of the Elegant Billbergia: A Rebuttal

Geraldine Grossman

It is my nature to be frank and outspoken. After reading the recently published and biased proclamation that tillandsia is king of all bromeliads and the cocky rebuttal in favor of the vriesea that followed later, I reacted with anger but, oddly enough for me, simmered in silence—that is, for a short time only. Then, I came to the conclusion that remaining silent was being sissy and tantamount to meek and passive acquiescence that the tillandsia is the so-called king. Therefore, I'm submitting this rebuttal in spite of the fact that I am a very busy person and really do not have the time to be doing this—but I shall rebut nevertheless at some expense to myself.

Since the author of the first rebuttal preferred to conceal his (or her) identity with an obvious pseudonym, I, too, shall do this but in a different way. A nom de plume will suffice. I happen to be a dedicated, dyed-in-the-wool billbergia enthusiast. I am, at the same time, plenty weary of hearing it put down among the stentorian shouts of praise heaped on the tillandsia, vriesea, aechmea, and neoregelia, the glamor crowd of the bromeliads. So I am turned on full blast defending the innocent billbergia, a worthy opponent, indeed equal any day to dethroning the King Tillandsia.

In my opinion, there is no doubt about the billbergia's being crowned King rather than the tillandsia. It is superior by far on many counts and for many reasons. Let me recount just a few of these. In fact, I shall detail five regions in which the billbergia stands out and way high above its nearest competition. One, the variation of beautiful foliage; two, the lovely flower; three, the outstanding body contour; four, the adaptability; five, the utilitarian size. Permit me to be specific in each of the five instances to convince the doubters.

• **The Foliage.** In this category, my candidates are *Billbergia vittata* and *B.* Red Wine × *amoena.* Both of these dandies reign supreme. The stripes, the bands, and the shades of pink, red, and amber are breathtaking with no plant coming near to their supremacy.

• **The Flower.** Here I bring forth two champs of special gorgeousness: *Billbergia macrocalyx* and *B. distachia* var. *straussiana.* These plants exhibit eye-catchingly beautiful petals, bracts, flower, and peduncle. A runner-up easily is *Billbergia magnifica.*

• **The Body.** For excellence in contour, I direct your attention to *Billbergia elegans,* a creation in a class all by itself. Few, if any, bromeliads can come close to matching the urn shapes of *Billbergia* Muriel Waterman and *B.* Catherine Wilson.

• **The Adaptability.** The champion does well in the ground, the pot, and the hanging basket. Some prosper in the forest tree. Of special interest is its beautification of the hanging basket. Since most of its inflorescences cascade or arch, it is the ideal plant for the basket. Here I nominate *Billbergia porteana* with its graceful arches, so full of color. A basket arranged with several blooming species is eminence par excellence. With careful planning, the grower may produce a basket with plants blooming all year round. Very few other genera could be used in the basket. Imagine *Aechmea bromelifolia* or *caudata* residing in a hanging basket.

• **The Size.** Since most billbergias grow straight and up, it makes sense that it is invaluable where space is at a premium. It is a true friend of the apartment dweller as well as the owner of the small lath- or greenhouse or land plot.

It is hard to find any other genus (including the glamor set) that has all five of these attributes. Of course, it is evident that some of billbergia's competitors have rather colorful foliage, attractive flowers, shape, and the rest, but it is the rare specimen that displays all of these characteristics in one plant as well as does the billbergia! Because of these fine qualities the billbergia year after year commands the Blue Ribbon and, not uncommonly, the Best of Show awards.

By now, it is hope and wish that I have convinced the readers that I know what I'm talking about, that I am knowledgeable in bromeliad horticulture, and more important that the billbergia has earned the right to be crowned King of all Bromeliads. I ask only that the readers be fair in their judgment. I am relieved, frankly, to get this off my chest. I am convinced that my rebuttal will have opened some eyes as to real value. I do not purposely downgrade the tillandsia and the vriesea—they are nice plants but they can't compare to my champion. The real King is the elegant *Billbergia.*

