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Cover photographs. Front: Multiple plants of *Tillandsia utriculata* form dense epiphytic colonies on the few remaining trees near Toniná, Mexico. See the accompanying article by Robert and Virginia Guess in this issue. Back: World Bromeliad Conference 2004: Chicago.

FEATURE ARTICLES

BROMELIAD SOCIETY BUSINESS AND NEWS

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Deuterocohnia chrysantha: An Interesting Chilean Endemic

Georg Zizka[1]

The Chilean flora comprises approximately 5660 species of higher plants, of which 2727 are endemic (48.1 %) (Marticorena 1991). Bromeliaceae, with 23 species of the genera *Puya* (7 species), *Tillandsia* (6), *Ochagavia* (4), *Greigia* (4), *Fascicularia* (1) and *Deuterocohnia* (1), display a comparatively low diversity in Chile. Nevertheless most of these species are endemic to the country with the only exception of *Tillandsia usneoides*, *T. virescens*, *T. marconae*, and *T. landbeckii*. With the exception of the widely distributed *T. usneoides*, the other tillandsias extend to the arid regions of adjacent Peru; *T. virescens* is also found in Bolivia and Argentina. In Chile, these species are restricted to the northern part of the country and display interesting disjunct distributions.

In addition to the high endemism levels, Chilean bromeliads are of interest as to the biogeography and evolution of the bromeliad family, especially in relation to its southern border. *Fascicularia* and *Ochagavia* are endemic genera, whose systematic relationships among the Bromelioideae remain unclear. The genus *Greigia*, being of principally Andean distribution, is represented with four species in the humid-temperate Valdivian lowland forests of Southern Chile and on Robinson Crusoe Island. The Chilean puyas represent both known subgenera and occur, as does *Deuterocohnia chrysantha*, well separated from the area of the other species of their genus. The Chilean bromeliads have recently been revised for the "Flora de Chile" (Zizka & Nelson 1997, Will & Zizka 1999, Zizka et al. 1999, 2002).

Deuterocohnia chrysantha resembles "typical" terrestrial pitcairnioid bromeliads from arid regions with succulent leaves in a dense rosette, often of a reddish-brown color. The axes form a considerable number of lateral branches, but unlike, for example some hechtias, the lateral axes are not long caulescent but comparatively short, thus resulting in a dense, hemispherical, cushion-like growth habit (FIGURE 1). These "cushions" reach a height up to about 50 cm and a diameter to over 1 m. The leaves have a straw-colored sheath 1.5-2.5 x 3.1-5.5 cm, glabrous and suborbicular and distinct from the blade. The blade is 10-25.5 x 2.2-4.3 cm, spinose-serrate with retrorsely curved spines 0.5-0.7 cm long, triangular, reddish-brown, densely lepidote below and densely lepidote to ± glabrous above. As in other *Deuterocohnia* species (except those formerly placed in *Abromeitiella*), *D. chrysantha* produces persistent, woody inflorescences to 1.5 m high (FIGURE 2). Each vegetation period, new lateral, simple flowering branches 4-18 cm long are produced from dormant buds of the woody inflorescence axes, bearing numerous sessile, conspicuous yellow flowers 2.0-2.5 cm long in the axil of a brownish, ± coriaceous, glabrous, acuminate bract. The 3 brownish, oblong

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Figure 1.
Cushion-like habit of *Deuterocohnia chrysantha.*

Figure 2.
Portion of *Deuterocohnia chrysantha* inflorescence. The woody, perennial axes produce new flowering shoots every year. The flowers are probably pollinated by hummingbirds.

Figure 3.
Deuterocohnia chrysantha in its natural habitat in Pan de Azucar National Park, Northern Chile, growing together with other succulents such as *Copiapoa* sp.

brownish, oblong to obovate sepals are 0.8-1.0 x 0.4-0.5 cm, have a rounded, emarginate apex, and are coriaceous with membranous margins. The 3 yellow, apically ± greenish, spathulate petals are 1.7-2.3 x 0.7-0.8 cm, membranous, the apex ± emarginate, sometimes with a short mucro; adaxially they bear one scale with 3 irregular, acute apical lobes. Stamens and style are exserted at flower, the latter exceeding the stamens for about 2-3 mm. The stigma is divided into 3 distinct lobes. The numerous conical seeds are 0.2 x 0.1 cm large, including a lateral, asymmetric appendage.

