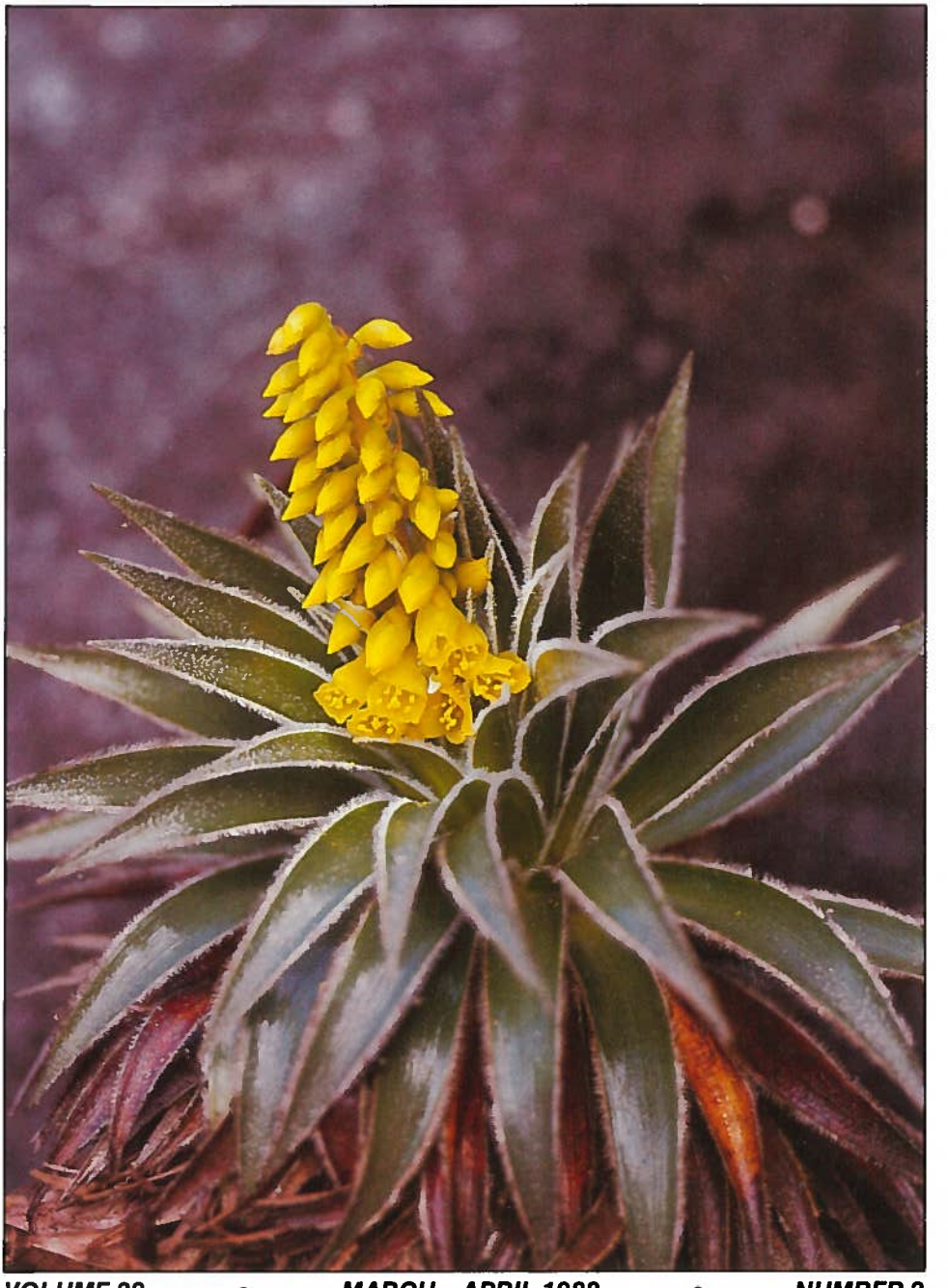
Journal of The Bromeliad Society



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Cover photographs. Front: *Lindmania holstii*, showing the yellow, secund flowers and white, hairy-margined leaves. This new species described by Drs. J.A. Steyermark and L.B. Smith on pages 51–53 was collected by Bruce F. Holst in the Venezuelan Guayana. Photograph by B.F. Holst. Back: *Aechmea* ×Foster's Favorite is shown in bloom. M.B. Foster's description and a photograph of his painting of his hybrid appear on pages 55–57. Photograph by Marcel Lecoufle.

CONTENTS

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Lindmania holstii, A New Species from the Venezuelan Guayana

Julian A. Steyermark[1] and Lyman B. Smith[2]

Lindmania holstii Steyermark & L.B. Smith, sp. nov. TYPE: Venezuela. Estado Bolívar: Distrito Piar, Murisipán-tepui, summit 5°53′N, 62°3′W, 2,300 m, 22 Mar. 1987, *Bruce K. Holst & F. Oliva Esteva 3539* (holotype, MO; isotypes, F, NY, US, VEN).

Breviter caulescens, florigera 10–15 cm alta leviter curvata ascendens. Folia densissime rosulata ad 7.5 cm longa, squamis minutissimis orbicularibus; vaginis suborbicularibus semilunatis basi 22 mm latis 9–12 mm longis; laminis anguste lanceolatis vel vetustioribus ligulato-lanceolatis 4.5–7.5 cm longis basim versus 10–13 mm latis, basim versus minute serrulatis aliter glabris, supra primo trichomis albidis onustis, marginibus trichomas conspicuis patentibus albidis 1 mm longis densissime vestitis. Scapus rectus 1.5–3 cm longus glaber, scapi bracteis rigidis erectis dense imbricatis subfoliaceis lineari-lanceolatis 1.5–3 cm longis 2–5 mm latis marginibus trichomis albidis densissime vestitis quam internodiis multo longioribus. Inflorescentia racemosa, 4–7 cm longa 2–2.5 cm lata multiflora secundifloraque; bracteis florigeris lineari-lanceolatis 6–12 mm long. 1.5 mm latis supra medium marginibus albido-lanuginoso-ciliatis aliter glabris quam eis scapi brevioribus; pedicellos inferiores superantibus; pedicellis curvatis secundis 4–5 mm longis 2 mm latis superne paullo clavatis glabris; sepalis convolutis ovatis rotundatis 5 mm longis 3–3.5 mm latis; petalis luteis 10–12 mm longis unguiculatis, laminis suborbicularibus rotundatis 6–7 mm longis 7–8 mm latis; antheris ovato-oblongis apiculatis 2 mm longis; ovario supero; ovulis extremitatibus paullo appendiculatis.

Lithophytic herbacious caulescent plant, flowering to 10–15 cm high, densely rosulate, forming a leafy cluster 10–15 cm across. Leaves coriaceous, highly lustrous above, olive green both surfaces, white basally, scales on leaf surface minute, orbicular; sheaths suborbicular, semi-lunate, 22 mm wide at base, 12 mm high. Lamina lanceolate or on older leaves ligulate-lanceolate, pungently long acuminate at apex, 4.5–7.5 cm long, 10–13 mm wide in basal ¼, 5–9 mm wide above the middle, the basal 5–6 mm minutely serrulate with teeth 0.5–1 mm long, elsewhere entire, uppermost leaves with upper surface sparsely pubescent with white trichomes, these disappearing in age on older leaves, margins with an indument of dense, conspicuous, spreading white trichomes 1 mm long. Scape erect 1.5–3 cm long, 2–5 mm wide, glabrous, densely bracteate, the bracts erect, rigid, imbricate, subfoliaceous, linear-lanceolate, 1.5–3 cm long, 2–5 mm wide, much exceeding the internodes, the margins with dense, white trichomes. Inflorescence

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[2] United States National Herbarium, Smithsonian Institution, Washington, D.C. 20560.

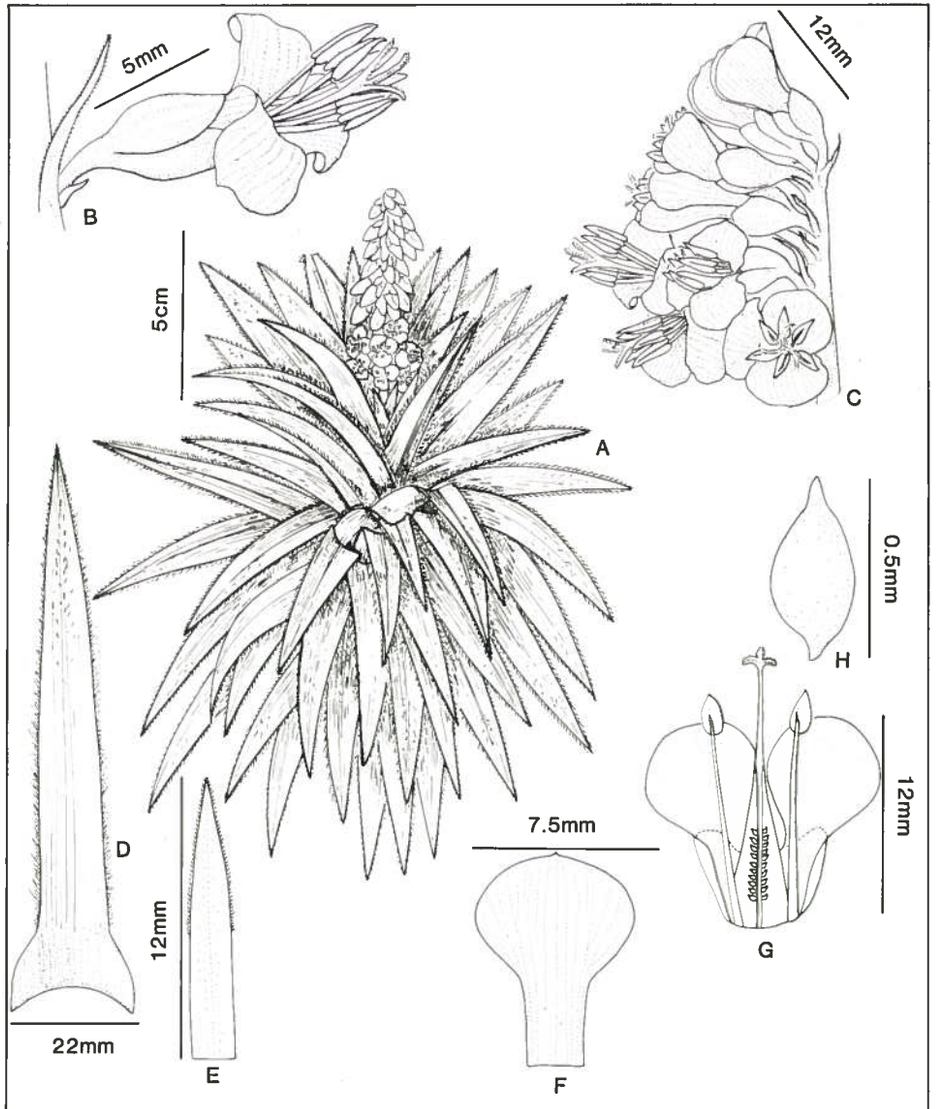
B.F. Holst

Fig. 1. Lindmania holstii habitat on sandstone.