Reprinted from the San Diego Bromeliad Society Newsletter
November 1989

Fruiting Bromeliads

Carol Johnson

We have all read articles regarding the sapor of bromeliad berries and nearly every day we encounter the pineapple *(Ananas)* in some form. We have also been regaled with theories which purport that the brilliant foliage and bizarre markings of the plants are nature's way of attracting pollinators to the blooms. Little has

been said about the bromeliads with insignificant blooms and ordinary green foliage which nearly always self-seed and in the process produce spikes of fruit (berries) of incredible and long-lasting beauty. Birds and other predators are attracted by the fruit, eat it and leave their droppings in various places where the seeds sprout and the habitat of the bromeliad species is expanded. Plants produced from these self-seeding species nearly always come true to the parent. All are in the subfamily Bromelioideae and the majority are aechmeas.

Then, there are bromeliads that may or may not be self-seed and when they do, the progeny bear only slight resemblance to the parent. I am thinking, in this regard, of *Aechmea chantinii, Aechmea zebrina* and many aechmeas in that related subgenus, *Platyaechmea.* I suspect that ants are the pollinators of these plants in my greenhouse and no longer attempt to grow seeds produced by *Aechmea chantinii* and *Aechmea zebrina* as the product may be hundreds of dissimilar seedlings. It is possible to isolate, hand pollinate and tie off the blooms, but then we are no longer discussing a natural occurence.

In the interest of conserving space, many growers have discarded those bromeliads which have insignificant blooms and thus are not aware that they are missing the most beautiful stage of the plants' lifespan. Listed below are those that I grow strictly for the beautiful spikes of berries. There are many more, but these are my favorites:

• *Aechmea pubescens* has whitish yellow flowers followed by often two-foot-long spikes of geometrically arranged blue seeds (fertile) that stay in color several months.

• *Aechmea mexicana.* This plant also has spectacular red foliage when grown in strong light, but here again the insignificant panicle of blooms is followed by berries that progress through white to blue.

• *Aechmea lueddemanniana.* Pink flowers followed by blue, viable seed pods.

• *Aechmea angustifolia.* This plant is quite variable, but the bloom spike is a dense cylinder of yellow blooms followed by large blue, white, and/or yellow seed pods.

• *Aechmea bracteata.* This aechmea can also produce red foliage in strong light, but the most spectacular spikes of red and green berries are produced on fertilized plants which then produce larger bloom spikes. The berries eventually turn black.

The accompanying table details those plants that come to my mind as belonging to the desirable fruiting category. Most of the plants listed here are rarely seen in shows, blooming or nonblooming, as their decorative value is negligible. When in berry, they stand little chance in the blooming section of a show (where the rules say they must be entered) since the foliage is then past its prime and the

plant has probably already produced several offsets. Consequently, the public rarely sees fruiting, decorative pineapples, *Portea petropolitana* with its handsome blue fruit, *Areococcus flagellifolius*, ×*Anamea* Scorpio, and the like.

Bromeliads with outstanding fruit.

Plant Name	Foliage	Plant Size	Blooms	Berries
Aechmea				
allenii	green	small-medium	pink	pearl white, blue if fertile
angustifolia	green	medium	yellow-green	blue
bracteata	green	large	yellow-green	red/green to black
castelnavii	green	large	pink-white	black
chantinii, var. *chantini* f. *amazonica*	green	large	yellow-orange	red & white, blue if fertile
dactylina	green	medium	yellow	blue & white
dichlamydea var. *trinitensis*	green	large	blue-purple	blue
filicaulis	green/red	small	white	blue/white
fulgens & miniata	red-green	medium	blue	red
lingulata	green	large	pale yellow	purple to black
lueddemanniana	green/red	medium/large	lavender	blue & white
mertensii	green	small	yellow	blue & white
mexicana	green	large	rose	pearl/blue
nudicaulis	variable	small/large	red/yellow	red
penduliflora	green/red	medium	yellow	blue & white
pubescens	green/red	medium	yellow/white	blue
racinae	green	small	yellow	red/orange
recurvata	green	small	red	black
retusa	green	large	orange/red	orange/red/blue, blue-violet if fertile
servitensis	green	medium	yellow/orange	pearl
tillandsioides	green	small/medium	yellow	blue
tocantina	green	large	orange/yellow	orange
tonduzii	green	medium/large	yellow	black
victoriana	green/red	medium	blue	purple/black
Ananas	various	small/large	yel./red/blue	edible fruit
Billbergia *viridiflora*	green/red	medium	green	orange
Bromelia *balansae*	green	very large	red & white	yellow
Neoglaziova	banded	small/medium	red	maroon
Portea *petropolitana* var. *extensa*	yellow/green	large	lavender	purple
×*Anamea* Scorpio	variable	small	yellow	bronze

Many hybrid aechmeas have attractive berries which are usually not viable. *Examples: A.* Royal Wine, *A.* Foster's Favorite, *A.* Valencia.