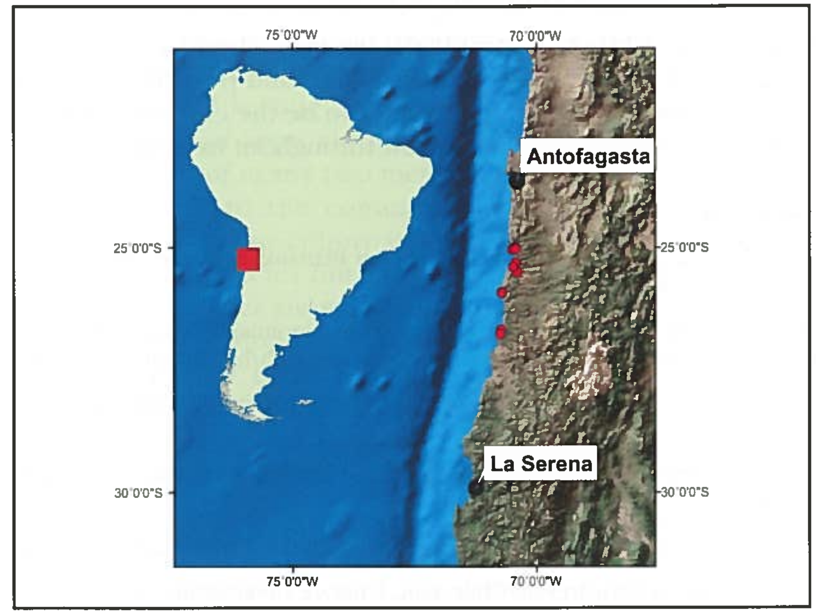

Figure 4. Distribution of *Deuterocohnia chrysantha* in northern Chile.

The inflorescence branches are placed well above the cushionlike vegetative parts, making *Deuterocohnia chrysantha* an amazing plant in its desert habitats, where it can be found accompanied by species of the cactus genus *Copiapoa* and other desert plants (FIGURE 3). No pollinators have been observed by the author, but this bromeliad is most probably pollinated by hummingbirds, which where observed to pollinate *Puya boliviensis* in this area. According to Muñoz (1966), who provides a nice illustration of the plant, the Chilean name is *Chaguar del jote*.

Deuterocohnia chrysantha was first described in 1860 by the famous Chilean botanist R.A. Philippi in his "Flora Atacamensis" as *Pitcairnia chrysantha* and transferred to the genus *Deuterocohnia* by Mez in 1894 (nomen) and 1896. It has a comparatively narrow distribution extending from 25°01´-26°41´S and 70°24´-70°45´W (FIGURE 4), occurring from 15-800 m elevation on the western slopes of the Cordillera de la Costa in northern Chile. Mean annual rainfall in these coastal desert regions is very low and highly unpredictable.

Fifteen species are presently recognized by Luther (2000) in the genus *Deuterocohnia* (incl. *Abromeitiella*). The six species of the genus studied by Horres & Zizka (1995; *D. brevifolia*, *D. glandulosa*, *D. lorentziana*, *D. lotteae*, *D. meziana*, *D. scapigera*) display a remarkable degree of leaf succulence, the values of the succulence quotient (after Willert et al. 1990) being comparable to *Agave filifera*, *A. attenuata*, or *Aloe ramosissima*. *Deuterocohnia chrysantha* is also found growing in highly arid areas of northern Chile. Molecular studies in this genus emphasize the isolated position of *D. chrysantha* (Horres et al. in prep.).

While some Chilean bromeliads are considered endangered (e.g., *Greigia bertereoi* from Juan Fernández Islands and possibly *G. pearcei* from the mainland), this fortunately appears not to be the case for *Deuterocohnia chrysantha*, which is relatively abundant throughout its range.

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An Isolated Population of *Tillandsia utriculata* in Chiapas, Mexico

Robert Guess and Virginia Guess[2] **Photographs by Robert Guess**

Although *Tillandsia utriculata* Linnaeus is widely distributed in dry, lowland forests ranging from Florida, into several Caribbean islands, the Gulf states of Mexico, Central America, and northern South America, it is not commonly found in the state of Chiapas (Smith and Downs 1977; Utley 1994). We recently located a single population of *T. utriculata* consisting of more than one thousand epiphytic plants concentrated along a short section of a well-traveled road leading from Ocosingo to the Maya ruins of Toniná. Here, at an elevation of approximately 900 meters, the mature, monocarpic plants attain a height of nearly two meters and flower at the end of May and into June, just prior to the commencement of the rainy season. The distribution of this dense colony is limited to a narrow fringe of trees, consisting of mixed species but mostly red-flowered thorny acacias, that frame the road as it passes among small cattle ranchos, sugar cane fields, and a large military installation constructed soon after the 1994 Rebellion in Chiapas. The plants of *T. utriculata*, restricted by such development to this habitat, share the few remaining trees with occasional specimens of *T. streptophylla* Scheidweiler ex E. Morren, *T. capitata* Grisebach, *T. balbisiana* Schultes f., *T. belloensis* W. Weber, and *T. juncea* (Ruiz & Pavon) Poiret.

