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Cover photographs. Front: *Guzmania eduardii* André ex Mez, from southern Colombia. Photograph by Werner Rauh; his description of this species is on page 65. Back: *Guzmania mucronata* (Grisebach) Mez. Photograph by Heinz Hemker, a member from Steinfurt, W. Germany.

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The Corolla of *Navia*

Julian A. Steyermark

After having worked with Julian Steyermark for four years both in the field and in the herbarium, I think it fair to say that the Bromeliaceae was his favorite plant family both to collect and to describe and that Navia *was his favorite genus. He marvelled at their beauty and variety and was fascinated by their distribution. More than once did he tell me as I was about to go on an expedition to keep an eye out for them in their preferred habitats of shady crevices and rocky areas. Upon returning, the second question he would ask (the first being, "How many collections did you make?") was, "Did you find any* Navia?"

It is most fitting that one of the last papers he was to write, in the midst of a most concentrated effort to complete his huge Flora of the Venezuelan Guayana, was on Navia. *He became especially excited about this discovery of the corolla lobes and set everything else aside for a few days to dissect flowers of various species. And then he said, as he frequently did, "Here's another example of how little we know about tropical plants." A modest statement from a man who knew more than most.*

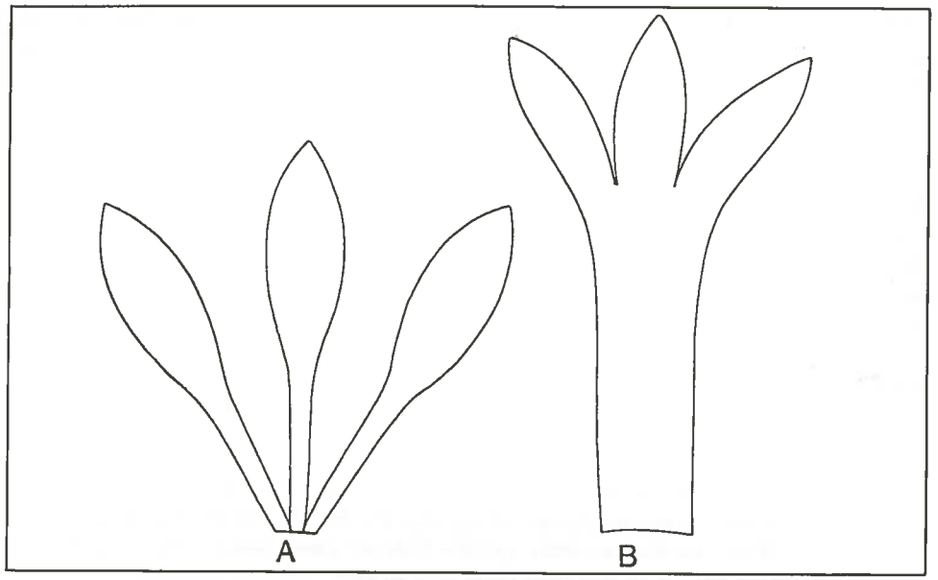
–Bruce K. Holst

Fig. 1
Dr. Julian A. Steyermark
Jan. 27, 1909–Oct. 15, 1988

The genus *Navia* is one of the most beautiful and ornamentally attractive genera of the Bromeliaceae. The genus was established in 1830 by Martius ex Schultes filius, based on a Martius collection from Cupati, Río Japura (Caquetá) in Amazonas, Colombia, and described as *N. caulescens*. An additional species, *N. acaulis* was described at the same time from another Martius collection taken from a different locality in Colombia (Araracuara, in Vaupés-Amazonas). Following the description of these two Colombian species, two more were found in Guyana, *N. angustifolia* (Baker) Mez, in 1896, based in *Cryptanthus angustifolius* Baker, and *N. gleasonii* L.B. Smith in 1930.

With the exploration of Mount Duida, famous sandstone table mountain of the "Lost World" of the Venezuelan Guayana, in 1929–1930 by G.H.H. Tate of the American Museum of Natural History, two more species, *Navia brachyphylla* and *N. duidae*, the first ones known from Venezuela, were described by Lyman B. Smith.

Continued exploration of these sandstone mountains, as well as the surrounding lowlands of igneous outcrops and white sand savannas, has increased tremendously the number of species. By the year 1974 when Dr. Smith's treatment of the genus appeared in Flora Neotropica, 74 species were already known,



drawing by the author

Fig. 2 Showing two types of corolla in *Navia*. A. Free petals illustrated by *Navia grafii* and other similar species. B. Connate petal type occuring in many species of *Navia*.

B.K. Holst

Fig. 3 Inflorescence of a species having separate petals similar to those found in *N. grafii*.

principally from the Venezuelan Guayana from expeditions made by Maguire, Cowan, Wurdack, Cardona, and Steyermark. Since 1974 to the present, the number of species has increased to well over 100 through the expeditions principally made by Huber, Liesner, Steyermark, Davidse, Plowman, Thomas, and others. The majority of these novelties have come from the summits or escarpments of the sandstone mountains, but no end is in sight for the number of future species to be discovered and added, since it appears that each new expedition to previously unexplored sectors of the Roraima Formation in Venezuela, Guyana, Colombia, and northern Brazil yields additional taxa of the genus.

After these many years during which the genus has been known and available for study, one would assume that the basic floral structure of *Navia* would be sufficiently documented. In Dr. Smith's monumental publication of the Bromeliaceae for the Flora Neotropica, the corolla of *Navia* is described as having the "petals high-connate in a slender tube." During many years of collecting in the Venezuelan Guayana, I had never taken the opportunity of actually examining in detail the corollas of *Navia,* and apparently others had likewise failed to do so. The reasons for this neglect are several: *Navias* often are found in sites difficult of access or remotely distant from base camp, and with limited time at one's disposal, after a large collection has been accumulated during a day's trip, the major effort is made to enter the numerous collections and their data into the field notebook. In the case of *Navia,* attention was given principally to the color of corollas, bracts, and leaves, as well as habit and habitat. This limitation of time for the preparation of specimens diverted attention from detailed examination of the corolla under living conditions. Added further to the problem has been the lack of success in growing *Navia.* This has hampered close observation of living material. I well remember how the famous horticulturist and explorer of Bromeliaceae, the late Mulford B. Foster, expressed keen disappointment at not being able to grow *Navia* from seed I had sent him from my collections. Now, Dr. Bogner at the Munich Botanic Garden and Henrique Graf, a grower in Caracas, have been able to cultivate this genus successfully.

During April, 1986, a surprising observation on *Navia* flowers was made by the author and his assistant, Bruce Holst, while on an expedition to the Río Coro Coro at the base of Cerro Vutaje in Territorio Federal Amazonas, Venezuela. A beautiful *Navia* with white corollas and rose-colored bracts was collected and a careful examination made of the living corolla. To our amazement, the petals were found to be completely free from one another and separate from the base, not coalesced as the extant literature had indicated. This *Navia* was then described as a new species, *N. grafii* Steyerm. & Holst, named in honor of the bromeliad grower of Caracas, Henrique Graf, who had accompanied us that day together with Parker Redmond, another plant enthusiast from Caracas. In the publication of this new species (Steyermark & Holst 1986) we called attention to our observation that the petals were free or nearly so and that this was at variance with the

generic description of the corolla. I thought at the time that this might be an anomalous situation to which I directed Dr. Smith's attention.

However, after later dissections made on several additional species, previously described as well as new ones in the process of being described, showed a similar condition of free or nearly free petals, I began to change my concept of the *Navia* corolla. Furthermore, Dr. Smith had examined topotypic material of the type species, *N. caulescens,* and found, after dissection, that the petals of that species were indeed separate. Although this condition of free petals does exist in apparently a number of species of the genus, it is not universal, since an examination of other taxa of the genus reveals a definite corolla tube with the stamens inserted at various levels. The condition of free petals, on the other hand, was to be expected, since they also occur in such genera of the Pitcairnioideae as *Brocchinia, Lindmania, Pitcairnia, Puya,* and others.

In the future, collectors should be aware of the variation from free to connate petals, and examine living material carefully to record each species examined. The generic description of *Navia* must be emended, therefore, as follows: Petala libera vel in tubum varie conjuncta.

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Missouri Botanical Garden
St. Louis, MO

Research Grant Availability

Proposals are solicited from qualified persons wishing to conduct research on bromeliads. Grants normally not to exceed $500.00 are available from the Victoria Padilla Memorial Bromeliad Research Fund. Proposals dealing with either applied or basic problems are encouraged. Interest, for instance, has been expressed in finding ways to improve seed storage and in circumventing self-incompatibility in rare species or those represented in culture by a single clone. Individuals wishing to submit proposals should contact David H. Benzing, Department of Biology, Oberlin College, Oberlin, Ohio 44074.

Julian A. Steyermark

Lyman B. Smith

The last time I saw Julian was when he took Ruth and me to the Grand Savanna in the middle of the Guayana Highland with its tepius or what we call mesas in our Southwest. This region in southern Venezuela and adjoining countries has an endemic flora of *Lindmania, Connellia, Brocchinia, Ayensua,* and *Navia.* Most of the many new species Julian and I described and published jointly.

We approached the Grand Savanna from the north where the ring of elevation was at its lowest and there we saw our first and largest bromeliad, *Brocchinia micrantha,* with a palm-like trunk over six feet high (2 m) and a very open, spreading inflorescence still higher (2.6 m) rising from a spreading rosette of yard-long leaves. It seemed strange that this giant, second only to *Puya chilensis* in height should be named for its tiny flowers.

We came out on the Grand Savanna and soon saw a quite different *Brocchinia reducta* with no stem, a tubular rosette of a few leaves and a low-flowering shoot. We toured the Grand Savanna widely finding a tiny new *Drosera* and a new genus of aroid but only one more bromel, a large brocchinia with a tubular rosette, which later proved to be carnivorous. Most bromeliads use their tanks to harbor insects and other animals and make use of the bodies left to provide the nourishment lacking in swampy or epiphytic habitats but a few have gone a step further and become carnivorous by trapping and drowning nonaquatic insects.

On leaving the Guayana Highland, Julian could no longer conceal the extreme pain of arthritis and shortly after our return to Caracas he had new hip bones put in one after the other. His friends thought he made a remarkably quick recovery but for Julian anything short of immediate was too slow and he went back to exploring and collecting as soon as possible. Fortunately, helicopters were now available and they put Julian on top of tepuis from the size of a football field to a giant 30 miles across. He could not have operated as in the early days when he had to hire Indians to carry in food and operating gear and then cut a path through the dense forest covering the scree until they found an opening where a stream had cut a gorge into the perpendicular side of the tepui. With luck, Julian could go up on top and find new species that grew only there.

I first met Julian when I was an herbarium assistant at the old Gray Herbarium and he had come to Harvard for a master's degree. Even then it was evident that he was a man of great intelligence and terrific drive. After gaining his doctorate, Julian went to the Botany Department of the Field Museum and collected for them in Guatemala where he ascended several mountain tops never

[continued on page 69]

Offsets or Seeds?