racemose, densely many- and secund-flowered, 4–7 cm long, 2–2.5 cm broad; floral bracts linear-lanceolate, 6–12 mm long, 1.5 mm wide, white lanuginose-ciliate, elsewhere glabrous, shorter than those of the scape, exceeding the lower pedicels. Pedicels curved, 4–5 mm long, 2 mm wide, slightly clavate above, glabrous. Sepals yellow green, fleshy, convolute with the left margin overlapping the right margin of the one adjacent, ovate, rounded, 5 mm long, 3–3.5 mm wide. Petals yellow, 10—12 mm long, unguiculate, free, the claw 4–5 mm long, 3 mm wide, the lamina suborbicular, rounded, 6–7 mm long, 7–8 mm wide at the middle. Stamens exserted; anthers versatile, dorsifixed, ovate-oblong, 2 mm long, apiculate; filaments 9.5 mm long, flat, glabrous. Ovary lance-cylindric, 6 mm long, 3 mm wide basally; style 7 mm long; ovules elliptic-oblong, appendiculate at both ends.

Paratypes. Venezuela. Estado Bolívar: Distrito Piar, Aparamán-tepui, 5°54′N, 62°7′W, 2,100 m, *Holst 3711* (MO, VEN); Murisipán-tepui, 2,400–2,500 m, 25–26 Mar. 1987, *Delascio 13060* (MO, VEN); Kamarkaibaray-tepui, 2,400–2,500 m, 25–26 Mar. 1987, *Delascio 13139* (MO, VEN).

This distinctive species is well marked by the secund, densely-flowered inflorescence with yellow petals and by the short leaves with margins densely white-ciliate. It occurs commonly in crevices and on ledges of the sandstone summits of the table mountains, sometimes known as Los Testigos, lying between Ptari-tepui and Auyan-tepui. The most closely related taxon to this species is apparently *Lindmania aurea* L.B. Smith, Steyermark & Robinson of Chimantá Massif. From



A. Habit of plant; B. Flower with bract; C. Upper portion of inflorescence, showing secund habit; D. Single leaf; E. Floral bract; F. Petal; G. Detail of portion of flower, with longitudinal section through ovary; H. Ovule.

drawing by John Myers

Fig. 2. Lindmania holstii

this and other species of the genus, it differs in the secund, densely flowered inflorescence with short pedicels, and the densely white-ciliate leaf margins.

The senior author wishes to express his great appreciation to Armando and Fabian Michelangeli of the Terramar Foundation for helicopter support which made possible the discovery this species.

BOOK REVIEW

Bromeliaceaes of Venezuela; Native and Cultivated, by Francisco Oliva-Esteva and Julian A. Steyermark. Caracas, Venezuela: E. Armitano, 1987. 397 pages, extensively illustrated in color, black and white drawings, maps; bibliography, index; 27 × 24 cm. $49.00 plus $7.00 handling and postage. Available from Mrs. Cindy Andrews, 159A Grant Street, Framingham, MA 01701.

Sr. Oliva's earlier book, *Garden Plants of the Tropics* (Venezuela), was reviewed in the November-December 1987 *Journal.* Dr. Steyermark contributed the introduction to that work. In this new book, they are collaborators. They are both well known: Dr. Steyermark as director of the Missouri Botanical Garden and eminent collector and researcher of bromeliads, Sr. Oliva as a prominent landscape architect and bromeliad explorer.

The book begins with a description of the area of the Venezuelan Amazonian region called Guayana, the "Lost World," and lists briefly the genera peculiar to the area. Next is a history of the Bromeliaceae, also brief and somewhat cursory. The body of the book (355 pages) contains easily understandable plant descriptions arranged alphabetically under subfamily by genera. With each description the authors name the discoverers or collectors, give dates and derivations of names, and sometimes include excellent black and white drawings to emphasize details. The plant photographs, most of them by the authors, are particularly valuable since they show not only the plant characteristics but in many cases the habitats. The sight of a dozen *Tillandsia fendleri* inflorescences standing above the canopy of a forest tree is exciting. The short descriptions are easy to read, and there is a lavish quantity of color pictures and other illustrations.

The descriptions of native bromeliads and of numerous others imported from Central America as well as other countries of South America are mingled. No explanation is given why these imports were included when the native population is so large.

With this book we can begin to see and understand the Lost World with its table mountains called variously "tepuy, jidi, cerro, meseta." The *Journal* has published several articles about this region, but none has shown as clearly the topography and the bromeliads of the region. For example, there is a Landsat infrared photograph converted by Sr. Oliva into a black and white outline map and also into an oblique-angle drawing of the same area. There are many large photographs of the region emphasizing many of these mountains. These illustrations explain clearly why some were never investigated before the helicopter made their exploration possible. They also let us begin to understand why some species are found only on one of these mountains and nowhere else.

[continued on page 79]

The First Patented Bromeliad in America

Racine Foster

This report about a bromeliad deviates from a collecting or growing standpoint. This is an invented plant as they call it in the United States Patent Office. It is presented, mainly, for those who did not read the original announcement in the *Bromeliad Bulletin* Vol. V, March-April, 1955, No. 2.

In 1945 Mulford Foster made a hybrid between his new species *Aechmea racinae* and *A. victoriana* var. *discolor* which resulted in the hybrid called *A.* ×Foster's Favorite. It was such a beautiful plant that Mulford wanted to take out a patent on it. Later, there was a cryptanthus or two patented, but at the time, in 1948, this was the only aechmea to be patented, and as far as we know it was the first bromeliad to be patented. The patent was filed Sept. 17, 1948 and was granted over a year later on Nov. 15, 1949. In the Patent Office it is known as Plant Patent #898 with a serial number 49,777.

The process of obtaining a plant patent was no simple, easy affair. First, you had to locate, in Washington, D.C., the proper ornamental plant agent. For instance, you could not use an agent who handled patents on potatoes. After much correspondence to various patent lawyers, we settled on one, Mr. Orville M. Kile. That meant the initial trip to Washington and an agreement to pay him something like $750.00 for his work. (The total cost of this patent was over $1,000.00). Back home we had to write up the claim in the prescribed form: in two columns, in a certain style; in reviewing the invention Mulford had to close with his claim that this plant was a novelty, or new.

It took us a long time to arrive at the form of language demanded. Also, a true-to-life painting had to accompany the application. Thank goodness we didn't have to hire an artist to do this as Mulford was quite capable of making his own painting.

What follows are quotations from the patent description:

"My present invention relates to a new and distinct variety of hybrid Aechmea plant. It was originated by me through the process of cross pollination of two new species of Aechmeas discovered by me in the jungles of Brazil. One of these parent plants is now known botanically as *Aechmea racinae* and the other as *Aechmea victoriana* (var. *discolor)* both named and published subsequent to my discovery of them.

"I have reproduced asexually in my greenhouse in Orlando, Florida, considerable quantities of this new hybrid and its characteristics are definitely fixed.

Fig. 3.
Aechmea × Foster's Favorite from M.B. Foster's painting prepared to accompany his patent application.

"My new variety is distinctly and outstandingly different from any Aechmea known or described, especially with respect to its leaf coloring and the formation of its inflorescence. It differs from both its parents in color and leaf shape as well as in its inflorescence.

"The accompanying illustration [fig. 3, above] shows the form and coloring of the leaves of my new variety in natural tints although it gives only a faint idea of the glossy, almost varnished appearance that the leaves of this plant produce. When young, the plant is often nearly all green but changes to its richness in color as it matures, often retaining one or more basal leaves of green.

"This new hybrid *Aechmea* more nearly resembles in form and color one of its parents, the *Aechmea victoriana*. However, it is much more vigorous in

growth and larger in size, and the most outstandingly distinguishing character is the rich coloring of the leaves. These leaf colorings according to the (British) Horticultural Colour Chart are shown as follows:

"Small basal leaves are Fern Green No. 0862. The few succeeding leaves: Currant Red No. 821 with shots of Fern Green near tips of leaves. Balance of leaves: Currant Red No. 821 with shots of Spanish Orange No. 010 and Burnt Orange No. 014.

"These basic colors vary in tones and hues according to the light exposure in which the plants have been grown.

"When this new hybrid is about two years old and after it has developed a flower spike, one or more new offshoots will be produced at the base of the plant as shown in the accompanying illustration. This is the only means of asexual propagation of this plant; being a hybrid it does not reproduce itself from its own seed.

"Having thus disclosed my invention, I claim:

"The new and distinct hybrid Aechmea plant as herein shown and described, characterized as to novelty by the distinctive glossy sheen and unusual red coloring of the leaves with this color equally brilliant on both sides of the leaves; its strong resistance to scale or other insect infestations; and its ability to thrive with a minimum of watering as it retains in its leaf cups from only occasional waterings."

Mulford B. Foster
Orlando, Florida

Anne Collings of Fort Myers, FL, the **New England Bromeliad Society,** and the **Hawaii Bromeliad Society** have contributed most generously to the *Journal* color processing fund. We are grateful for their support.

A RESEARCH ASSISTANTSHIP IS AVAILABLE for work on the bromeliads at Washington State University, Pullman, WA. The assistantship is designed to support the student's graduate program of study. For more information write to Dr. A.J. Gilmartin, Department of Botany, Washington State University, Pullman, WA 99164-4230. Apply immediately to Botany Department by asking for application materials from Linda Kibler, Botany, WSU, Pullman, WA 99164-4230. Phone 509-335-3066.

Experiments with Water Supply

Dottie Oishi

I've been experimenting with acidifying our water supply. There have been some very interesting findings and enough testing to confuse totally a non-chemist like me. The article, "Water and Good Growing" by C.A. Wiley [please see pages 59–65] intrigued me to the extent that I bought a Wardley's Senior Deluxe pH Test Kit for Aquarium Water and set up my lab. That's a lot funnier than you know.