According to Gardner (1984, 1986), there are two subspecies of *Tillandsia utriculata*: the smaller, *T. utriculata* ssp. *pringlei*, a polycarpic saxicole from east-central Mexico (a geographic region that does not include Chiapas); and *T. utriculata* ssp. *utriculata*, a more widespread monocarpic epiphyte. While these two subspecies vary widely in plant height from 25 centimeters to 158 centimeters, the flowering plants with white petals of *T. utriculata* from Ocosingo consistently measure over a meter and a half tall. Based on Gardner's description, it is possible that they are *T. utriculata* ssp. *utriculata*. On the other hand, because of the isolated and limited habitat in which this population grows in Chiapas, as well as the minimal variation among the plants, it is also likely that they could represent a new subspecies of *T. utriculata*.

Consistent with our interests in the biogeography of Chiapas, as well as our concerns over the increasing decay in its ecosystem, our aim here is to document the only plants of *Tillandsia utriculata* that we have located to date in this state, rather than enter into any taxonomic controversy. In so doing, however, we cannot ignore the confusion that arises in the identification of this species in relation to several others. As we have experienced, the slight differences among these species, the occasional mislabeling of photographs in the literature, and changes in the nomenclature confound a clear identification. In trying to distinguish among

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Figure 5. *Tillandsia utriculata*. The adpressed flowers of *Tillandsia utriculata*, tubular with white petals and exserted stamens, are short lived and few in number at any one time.

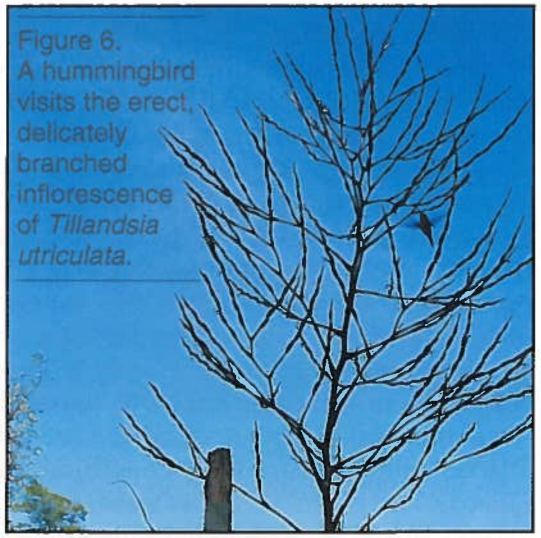

Figure 6. A hummingbird visits the erect, delicately branched inflorescence of *Tillandsia utriculata*.

Figure 7. *Tillandsia utriculata*, the largest and only monocarpic species represented in this niche, competes with other *Tillandsia* for limited space.

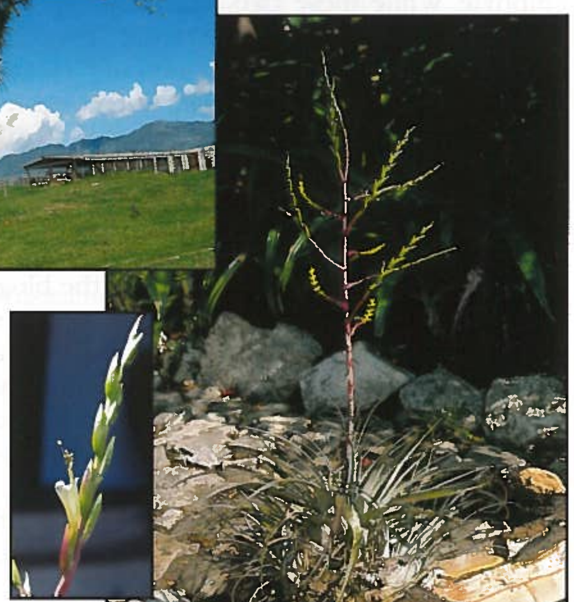

Figure 8 (and inset). *Tillandsia limbata*, a polycarpic species, has a slender inflorescence and white to greenish petals.