Greg Stewart

I have been growing tillandsias from seed for about eight years now and my father-in-law Rolley Reilly has also been heavily involved, with both of us sharing the same ideals. We have approximately 100,000 seedlings in various sizes at the moment so it looks like we are going to cover this continent from one end to the other. We have no trouble in our cultural growing of tillandsia seeds but this is another story. I would like to comment on one problem we are having with our offsets when the mother plant has a reasonable amount of seed set on it.

In the last four years, I have been concentrating on setting seed on my tillandsias for the purpose of growing from seed. I have been very successful on most plants in setting a good crop of viable seed, especially on some of the rarer varieties such as *Tillandsia duratii, T. viridiflora* var. *variegata,* and *T. dyeriana.* I have two clones of most species so self-sterile plants don't worry me as I have an alternative pollen supply.

One thing, however, that does worry me is that since I have been setting seed my offset production and quality have fallen away remarkably. Some of the offsets on the silver varieties of *Tillandsia* have been reaching only half their growth potential before flowering, and I must put this down to the seed the plant was carrying prior to or during pupping. The larger, greener tillandsias are not

T.U. Lineham

Fig. 4.
A small sample of the approximately 100,000 tillandsia seedlings and a few of the mature specimens cultivated by Rolly Reilly and Greg Stewart near Brisbane, Australia.

affected as much as the silver and grey varieties, but it is still a little disconcerting as it is always better to have nice, robust offsets. Any plants that I have not set seed on seem to be producing normal, large offsets with no stunting effect.

I must say that somewhere along the line a decision must be made to go either with the setting of seed and risk reduced offset size or not to set seed, or on self-fertile varieties to cut the inflorescence off directly after the plant has finished flowering. The ideal situation, of course, is having two clones of each variety and set seed on only one leaving one for offset production only. I am now working toward this goal.

My cultural conditions for most of my silver tillandsias are as follows. I grow under 50 percent sarlon shade cloth so a very good air flow is obtained most of the year. As we live in a subtropical climate and I do not get frost, the greenhouse is not covered in winter. The water in Brisbane is not ideal but plants seem to exist with it quite well. I water every second morning in summer with the plants being given a good soaking for 10 minutes by a heavy misting system. During winter, I hardly ever water the silver tillandsias but if it hasn't rained for one week they are then given a light watering.

In summer, I fertilise weekly with a 10:2:9 ratio product using at one-third strength. During the four months of winter, I cease all fertilising with a gradual wind-down during autumn and a slow build-up in spring.

The system I am using for growing these plants may in some way have something to do with the smaller offsets produced on seed-bearing plants.

This is an expanded version of an article in Bromeliaceae, *bulletin of the Queensland Bromeliad Society, January-February, 1988. Reprinted by permission of the author*

Mark Dimmitt, Editorial Advisory Board member and chairman of the BSI Conservation Committee, comments on Mr. Stewart's observations as follows:

I am pleased that people are getting into seed propagation; there will come a day when many of these plants will no longer be available from the wild.

I have not observed in my plants any decrease in vegetative offshoots of gray-leafed species that have set lots of seed capsules, but I am notorious for heavy fertilizing (I feed almost every week with about one-third strength solution).

Since Mr. Stewart is not feeding throughout the year, I am not surprised that he sees decline in growth during seed production as reproduction is known to require a significant part of a plant's energy budget. Most tillandsias will grow through the winter if days are in the 70s (20s C) and would thus benefit from feeding all year.

If seed production retards vegetative growth even with increased feeding, seeds are still a much faster way to increase a species because many thousands of seeds are produced by the energy needed to produce two or three offsets.

The Arizona-Sonora Desert Museum
Tucson, Arizona

Stomata in *Tillandsia bryoides*

Timothy M. Evans and Gregory K. Brown

Introduction. Stomata are the microscopic structures on vascular plants that are responsible for the regulation of gas exchange. That function includes both the uptake of CO_2 from the atmosphere to be used in photosynthesis, and transpiration, the process controlling the loss of water vapor from plant tissues. By controlling gas exchange, stomata play an important role in protecting the plant against excessive water loss while still allowing a sufficient amount of CO_2 to enter the plant.

Each stomatal apparatus is composed of two specialized epidermal cells called guard cells, which expand or contract as they become more or less turgid, changing the size of the aperture between them. During the day, while the plant is actively photosynthesizing, the stomata are usually open, allowing CO_2 to enter the plant. At night or during periods of water stress, however, the stomata close to prevent excessive water loss (Benzing 1980).

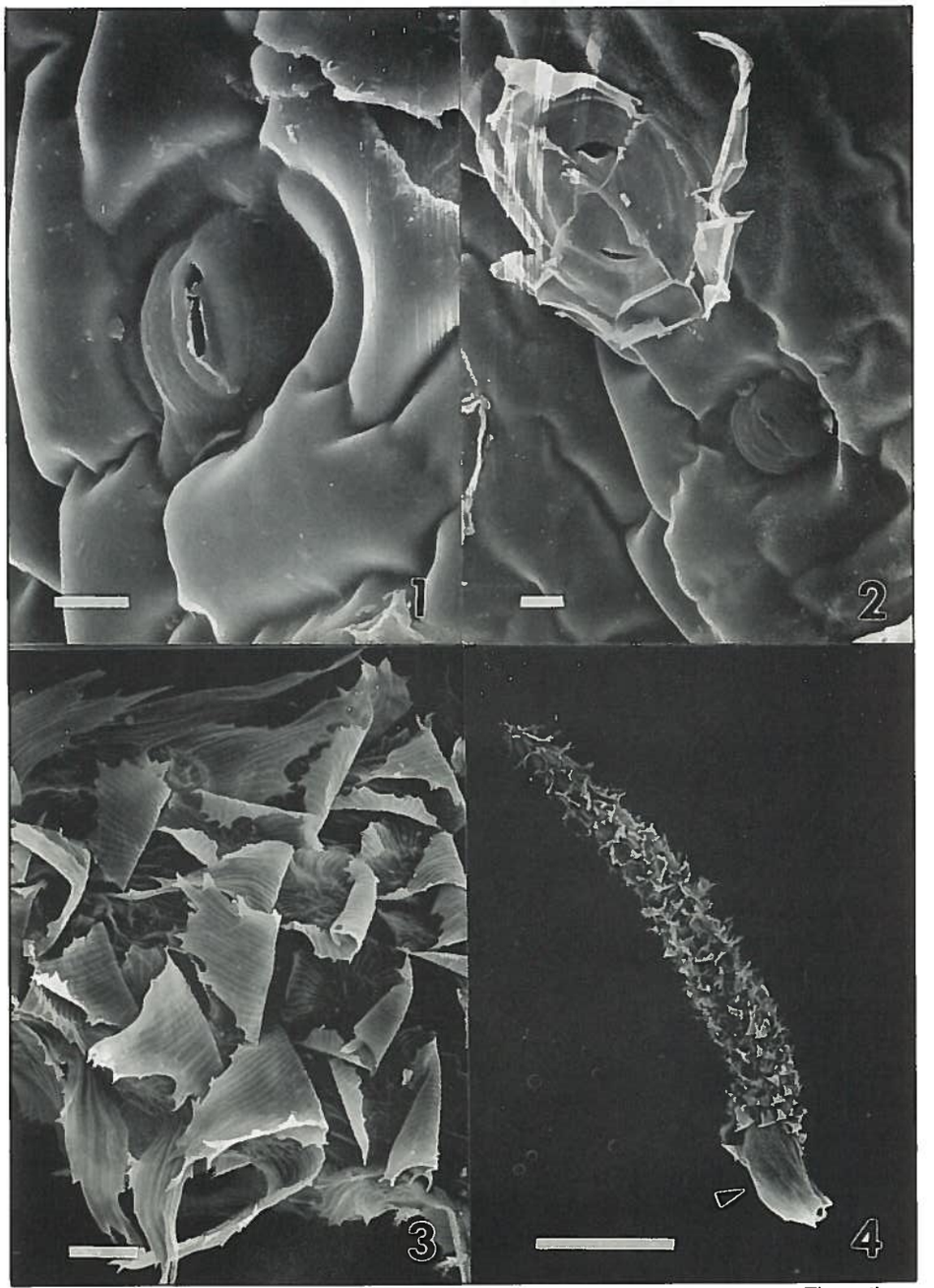
Apart from having functional significance, stomata are also useful in plant systematics (Redford et al. 1974). Study of the shape and arrangement of the subsidiary cells (the epidermal cells surrounding the guard cells) has identified several classes of stomata and these classes may be used as diagnostic characters at the genus or species level.

Stomata are considered to be universal in vascular plants, although they may be greatly reduced in number or even absent in submerged aquatic species. In terrestrial species, they are associated with aerial portions of the shoot, the leaves in particular, and are rarely found on roots.

It has been suggested that a member of the Bromeliaceae, *Tillandsia bryoides* Grisebach ex Baker, does not have stomata (Tomlinson 1969, Benzing 1980, p. 68). This proposal is peculiar because *T. bryoides* is saxicolous and epiphytic in dry habits of Peru, Boliva, and Argentina. Linsbauer (1911) advanced the idea that with this species water escapes through areas on the leaf where the cuticle, a waxy waterproofing substance associated with the leaf epidermis, is lacking.

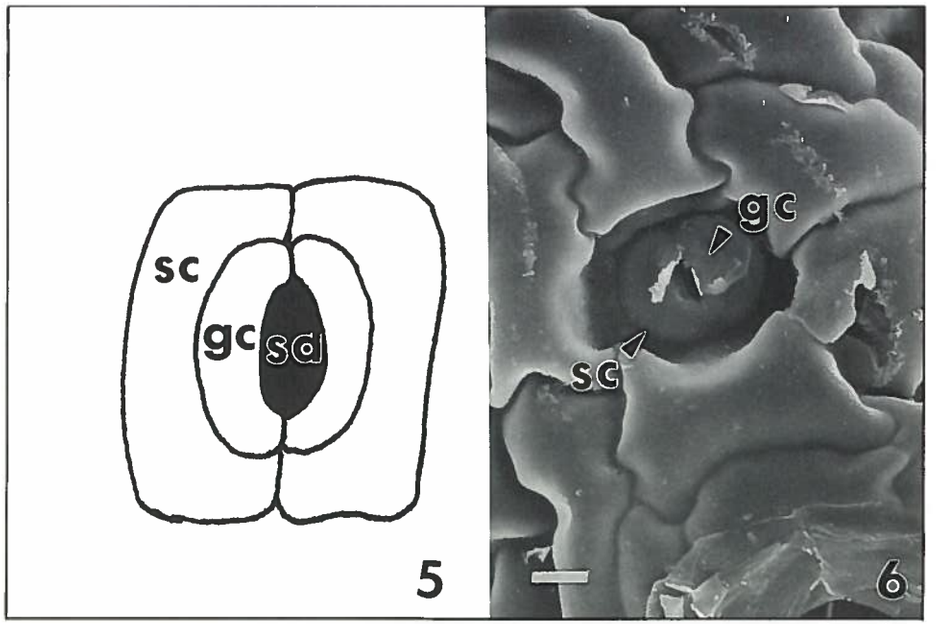
The purpose of this research was to determine if *Tillandsia bryoides* possesses stomata, and if not, to document Linsbauer's proposal. Another motive of this research was to determine the class of the stomata in *T. bryoides* to be used as a possible taxonomic character in the future.