My lab consisted of a cafeteria tray (very clean) balanced on several pots over, in, and around my potting mix. I have a lab coat, but the temperature and humidity in the greenhouse warranted halter and shorts instead. Not the best of conditions, just interesting and fun.

I experimented as follows:

	pH
Took 1.0 gallon unsoftened city water	7.4
Added ¼ tsp. white distilled vinegar (5%)	6.8
Added another ¼ tsp. of same	6.5
Then took 1.0 gallon rain water	7.3
Added ¼ tsp. white vinegar	6.8
Added another ¼ tsp. of same	6.5
Added 1 tsp. Ferti-lome African Violet fertilizer (low salt)	7.3!

Note the jump in alkalinity. It took 2¼ more tsp. of vinegar to get the pH down to 7.0, or neutral.

A similar test with different fertilizers proved worthwhile. The African violet fertilizer was rated at 12-36-14 and I liked the low nitrogen but not the alkalinity. Peter's 20-20-20 alone made the water acid. Hyponex 7-6-19 did likewise.

Get and read a copy of Mr. Wiley's article. Believe me it took several readings, but now I'm fairly certain that a lot of my feedings have been in vain. If the soil becomes the same pH as the water it receives, then mine is alkaline. Bromeliads cannot assimilate their nutrients under those conditions. Although they look really good to me, I'm wondering how much better they would look if they could use all the goodies I give them.

Okay. Another fun, but very smelly, test I made was to work on the "banana peel deal." I've long since forgotten where I read that chopped, ripe banana peel in vase-type bromeliads are beneficial. After a couple of years of testing, I've seen no damage to the cups. Not knowing what the peel could yield, I took two very

ripe bananas and made my preteen son eat them so I could have the peels. I chopped them and put the pieces in a gallon container filled with rain water. After two weeks, the smell resembled that of rotted neoregelia blooms and then some. If they could smell any worse, I don't know how! But the pH turned out to be a whopping 6.3. So banana peel is a natural acidifier?

If you would like to do a little recycling of banana peels, here's the easiest way I've found to handle them. Split the ripe peel into ¼ – ½-inch wide strips, then chop or slice pieces about the same size in length, and let them dry. They are then easy to drop into the cups of your bromeliads. By the way, I didn't notice any discoloration of the leaves from the peels.

Palm Bay, Florida

Reprinted from Bulletin, *Bromeliad Society of Central Florida; August 1978*

[1 U.S. gallon=3.8 liters; 1 teaspoon=0.45 gram (approximate metric equivalents)]

Water and Good Growing

C.A. Wiley

[Mr. Wiley was president of the Bromeliad Society, Inc. from 1969 through 1971. One of his instructive and thought-provoking articles for the Journal *is reprinted here for the benefit of new members and others who might like to review this basic subject.* – Ed.]

One of the most important elements in growing bromeliads is water. Most of us have been growing plants without worrying about water. Why worry about it now? I answer this question by saying, "I want to grow some of the problem plants and not have them die for me, I want my plants to mature without brown tips on the leaves, and I don't like the accumulation of salts around the base of the plants." These are the kinds of problems associated with high concentration of dissolved salts in the water.

When you decide to do something about watering, if you have a poor quality water, you can expect a definite improvement in growth, and this can be accomplished by a modest commitment on your part to spend a little more time when watering and a maximum of $5.00 for equipment. Beyond this a number of incremental improvements in growth may be achieved, limited only by your pocketbook and determination. Remember, good growing is good watering.

RULES FOR WATERING

The first rule is "never sprinkle." When you water, do a lot of it. Flood your bromeliads completely. Once a month, or even more frequently in the summer, after you finish watering all of your plants, go back in a half hour and do it again.

The second rule is "acidify your water." To understand this, it is necessary to know about acidity, alkalinity, and the pH scale. A pH of 7.0 is neutral, pH above 7.0 is alkaline, and one below 7.0 is acid. For a change of one point in the pH scale the acidity or alkalinity changes by tenfold: i.e. pH 6.0 is ten times more acid than pH 7.0, and pH 5.0 is one hundred times more acid then pH 7.0.

ACIDIFY YOUR WATER

For diagnostic purposes, the pH value of the water is just as important to the grower as a blood analysis is to a doctor. A pH test kit may be purchased at any aquarium store where they sell tropical fish and tanks for use in the home. Such a test kit should be used to check the water you put in your plants after it is acidified. The easiest way to acidify water is to use a proportioner which injects a small amount of acid into the main water stream as you do your watering. A number of proportioners are available on the market. The method of use is the same in each instance. The acid solution is put in a container and a plastic tube from the proportioner brings the solution up for injection. One ounce dry measure of citric acid is sufficient in most instances to reduce the pH for 100 gal. of water by one point. One of the proportioners on the market is set for a ratio of 128 to 1. In this instance, dissolve one ounce of citric acid in one gallon of water and turn on the hose. Another one of the inexpensive and reliable proportioners has a ratio of 16 to 1. In this instance, dissolve one ounce of citric acid in one quart of water to prepare a stock solution. Four ounces of this stock solution in one gallon of water will be the amount for this proportioner. In those instances where smaller quantities of water are needed, ¼ oz. of the above stock solution can be added to one gallon of water for direct use. In all instances, check the pH of the acidified water before you put it on your plants. The quantity of citric acid may be adjusted until the pH comes within the range of 6.5 to 5.5.

Most water in the United States delivered to homes through the usual water mains has a pH above 7.0. This may be true even where the natural supply is acid, because the water company can save a considerable amount of money as a result of reduced pipe line replacement when they add calcium to the water to make it alkaline. The best way in any event is to call your local water company and ask for an analysis. When you receive this analysis, in addition to a pH value, you will find a list of elements and compounds in solution, together with a figure representing the total of dissolved solids in parts per million.

THE BENEFIT FROM USE OF ACIDIFIED WATER

The principal benefit from the use of acidified water is making nutrients available. For terrestrial bromeliads the pH value of the growing medium determines the availability of nutrients.

Nitrogen, an important nutrient element, is adequately available to plants within a pH range of 6.0 to 8.0.

Phosphorus, one of the mineral elements, is needed in large amounts at least equal to the quantity of nitrogen. This is the nutrient for new growth, root development, and formation of seed. It is available only within a pH range of 6.5 and 7.5. At a pH below 6.0 the plant tends to grow leggy and weak, even with adequate light.

Potassium is the nutrient necessary for flower production, and to build resistance to disease and cold. A pH of 5.5 is about the limit on the acid side for plants to assimilate potassium in adequate quantities.

Sulfur and *calcium* are essential elements for plant growth. Calcium is needed for cell wall and membrane construction. Sulfur is needed as one of the major components of some amino acids making up most proteins. These elements are available over a pH range of 6.0 to 8.0.

Magnesium and *iron* are instrumental in the formation of plant fiber. Magnesium is a structural component of the chlorophyll molecule, and is available in adequate quantities within a pH range of 6.0 to 8.5. Iron is not available in adequate quantities except in an extreme acid conditions at a pH of 6.0 and lower.

Manganese, boron, copper and *zinc* are essential trace elements present in most commercial fertilizers. They all require a pH of 6.5 or lower for assimilation.

POTTING MIX VS. WATERING PROCEDURES

The potting mix will eventually have a pH the same as the water used. Each of the elements needed for nourishment by your bromeliads becomes unavailable outside of the listed pH values, being taken up and locked in by the organic material in the potting mix.

The various components of the potting mix and their proportions are less important than the watering procedure. If the mix won't hold moisture, it may be necessary to water every day; on the other hand, an over-potted bromeliad with a heavy mix may not do well if it is watered more often than every 10 days to two weeks.

TROPICAL RAINFOREST CONDITIONS

We can improve our growing conditions if we understand conditions in the tropical rainforest. These can be summarized as follows:

1. Warm humid conditions promote rapid decomposition of debris.
2. Required nutrients are available from the decomposition of debris.
3. First rains wash a rich nutrient over all plants.
4. During the growing season it rains about every day.

5. Nitrates are exhausted first; phosphorus and potassium are the principal elements of nutrition at the end of the growing period and on into the dry season.
6. Dry season promotes dormancy.
7. Wet, shady situations tend to become acid.
8. Dry, desert situations tend to become alkaline.

LIFE CYCLE OF TANK TYPE BROMELIADS

In epiphytic bromeliads, the pH of the water in the tanks will change from time to time. These changes can be followed with a pH meter and may be of value in the determination of selective nutrient uptake at each life cycle phase. It is important that measurements be made the same time each day. Respiration will result in a change of CO_2 concentration, and consequently pH values. It is also important to use pure water in preparation for tests of this type. Build-up of calcium and magnesium from most tap water will completely mask any meaningful pH change. Another complicating conditions which should be avoided for testing purpose is the possible introduction of organic debris and its decomposition, which will make the water more acid.

1. *Seeding Phase:* The demands of new growth and root structure exhaust the acid element of the nutrient supply much more rapidly than the other elements. The three principal fertilizer elements might be proportioned in the ratio: 1-4-2 (nitrogen, phosphorus, potassium). This ratio will insure an adequate acid balance. At this phase, however, the tanks are hardly large enough to hold sufficient water for a pH test.

2. *Juvenile Phase:* In their native habitat, most tank broms at this phase have their tanks fairly well developed. Changes in the pH of the water can be followed very easily. Vegetative growth is accelerating. All of the nutrient elements, on the average over the yearly cycle, are required at about the same rate. At the end of the growing period each year, nitrogen is at its lowest ebb. At the beginning of the following year's growing period, however, nitrogen is again available to the plants in relatively large amounts. Normally, the pH of water in the bromeliad tanks during this phase is relatively stable. In their native habitat, this is assured by heavy and frequent rains during the growing period, and a minimum amount of nutrients in the tanks at the beginning of the dry season.

3. *Maturity Phase:* This is the phase that starts when vegetative growth is complete and potassium is then taken up in increasing amounts. This is the phase crucial to success of the bloom. As potassium is being taken up by the plant, phosphorous is left in solution and the pH becomes increasingly acid.

4. *Flower Production Phase:* This is the pay-off for everything that has gone before. Healthy stock with a proven superior inflorescence may fail to throw a good inflorescence if the preferred proportions and quantities of nutrients fell short of requirements during any of the previous phases. Very little if any nutrient is required or taken up during the flower production phase; therefore, pH tests will hold fairly constant between 6.0 and 7.0. Potassium stored in the leaves will flow into the inflorescence. After the final stage of flowering, phosphorus will again be taken up in an amount about twice as much as any other nutrient.