Figure 9 (and inset). *Tillandsia makoyana*, a monocarpic species, grows in the sem-arid vegetation of the Central Depression of Chiapas.

those related to *T. utriculata* that grow in Chiapas, the temptation often exists to simply refer to them all as *"El Arbol de la Vida,"* a sobriquet used by the local people for bromeliads having tall, multi-branched, red and green colored inflorescences, and white flowers. Our inquisitiveness over this quandary, however, overcame such a tendency, and with the assistance of Harry Luther, we reached some tentative conclusions.

Of the several *Tillandsia* species morphologically related to *T. utriculata*, we know of only three that occur in Chiapas. Although the three share some common field characteristics, differences in petal color, position of the flower on the spike, configuration of the spike, the form of the plant body, and the reproductive pattern provide clues to identification. These species range throughout the various physiographic zones of Chiapas, but in relatively small numbers at any one location. None, however, grow among the numerous specimens of *T. utriculata* in Ocosingo. Of the three, a relatively large population of *Tillandsia limbata* Schlechtendal flourishes in the western section of the Central Depression in the Municipio of Ocozocoautla. This polycarpic species with white to greenish flowers also grows in a few small niches of the Pacific Coastal Plain, one in particular in the Municipio of Escuintla. The monocarpic plants of *Tillandsia makoyana* Baker with characteristic green flowers are more apt to be found in the eastern section of the Central Depression, as well as along the steep, semi-arid escarpment that divides the Central Plateau and the Central Depression, in and beyond the Municipio of La Trinitaria. Although reports exist of a "rare" purple-flower form of *T. makoyana*, we have found no such specimens in Chiapas. The third species, also monocarpic, common throughout the Central Plateau from east of San Cristóbal de Las Casas to Comitán and Las Margaritas, but with white flowers, has for decades been identified as *Tillandsia dasyliriifolia* Baker. Plants of this species, one of the more conspicuous tillandsias in the highlands of Chiapas, are hauled into the local market of San Cristóbal by the hundreds to be sold during the Christmas season for decorations in homes and churches. The identity of this species is the most problematic.

Figure 10 (and inset). A species of *Tillandsia* with a stout, multi-branched inflorescence often identified as *T. dasyliriifolia* may be *T. drepanoclada*, or a new species.

The descriptions by Utley (1994) and by McVaugh (1989) of *Tillandsia dasyliriifolia* as having purple or violet petals and not known to occur in Chiapas suggest that this species is being misidentified in many reports from this state, including some of our own. Luther proposes that the species with white flowers from Chiapas could be *T. drepanoclada* Baker, a synonym once used for *T. dasyliriifolia* in accounts by Smith and Downs (1977) and by Rauh (1979). The only current information we could find on *T. drepanoclada*, first described by Baker (1889) from a herbarium specimen, appeared on a Web site related to the environment and natural resources of Mexico (SEMARNAP 2003). Here, it was reported from the Mexican states of San Luis Potosí, Jalisco, and Oaxaca, as well as from El Salvador and Honduras. *Tillandsia drepanoclada* recently received species status (Luther 2002).

Since we have never observed a violet or purple flower in any of the species related to *T. utriculata*, we can only conclude that what has been reported previously as *T. dasyliriifolia* in Chiapas may be *T. drepanoclada*, or possibly even a new species. This is clearly a complex within the genus *Tillandsia* that requires more study in order to dissipate the confusion in the taxonomy. As the controversy will no doubt continue, our intent here has been only to document a single population of *T. utriculata*, and to note the complexities of identifying it in relation to similar species.

Acknowledgments

Our thanks to Harry Luther at the Mulford B. Foster Bromeliad Identification Center, Marie Selby Botanical Gardens, who with great patience and determination guided us in our attempts to distinguish among these related species. He further corrected our use of *Tillandsia dasyliriifolia* Baker by introducing us to *Tillandsia drepanoclada* Baker. We also acknowledge Renate Ehlers and her work, currently in progress, on this complex of plants. She is one of the few investigators in recent years who has repeatedly returned to Chiapas to study species of *Tillandsia* in their natural habitat.

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New BSI Directors

Tom Wolfe[3]

There were several new directors elected and/or appointed to the BSI Board of Directors during this past year. These directors represent this constituency in their respective regions. If you have any questions or concerns regarding the BSI please feel free to contact the director(s) in your region.