Methods and Materials. Plant material was obtained from the University of Heidelberg Botanical Gardens and was fixed in FAA. It was later transferred into 70% ethanol and stored at or below 0° Celsius. Mature leaves were dissected



The authors

Fig. 5 1. Bar = 10 μm. Stoma is present on *T. bryoides* leaf. 2. Bar = 10 μm. Stomata are often located near the bases of trichomes. 3. Bar = 100μm. Shows the dense trichome cover on the leaf surface. 4. Bar = 1000μm. Stomata are absent at the base of the leaf (indicated by arrow).



the authors

Fig. 6 5. Illustrates the arrangement of the subsidiary cells in the paracytic stomata type (gc = guard cell; sc = subsidiary cell; sa = stomatal aperture). Adapted from Fig. 7-4 in Radford et al (1974). 6. Bar = 10 µm. Paracytic stoma from *T. bryoides*. The outline of the guard cell is difficult to see.

with the aid of a dissecting microscope and the trichomes were removed with a razor blade. In preparation for scanning electron microscopy (SEM), the leaves were first hydrated in a graded ethanol series. They were then treated with a 2% osmium tetroxide solution, followed by thiocarbohydrazide and then given another treatment of osmium tetroxide (Brown and Gilmartin 1989). The leaves were then dehydrated in a graded ethanol series to 100% ethanol, critical point dried, and sputter coated with gold.

Results. Stomata were found on the leaves of *Tillandsia bryoides* (fig. 5-1). They are located frequently near the bases of trichomes (fig. 5-2). Since the trichomes form a dense cover over the leaf surface (fig. 5-3) stomata are invisible until the trichomes have been removed.

Where there are no trichomes, stomata are absent at the bases of the leaves (fig. 5-4). On the remaining area of the leaf, there are about 0.07 stomata/mm² (Table 1).

Table 1. Stomatal densities in bromeliads.

Species	Stomata/mm²
Ananas comosus	70-85
Tillandsia usneoides	7
Tillandsia bryoides	0.07

The average diameter of the stomata including both the guard cells and the subsidiary cells is 25.28 micrometers along the axis parallel with the aperture and 26.88 micrometers along the axis perpendicular to the aperture. The stomata appear to be the paracytic type, according to the arrangement of the subsidiary cells (Fig. 6-5, 6-6), as described by Radford and others (1974).

Discussion. Compared with stomata densities of other bromeliads (Benzing 1980, table 1), *Tillandsia bryoides* has relatively few stomata/mm². There is a correlation between the location of trichomes and the distribution of stomata in *T. bryoides* in that each stoma is usually located at the base of a trichome.

One hypothesis about the functional advantage of the stomata/trichome association is that the trichomes create a cushion or boundary of still air that reduces the rate of transpiration (Tomlinson 1969). If this is the case, the ideal position for a stoma would be near the base of a trichome, thus insuring that it is covered.

There has been little research into bromeliad epidermis structure and such studies would likely prove to be useful in future taxonomic studies of the family. More specifically, study of stomatal architecture seems to hold promise for taxonomic use.

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The Bromeliads: Genera–Species–Hybrids (Continued)

Louis Dutrie

[This eighth part of the Dutrie series concludes his description of vrieseas and vriesea hybrids. In the two remaining parts of this long series, M. Dutrie discusses selection of parents, hybridizing procedures, bromeliad culture and the use of bromeliads. –Ed]

PERSONAL HYBRIDS OF VRIESEAS

After having pointed out and described the best hybrids obtained principally at Liège and Versailles, I believe it will be permitted me to speak of the attempts I have made in my greenhouses.

In 1935, I began planting seed obtained from hybridizations made in 1934. I stopped proceeding with these crossings in 1944 only for a very good reason.[1]

I carried out more than 100 plantings issuing from those crossings between species and hybrids of the most diverse kinds. I shall describe here the results obtained. Many other crossings had been made but, for the same reason, I was not able to harvest the seed.

In December 1938, I displayed at the meeting, under the names of *V. pulchella* and *V. nitida*, two hybrids of *V. brachystachys* × *V. cardinalis*, small plants with a spike about a dozen cm long on a very erect stem of 25 or 30 cm, the first with light red bracts, the second, red, flushed with yellow (if I remember rightly), forming pleasing miniatures quite superior to the classic *V. brachystachys*. Each of them was awarded a Certificat de Mérite with congratulations.

Two months later, the 5th of February 1939, I displayed a third product of the same crossing that I had christened *V. medio rosea*. It was a charming plant with a flower of the most delicious color. On a rose-colored stem of 35 cm, the spike, somewhat triangular, 12 cm long, was rose at the base of each bract, this passing from rose at the base to red at the center and golden yellow at the top. I know of no other vriesea of which the color is so fresh and pleasant....

In October 1939, I displayed, without giving them a name, a group of six hybrids of *V.* Africain × *V. cardinalis*. The plants, in rosettes of about 25 cm in diameter, carried floral stems very upright, rigid although slender, with spikes 12–15 cm long, all of different colors, going from rose to a red that was almost black....

From 1940 on, the flowering of the hybrids followed one another at an accelerated pace. In 1941–1942, about a hundred were in flower, many of which

1. My establishment was destroyed by a bombardment on 10 April 1944.

had branched stems. They ran the gamut in size, form, and color. I was, unfortunately, absent at the time of their most abundant flowering, but a good number flowered again after my return from France at the end of March 1942 and the flowering continued at a much slower rhythm, but without interruption, until April 1944.

It was difficult for me to establish the exact origin of many of these hybrids. During my absence, in the course of repotting and successive change of position of the plants, many labels were lost. It was, however, easy to recognize in the species with broad spikes and bicolored bracts, the descendants of *V. brachystachys major* and *closoniana*. They, crossed with *V. vigeri*, *V. vigeri major*, and *V. kitteliana* were, without any doubt, the parents of the branched bicolors of which I formed a group under the name of *V. polybrachystachys*. Among these last, the position of the two colors, bright red and gold, corrected happily the dullness of the inflorescence of the spikes of the same width but of only one color. Other bicolors, having a less heavy spike, were obviously descended from *V.* Polonia or *vigeri*.

The species with a very large single spike up to almost a meter in length issued indubitably from *V.* Wallonia, the violets and blacks from *V.* Mephisto and *V.* Africain, and from *V. kitteliana*, and of the two *vigeri*, the hybrids had slender spikes of all shades.

Is it necessary to give names to all this mishmash? The task offers no difficulty. I have had a long list quite ready. But a name, even if descriptive, reveals very little of the plant. *Aurantiaca, violacea,* indicate, indeed, the color; *minima* or *excelsa* give an idea of the size, but nothing more. As for the proper names, one must evoke the recollection of an old unyielding Gaul, of a famous painter, or of a conquering negus at Adoua, without anything to teach us about the plant.

To avoid having to consult my notes every moment, I got the idea of replacing for the time being and for my personal account, the names by numbers, of which each figure, according to the place it occupies in the number, should recall one characteristic of the plant. The species with single spike were thus represented by a number of three figures. Those with a branched stem, by a number of four figures.

In both cases, the first figure classes the plants by order of size, 1 representing the smallest size, such as that of *V. brachystachys* of 10–15 cm in diameter, 2 indicates a diameter of 20–25 cm, 3 of 30–35 cm, approximately.

The second figure gives in decimeters the total height of the floral stem.

The third figure, for the species with a single spike refers to the color, following the scheme below:

1. Yellow
2. Orange
3. Light red, scarlet, cardinal
4. Bright red to cherry red
5. Cherry red to purple
6. Violet or black
7. Bicolor, light red and yellow
8. Bicolor, cherry red and yellow
9. Bicolor violet or black and yellow
0. White.

For the plants with branched stem, the third figure gives the number of branches; the fourth refers to the color.

The simple reading of the label thus put, so to speak, the plant before my eyes. Reading, for example, 138, I saw a small plant with a single stem, of 30 cm in height, with cherry and yellow bracts. If I read the number 2553, I would instantly picture to myself a plant of about 25 cm in diameter, a floral stem 50 cm in height, carrying five branchings, and with scarlet bracts. These indications, even though brief, are amply sufficient for me.

I endowed with names, however, some characteristic hybrids, such as:

- No. 132—*V.* Aurora minor, a pretty, smaller edition of the beautiful hybrid, Aurora.
- No. 352—*V. macrostachys,* enormous red spike, flushed with yellow, attaining a length of 32 cm, and 8 cm in breadth, must be descended from *V. poelmanni.*
- No. 24252—*V. tricolor,* an issue from *V. kitteliana* × *V. medio rosea;* the flower has the freshness of the latter. The rachis and base of the bracts are bright rose, the middle light red, the point yellow; the coloring very delicate.
- No. 2534—*V. roseo-salmonea,* of the same origin, rose in the center, salmon on the edges; the coloring of a great freshness. *[the author continues with four more examples.]*

HYBRIDS OF TILLANDSIAS, VRIESEAS, AND GUZMANIAS

Bigeneric hybrids between tillandias and vrieseas are very rare. At the Jardin Botanique de Liège, the crossing of *Vriesea* Wallonia by *Tillandsia fasciculata* produced a plant having all the exterior characteristics of a *Vriesea.* The hybrid is delicate; sown in 1912, it had not yet flowered in 1939.

The *Vriesea* Souvenir de Joseph Mawet was pollinated in 1921 by *Tillandsia caespitosa.* The offspring resembled the male parent but was more vigorous. M. Ch. Chevalier, the originator, gave it the name of *Vrieslandsia* Prof. Bouillenne. It was described in the *Bulletin de la Société Nationale d'Horticulture de France,* in July 1931.

Between *Guzmania* and *Vriesea* only one hybrid is recognized at this time, obtained by E. Lemoine of Nancy, the result of a crossing between *Guzmania zahnii* and *Vriesea splendens.* It is cultivated under the names of *V. magnifica* E. Morren, of *Caraguata magnifica* Hort., or of *Tillandsia magnifica* Hort. Lemoine. It has the appearance of a *Guzmania,* the inflorescence of a *Vriesea.* Numerous leaves, pliant and elegant, green, strongly tinted with wine red. The floral stem, high, very erect, extending beyond many of the leaves, terminating in a panicle formed of upright spikes, with orange-red bracts surrounding the yellow flowers. Not very floriferous. To my great regret, I have never been able to procure a specimen of this plant. The description given here is by M. Chevalier.

[continued on page 68]

Guzmania eduardii, A Rare Guzmania

Werner Rauh

Guzmania eduardii André ex Mez (synonym: *Caraguata morreniana* André) is a striking species (photograph on front cover), very rare in cultivation. It is known only from southern Colombia, growing epiphytically in rain forest at an altitude of 100–1200 m.