5. *Seed Production Phase:* Nothing much will happen unless pollination took place. Nothing much will happen even if good pollination took place unless sufficient phosphorus-rich nutrition is still available in the leaves. Most tank type bromeliads take up to a full year to mature their seed. The drain of stored nutrients necessary to mature a viable seed crop is such that production of vegetative juvenile growth is seriously hampered. The drain of potassium during flower production, followed by the drain of phosphorus for seed production, will completely exhaust many of the less vigorous bromeliads.

All dry-growing tillandsias, and most other epiphytic bromeliads have a very low metabolism level. In their native habitat, nutrient levels are usually much less than 50 parts per million. This means something less than 10% of the amount usually recommended on the package of commercial fertilizers. To exceed this amount may possibly cause conditions which inhibit the plant's ability to take up a specific element when needed. Failure of an inflorescence or a viable seed crop is not necessarily an indication of insufficient phosphorus or potassium, but possibly an excessive quantity of nitrogen.

The one most important element for further consideration is, "What is the effect on the outlined changes if tap water is substituted for pure water?"

1. *Changes in pH:* With pure water, the most drastic change in pH is during the maturity phase when potassium is taken up, and the water in the tanks goes from acid to more acid. With tap water, concentrations of calcium and magnesium may completely submerge these effects and all tests are alkaline.

2. *Changes in Nutrient Element Concentration:* Further research is necessary in this area; however, a number of phenomena relating to these problems are understood. These are principally associated with the ability of the plant to take up required nutrient elements. Some of the components of tap water may tend to inhibit a plant's ability to take up a particular required nutrient. One such situation is the taking up of sodium with or in preference to potassium under certain conditions.

Many problems associated with the use of alkaline tap water may be minimized by acidifying it before use.

Changing nutrient requirements from phase to phase during the life cycle of tank bromeliads points up the necessity of making changes in your feeding program. It becomes obvious that a feeding program is a must if you want prime quality plants. When your plants are actively growing, feed them with a balanced mix. When your plants being to terminate vegetative growth, feed with a low nitrogen, high potassium mix. When your plants tend to become dormant, reduce quantity and frequency of feeding.

Your feeding program should be designed giving due consideration to conditions as they exist in the bromeliad's native habitat. These conditions are: nutrient supply is very dilute and the bromeliad metabolism is very low.

Rainwater is the quality standard for good water. It has a normal characteristic pH of slightly acid, i.e. about 6.8. Usually some complex nitrates are held in solution in an amount between one and ten or twelve parts per million. This is not much, but without it, plants would not look so lush and green soon after the first good soaking rain. That is the kind of water bromeliads like. However, if it were not for the fact that most of them can survive with a poor quality water, very few of us would have any bromeliads. The water supply in many areas, in addition to being alkaline, is also degraded by high concentrations of dissolved salts. The limits of concentration for most bromeliads are:

1. Total concentration of salts less than 350 parts per million.
2. Percentage of sodium less than 30 parts per million.
3. Boron less than 0.5 parts per million.
4. Chlorides less than 5.5 parts per million.
5. Sulfates less than 5.6 parts per million.

Many of the high elevation bromeliads find even this concentration of salts intolerable. On the other hand, many bromeliads in cultivation have adapted and are able to tolerate concentrations in excess of the limits listed here. The full potential of many bromeliads can not be realized, however, unless total dissolved salts in the water supply is less than 50 parts per million.

A tolerance for higher concentrations means growing and flowering, but usually marked by less than optimum growth, conformation, and color.

Comparison of a water analysis from the water company with the above listed limits for bromeliads should be made. If your water supply falls short of these limits, you may be limited to growing the more robust, easy-to-grow bromeliads, or you may want to purify your water supply.

The most practical method for purification is reverse osmosis. Systems are available from five gallons of pure water a day, on up to any required amount. The cost ranges from 2 or 3 cents a gallon on down to a few tenths of one cent,

dependent on the quantity of water required. Reverse osmosis for the purification of water is a process based on the characteristics of certain materials which under pressure will allow water molecules to pass, but will reject molecules larger than that of water. Molecules of dissolved salts on the average range somewhat larger, and as a result about 90% of dissolved salts are eliminated. In most instances then, the pure water from reverse osmosis approaches the quality of rain water.

The importance of pure water can be appreciated if one considers what happens to water in the tanks of bromeliads as evaporation takes place. When half of the water evaporates, the concentration of dissolved salts doubles. When ten percent of the water is left, the concentration has become ten times the original amount. If the water supply has a dissolved salt content of 300 to 400 parts per million, evaporation will bring the concentration up to the point where the salts will come out of solution and crystalize on the base of the plant.

High humidity will slow down evaporation. Pure water will not build up to a high salt concentration between waterings, and heavy watering to entirely flush the plant tanks will help to insure achieving the full potential of your bromeliads.

Palos Verdes Estates, California
[Reprinted from Journal *26:59-65; 1976]*

We are sorry to report that **DR. THOMAS J. MONTGOMERY, JR.** died on 23 January 1988. He had been in poor health for a long time. Tom was a director from the Texas Region, and chairman of the Awarded Cultivars and World Conference committees. He was a frequent contributor to the *Journal* in addition to conducting "Questions and Answers" for the past two years with Bob Heer. His gracious personality and his ability to communicate his keen observations about bromeliad culture will be greatly missed. We offer our sympathy to his wife Pat and to their family. – TUL

ELOISE BEACH, well known lecturer and grower of prize-winning bromeliads, will be in charge of "Questions and Answers" beginning with the May-June issue. We welcome her decision to assume this job.

WALTER RICHTER, honorary trustee, author of *Bromeliads* and *Houseplants of Today and Tomorrow* and, in the past, a frequent contributor to the *Bulletin* and *Journal* is reported to be in poor health. His address is: Postfach 52/DDR 963, Crimmitschau. East Germany.

1988 World Bromeliad Conference

Connie Johnson

There's still time, but hurry. Don't let it happen without you. Treat yourself to the ultimate bromeliad experience. See thousands of bromeliads in a lush, lavish, tropical setting. Take a stroll through our simulated rainforest where each turn will bring you to a new feast for the eyes.

See fantastic exhibits of all types. Enjoy easy-to-understand, educational seminars. Attend interesting workshops. See and buy the most exciting new plants in the bromeliad world. See bromeliads of the future. Be a zealous bidder at the zany rare plant auction. Renew old bromeliad friendships and make new ones at the reception and banquet.

Tour the finest bromeliad gardens in the Miami area, being conducted on a round robin basis, with continuous shuttle service. Stay as long as you like at any of the gardens—just catch the next bus. See the gardens of:

- Mike and Jane Keys—here neos reign supreme in a kaleidoscope of colors amid many other specimens.
- Dean Fairchild—though neos hold a slight edge, aechmeas, guzmanias, vrieseas, and others can be found in abundance.
- Connie Johnson—one of South Florida's finest bromeliad patios where spineless varieties dominate the collection.
- Nat De Leon—a natural setting under oaks and other native trees, with great masses of bromeliads used in the landscape.
- Tom and Nancy Steinmetz—bromeliads mingle with the pines and palms and adorn the poolside patio.

It all happens May 20 - 22. The Hotel Inter-Continental will be the center of the happening. Let's all make MIAMI MAGIC together!

Schedule of Events

(Times subject to change)

Wednesday, May 18, 1988

9:00 a.m. to 5:00 p.m.	BSI Board meeting (tentative).
9:00 a.m. to 11:00 p.m.	Entries.

Thursday, May 19, 1988

7:00 a.m. to 8:00 a.m.	Late entries.
8:00 a.m. to 5:00 p.m.	Judging.
9:00 a.m. to 5:00 p.m.	Everglades tour.
7:30 p.m. to 11:00 p.m.	Reception.
9:00 p.m. to 11:00 p.m.	Advance plant sales; show preview.

Friday, May 20, 1988

9:00 a.m. to 5:00 p.m.	Show opens; plant sales; garden tours; theater. Hourly Raffle.
9:00 a.m. to 12 noon	Seminars.
1:00 p.m. to 5:00 p.m.	Seminars.
7:00 p.m. to 8:00 p.m.	Magic Potion Hour.
8:00 p.m. to ?	Rare Plant Auction.

Saturday, May 21, 1988

9:00 a.m. to 5:00 p.m.	Show; plant sales; garden tours; theater. Hourly Raffle.
9:00 a.m. to 12 noon	Seminars.
1:00 p.m. to 5:00 p.m.	Seminars.
7:00 p.m. to 8:00 p.m.	Witches Brew Hour.
8:00 p.m.	Banquet

Sunday, May 22, 1988

9:00 a.m. to 5:00 p.m.	Show; plant sales.
5:00 p.m.	Show closes.

Monday, May 23, 1988

All day	Judges School #3. Post-conference tours and collecting trips begin.

Registrar:
Elaine Mills, 9735 SW 138 Street, Miami, FL 33176 (305) 235-3036

Hotel reservations:
Hotel Inter-Continental 100 Chopin Plaza, Miami, FL 33131 (305) 577-1000
World-wide toll free: 1-800-327-0200

For other information:
Bromeliad Society of South Florida, 13075 SW 60 Avenue, Miami, FL 33156
(305) 667-7890

The Bromeliads: Genera–Species–Hybrids (continued)

Louis Dutrie

[In this fourth installment, Louis Dutrie describes his experience with interspecific and intergeneric hybrids of the Neoregelia (Aregelia), Nidularium, *and* Canistrum *genera. As before, plant names from the Smith and Downs monograph are preferred while synonyms are shown in parentheses or, when not clearly identified, in quotation marks.* –Ed.]

IV (continued)

Hybrids Produced by the Author Himself

Through my own efforts I have produced a number of crosses including the following...

• Crossing *"Aregelia Marechali"*[1] with *N. concentrica* var. "proserpinae" gave rise to a whole new series of plants of different shapes with none approaching the dimensions of *N. concentrica.* In general, the plants were not as sturdy as *"A. Marechali"* and the leaves were noticeably wider, up to 5 to 6 cm, rather thick and green on both surfaces. The bracteate leaves were, for the most part, rose colored or red of all shades, always bright and clear. I presented a group of a dozen different kinds–all of them different–at the 7 May 1939 meeting. A Certificat de Mérite, first class, was awarded to the lot under the name *Neoregelia* ×Amabilis. This is the same hybridization from which M. Morobé later obtained his *Neoregelia* ×Glory, mentioned above.