Michael Andreas—Florida. Michael works as a computer specialist at Cape Kennedy Space Center. He and his wife Karen have been growing bromeliads for many years. He is the Webmaster for the Florida Council of Bromeliads web site and is active in the Bromeliad Society of Central Florida.

Dr. Theresa Bert—Florida. Terrie is a scientist at the Mote Marine Laboratory in St. Petersburg, Florida. She has been growing bromeliads for many years and is an accredited BSI Bromeliad Judge. She is very active in the Sarasota Bromeliad Society where she has held many offices including President.

Dr. Gregory Brown—Western Region. Greg is a professor at the University of Wyoming heading up scientific research projects on various aspects of bromeliad culture, taxonomy, etc. Greg publishes papers on his findings and enjoys growing species.

Dr. Lawrence Giroux—Florida. Larry is a retired medical doctor and has enjoyed growing bromeliads for many years. He is an accredited BSI Bromeliad Judge and is the co-editor of the Caloosahatchee Bromeliad Society newsletter. He is also the Editor of the Journal of the Cryptanthus Society.

Gloria Irizarry—Southern Region. Gloria is a long time bromeliad grower. She is very active in the New Orleans Bromeliad Society along with her husband Rei. She is currently a student BSI Judge and is hopeful in starting an affiliate once again in Mobile, Alabama.

Roger Lane—California. Roger has served as BSI director in the past and was appointed to replace a director who resigned. Roger is an excellent grower and an accredited BSI Bromeliad Judge. He's very active in the northern California Bromeliad Societies and serves on the BSI Judges Certification Committee.

Geoffrey Lawn—Australia. Geoffrey is a long time bromeliad grower in the Perth area of Australia. I don't know Geoffrey personally but my understanding is that he is an excellent grower and is very interested in perpetuating the BSI into a more international organization.

[3] BSI President

David McReynolds—Northeast Region. David, as all other growers in the northeast, is an inside grower. He is a New Yorker and is active in the New York Bromeliad Society. David brings many years of business experience to the BSI Board.

Jack Percival—California. Jack is a charter member of the North County Bromeliad society and has also been active in the San Diego Bromeliad Society. He has served as President of both societies and is an accredited BSI Bromeliad Judge. Jack has also contributed articles for the BSI Journal.

Rick Richtmyer—Texas. Rick is a geological engineer and he and his wife, Carol, have grown bromeliads for many years. He has served as a BSI director in the past and is an accredited master BSI Bromeliad Judge. He is very active in the Houston, Texas Bromeliad Society and was also very active in the Dallas Bromeliad Society when he lived there.

These directors bring tremendous experience and expertise to the BSI Board of Directors. They work hard throughout the year and at the annual board meetings to handle the business of the BSI. They are doing an excellent job and I am pleased to serve with them.

Dr. Robert W. Read - In Memoriam

Larry Giroux[4]

Dr. Robert (Bob) W. Read, retired curator and taxonomist with the Smithsonian Institution in Washington, D.C., died on July 15 at the age of 71 in Naples, Florida. Anyone involved with bromeliads during the last 45 years would have heard of Dr. Read. His accomplishments as a botanist, taxonomist, and horticulturalist are myriad. He was an Honorary Trustee of the BSI and he served on the Editorial Advisory Board of the Journal of the BSI.

Following his retirement, Bob and his wife, Betsy moved to Naples where they joined the Caloosahatchee Bromeliad Society. They frequently attended meetings and presented programs. After an absence of several years due to poor health, Bob and Betsy returned as members, one year ago. In July, 2002 Bob presented a program about his latest projects which included the reclassification of some of the large aechmeas and his two-volume revision of Nehrling's 1940's book, *My Garden in Florida*. Dr. Read's books are entitled *Nehrling's Early Florida Gardens* and *Nehrling's Plants, People, and Places in Early Florida*.

Long-time members of the Caloosahatchee Bromeliad Society and residents of Southwest Florida are more intimately familiar with Dr. Read as an advocate of the preservation of tropical plants. Although the Botanical Gardens of Bonita Springs, which Dr. Read endorsed, never materialized; The Naples Botanical Garden, of which he was the founding chairman, is now a vital land preserve in southwest Florida.

[4] BSI Director, Florida

Figure 11. Dr. Read with *Puya dasylirioides* in Costa Rica (1975).

Figure 12. Photographing a *Hohenbergia* in Brazil (1982).

Figure 13. Working with artist Dr. Regina Hughes at the Smithsonian Institution (1983).