When flowering it looks very like *Guzmania lingulata* (Linnaeus) Mez var. *lingulata,* widespread from British Honduras and the West Indies to Ecuador, Peru, Boliva, and Brazil, but *G. eduardii* is not related to *G. lingulata.* The latter has simple corymbiform inflorescences, whilst *G. eduardii* has densely digitate, bipinnate inflorescences with about 10 spikes. But in both species the upper scape bracts and the basal primary bracts form a showy involucre about the inflorescence. In *G. eduardii* the densely arranged floral bracts about equal the sepals, pale green or yellow; the petals are white or yellow, with spreading lobes. In *G. lingulata* the floral bracts are shorter than the white sepals; the petals are always white.

Cultivation of this plant is easy in a humid, not too warm climate.

Institute for Systematic Botany and Botanical Garden
of the University of Heidelberg
West Germany

COLOR in the *Journal* has been of great interest to readers and editors ever since Racine Foster pasted gold Christmas stars on volume 2, number 6. The cost of color reproductions continues to average $700.00 for each issue. The first contribution for 1989 to help with that expense has come from **THE BSI TEXAS, OKLAHOMA, AND LOUISIANA JUDGES SYMPOSIUM '88.** We appreciate that thoughful gift. Affiliates can provide tangible evidence of participation by making similar contributions. The proceeds of a special plant sale at one meeting, for example, would be a big help.—TUL

NOTICE OF BSI BOARD OF DIRECTORS MEETING

The annual meeting of the Board of Directors will be held in Los Angeles, California, on May 20, 1989. The place and time will be announced when available. This will be an open meeting. Members are invited to forward matters for consideration by the Board to the president before the meeting date.

Brazilian Reports, Numbers 5, 6, and 7

Elton M.C. Leme

***Aechmea orlandiana* subspecies *belloi* Pereira & Leme.**

During the evening of the last day of a weekend excursion in Espírito Santo with Renato Bello and Roberto Menescal, we came across old trees spaced well apart along the roadside. They were the remains of vegetation that used to form the landscape. On those trees that now shade grazing cattle, we saw large numbers of a bromeliad covering all of the branches. The scene took place in the region of Castelo about 700 m above sea level in a valley surrounded by mountains with uprising granite formations that are the home of *Vriesea fosteriana* L.B. Smith.

After further studies back in Rio de Janeiro, we came to the conclusion that we had a new subspecies of *Aechmea orlandiana* L.B. Smith. We named it subsp. *belloi* in honor of Renato Bello.[1] This discovery is most interesting if we consider that the species *orlandiana* was found in only one place, Cachoeiro de Itapemirim, in two collections by M.B. Foster in 1939 and 1940.

The basic characteristics of subsp. *belloi* distinguishing it from sp. *orlandiana* are: the totally green leaves, the inflorescence with branches more sparsely arranged, and the orange primary and floral bracts. In short, it is an attractive bromeliad to be cultivated preferably on tree branches to which it sticks quickly. Through its well-developed stolons it forms, in a short time, a highly ornamental clump.

***Nidularium pulcherrimum* Pereira & Leme.**

Nidularium pulcherrimum Pereira & Leme[2] may be one of the most beautiful components of the subgenus *Canistropsis* Mez. The very specific name of the plant signifies its degree of beauty. The brothers Luiz Carlos and Sergio Gurken were the collectors of this new species. It happened in 1972 in the south of the State of Rio de Janeiro near the ocean.

This species has a short scape and the inflorescence—a big one when compared to other species of the subgenus *Canistropsis*—is supported by the rosette. It is closely related to *N. microps* but differs from it in having a more developed inflorescence that can reach a diameter of 12 cm, with branches proportionally developed; the sepals have a well-developed tip; the petals have erect blades when in bloom and are not spreading as is the case with *N. microps*. Without question, *N. pulcherrimum* will be a success in any collection because of the intense pink of

1. Bradea 4(34): 266-267; 1986
2. _____ 4(32): 277-278; 1986

Fig. 7
Aechmea orlandiana
subspecies *belloi*
Pereira & Leme

Photographs by the author

Fig. 8
Nidularium pulcherrimum
Pereira & Leme

its bracts. In nature, its population is extremely threatened since it inhabits a part of the country of increasing value for development and by intense touristic activity.

***Nidularium weberi* Pereira & Leme.**

In order to pay him tribute, we named this unusual species for the late Wilhelm Weber, the bromeliad specialist. *Nidularium weberi* is in the subgenus *Canistropsis* Mez. Occurring in the woods of Bahia, south of Ilhéus, it grows in the forest soil and sometimes on the lower parts of the trunks of the trees. In places where their presence is typical, some reasonable population groups were seen covering the ground here and there, interspersed with other taxa.

Its leaves are of a delicate texture and are almost entire; the scape is not well developed; the bracts and sepals keep well developed thorns (an unusual character of the group to which they belong); the petals are blue, naked, with callosities at the base of the lobes, and connate by 8-10 mm at the base. *N. weberi* may be considered a discrete part of the subgen. *Canistropsis* when compared to the other species. Morphologically it is even more distinct than *N. selloanum* (Baker) Pereira & Leme (syn. *Andrea selloana* [Baker] Mez) which we consider in perfect harmony with the present concept of *Canistropsis*.

Nidularium weberi may be found in bloom in nature in the months of December and January.

The Bromeliads: Genera–Species–Hybrids *[continued from page 64]*

Personally, I was successful in making several crossings: *Vriesea incurvata* × *Guzmania zahnii, Guzmania lingulata splendens* × various *Vriesea* with single spikes, *Guzmania lingulata splendens* and *Guzmania cardinalis* × diverse vrieseas with branched stems.

• *Vriesea incurvata* × *G. zahnii* produced plants that were of rather small size (size 2), having, in general, the appearance, though smaller, of *G. zahnii* with green leaves, or brown, or more or less lined with wine red at the base. Stem rigid, very upright, slender, height 40 cm comprising a single spike, 12–15 cm long, medium breadth, always vividly colored, yellow being dominant. . . .

• *G. lingulata splendens* × *Vriesea* with single spike gave plants of perfect form, robust, with rather large leaves, well open, often tinted with brown or lined with red at the base. Strong spike, with imbricated bracts, stem strong and very straight, adorned with golden yellow to scarlet, the coloring always bright and very vivid.

• *G. lingulata splendens* and *G. cardinalis,* pollinated by divers vrieseas with branched floral stems provided a whole series of plants from medium-sized to large, with numerous leaves, broad, more or less tinted with brown or red, forming rosettes of impeccable form, very vigorous. As with all the guzvriseas, the floral stem was strong and very upright, the spikes being strong without being heavy, the coloring intense. . . .

Of these various *Guzvriesea,* I sowed more than 10,000 seeds between 1942 and 1943. *[To be continued]*

Julian A. Steyermark *[continued from page 55]*

before botanized and collected a number of new species including several bromels. This set a pattern which he followed consistently of collecting everything, but he was very discerning and made very few duplications.

His over 240,000 collection numbers are probably an all-time world record. True, he had help, but he was on the spot to direct it and not like some would-be competitors who stayed at home and sent assistants to use his numbers on collections. His publication record is very good.

Smithsonian Institution
Washington, D.C.

Neoregelia johnsoniae, an Extraordinary New Species from Eastern Peru

Harry E. Luther

***Neoregelia johnsoniae* Luther, sp. nov.**

A *Neoregelia bahianae* (Ule) L.B. Smith similis sed laminis foliis tenuis non crassis succulentibusque; inflorescentia grandi; sepalis longioribus, perasymmetricis, acuminatisque; ovario longioribus differt.

Plant with very short, erect rhizomes, clustering. *Leaves* ca. 12 in number, thin coriaceous, sparsely appressed lepidote especially abaxially, pale yellow-green, the inner leaves erect to spreading, the outer leaves reflexed and folding downward. *Leaf sheaths* conspicuous, somewhat inflated, to 10 cm long, 4.5 cm broad, pale, concolorous with the blades, entire, the upper portion of the innermost leaf sheaths with irregular purple-red markings. *Leaf blades* to 30 cm long, 3 cm broad, serrate with widely spaced 1-mm long, dark, antrorse spines, irregularly purple-red spotted especially abaxially, apex purple-red, rounded and apiculate. *Scape* 4–6 cm long. *Scape bracts* imbricate, elliptic to ovate, slightly serrate or entire, the upper involucrate about the inflorescence, about equalling

J. Kress

Fig. 9 *Neoregelia johnsoniae,* collected in northeastern Peru, is separated from its most closely related relatives by nearly 3,000 km. This is another example of yet unexplained neoregelia distribution mysteries.

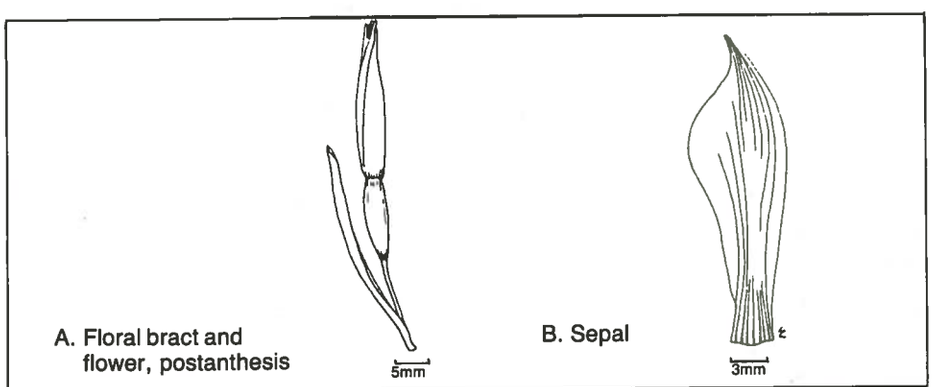
the ovary. *Inflorescence* simple, ca. 36-flowered, 6 cm in diameter. *Floral bracts* entire to 34 mm long, 8 mm wide, entire, thin, nerved, pale green. *Pedicels* 15–24 mm long, slender, distinct. *Sepals* asymmetrical, to 25 mm long, acuminate, connate basally for 2 mm. *Petals* to 32 mm long, acute, connate for 1–2 mm or entirely free, dark blue toward the apex. *Ovary* to 12 mm long, 5 mm in diameter.

Type. Peru. Loreto: On the Río Napo NW of Iquitos near Exploranapo camp, collected in 1983, flowered in cultivation May 1988, *Carol M. Johnson, s.n.*, BIC 290 (holotype, SEL; isotype, US).

This odd plant is very difficult to place systematically. It shows some relationship with *Neoregelia bahiana* (Ule) L.B. Smith from southeastern Brazil but differs from that species in many characteristics including softer, thinner leaves, a larger inflorescence, very asymmetrical sepals each with an acuminate apex, and a longer ovary. The habit of reflexed, outer leaves, similar to that of *Aechmea orlandiana* L.B. Smith, seems to be otherwise unknown in *Neoregelia* subgenus *Neoregelia* although a few species in subgenus *Hylaeaicum* are vaguely similar in this respect. The long, slender pedicels and overall habit make it clear that *Neoregelia johnsoniae* does not belong in the latter subgenus.