• On the first of October 1939, a variety of *Neoregelia* ×Amabilis with leaves marbled and dotted with a blackish brown, inherited from *N. concentrica,* was given a Certificat de Mérite under the name of *"Aregelia amabilis* var. *maculata."*

Let us note in passing that many horticulturists do not appreciate leaves marked with dark spots. I have seen superb specimens of *N. concentrica* scorned for this reason. Having been grown in bright light, they became magnificently spotted and marbled with blackish brown dots on a background of bright yellowish green. Beautiful specimens, evoking the admiration of connoisseurs. *De gustibus et coloribus...*

• The back cross, *N. concentrica* × *"Aregelia Marechali"* produced, among others, a plant with short and very wide leaves, brownish, those at the center becoming colored with a cherry red shade. Called *"Aregelia rubida,"* it obtained a Certificat de Mérite by acclamation on 6 August 1939.

• On this same date, I presented *N.* ×Decora, the hybrid of *N. concentrica* var. "plutonis" × *N. princeps* to the jury. The plant formed a perfect rosette, leaves

short and wide, rounded at the tips, olive green and flecked with deep green spots. The center leaves were of bright red. I was able some time later to see other descendants of this seed batch but with a less beautiful form than mine with rose-carmine bracteate leaves. One characteristic of the plant is the long duration of its coloration: it stays fresh for months. It obtained a Certificat de Mérite, first class, with congratuations....

• *"Aregelia Marechali"* × *N. chlorosticta* produced plants of a shape intermediate between those of the two parents, but sometimes with that of *N. chlorosticta,* resulting in a great diversity of leaves ranging from bronzy green and more or less spotted with reddish brown to violet-brown, or red spotted on a bright green color. There was, in short, a full range of greens, browns, and reds. It was a valuable acquisition for florists. Because of its moderate size and its colors it lent itself admirably to all kinds of decoration.

Some specimens of this cross belonged to a group...presented because of their decorative leaves to the 2 July 1939 meeting. This troup was awarded a Certificat de Mérite, first class with congratulations.

Since their leaves attained such brilliance, the hybrids of *"Aregelia Marechali"* × *N. chlorosticta*–to which, for the sake of brevity, I had given the name *"Aregelia maresticta"*–should be grown in bright light. They turn out very well in small pots on hanging shelves.

• From *"Aregelia Marechali"* × *N. princeps* I got *N.* ×Lepida, a plant a little less sturdy than the parents, with a compact rosette of average width, glaucous green, dull leaves. It is characterized by the great area over which the coloration of the center leaves extends at the time of blooming. I have seen this cover a diameter of more than 25 cm in some plants. Inherited from *N. princeps,* the sepals and bracts of the inflorescence are colored a delicate rose, bright rose, or red. The bracteate leaves show all the shades found in *"Aregelia Marechali"* and they stay fresh for many months. This pretty plant was not presented at the meeting, but it has already been reproduced in quantity because it produces abundant seed.

• *N. marmorata* pollinated by *"A. Marechali"* gave *"Aregelia atrata,"* a very robust plant, exceptionally vigorous, with leaves from 50 to 60 cm long, 8 cm wide, leathery, rounded at the tip, spotted and marbled with brownish black markings which will not become fully evident if the plant is not grown in bright light.

• In conclusion, *N. binotti,* with inner leaves which do not take on color, but which have a very beautiful shape, was crossed with *"A. Marechali,"* with *N. princeps,* and with *N. concentrica* in the hope of uniting in the descendants the shape of the mother and the coloration of the father. Some specimens responded to this wish. Among others, one of them flowered at the Ecole d'Horticulture de Melle in 1944 or 1945. Leaves short and wide, forming a compact rosette, with the central leaves cherry red. It might be interesting to see what these new seedlings would produce, but I don't think that we should expect miracles....

V

Nidularium *Hybrids*

• *Nidularium fulgens* × *N. innocentii* presented me with plants that were quite diverse, with leaves that were sometimes brilliantly green, sometimes dull or glaucescent; others had brownish or decidedly brown leaves. In some cases the leaves were violet-brown on the underside, always broad, sometimes with delicate and dense spines like *N. innocentii,* sometimes with stronger and fewer spines like with *N. fulgens.* Many were interesting and equal in merit to the parents, but none outclassed *N.* ×Chantrieri or equalled *N.* ×Mme. R. Morobé, which has the same parents.

• *Nidularium* ×François Spae, frequently with leaves brownish above, much darker beneath, and with the inflorescence rising a little above the center. The bracteate leaves varied from blush to bright red passing through orange-red, like those of *N. innocentii.* Some remarkable examples of this cross flowered at the Ecole d'Horticulture de Melle. One had a very large core, bright red, particularly brilliant. I believe, at least so far, that these hybrids of *Nidularium* are sterile. That was also the case with ×*N[eolarium]* Souvenir de Casimir Morobé and *Nidularium* ×Mme. R. Morobé, mentioned above.

• *Nidularium rutilans* × *N. innocentii.* The plants produced by this cross had the appearance of *N. rutilans.* With respect to the coloring of the bracteate leaves, it was never the pure red that I had tried to obtain by introducing *N. innocentii* in which no trace of blue can be detected. I did obtain improved colors, but no plant showed the sought-after pure red shade.

• M. Morobé came much closer when crossing *Nidularium rutilans* and *"Aregelia Marechali"* in the coloration of which there certainly is more blue than in that of *N. innocentii.* This hybrid, ×*N[eolarium]* Souvenir de Casimir Morobé, sports a beautiful, almost pure red coloration.

Canistrum *Hybrids*

I pollinated *Canistrum lindenii* var. *roseum* form *procerum* Reitz *(Canistrum roseum)* with *C. cyathiforme* (Vellozo) Mez and inversely. These two species produced seed in abundance which germinated rapidly and grew vigorously. Their life was, unfortunately, very short. They were sown April 14, 1943; they perished April 10, 1944.

Bigeneric Hybrids

Between Neoregelia and *Nidularium:*

Neoreglia ×Amabilis	× *Nidularium fulgens*
Neoregelia concentrica	× *Nidularium rutilans*
Neoregelia binotti	× *Nidularium innocentii*
Nidularium "lubbersianum"	× *"Aregelia Marechali"*
Nidularium innocentii	× *Neoregelia princeps*
Nidularium innocentii	× *"Aregelia Marechali"*
Nidularium fulgens	× *Neoregelia* ×Amabilis

Fig. 4
Louis Dutrie counted some guzmanias among the most beautiful of the bromeliads. He listed both *Guzmania musaica* (right) and *G. zahnii* (below) among those cultivated.

Photographs by Marcel Lecoufle

Fig. 5
Guzmania zahnii, among the guzmanias used in M. Dutrie's extensive hybridizing programs.

Unfortunately, I have nothing in particular to say about the hybrids resulting from these crosses. A certain number, sown between 1937 and 1939, flowered during my absence; the others were not sown until my departure in December 1942, and did not have time to flower.

However, I did see several hundreds of them flower in 1942 and 1943 without being able to establish their pedigree; their labels having completely disappeared. That is most unfortunate, for whoever had wished to go to the trouble, would have been able to classify among the *Nidularium* hybrids which flowered at my place in 1942-1944 a collection of some 50, and perhaps 100 species or varieties that were quite distinct. How would one find one's way about among such a diversity?

Thus, there remains to us only the one proof of the cross of between a neoregelia and a nidularium; this is *Nidularium rutilans* × *"Aregelia Marechali,"* of M. Morobé, the inflorescence of which is that of a nidularium. A single case does not make a rule. It is possible, however, that the hybrid always retains the same type as the mother plant, as is the case here. It could also be that one or the other of the parents, the male or the female, imposes its kind upon its descendants if its own particular influence predominates. However that may be, this authentic and unique hybrid is a beautiful plant and hybridization between the two genera ought to be repeated.

Among the last seedlings that I produced (made in April 1944) were those of *Nidularium "lubbersianum"* × *"Aregelia Marechali."* This last had been selected with care for the brilliant orange-red coloring of its bracteate leaves, a shade which I hoped to transmit to the bracteate leaves of *N. "lubbersianum,"* too lacking in color. In effect, if one could obtain a *N. "lubbersianum"* with bright red bracts, it would compare with *Guzmania lingulata* var. *splendens* and should be the most beautiful among the nidulariums. It is, therefore, most desirable that this hybridization be tried again.

Some crosses were tried with success between aechmeas and nidulariums:

Aechmea fasciata	× *"Areglia Marechali"*
Aechmea ×Fulgida	× *Neoregelia* ×Amabilis
Aechmea "Marechali"	× *Aechmea fulgens* var. *discolor*
Aechmea ×Ortgiesioides	× *Nidularium fulgens*
Nidularium rutilans	× *Aechmea fulgens discolor*
Nidularium innocentii	× *Aechmea fulgens*
"Aregelia Marechali"	× *Aechmea fulgens discolor*

These crosses created no hybrid worthy of being retained as a commercial plant...I believe, however, that I must point out a curious fact: A hybrid of *Aechmea fasciata* × *"Aregelia Marechali"* flowered in 1943 at the Ecole d'Horticulture de Melle and produced in an extraordinary manner a profusion of seeds without having had recourse to artificial pollinization. A bigeneric hybrid: a mule, but fertile, really most unexpected.

The seeds sown at my place germinated with a remarkable willingness and grew vigorously. With the help of M. Ch. Chevalier I had some of the seeds brought to the Jardin Botanique at Liège. If they had been sown and had been able to escape the robot bombs they would have been at this moment (May 1946) in full flower. It would have been interesting to see if, through atavism they would not approach one or the other of the parents, thus producing new forms. One would surely be open to disappointment if one waited for miracles to happen, or even plants worthy of cultivation. The experience, however, would certainly be interesting from a scientific point of view.

Guzmania

The genera *Guzmania* Ruiz & Pavon, *Caraguata* Lindley, *Massangea* E. Morren have all been united into the genus *Guzmania* by Mez. This genus comprises, thus, quite a number of plants of great decorative value, some of which could be counted among the most beautiful of the bromeliads. Among the species cultivated we can mention:

Guzmania lingulata splendens Hort.[2]...
G. lingulata var. *cardinalis* (André) André ex Mez, DC., Colombia...
G. devansayana E. Morren, Colombia...
G. musaica E. Morren, Colombia...
G. peacocki[3], the Andes...
G. monostachia (Linnaeus) Rusby ex Mez *(G. tricolor)* Ruiz & Pavon, the Andes...
G. zahnii (Hooker filius) Mez, DC, Central America....