Many aechmeas produce berries that turn dark (usually blue or purple) only if they are pollinated and contain seed. –HEL.

Reprinted from Florida Council of Bromeliad Societies, Inc. Newsletter, *February 1989*

Bromeliads in Hanging Baskets

Geoff Lawn

With the current revival of interest in hanging baskets and containers of all shapes and sizes, bromeliads can be promoted as ideal subjects for this culture. Not everyone has suitable trees or an equable climate for real success outdoors, so hanging containers under cover becomes one alternative answer.

Many of our miniature- to medium size epiphytes and some terrestrials fulfil this role admirably. They add contrast and height to a display be it the private patio, shadehouse, pergola, or public show. Consider also that suspended to two metres up, generally bromeliads receive more light and better aeration. Often on still, winter nights, colder air settles at bench, floor, or ground level. This is a crucial factor from which susceptible species may escape by higher placement. To minimise frost strike and heat radiation, hanging containers need positioning at least half a metre clear of solid roofs, walls, and rafters.

From a functional viewpoint, not all hanging containers are well designed for plants generally, despite their intended purpose. One fault is too few or small drainage holes, making extra crocking necessary. Some pottery has side peepholes or coves too cramped for accommodating anything but the dwarfest kinds. Another point is that a concave shape at the rim creates replanting problems if the root-ball is to remain reasonably intact. In terms of culture, metal containers should be treated with caution—they can heat up and cool off rapidly during the daily cycles. For epiphytic bromeliads, the container's width or diameter is invariably more important than the depth as many are shallow rooted.

The following selection is a basic list from which to progress.

- *Acanthostachys strobilacea*

- *Aechmea* Bert, *calyculata, corymbosa, fasciata* var. *purpurea, filicaulis,* Foster's Favorite, *fulgens* var. *discolor, gracilis, lasseri, lindenii, lueddemanniana,* Mary Brett, *orlandiana, pineliana* var. *minuta, racinae, recurvata,* Royal Wine, *weilbachii.*

- *Billbergia amoena* var. *minor,* Catherine Wilson, *chlorosticta, distachia,* Fantasia, *lietzei, leptopoda, nutans,* Santa Barbara.

- *Cryptanthus pseudocaposus (C.* 'Cascade').

- *Dyckia brevifolia, leptostachya, fosteriana, minarum, tuberosa.*

- *Guzmania lingulata* var. *minor.*

- *Neoregelia albiflora, ampullacea, bahiana, doeringiana, lilliputiana,* Marcon, *punctatissima,* Polka Dot, Petite, Pepper, *tigrina, tristis.*

- *Nudularium billbergioides, burchellii.*

- *Orthophytum navioides, saxicola.*
- *Quesnelia humilis, liboniana, marmorata.*
- *Tillandsia:* most small, silvery leaved, and soft varieties.
- *Vriesea carinata, ensiformis, guttata, psittacina, scalaris.*

Decide on your subject's main attraction and hang it to best advantage. Many of the aechmeas, billbergias, and neoregelias with leaf reverses, striped, mottled, or banded are enhanced by being staged above eye level. With the increased exposure, the soft-leafed plants positively glow through their translucent foliage but extra shading and watering may be required. Attachment to beams, away from head height and walkways should be secure as sometimes winds turn baskets into swinging pendulums capable of being dislodged.

If you can't bear the thought of setting aside your best or only bench specimens for this transfer, why not compromise by placing pot and all in a slat raft—the bromeliad will probably appreciate the temporary change as much as you.

This exercise really is small-scale landscaping for aerial gardens. Hanging containers are a standard practice, of course, but we need not become complacent with this simple yet effective technique. The diversity is there to enjoy.