The very surprising collection locality on the upper Amazon drainage is very strange and inexplicable considering that the most closely related species of *Neoregelia* are nearly 3,000 km to the east. On the other hand, *N. cathcartii* Reed & Read is similarly disjunct in northern Venezuela. Further botanical and horticultural exploration may shed additional light on the distribution of *Neoregelia* subgenus *Neoregelia* beyond southeastern Brazil.

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



G. Culbertson

Fig. 10. Neoregelia johnsoniae

Misnamed Bromeliads, No. 3

Harry E. Luther

***Aechmea chantinii* (Carrière) Baker forma *amazonica* (Ule) Luther.**

The epithet "amazonica" has been a source of confusion for growers of the genus *Aechmea* for many years. Most plants cultivated as *Aechmea amazonica* or *A. chantinii* "var. amazonica" are very dark purple or reddish color phases of *A. chantinii* with prominent silver bands. The plant described by Ule in 1907 as *A. amazonica* had concolorous (nonbanded) foliage, quite different from the zebra-striped plants of today. To make matters even more confusing, plants equivalent to Ule's species are often labelled *Aechmea tillandsioides* var. *tillandsioides*, a separate and distinct taxon.

In 1987, I proposed the combination *Aechmea chantinii* var. *chantinii* forma *amazonica* for the plain green or reddish, nonbanded plants of this species that grow randomly throughout the range of the typical variety. The common banded ones, whether green, purple, red, or black are *Aechmea chantinii* var. *chantinii* f. *chantinii* or just *A. chantinii* for short. The only other botanical variety of this species is var. *fuchsii* Luther, a very large, flowered type formerly cultivated as *A.* 'Pink Banners'. It is so far known only from eastern Ecuador.

A Key to the Subspecific Taxa of *Aechmea chantinii*

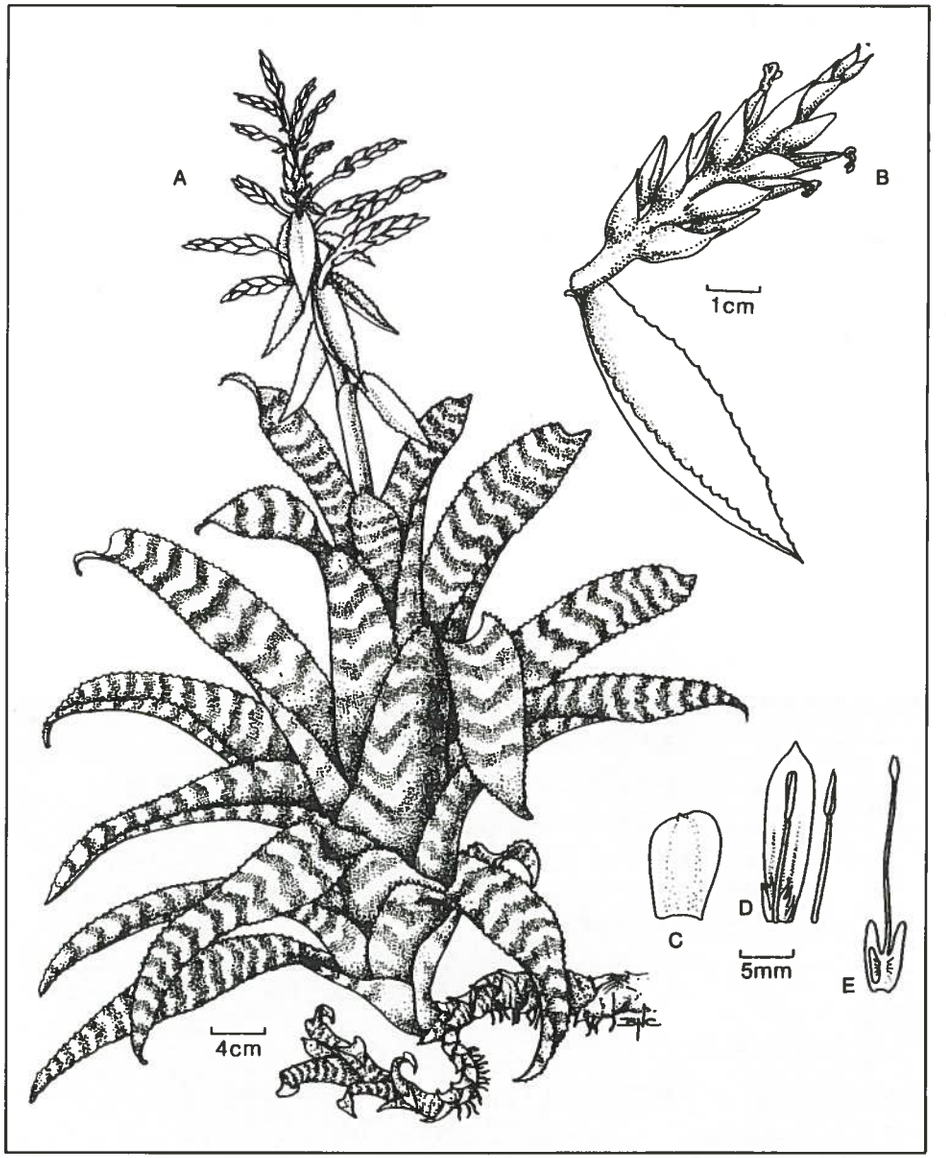
1a. Leaves concolorous (nonbanded) . . . . . var. *chantinii* f. *amazonica.*
1b. Leaves conspicuously silver banded.
  2a. Flowers to 30 mm long. . . . . var. *chantinii* f. *chantinii.*
  2b. Flowers to 40 mm long . . . . . var. *fuchsii.*

[Adapted by the author from Selbyana *10:56-58, 1987]*

(See drawing on next page)

***Quesnelia edmundoi* L.B. Smith var. *rubrobracteata* E. Pereira.**

From time to time, the fictitious *Aechmea* "cleistogama" appears in cultivation. That name is unpublished, has no validity, and all the plants so labelled that I have seen are the red-bracted, pale blue-flowered variety of *Quesnelia edmundoi.*



Barbara N. Culbertson

Fig. 11
Aechmea chantinii var. *chantinii. A, habit. B, branch of inflorescence. C, sepal. D, petal and stamens. E, pistil and ovary.*

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

Aechmea nidularioides, Subgenus *Aechmea*

Carol M. Johnson

This plant is one of several forms collected in 1983 near Iquitos, Peru and it is the most attractive. A medium-sized plant, the foliage is red at all times, but the color intensifies as the bloom spike appears. The white-tipped, red bracts are stiff and brittle. The white blooms appear between the bracts in the fashion of its namesake, opening a few at a time. Until I bloomed it, *Aechmea nidularioides* resembled very closely the *streptocalyx* collected in the same area. Like *streptocalyx*, it is quite temperamental. It seems to need fertilizer, but loses color when it is applied and it will not tolerate temperatures much below 50 degrees (F). Application of Florel aborts the bloom and causes grotesque plant growth. The plant also seems to require a pollinator that Florida cannot supply, as all efforts to cross-pollinate between the various forms has produced no seeds. It is a generous pupper, however.

Longwood, Florida

Carol Johnson

Fig. 12. Aechmea nidularioides

Tillandsia harrisii, A New Tillandsia From Guatemala

Renate Ehlers

I would like to introduce a new tillandsia from Guatemala that I received from Femo-Luftnelken, Langenfeld, West Germany, and described in Die Bromelia, the journal of the German Bromeliad Society.[1] I dedicated this species to the memory of Bill Harris who discovered it near the Teculutan River in Guatemala growing in large groups on rocks in full sun. In 1985, Bill Harris was assassinated.[2] This silvery plant is very attractive and easy to cultivate; when flowering it is a real beauty.

***Tillandsia harrisii* R. Ehlers, sp. nov.**

Tillandsia harrisii belongs to the subgenus *Tillandsia* and is related to *T. hondurensis* Rauh, but differs as follows: the plant is much bigger and long caulescent up to 80 cm. The sheaths are longer and narrower, the scape is distinct and up to 12 cm long. The inflorescence is much longer than the leaves, not subglobose like *T. hondurensis*, but narrow lanceolate and more than 5 times as long as the diameter. The floral bracts are broadly ovate to suborbicular and glabrous, the sepals are also glabrous.

Fig. 13
Tillandsia harrisii R. Ehlers

Klaus Eistetter

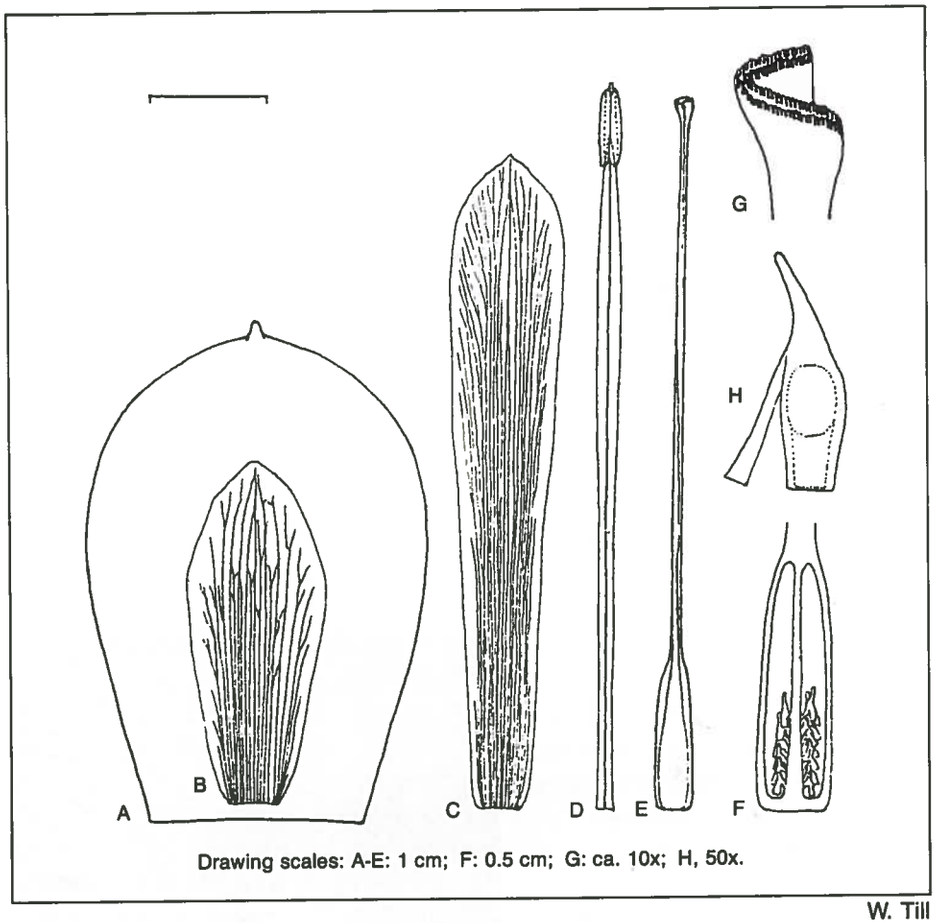


Fig. 14
Tillandsia harrisii. A, floral bract; B, anterior sepal; C, petal; D, stamen with dorsifixed anthers; E, gynoecium; F, ovary; G, stigma; H, seed.