Guzmania *Hybrids*

According to D. Bois (Dictionnaire d'Horticulture), no *Guzmania,* with the exception of *G. lingulata,* produces seed in the greenhouse, even with artificial pollinization. They have been obtained, however, and without need of intervention, from *G. peacocki* and very easily after intervention from *G. monostachia. G. lingulata splendens* and *G. lingulata* var. *cardinalis* produced them also but with more difficulty. I have not succeeded in harvesting any from *G. musaica* and have not tried to do so with *G. zahnii.*

I have been successful with a few crosses:

G. peacocki	× *G. lingulata splendens*
G. lingulata splendens	× *G. lingulata splendens*
G. lingulata var. *cardinalis*	× *G. lingulata* var. *cardinalis*
G. lingulata var. *cardinalis*	× *G. zahnii*

• The crossing of *G. peacocki* × *G. lingulata splendens* is the easiest. *G. peacocki* fructifies naturally. The plants obtained were of a size intermediate between the two parents, with brownish leaves or, as with some, brown or more or less violet but not attaining in any one of them the intensity of coloring of the mother plant. The flower, noticeably larger than that of *G. peacocki,* reached

[continued on page 80]

Regional Reflections

SHORT SUBJECTS

Streptocalyx arenarius (fig. 6) was collected by Geoffrey Johnson in March 1984 on the flood plain of the Huallaga River between Tarapoto and Moyabamba, San Martín province, Peru. It bloomed in February 1987 in our nursery. Harry Luther verified the identification. A large, spiny plant, at blooming time it occupied about eight square feet of bench space. The leaves are a shiny maroon and the spines are black. As with most *Streptocalyx*, the blooms are very beautiful and last a long time. It set no seed for us. The offsets look like elongated pinecones and are extremely antisocial. We have not removed any, as yet.

Carol M. Johnson
Longwood, Florida

Carol M. Johnson

Fig. 6. Streptocalyx arenarius

Bob Whitman contributed this picture of *Tillandsia ionantha* (fig. 7) describing it as unusual: 5½ inches tall and 11 inches in circumference. He found it in a nursery and insists that it has never been fertilized.

Beaumont, Texas

Another *Tillandsia ionantha* (fig. 8) was found by Richard Lum in a Honolulu plant nursery and described there as "some kind of succulent." Richard says that he bought the lot of five or six, washed the potting soil off and mounted them on driftwood. He adds, "they have since flowered, confirming my suspicion that they were *T. ionantha* (I grow many hundreds of them). These plants are

Fig. 7

Lois Boudreaux

T.U. Lineham

Fig. 8

Two specimens of *Tillandsia ionantha*, probably var. *scaposa*. P.T. Isley's recently published *Tillandsia* describes this variety as the largest, "plants of 15 cm (6") in width and height are not uncommon."

typically 15 cm [about 6"] in height and width at the top. I just counted ten strong, sizeable keikis on one with many more seemingly starting to emerge near the bottom of the plant."

Honolulu, HI

LETTER FROM JAPAN

Editor: I am glad to hear that you were in Japan and used to visit Nagoya, which you found a very hot city. No doubt, as it is situated on the same latitude as your Tulsa, Oklahoma. Mr. Isley visited me at Kobe, where I lived at the time. He appeared to have come to Japan to find a market for tillandsias which he took up as his business, but could find no buyers. He phoned me from his hotel in Tokyo and came to see me. Perhaps he found my address in the membership roster of the Society. I was the only collector of tillandsias in Japan at that time, but being an amateur could offer no help in his business. We discussed the possibility of selling this plant in Japan only to agree that it was too early yet.

Since then, it is a long story how I endeavored to demonstrate this plant to the public, and failed after all. My first target was the avid collectors of cacti and succulents. There was, and still is, a large group of them, but nobody showed the slightest interest in tillandsias. I cannot yet understand why because these people are so hot for such similar plants as *Agave, Aloe, Dudleya,* and the like, not to mention *Dyckia* and *Hechtia* which they accept as succulents.

My next attempt was with the bonsai lovers, especially the collectors of miniature bonsai. The photos in my article in the *Journal*[1] were made to attract their interest, but, it was no more than a "strange thing" to them.

In 1975, I wrote a long article in a gardening magazine introducing tillandsias with 27 color photos of blooming plants. I expected some reaction, but none. I heard later on that several persons wanted to get in touch with me, but my address was not mentioned in the magazine.

At the same time, I started displaying the real plant in bloom in the flower shop of a department store in Osaka. I showed a dozen plants every week and continued it for about five years. But the sales were slow, one or two plants a day, and the buyers were limited to the "Green Intelligensia"—mainly orchid enthusiasts.

Then after I took sick and retired from business, this display-sale stopped by itself. Then, after moving from Kobe to the present address, I succeeded in

[1]Vol. 24:19-20; 1974.

arranging with the Higashiyama Botanical Garden of Nagoya to open a tillandsia show with my collection and theirs. It opened in 1982, in June, for one week, but the blooming season having passed I was unable to demonstrate the beauty of this plant to visitors. They simply marvelled at seeing queer plants living on hapuu slabs.

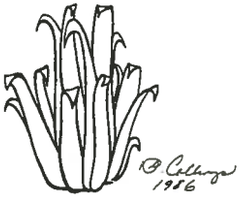
This show, however, served to arouse the interest of other botanic gardens in our country and I was asked by several gardens to give them my collection. By this time, I had become enchanted with the beauty of neoregelia cultivars. So, by making room for neos, I agreed to divide my collection among five of the gardens.

Thus, my endeavour to make tillandsias popular in the market, like cacti and succulent plants, failed completely. They will remain in hothouses in botanical gardens and will seldom get out of the gate. Fortunately, a large merchant of cacti and succulent plants was interested and I sold all the remainder of my collection to him. So, a route to the public is secured.

At present, the holders of the largest collection of bromeliads in our country is Atagawa Tropical & Alligator Garden. Last year they imported from your side 250 species of tillandsias to complete their collection. Their laboratory staff, and my friend, Mr. Hideo Shimizu, is now a member of the Society. He wrote an article about tillandsias in a recent issue of a gardening magazine and is going to introduce this plant to the public on TV next Sunday. This is the first time that tillandsias have been the subject of a broadcast in Japan. So, I believe some large reaction must appear this time.

I have obtained from Mrs. Harbert a list of present members of the Society in Japan. I know most of them as they are either staff members or curators of botanical gardens where my tillandsias went. The botanical garden in Nagoya and Hiroshima too, have collections of about 100 species. So, you see tillandsias are now quite popular among botanic gardens of our country. It is a question of time that they appear in the market. In fact, *T. flabellata, T. ionantha,* and *T. stricta* are already sold in some flower shops. Please tell these situations to Mr. Isley.

K. Yamaguchi
637-4 Yoriki, Kounan-Shi
Aichiken 483, Japan



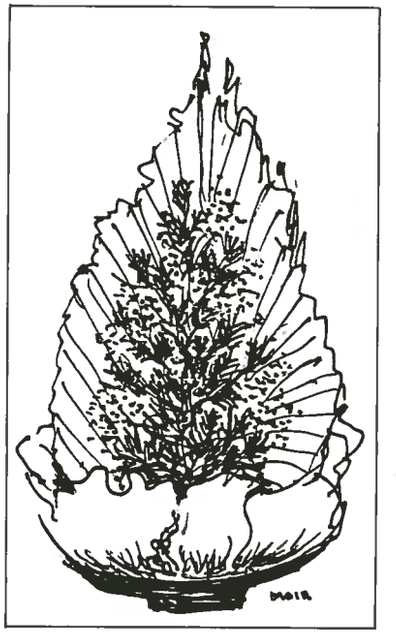
Bromeliad Arrangement No. 20: A Center Arrangement with *Aechmea mulfordii*

May A. Moir

Tibor Franyo
Honolulu Academy of Arts

Fig. 9. A dry arrangement for a buffet table with *Aechmea mulfordii,* fan palm leaves, a black grass, and pieces of platycerium.

There was a request for a flower arrangement to be used in the center of a large, round buffet table. There were problems of making and transporting the arrangement to its destination days ahead of time. We decided that the best thing to do was to make a dry arrangement. It is fortunate that I always keep many kinds of dry plant material on hand.



It is best to decide on the container first and my choice was a round, shallow brass dish with a firm footing. Next, I used the largest size kenzan (needle holder) secured in place with clay. A big, strong heliconia stem was cut and placed in the center of the kenzan. I had some large, dry fan palm leaves and chose three of the best and trimmed them to be a good proportion to the container. The palm leaves were then pinned to the heliconia stem. *Aechmea mulfordii* is a very satisfactory dry material which I use often. For this arrangement I spray painted the *mulfordii* punkin red and pinned the pieces in the wedges. The red against the pale tan of the palm made a good contrast. For a different color and texture I used black grass, Uki *(Cladium leptostechyum),* an endemic sedge, which I had collected on the island of Lanai last July. To hide all the stems and give the arrangement a finish I used pieces of platycerium that is silver-tan and shiny blending with the brass of the container. An arrangement like this can last for months.

Honolulu, Hawaii

[We are sorry that this one will be the last of the series. Mrs. Moir has been very generous with her time and willingness to contribute to our understanding of this art form. It is not easy as she says to create something different each time, to have it approprate for the Honolulu Academy of Arts where these arrangements have been displayed, to get the slide, write the copy, and make the drawing. We agree, but still hope that she will be back occasionally. Thank you, May. – TUL]

Book Review *[continued from page 54)*

In comparing this book with Dr. Lyman B. Smith's 1971 work, *Bromeliaceae (Flora de Venezuela,* vol. 12, pt. 1), we find in it descriptions of 226 species, 75 percent of the total number of species (305) described by Dr. Smith. We did not compare the two in detail for changes, migrations, and synonyma, but did note the inclusion of two new genera: *Brewcaria,* and *Steyerbromelia.* The main differences are that Dr. Smith's book is inclusive and technical while this book is selective and more suitable for the general reader. The authors have made a valuable addition to the bibliography of bromeliads. It provides a current inventory which takes into account major changes such as the shift from *Cottendorfia* to *Lindmania* and describes and illustrates the relatively new *Brewcaria* and *Steyerbromelia.*

Recommended for all botanical book collections. Both amateur and professional bromeliad specialists will find the book useful. –TUL

a diameter of 12–15 cm which is not so bad. The bracts were generally of a purple hue, lighter than that of *G. peacocki,* but far from the bright red of *G. lingulata splendens.* Some, however, displayed bracts of a beautiful cerise. It is probable that in working again with these plants one could obtain, and perhaps might be able to fix, an intermediate that would be interesting both from the standpoint of the flower and of the foliage. It is unfortunate that I did not have the opportunity to pursue this research. Man proposes, the RAF disposes.