Reprinted from Bromeliad Newsletter, October 1989
(Bromeliad Society of New South Wales,
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Announcement on the Journal *Selbyana* The Marie Selby Botanical Gardens

Selbyana, the journal of the Marie Selby Botanical Gardens, is devoted to the publication of original research on tropical plants, especially epiphytes. The journal emphasizes taxonomic and floristic treatments, but also includes research on anatomy, cytology, systematics, phylogeny, ecology, biogeography, and physiology of tropical plants. *Selbyana* is available for the publication of research of the Gardens' staff as well as outside contributors. All manuscripts submitted are reviewed by at least two specialists on the subject.

Selbyana is published annually. Subscription price is $55 per volume for all libraries and institutions (includes normal shipping). Personal subscriptions are available at $35 per volume. For subscription information, and for information about the availability of back issues, contact Mrs. Ruby Hollis, Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, Florida 34236. Telephone (813) 366-5730.

Questions & Answers

Conducted by Kathy Dorr

All readers are invited to send their questions and observations about growing bromeliads as a hobby to the editor. Answers will be sent directly to you and some questions will be published.

Q. Are bromeliads parasites? What is the difference between a parasite and an epiphyte?

A. Webster says: "Parasite—a plant or animal that lives on or within another organism, from which it derives sustenance or protection without making compensation."

"Epiphyte—a nonparasitic plant that grows on another plant but gets its nourishment from the air, as certain orchids, mosses, and lichens; air plant."

Bromeliads manufacture their own food and only use the plant or tree for attaching themselves.

Q. I have used all kinds of so-called permanent ink pens and pencils to label my tags, yet none of them seems to last. Do you have any suggestions?

A. I have tags that have lasted until they became so brittle they broke and had to be replaced. I use a #2 pencil—one you can buy anywhere. It has proved the most satisfactory and lasted the longest. Another hint is, if the plant is grown outside, tuck the "name" end of the tag down in the soil.

Q. What should I use as a potting mix? Everyone I ask gives me a different answer.

A. The only answer to this question is whatever works best for you! Everyone, as you may have found, has their own opinions on this, but not everyone grows his or her plants under the same conditions, i.e., location, watering, fertilizing, movement of air, etc. The following ingredients are some that I have been told are used: chopped osmunda, bark, peat moss, crushed granite, sand, oak tan bark, lava rock, turkey grit, German peat, osmunda, sphagnum moss, fir bark, calcite, chicken grit, humus, charcoal, leaf mold, compost, tree fern, sponge rock, redwood shavings, dried kelp, pumice stone, manure, hapuu, river grit, gristed tree fern, coconut fiber, shredded redwood bark, nutrifoam, sheep manure, wood ash, commercial azalea mix, path bark, and perlite and on and on. Some are used alone and some are used in combination with others. In general, it would be advisable to use an acid mix of your choice that drains well. If your plants are doing well, you apparently have chosen the right combination. If they are not doing well, try experimenting (with a **few** plants at a time). If you water infrequently, your mix should be able to retain some moisture. If you water heavily, it is best to have a mix that drains well. Most bromeliads are quite hardy and will grow in almost anything.

Q. My dyckias are not looking so great. I grow them in pots and give them plenty of light, water regularly and fertilize on occasion. What could be the problem?

A. More than likely you have root mealybugs. Turn the pot over and remove the plant and you will probably find fuzzy, white around the inside of the pot and attached to the roots. Wash the roots and repot the plant in new mix and pot. As an extra precaution, pour some insecticide down through the new mix after potting. I usually use Cygon, but you may prefer something else. Let it set for at least twenty-four hours before watering and then water thoroughly.

Also, remember dyckias are terrestrials and need larger pots than some of the bromeliads to accomodate their extensive root system.

Q. What bromeliads would you suggest for long-lasting, colorful inflorescences?

A. For a striking inflorescence that will last (usually) a minimum of six months and sometimes longer, I suggest the following: *Aechmea fasciata, A.* Foster's Favorite, *A. fulgens* var. *discolor, A. miniata, Tillandsia lindenii, Vriesea splendens* and *V.* × *mariae,* to name a few.