The details of the flower were drawn by Dr. Walter Till, Vienna, who has my thanks for his cooperation.

NOTES:
1. The Latin diagnosis and expanded text appear in Die Bromelia 3/87:34-35.
2. Jerry Robinson, Paul T. Isley III. "Bill Harris, 1927-1985." J. Brom. Soc. 35:268; 1985.

Stuttgart, West Germany

Aechmeas from Seed to Seed

Arla Rutledge and Harvey Kendall

[In 1977, Arla Rutledge and Harvey Kendall wrote a series of articles about growing bromeliads from seed: aechmeas, neoregelias, and cryptanthus. Mr. Kendall has reviewed this work and had made what he calls a few cosmetic changes only. There certainly can be no definitive statement made on this subject because we do not have standard growing conditions but here are the observations and recommendations of two experienced growers. We plan to reprint similar information about growing tillandsias from seed as a continuation of this series. By coincidence, there are articles on tillandsia culture also in this issue. –Ed.]

The complete life cycle of a plant is truly a marvelous process. Having a hand in the process adds to the thrill. If you have acquired some experience in raising and blooming bromeliads, you may wish to extend your skills to include hand pollination, harvesting seed, sowing the seed, and caring for the young seedlings.

The species aechmeas that develop berry fruit provide good material for the novice. Included in this category are *Aechmea fulgens, A. ramosa, A. lueddemanniana, A. mexicana, A. castelnavii, A. nallyi, A. racinae, A. miniata, A. victoriana, A. angustifolia, A. bracteata, A. coelestis, A. mertensii, A. penduliflora, A. tillandsioides.* The flowers are usually accessible, the flower parts easily identifiable, the berries visible, and the seed evident. Since the anthers and the pistil in the aechmeas are at approximately the same height, some may self-pollinate, the close proximity bringing the pollen from an anther onto the pistil at a propitious moment and thus causing fertilization. Also you may have insects in your area that are attracted to the pollen or to the nectar secreted at the tip of the pistil. In that case, the insect will spread the pollen within one flower, from one flower to another, or from the flower of one plant to the flower of another. Some plants require the pollen from the flower of the same species but from another clone before fertilization will occur.

HAND POLLINATING

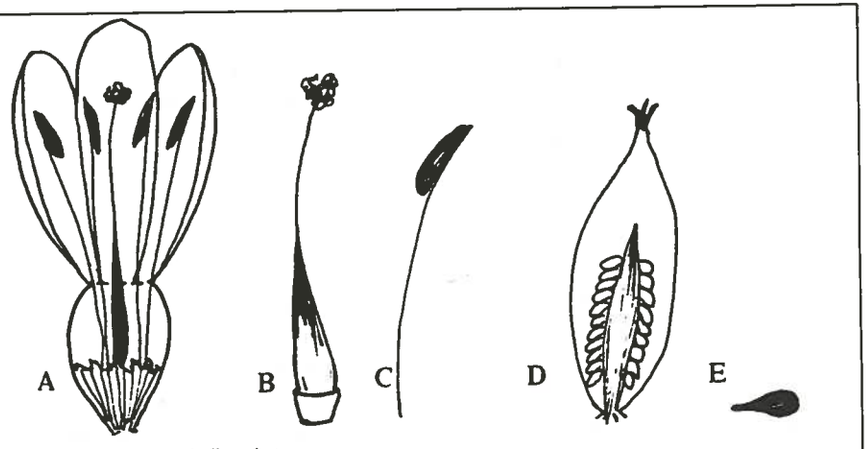
If you are intent on getting seed on your plant, it is best not to rely entirely on nature. You will increase your chances of obtaining seed if you will enter into the pollinization process yourself. (Note: not all of the aechmeas will open their petals for you. These types are naturally pollinated by insects with a long proboscis, but you can accomplish the same effect by spreading the petals and pollinating as described below.) In most instances the pollen in bromeliads remains viable for a period longer than the time that the pistil will receive it. In aechmeas you can expect the pistil to receive pollen over a period from as little as 15 minutes to more than an hour, depending on the species concerned. The pollen

will ripen shortly before this period begins and will remain viable considerably longer. The reception period can be determined by observing the pistil with a magnifying glass. When a bead of nectar is present on the tip of the pistil, it is receptive to the pollen. The aechmeas are usually fertile during the early daylight hours.

Using a small artist's brush or the tip of a pencil, dab into the flower and look to see if you have picked up any pollen. It will show as a bright yellow powder or a coarser meal on your brush or pencil. Proceed from flower to flower, if you have more than one open, and dab several times at each to assure that the pollen reaches the pistil. If you are not sure that the pistil is receptive, it is recommended that you repeat the process at half-hour intervals throughout the morning.

Do not be surprised if you do not find ripe pollen. Since most bromeliads have alternate means of propagation, they do not always have perfect seed production mechanisms. Frequently a plant will simply not produce pollen. Such cases may respond to pollen from another specimen of the same species, and it is even believed that seed production can be stimulated by the presence of pollen from a different species even if actual hybridization does not occur.

Cross-pollination or hybridization is a bit more complicated. Most hybrids occur between two species of the same genus. Rarely can we succeed in crossing two plants from different genera. To cross pollinate, we take the pollen from one species and apply it to the pistil of another species. In the aechmeas, the parts of the flower are so close together that the pistil may accidently pick up pollen from



A. Petals, showing pistil and stamens.
B. Pistil, stigma and ovary.
C. Stamen, showing pollen.
D. Fruit, showing arrangements of seed.
E. Aechmea seed.

its own anthers and the cross is thus thwarted. To assure a cross, professionals will use a small manicurist's scissors to trim off the anthers before the unwanted pollen is ripe. When attempting a cross with a plant that does not respond to its own pollen, the cross might seem to be a foregone conclusion; however, as mentioned above, the seed may not carry any traits of the pollen parent, because the seed plant developed seed merely by being stimulated with another plant's pollen without actually transmitting the pollen's life force to the ovary. For these reasons, only the resulting seedling plant can tell us whether or not the cross occurred.

HARVESTING

After pollination, we must continue to care for the plant appropriately until a berry forms and seed ripens. This waiting period may be from 2 to 10 months, depending on the species. In almost all instances the ripe period is signaled by a change of color in the berry. This color change may be from orange to brown, from red to brown, from light blue to purple, or from white to blue or purple. The color change usually occurs quickly—within the period of a day. When the berry-type fruits have reached the harvesting stage, the fruits will be soft to the touch and a gentle tug will easily remove the berry. You should harvest each berry as it ripens and not wait for the later ones to be ready. Delay could cause fatal spoilage. On the other hand, harvesting the berries before the ripening stage is reached could give immature seed and no germination. It will be noted that not all the fruits on a spike are ripe at the same time. Ripening occurs over a period of several days, one or two berries a day. Do not remove the spike from the plant until all fruits have ripened. To do so will stop development in the yet unripe berries.

In the nonberry-type aechmea blooms such as *A. fasciata, A. orlandiana,* or the cob-type such as *A. bromeliifolia, A. triangularis,* or *A. pineliana,* the difference in the flower head arrangement and the absence of a distinct color change in the fruits when ripe make harvesting a little more difficult. Since in a number of aechmeas the fruit is concealed in the bracts or buried in the base of the cob-type bloom, a close check will reveal the fattening of the fruit and only a slight, if any, color change when ripe. However, a gentle tug on the fruit and its easy removal will indicate the fruit is ready to harvest.

To harvest the seed, pick the berry and squeeze its contents into a small jar. You will immediately recognize the seed. It may be long and thin or shaped like a tiny egg. (On rare occasions, as in *A. chantinii,* which is one of the aechmeas that require hand pollination in the absence of insects, the seed may actually have germinated in the berry. In that case, you will see scraps of green. These tiny plantlets are usually hardy and may be plucked out at this point and grown as any other seedlings.) When you have harvested the ripe berries and have them in a jar, fill the jar half full with water, tighten the lid and shake the jar. Repeat the shaking frequently for the next 24 hours. It may also be advantageous to include a drop of liquid detergent in the jar. This agitation and soaking will remove much of the sticky pulp from the seeds. After one day in the jar, the seeds may be dried. Pouring the seeds and liquid into a small mesh sieve, such as a tea strainer, is a simple

method of removing the seed from the jar. Spread them on a sturdy paper towel. After one to two days, depending on the humidity, the seeds should be scraped off and stored. It is important that the seeds be allowed a certain amount of air exchange so that they will not mold or germinate prematurely. Therefore, keep them in a paper envelope—not in plastic. A dry glass is acceptable only if the seeds are completely dry and if the jar is large enough to assure adequate air for the seeds.

SOWING

The seeds are, of course, ready for planting as soon as they are harvested. (Unless you really need thousands of plants all alike, be kind and helpful and send some to the Seed Fund.) But contrary to previous reports you may have seen, the seed of many bromeliads will remain viable for as much as 12 months, although the percentage of viability decreases with age. . The preparation of seed beds for this type of bromeliad is relatively simple. You will need a plastic container with a transparent lid such as a plastic shoe box, refrigerator dish, etc. For a small planting you can use an inexpensive plastic beverage glass such as those used on airlines; the cover can then be a plastic sandwich bag. The bottom of the container must be perforated. A hot nail held by pliers will work. Handier is an electric soldering gun. The planting medium should be a fine-textured commercial houseplant mix. It might be helpful to sterilize the container with a rinse in bleach water and to sterilize the mix by heating in a pressure cooker, oven, or a microwave oven, but our modern spectral fungicides such as Benlate, Benomyl, or Physan will obviate any damping-off problems. Prepare some pure water—rain water or bottled drinking water is recommended and absolutely necessary if your water is as heavy in minerals as ours in southern California. Never use water from a water softener. Add the fungicide as recommended by the manufacturer. Use this water to saturate the soil. Fill the containers about one inch with the moistened mix. Compact it with your fingers to obtain a smooth, firm surface. Spread the seeds on the surface so they are not touching each other. You may want to note the number of seeds so you can later compare it to the number of seedlings. Such information is important for further investigation and experimentation in the field of seed viability. Do not cover the seeds with the mix. A soil covering means certain failure of the seeds to germinate. Place a lid on the container, mark it with the name and date, and set it in a light, warm spot away from the direct rays of the sun. The top of a refrigerator is frequently used for seed germination, since it is warmed by the even heat given off by the refrigerant coils.

GERMINATION AND CARE OF SEEDLINGS

How long will you wait before you see green sprouts? Germination usually occurs in about 14 days. However, if the seed is old, the period may extend to as much as 30 days. Keep a close watch on the seed beds. If they become dry, set them in a pan of pure water until the mix is damp again. Watering from above may shock the tiny organisms and cause the germination to stop. Even after the seedlings are well on their way, overhead watering may be fatal, because the tiny root system of the seedling may be dislodged from the medium.