• *Guzmania lingulata splendens* and *G. lingulata* var. *cardinalis,* each one in turn being the pollen carrier and seed carrier, made a much happier cross. The hybrids reproduced exactly one of the two parents or showed intermediate characteristics. Diverse tints of the foliage from light green to brown, or the bracts from light red to cerise, indicated the predominating influence of one or the other of the forebears. I had thus flowered simultaneously a series of varieties easy to distinguish whenever they were compared but, to sum up, very similar. A group of these *G. lingulata* × *cardinalis* displayed at the meeting on April 1st, 1943, was awarded a Certificate de Mérite by acclamation.

These hybrids produced seeds more easily than the pure species. Let us hope that with their fertility crossing to each generation, one will eventually be able to sow guzmanias of this type as easily as one sows aechmeas and nidulariums at the present time.

If, however, at the moment I proceeded with the hybridization above I had had a *Guzmania* in flower it is the latter I would have asked for pollen. The cross of *G. lingulata splendens* with *G. zahnii* had given me before the war some hybrids of an exceptional quality to which I had given the name of *G. lingulzahni,* which joined the names of the two parents.

[To be continued]

NOTES:

1. As noted in the foregoing installment (*J. Brom. Soc.* 38:22; 1988), the identification of *Aregelia Marechali* is not clear. We are indebted, however, to Dr. R.W. Read for a degree of clarification. He cites page 10 of Dr. L.B. Smith's Studies in Bromeliaceae. IX (Contributions from Gray Herbarium of Harvard Univ., CXXIV) (Contribution from the Reed Herbarium, no. XXVIII (1977): *"Aregelia Marechali* Mez has not been transferred [to the genus *Neoregelia]* because it did not seem of specific value to the two interpretations given it...the material from Berlin was not exactly the same form as the original *A. Marechali,* and the original is not distinct from *A. princeps.* [Mez treated it] as a form of *A. princeps* on the basis of Morren's unpublished plate and supposedly authentic living material at Liège and Leyden. Further, the Berlin material from its description does not appear specifically separable from *A. Carolinae."* [As concluded in part also by Harry Luther.]

Further, Dr. Read says that he has two pictures of Morren plates labelled *A. princeps* taken at Kew [see *Journal* 84:5, fig. 1; 1984 for one of them] and "I couldn't tell you they are one and the same or if one is *N. carolinae,* since I cannot look under the leaves...or dissect the flowers to see the sepals, the most critical distinctions."

Dr. Read concludes his comments by saying that it is more likely that Dutrie's plants were "from Belgium or Morren's collection and, therefore, truer *Neoregelia princeps* of one form or the other...." It seems, then, that we should continue to use Dutrie's name *Aregelia Marechali* with quotation marks.

2. Probably *G. lingulata* var. *splendens* (Planchon) Mez. Smith & Downs (p. 1352) list *Nidularium splendens* Hortus ex Beer in synonymy.

3. Listed in Smith & Downs (p. 1352) as ? *G. peacockii* (E. Morren) Mez in syn. with *G. lingulata* var. *splendens.*

Tillandsia copynii, a New Miniature from Brazil

Eric J. Gouda

Tillandsia copynii, sp. nov. (figure 10) is a small, xeric species belonging to the subgenus *Diaphoranthema* (Beer) Baker. It is very close to the variable *Tillandsia tricholepis* Baker (fig. 11) and, therefore, also to *T. loliacea* Martius ex Schultes filius and the recently described *T. spiralipetala* Gouda.[1] It distinguishes itself from the latter two species by having an elongated stem (longer than the leaves) and slightly channelled, flexible leaves. It distinguishes itself from *T. tricholepis* in having fewer but larger leaves, about half as long as the stem (about 1/5 or less in *T. tricholepis),* and differently shaped, sized, and colored petals. Figures 10 and 11 and Table 1 show the major differences in flower characters between the two species.

Table 1. Differences in flower characters between the new species and the closely related *Tillandsia tricholepis*

T. tricholepis[2] (fig. 11)	*T. copynii* (fig. 10)
Flowers	
• 2-3(-5)-flowered	• (2-)3-6-flowered
• not fragrant	• fragrant at night
Floral bracts	
• about twice as long as the internodes	• about 1.5 times as long as the internodes
• membranaceous and hyaline	• chartaceous, colored, not hyaline
• distinctly veined when fresh	• veinless when fresh
• sparsely lepidote	• subdensely lepidote to densely lepidote at the apex
Sepals	
• glabrous or nearly so	• sparsely lepidote
• connate for about 1/3	• connate for about 1/5
• ca. 6.5 cm long	• 6.5-9 mm long
Petal blades	
• to about 1.5 mm wide	• about 2 mm wide
• slightly divergent	• recurved at anthesis
• strongly channeled	• becoming flat
• distinctly incurved at the apex	• not distinctly incurved
• pale yellow	• ochraceous, tinged with red at the base, to brown
• obtuse or subacute	• rounded
Style	
• shorter than the ovary	• about as long as the ovary
Self-pollinating	Self-incompatible

[1] *J. Brom. Soc.* 36:165-166, 177; 1986.
[2] Living (cultivated) material used to establish variability in *T. tricholepis.*

It is remarkable that self-pollination often occurs in *Tillandsia loliacea* and *T. tricholepis,* with their tiny yellow flowers, while *T. copynii,* which has slightly taller and more pigmented petal-blades, produces seed only after cross-pollination. Moreover, the flowers of *T. copynii* are fragrant at night while those of *T. loliacea* or *T. tricholepis* are not. *T. copynii* may have a different (specific) pollinator, a possibility that is more likely since it is geographically isolated from the other two species. It is at least more dependent on a pollinator and it is not unlikely that for this reason its area of distribution is rather small. Mr. Alrik N. Copijn, the collector of the type specimen, did not find either *T. loliacea* or *T. tricholepis* in the type area of this new species. Moreover, he noticed that all individuals of *T. copynii* occurred as epiphytes on the same species of host tree. No other epiphytic tillandsias were found in the type area, where the new species appeared to be abundant.

Etymology: This species is named after Alrik N. Copijn, the collector of all the type material.

T. copynii affinis *T. tricholepis,* foliis caniculatis, latioribus multo longioribus, bracteis floralibus chartaceis in stato vivo aveniis viridibus saepe rubro-tinctis, petalorum laminis ampliore et magis pigmentosa denique plana et recurvata necnon apice incurva, stylo pro rata longiore et tenuiore, differt.

Tillandsia copynii, sp. nov.

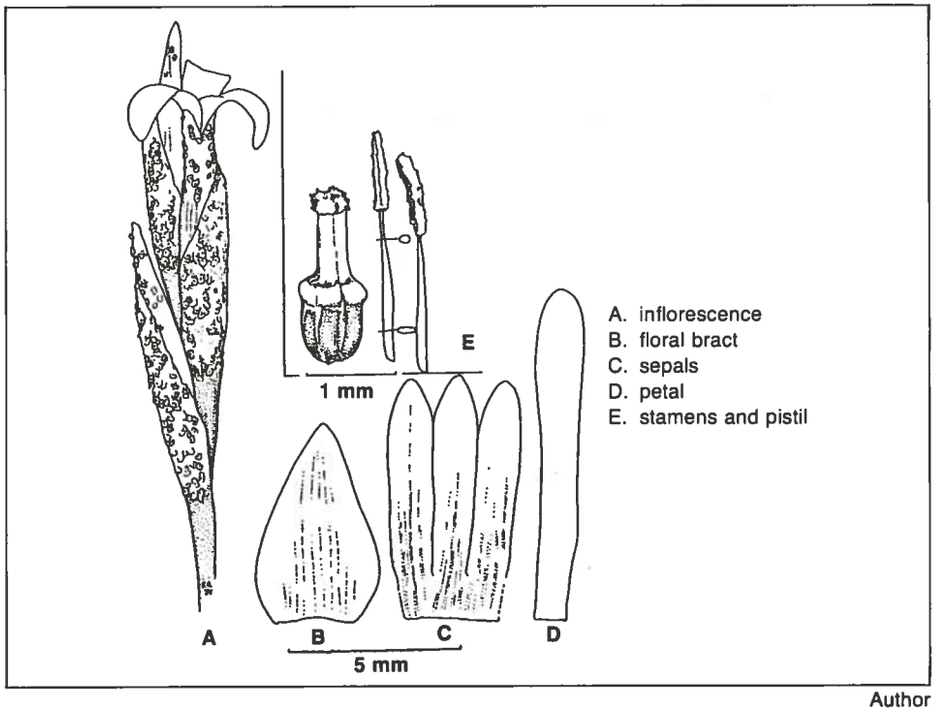


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Fig. 10. Tillandsia copynii.

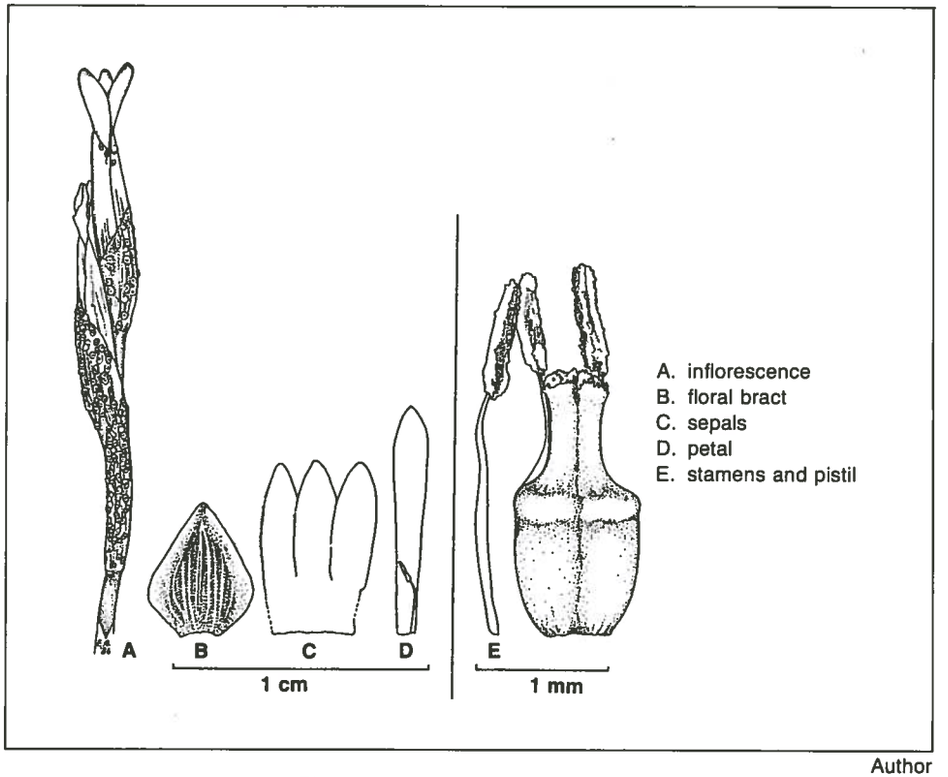

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Fig. 11. Tillandsia tricholepis.