Q. I have used sphagnum moss for a number of years in mounting Tillandsias and in my mix, but I find it dries out rather rapidly and is very difficult to get wet again. Is there anything I can use to allieviate this condition?

A. First of all, if you insist on using sphagnum moss, you can use a detergent in the water and it will help penetrate and wet the moss. However, you might be interested in using a moss that has become available within the past few years—New Zealand moss. It comes in long strand and short strand. It soaks up water like a sponge, keeps moist much longer, doesn't deteriorate like sphagnum, and is easily watered when it becomes dry. It has proven to be excellent for starting some bromeliad seeds, particularly orthophytum and vriesea. I am presently experimenting with tillandsia seed to see what success one would have with them on this moss.

Q. My *Vriesea glutinosa* and *Tillandsia viridiflora* var. *variegata* have what someone told me were called "hair" pups. How can I remove these without too much trauma?

A. The *Vriesea glutinosa* offsets can be removed when they are three or four inches tall and should be treated in the same manner as you would seedlings.

Tillandsia viridiflora var. *variegata* sends its offsets out on a short stolon. I have the most success with these if I leave them attached to the parent plant. Set the base of the offset on top of a pot of mix and pin it down with a hairpin or floral pin and leave them like this until they have rooted in the mix. At that time, cut the stolon and treat the plant as any rooted offset. This method works very well with any bromeliad that has stoloniferous offsets that are hard to get started.

Calendar *[continued from back cover]*

4 - 5 August South Bay Bromeliad Associates 23rd Annual Bromeliad Show and Sale. South Coast Botanic Garden, 26300 South Crenshaw Blvd., Palos Verdes Peninsula, CA. Saturday, noon to 4:30 p.m.; Sunday 10 a.m. to 4:30 p.m. Plant sales both days 10 a.m. to 4:30 p.m. Admission to gardens: regular—$3.00, students & seniors—$1.50. Philip Fetchko 213-664-6164.

The Bromeliad Society, Inc.

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.

M.A. Dimmitt

Crossing two species with different forms can produce a very new form (even though there are already over 400 species of *Tillandsia).* This hybrid between *Tillandsia streptophylla* and *T. paucifolia* (proliferating form) inherited distinctive characters from both parents.

Calendar of Events

5 - 6 May	La Ballona Valley Bromeliad Society 1990 annual Bromeliad Show and Sale. Veterans Memorial Auditorium, Overland Ave. at Culver Blvd., Culver City, CA. Saturday, noon to 4:30 p.m.; Sunday, 10 a.m. to 4 p.m. Admission is free. Potting demonstration both days at 2 p.m. Charlyne J. Stewart (213) 391-4118.
17 - 19 May	Bromeliad Society of South Florida 13th Annual Show and Sale. Fairchild Tropical Garden, 10901 Old Cutler Rd., Miami, FL 33156. Saturday and Sunday, 9 a.m. - 4 p.m. Milt Lesser 305-865-0020.
18 - 19 May	Hawaii Bromeliad Society 5th Annual Show and Sale. Ward Warehouse Shopping Center, 1050 Ala Moana Blvd., Honolulu. Friday, 10 a.m. to 9 p.m.; Saturday, 10 a.m. to 5 p.m. For information call 808-531-6411.
19 - 20 May	Baton Rouge Bromeliad Society 15th Annual Show and Sale "Stars on Earth," Baton Rouge Garden Center, 7950 Independence Blvd., Baton Rouge, LA. Saturday, 1–6 p.m.; Sunday, 9 a.m. –5 p.m. Michael Young 504-355-5408.
26 - 27 May	Greater Dallas-Fort Worth Bromeliad Society 19th Annual Show and Sale. Dallas Civic Garden Center, Fair Park, Dallas, TX. Contact Pat MacGregor 214-368-2400.
6 - 10 June	Ninth World Conference, "Bromeliads in Space," Wyndham Greenspoint, 12400 Greenspoint Dr., Houston, Texas. Betty Head, 7818 Braes Meadow, Houston, TX 77071. telephone 713-774-7778.
8 June	Cryptanthus Society Board Meeting, 2:30 p.m.; rare plant auction, 5–6 p.m. Both events Wyndham Greenspoint, Houston, TX (see World Conference above).

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