When the seed shows its first germination, it is usually a single leaf. However, soon another leaf will begin to appear. In a short period of time you will notice the second set of leaves beginning. At this point, the lid or covering on the container may be removed. This action should be done over a period of several days by moving the lid a small amount each day. Gradually removing the lid averts damping-off by allowing the seedlings to become adjusted gradually to the different atmosphere. To provide humidity in the area of the seedlings, if they are being cared for in the house, small containers of wet sand or gravel may be placed in the area of the seedlings.

POTTING UP

When the seedlings have reached one-half inch or more in height and the third set of leaves is in evidence, move them into a larger community container. (In some instances you will find certain aechmea seeds will germinate on an apparent stem with the leaves developing at the top of the stem. In this case the transplanting should be delayed until a tiny root appears at the base of the leaves. Then they may be moved to the community pot with the seedling being placed so the base of the leaves rests on the medium.) Prepare the community pot with the same medium used in the germinating pot. The new container could be a pony pack, a propagation flat, or a similar, shallow pan with good drainage. Pick individual plantlets from the seed bed with a knife tip, tweezers, or some similar instrument and plant them in the new pot so that their leaf tips barely touch. Such close proximity helps to maintain a high humidity around the plants. The root systems may be very small and unable to hold the plants erect. A good aid at this point is plastic toothpicks used to support the wobbly seedlings. Bottom watering is recommended until the plants are quite stable, and misting daily with a spray bottle will keep the medium surface moist and also create humidity. Include a fungicide in the spray if there is any evidence of fungus. Continue using a weak fertilizer solution every two weeks.

When the plants are again crowded—after 6 months or more—they may be transferred into individual pots. If the plants are showing sturdy growth and have a healthy, mature root system along with the hair-like seedling roots, they may be placed in the medium used for mature plants and off-shoots. The size of the pot you use is important at this point. A pot at least 3 inches is recommended, because the medium in the very small pots will dry quickly and may cause some losses. If clay pots are used, it will be necessary to water more often, as the porous texture draws the moisture from the medium causing it to dry quickly. Plastic pots retain moisture much longer.

Each time that the plants are transferred to a new pot, you may expect some losses. Even with good care, the loss amounts to about 10%. Give these casualties a decent burial and devote your attention then to the living.

MATURATION

The smaller aechmeas such as *A. mertensii* or *A. tillandsioides* should reward you with a bloom spike in three years. The larger plants will take a little longer to reach their mature size. When that first inflorescence appears, you will enjoy pride and satisfaction at bringing a bromeliad through its complete cycle—from seed to seed.

Reprinted from the Journal, *27:100-105; 1977.*

From the Tillandsia Man

Peter Johnson

Some time ago Grace Goode wrote to Peter Johnson, our Wellington member, and he sent her a long letter about his tillandsias. She thought his letter so interesting that she asked his permission to have it in the Bulletin, *so here it is.*

Christmas 1970 I did several evening shifts in the Norwood Begonia House (Parks Dept. of the Wellington City Council) and saw *Tillandsia lindenii* in flower and they had two other tillandsias. A large plant of *T. albida* and *T. bergeri.* Also a little orchid species of *Masdevallia.* I was able to get propagations of all three plants. I still have them greatly increased in size and have produced *lindenii* seedlings. My interest was thus directed to tillandsias and orchid species.

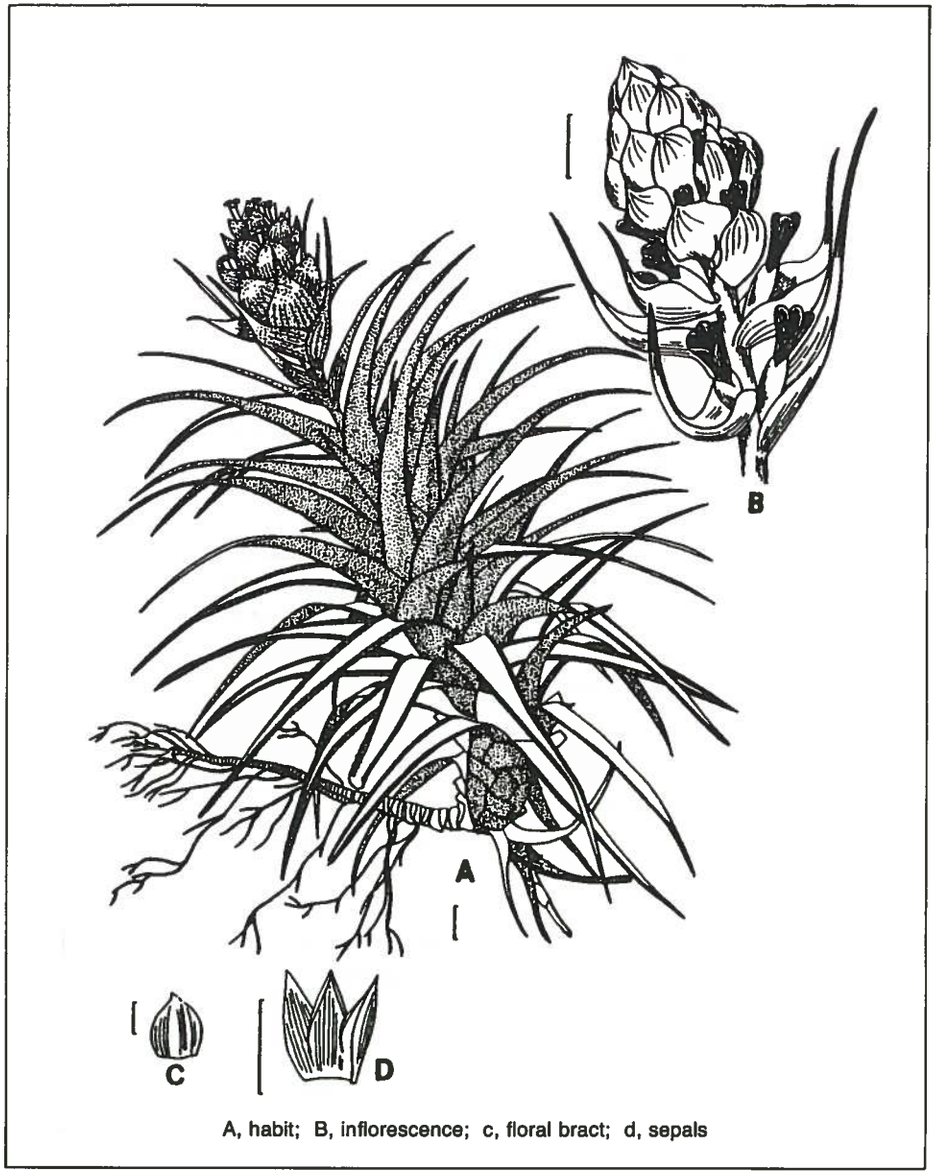
In 1971 I had little success in increasing my collection of either as people here didn't have any and those I spoke to preferred hybrids. A fellow collector imported some wild collected plants from Brazil (A. Seidel) which took several months to arrive, but were still healthy on arrival. He gave me 14 *T. stricta,* which I made into a 4 ft. mobile. With these beaut plants the effect was stunning.

Today, all my stricta are related to those stricta and I have stricta growing out of my ears, in fact, I produced so many from seed and division, I had to advertise in our Bulletin 10 *T. stricta* for $15.00, so people had the chance to produce a 4 ft. mobile like I had, and clear space for my other tillandsias. I still have several hundred left. Before my mobile collapsed several years ago I had 56 spikes on it and it was so crowded that it ceased to produce to its full potential. It was a magnificent sight in or out of flower.

My observations of these 14 *stricta* have shown four variations: *stricta* var. *violacea* (dark leaf), green leaf form, and dark, pale petals with green/silver bracts, or pink/red flower bracts, some flower heads thin and narrow, others branched and round. They all flower late winter/spring. Last spring was early and a very warm, mild August so they flowered a lot earlier and produced better sized spikes than previous years when our weather has not been consistent until Christmas. This year our weather packed up after Christmas and autumn bulbs were flowering in early March. We have still had a lot of good weather though, with plenty of sunshine and warm nights, so growth has been excellent. For a while night temps have been down during March. April has been a lot warmer, good hours of sunlight and only 4-5 degrees between day and high temps.

It is my thought that as you flower an abundance of one species naturally you have obtained that species' growing environment, though *stricta* has a wide distribution, which will produce many variations.

I have gone through the *Journals* back to 1973 and there is quite a lot to be gained regarding *stricta* and its varieties, but as it has been in cultivation a long time it is no doubt taken for granted in the hunt for new and more dynamic plants.



A, habit; B, inflorescence; c, floral bract; d, sepals

Fig. 15. Tillandsia stricta var. *stricta*

Going back now to the early 1970s, my bromeliad interest turned to tillandsias only but it was virtually impossible to obtain them. I was fortunate to get a few from the N.Z. Society, but they were hensteeth, as also were orchid species. Also I moved from Wellington to the Kapiti Coast where I worked in another nursery and built a house in Paraparaumu, which is a much improved climate. I also put up a 16′×8′ glasshouse.

In June 1973 I got several kinds of seed from Albert Schenkel in Germany, with which I had mixed success. *T. geminiflora* flowered in '79, *loliacea* '82, and *gardneri* in '86. *T. geminiflora-gardneri,* I now have 25 plants each, and sold quite a few over the years.

In March 1974 I received my first of many seeds from the U.S. Society and my collection is now made up mostly of my own seedlings, some sowings successful, others not, but this is the fun of it. Nothing's certain and every packet of seed is a challenge. Some, you can see from the outset, will be no good, but I sow them anyway – there may be just one good one. It's a real high reading the seed list every month and getting a few packets of seed.

Today, I don't know how many tillandsias I have or in how many species at the moment. I am replanting 200 *streptophylla* and next I shall be into several hundred *seleriana* all needing spacing out. They are my silent family and I have had many hours of pleasure and relaxation, pottering in my glasshouse.

I grow my seed mostly by the Dr. Oeser method[1] and the terrestrials on fine chopped bark mix in trays. I have no aids in my glasshouse, it is governed totally by the weather and the watering is all done by hand, mist-sprayed from a large fish tank under the bench, as this keeps the water at glasshouse temperature and conditions the water before use.

I have found in the past that with the use of a hose one can get a bit heavy handed, especially in the cooler months and ten years growing could go down the drain because of a little too much water. I find with hand misting I seldom have any losses as one can give more or less water as required. I have grown millions of plants under controlled conditions but find my no-aids glasshouses a real challenge. Also, I find I make more observations of the behaviour of my plants to the changing weather conditions. Some years the growth can be excellent in leaf colour or spike size, other years not quite so good.

I have in past years imported some plants but have found the cost with bringing up a growing family, exchange rates, etc., and there are always some losses, quite expensive, though I read lists I see very desirable I will wait for seed to be available.