Plant caulescent, 3–10 cm long (flowering up to 17 cm), with many cinereous-green leaves, polystichous along the stem, often forming dense clusters. *Leaves* flexible, much exceeded by the scape; *sheaths* small, with (ca.) 7 veins, tapering into the blade, membranous, broadly ovate, clasping the stem, 4–5 mm wide, glabrous except for the apex, pale-green; *blades* spreading or slightly recurved, fleshy to coriaceous, very narrowly triangular, slightly if at all canaliculate, 2–3 cm long, 1.5–4 mm wide at the base, long attenuate, very densely lepidote with slightly spreading scales. *Inflorescence* erect, simple; *scape* about 0.5 mm in diameter, 2–6 cm long, glabrous or with a few scales, almost entirely covered by 4–6 bracts; *scape bracts* erect, densely involute-subulate, chartaceous, oblong, short laminate to acute, slightly shorter or longer than the internodes, subdensely lepidote; *spike* subelongate, 1–3 cm long, sublaxly (2-) 3-6-flowered, wholly fertile; *rachis* partly exposed at anthesis, substraight, bluntly bicarinate, glabrous; *floral bracts* clasping the flowers, chartaceous, veinless (veined when dry), ovate, 6.5–7 mm long, 1.5 times as long as the internodes, much exceeded by the sepals, with broad membranous margins, subacute, ecarinate, subdensely appressed lepidote, cinereous, tinged with red. *Flowers* suberect, (sub-)sessile; *receptacle* ca. 1.5 mm long, obconic; *sepals* chartaceous,

receptacle ca. 1.5 mm long, obconic; *sepals* chartaceous, veinless (veined when dry), lanceolate, 6.5–9 mm long, with broad hyaline and veinless margins and apex, broadly obtuse, evenly connate for about 2.5 mm (about 1/5 of their length), ecarinate, sparsely lepidote only at the outside, green and often tinged with red; *petals* lingulate, about 1 cm long by 1.5 mm wide, ochraceous and often tinged with red (brown when dry), the blade becoming flat and recurved, rounded and not incurved at the apex; stamens deeply included, the anthers just exceeding the pistil; *filaments* fleshy, subterete; *anthers* subbasifixed, about 1 mm long; *pistil* about 2 mm long, style about as long as the ovary, ovary cup-shaped, then abruptly contracted into the short style, stigmas lobed. *Capsules* cylindrical, ca. 1.5 cm long, truncate, short beaked; *coma* white.

Type: Brazil: Minas Gerais: 5 km northeast of Paracatu, 12–15 July 1981. *A.J. Copijn s.n.* Grown by the author (holotype, U).

Institute of Systematic Botany
State University, Utrecht, The Netherlands

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I am grateful to Dr. A.J. Gilmartin, Dr. R.W. Read, and Drs. L.Y. Th. Westra for their helpful criticism of the manuscript.

Addition to the Smith and Downs Key to Tillandsia Species[1] by E.J. Gouda

48. Floral bracts 6–8 mm long; inflorescence almost always simple.

    49. Plant not more than short caulescent; leaves much longer than the stem, strongly canaliculate or subulate-involute, 2–4.5 cm long.
    49.1

        49.1. Leaves fleshy and rigid coriaceous, erect or arching-secund, canaliculate, pungent, appressed-leipdote; spike few-16-flowered; petals yellow, rarely brown or pale-violet. Peru, Bolivia, Paraguay, Brazil, Argentina, Uruguay.
        217. *T. loliacea*

        49.1. Leaves flexible, spreading to recurving, subulate-involute, filiform-attenuate, tomentose-lepidote; spike mostly 3-flowered; petals yellow-brown to dark-castaneous. Peru, Bolivia.
        217.1. *T. spiralipetala*

    49. Plant long caulescent; leaves shorter than the stem, slightly if at all canaliculate, 0.6–3 cm long.
    49.2

        49.2. Leaves to 2 cm long, but mostly much less (about 1/5 as long as the stem or less); spike 2-4(-5)-flowered; petal-blade yellow, obtuse or subacute, incurved along the margins and apex, only slightly divergent. Bolivia, Paraguay, Brazil, Argentina
        218. *T. tricholepis*

        49.2. Leaves 2–3 cm long (about half as long as the stem); spike (2-)3-6 flowered; petal-blade ochraceous, often tinged with red at the base, rounded, becoming flattened and recurved at anthesis. Brazil.
        218.1. *T. copynii*

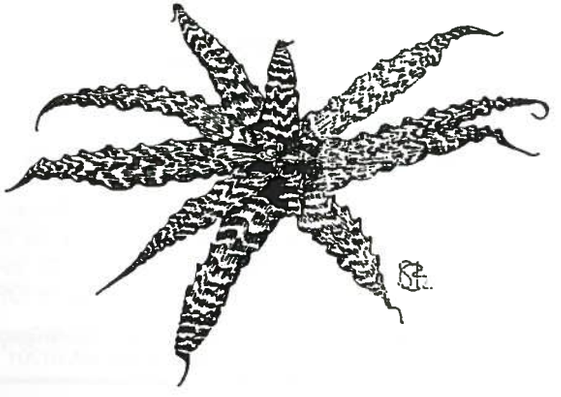
48. Floral bracts 10–45 mm long.

---

[1] L.B. Smith and R.J. Downs, Tillandsioidea. Flora Neotropica monograph no. 14, pt. 2 (New York: Hafner Press, 1977) p. 671-696.

Calendar of Shows *[continued from back cover]*

April 30–May 1	La Ballona Valley Bromeliad Society's annual show and sale. Culver City Veterans Memorial Auditorium, 4117 Overland Ave. at Culver Blvd. Culver City, California. Saturday, 12:00 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. Alan D. Levy (213) 836-3177.
May 20–22	World Bromeliad Conference, "Miami Magic." Host: The Bromeliad Society of South Florida. Descriptive article with addresses is on pages 66–67. Advertisement on page 89.
June 11–12	The Baton Rouge Bromeliad Society 13th Annual Show and Sale, Baton Rouge Garden Center, 7950 Independence Blvd., Baton Rouge, La. Contact Michael Young, 4364 Sycamore Dr., Baton Rouge, LA 70805 (504) 355-5408



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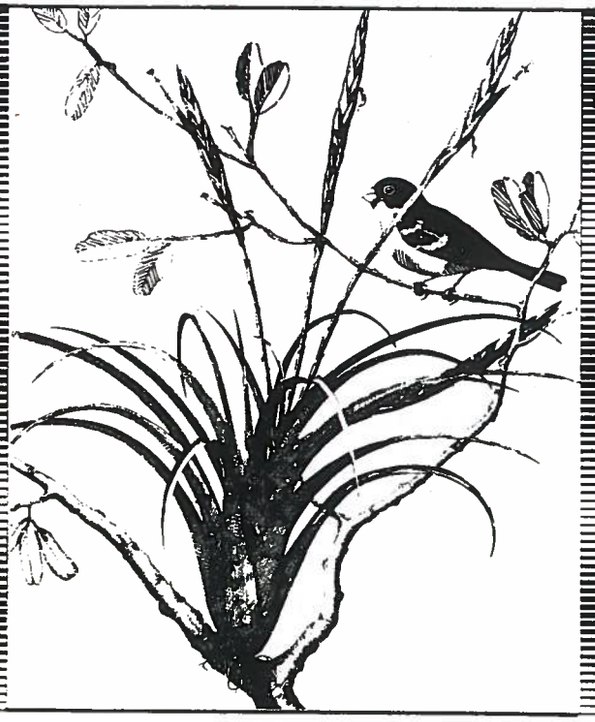

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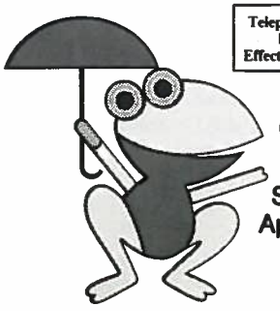

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World Conference: Tom J. Montgomery, 1704 Ave. K, Galena Park, TX 77547.

Marcel Lecoufle

Aechmea × Foster's Favorite *(A. racinae* × *A. victoriana),* the first patented bromeliad in the United States is described by Mulford Foster who made the hybrid (See pages 55-57).

Calendar of Shows

March 26–27	Tarrant County Bromeliad Society 11th Annual Show and Sale. Fort Worth Botanic Garden Center, 3220 Botanic Garden Dr., North Fort Worth, TX. Saturday, 1:00 p.m. to 5:00 p.m.; Sunday, 12:00 noon to 4:00 p.m. Rod or Bobbye French (817) 594-4813.
April 3	South Bay Bromeliad Associates & South Coast Botanic Garden Special Sunday Program, "The Rarest Flower on Earth." John Yellen will present a compete slide study of *Puya raimondii.* South Coast Botanic Garden, 26300 Crenshaw Blvd., Palos Verdes, CA at 2:00 p.m. Admission $1.50–$3.00. [See Jan.-Feb. 1987 *Journal* for related information.] Stan Oleson (213) 833-2657.
April 22-24	Bromeliad Society of Greater Mobile 11th Annual Show and Sale. Bel Air Mall at Penny's Fountain, Mobile, AL. Friday, 1:00 p.m. to 9:00 p.m.; Saturday, 10:00 a.m. to 8:00 p.m.; Sunday, 12:00 noon to 6:00 p.m. Sale hours same except Friday begins at 10:00 a.m. Jerry Shirey (601) 649-5185.
April 23-24	Shreveport Regional Bromeliad Society 8th Annual Show and Sale. Barnwell Garden and Art Center, 501 Clyde Fant Parkway, Shreveport, LA 71101. Saturday and Sunday, 1:00 p.m. to 5:00 p.m. Harvey C. Beltz (318) 635-4980.

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