I had a great deal of difficulty growing the bulbous tillandsias until the last two years. All they ever seemed to do was to back, whether grown from seed or imported. I never lost any but they would make new growth and basal leaves would go off.

I then decided to attach them pointing down and this made a great difference. I now have a spike on *circinnata*[2] which was very sad for quite some time. I use super glue for all my plantings. It is quick and easy, especially in spacing small seedings. They seem to root very quickly in it.

Since last spring I have put outside two large clumps of *albida, bergeri, pueblensis,* and *latifolia.* They have done very well, growth and colour have been very good. I have not watered them once as the rain we have had has maintained them enough and there has been no algae growth on them. I will have to keep a close eye on them come winter.

Going back to *stricta,* I created an *aëranthos* × *stricta* cross seven years ago. My first one flowered last spring, quite interesting as it is a colorful plant. Foliage similar to *aëranthos* but leaves shorter. Leaf colour either maroon, red, or green, all grown in the same light, and has *stricta* inflorescence, bracts, and petals. I have done a few other hybrids but await them to flower.

Over the years I have tried to establish a seed bank in New Zealand, but without response so am now trying to obtain plants of some I have only stock from one parent, so as to produce more of my own seed for distribution.

EDITOR'S NOTES:

1. *This method is explained in detail in* Bromeliads; a Cultural Handbook:*61-65; 1977. Available from BSI Publications, c/o Annie Navetta, 3236 S.E. Clinton, Portland, Oregon 97202. Price $3.60 postpaid.*
2. *Possibly* T. paucifolia. *See* J. Brom Soc. *32:28-31; 1982 and 39:24-25; 1989.*
3. *The drawing is from Smith & Downs* Tillandsioideae, *fig. 259.*

From Bromeliad Society of New Zealand Bulletin
September 1987 by permission

Mr. Harry E. Luther reviewed Mr. Johnson's letter, suggested the material in footnotes 1 & 2, and offered the following observations:

Tillandsia stricta flowers here (in the northern hemisphere) any time from November to June or July with much variation in foliage color and texture. Generally, the plants are larger and coarser to the south and more green and soft from northern South America.

A few collections, notably from Venezuela, are autogamous and lack pigment in the bracts and flowers. Best of all are large, silver plants from Paraguay. They are the slowest and least prolific here. *T. stricta* cv. Oeser and similar plants, both collected and of hort. origin may be hybrids *(T. stricta* × *T. meridionalis?).*

There are three known varieties:

T. stricta var. *stricta* (typical); *T. stricta* var. *violacea* (dark foliage); and *T. stricta* var. *albifolia* (probably not a variety, seems to be good species related to *T. neglecta).*

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

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. Is there any method of forcing plants such as *Guzmania sanguinea* to produce more than one offset?

A. Yes, but it is rather complicated. Working from the side of the plant that the offset is nearest, you split all the leaves (do not remove) from the outside in to the offset. Spread them apart and using a very sharp knife, remove the offset by cutting in behind it. The offset will usually have some roots if removed properly. After you have removed the offset, dust the cut section of the parent plant with a hormone powder. I use Rootone and find that it works quite well. Place the parent plant where it can be watched to see it is not watered in the center, but watered properly otherwise. I have seen as many as eight more offsets appear on a plant treated in this manner.

The removed offset usually is rather raw appearing and I do not pot it up for several days in order for it to harden off in the air before being potted.

Q. If the center of a plant becomes rotten, is there any chance of saving the plant?

A. First of all, it will depend on how far the rot has progressed. If you can lift out the center and clean out the mess and see good growth, you have a chance.

I'm always reminded of the first *Aechmea orlandiana* 'Ensign' I purchased. First of all, the nursery had removed it much too soon and it was small (Note: not the price, believe me!) and had to struggle. I had the plant for about a month when I reached down and pulled out the entire center. I cleaned it out very thoroughly and carefully dried the center with cotton swabs. I dusted the center with Rootone and kept it dry, but watered the mix and washed the leaves regularly. I placed the plant where there was good humidity and air movement. The plant grew a new center. I have found, on the other hand, that some plants will only throw offsets when treated in this manner.

Q. I like to see a pot full of plants. Is it necessary to remove the offsets from bromeliads?

A. My attitude is that this is a question of personal preference. If you prefer a large clump of flowering plants, then you may leave the offsets and remove only the old growth. You will note that not all the offsets mature and produce inflorescences at the same time. The mother plants may also crowd the offsets and cause them to be smaller or misshapen.

If, however, you decide that you want to grow a single plant, then it should be removed as soon as it reaches one-third to one-half the size of the mature plant and is showing mature characteristics. If the offset is left on the parent plant longer than this, it may become deformed—particularly neoregelias and nidulariums—and foliage color may not be uniform.

When removing offsets, the strongest ones should be removed first and as soon as possible, leaving the weaker ones to receive more nourishment and strength from the parent plant before being removed.

Q. Does removing the inflorescence before flowering encourage the production of more offsets?

A. There is controversy about this question. I have visited a nursery that removed every inflorescence as soon as possible on the theory that the plants produced more offsets. My own experience has led me to believe that any difference would be minimal, if the plants are properly taken care of.

How many offsets does one want? I have removed as many as 15 from an *Aechmea fasciata,* eight and more from different neoreglias, and at least ten from vrieseas. I agree that some plants do not produce this number of offsets, but when I removed the inflorescence before flowering, I did not get any increase of offsets on those plants, and did not get to enjoy the flowering, either.

Q. What does stoloniferous mean?

A. The plant propagates by means of offsets at the end of runners or stolons that will bend toward the growing surface and take root or attach by roots to whatever is available (see figure 11).

Q. Can bromeliads be grown hydroponically?

A. Yes—at least some of them will grow under these conditions. I have grown ananas, aechmeas, neoregelias, orthophytums, and even *Tillandsia viridiflora* var. *variegata* sitting in water. I have one *Neomea* that is in its fifth generation of being grown in water. The only decent looking variegated ananas I have ever grown spent its life sitting in the fish pond.

Q. What is binomial nomenclature?

A. Webster's Dictionary says: "The scientific system of giving a double name to each plant and animal, consisting of the name of the genus followed by that of the species." For example: *Ananas sativus* (pineapple).

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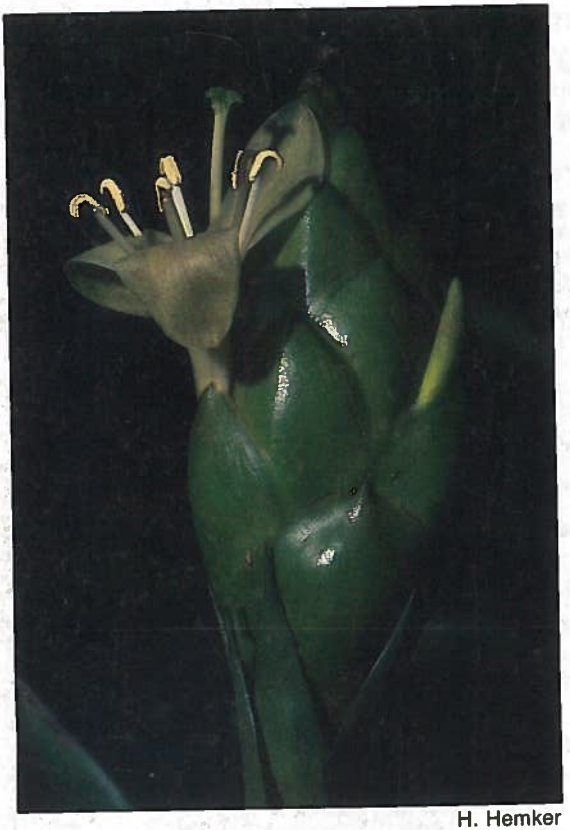
The Bromeliad Society, Inc.

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

Calendar of Shows *(continued from back cover)*

6-9 May	Bromeliad Society of Broward County 4th Annual Standard Show, "A Rainbow of Color" and Sale. Deicke Auditorium, Plantation, FL. Entries received Friday, 5 May, 8 a.m. to noon. Polly Pascal (305) 962-0018, John Laroche (305) 962-6838.
2-3 June	Baton Rouge Bromeliad Society 14th Annual Show and Sale. Baton Rouge Garden Center, 7950 Independence Blvd., Baton Rouge, LA. Saturday, 1:00 -6:00 p.m.; Sunday, 9:00 - 5:00 p.m. Michael Young (504) 355-5408.



H. Hemker

Guzmania mucronata (Grisebach) Mez, 1896, an unusual *Guzmania* with very large (for a guzmania), broad, spreading petal blades, is widespread in the coastal mountains of Venezuela. This species displays a flowering syndrome similar to the secund group of vrieseas: nocturnal flowers with large, durable, odd-smelling flowers that are widely attractive to and possibly pollinated by bats. No other species of *Guzmania* is known to me is at all similar in its floral display. The inflorescence of this specimen is about 10 cm long. This species was distributed to judges at the Sarasota (Florida) Bromeliad Show several years ago as - *Guzmania* sp. Venezuela.
—Harry E. Luther

Calendar of Shows

17-19 March 1989	Bromeliad Society of Greater Mobile 12th Annual Show and Sale. Fountain in Springdale Mall, Airport Blvd., Mobile, Alabama. Friday, 1:00 p.m. to 9:00 p.m.; Saturday, 10:00 a.m. to 9:00 p.m.; Sunday, 10:00 a.m. to 8:00 p.m. Mary Thompson (205) 626-7210.
18-19 March 1989	Tarrent County Bromeliad Society 12th Annual Spring Show and Sale. Fort Worth Botanic Garden Center, 3220 Botanic Garden Drive, North Fort Worth, Texas. Saturday, 9 a.m. to 6 p.m.; Sunday, 1 p.m. to 5:30 p.m. Free admission. Bobbie French (817) 594-4813. Donna Poe (817) 292-2281.
24-27 March 1989	The Bromeliad Society of Victoria, Inc. "Conference 89." Townhouse Hotel, Melbourne. Competitive displays, speakers, tours, discussion groups. Maurice J. Kellett, P.O. Box 115, Hurstbridge, Victoria 3099, Australia. (03) 718-2887.
29-30 April	La Ballona Valley Bromeliad Society's annual show and sale. Veterans Memorial Auditorium, 4117 Overland Ave. at Culver Blvd., Culver City, CA. Saturday, noon to 4:30 p.m.; Sunday, 10:00 a.m. to 4:00 p.m.; Potting demonstration both days at 2:00 p.m. Admission is free. Charlyne J. Stewart (213) 391-4118.
5-7 May	Bromeliad Society of Houston, Inc. 21st Annual Show and Sale. Houston Garden Center, Hermann Park, 15 Hermann Ave., Houston, Texas. Show hours: Saturday, 2 p.m. to 6 p.m.; Sunday, 11 a.m. to 4 p.m. Sale hours: Friday noon to 7 p.m.; Saturday, 10 a.m. to 6 p.m.; Sunday, 11 a.m. to 4 p.m. Jim Mayfield (713) 524-2797.

[continued inside back cover]