Photographs of Dr. Read that have appeared in the Journal over the years.

At the edge of the Everglades, in Naples, were his personal gardens which he named "Quest End." Bob had accumulated many of his favorite plants there including palms, cycads, orchids and, of course, bromeliads. Prominently displayed on his property was the group of aechmeas he was studying. This included *Aechmea mulfordii*, *A. rubens*, *A. blanchetiana*, *A. eurycorymbus*, and *A. emmerichiae*.

Although it is impossible to list all of Dr. Read's accomplishments over the past 50 years, there are several highlights of his career which Bromeliad enthusiasts would find interesting.

Until 1965, the plant that we all know and grow as *Quesnelia marmorata*, had retained the name given to it by Carl Mez 93 years earlier, *Aechmea marmorata*. This transfer to a different genus was justified by closer examination of the plant by Dr. Read and by his determining the characteristics which differentiated it from *Aechmea* and *Billbergia*. In the last 38 years no one has challenged Dr. Read's placement of this plant.

The late 1970's might be referred to as "the time of the *Hohenbergia*." It was at this time that this genus composed of generally large bromeliads was receiving much attention. During this period of *Hohenbergia* enlightenment, a combination of Dr. Read's thorough knowledge of this genus and the inquisitiveness of Ms. Eloise Beach of Orlando Florida resulted in the creation of a new genus. In 1974 she found an unusual bromeliad resembling a *Hohenbergia* in an Orlando garden, and she sent the inflorescence to Bob in Washington, D.C. Fresh plant material allowed further in-depth study, and in 1976 Dr. Read and Dr. Lyman B. Smith described a new genus, *Hohenbergiopsis*. This unique plant is now *Hohenbergiopsis guatemalensis*.

Bob worked with many renowned botanists and taxonomists during his career. He worked closely with Lyman Smith, and published the new genus, *Lymania* for his 80th birthday. Dr. Read also worked with Clyde Reed and Gilbert Daniels. In 1993 while already a Botanist Emeritus at the Smithsonian Institution and working from his home in Naples, he collaborated with Dr. H. Ulrich Baensch to reclassify two bromeliads from Mexico. Using existing keys to genera, Read and Baensch determined that *Aechmea macvaughii* and *Aechmea tuitensis* should not be Aechmeas but rather were somewhere between a *Billbergia* and a *Neoglaziovia*. And that is how the new genus *Ursulaea*, named after Dr. Baensch's wife, Ursula, was formed. The only two plants in this new genus remain *Ursulaea tuitensis* and *Ursulaea macvaughii*. Bob was also a taxonomic consultant for the Baensch's book, *Blooming Bromeliads*.

Bob spent most of his adult life exploring, investigating, and preserving tropical plants for all of us to understand better and enjoy more completely. He loved bromeliads, especially talking and writing about them. I hope now that whenever you see a *Quesnelia*, a *Hohenbergia*, or an *Ursulaea* you will recall the man who gave so much to the bromeliad world, Dr. Robert W. Read. We will all miss his stories, expertise, and especially his friendship.

Moving?

If your address is changing, even if your move is a temporary or seasonal one, you should notify the BSI Membership Secretary four to six weeks in advance. Even when you are temporarily away, your bulk mail is either discarded by the Post Office or, as in the case of your JOURNAL issue, is returned to us at a postage due cost of .99 cents within the USA. If you are moving, or have recently moved, please send your name, the old and new addresses, and the effective date to: John Atlee, BSI Membership Secretary, 1608 Cardenas Dr. NE, Albuquerque, NM 87110 or by e-mail to membership@bsi.org.

Seed Collecting in the Florida Everglades

Inez and Leonard Dolatowski[5] **Photographs by the Authors**

We had finally received our permit for collecting seeds in the Everglades. It was several pages long and listed the specific areas in which we could collect, as well as the particular tillandsias from which we could collect seed. We were so excited that we would have the opportunity to collect and hoped that it wasn't too late since the flowering season was over, and we knew the seeds were already "blowing in the wind." We decided to go the second weekend in June, which coincided with our 27th Anniversary. This was appropriate, as our very first trip to the Everglades was on our honeymoon.

There have been many changes since then, but the Flamingo Hotel is still there. Their little restaurant and bar, however, are no longer open during the summer season, and since it is a 40-mile, one-way road in, one does not plan on going out to eat. They have nice cottages, though, with two rooms, a bath, and kitchenette with all the utensils, and this is where we stayed.

The gas station that was there is now used only for storage purposes, but gas is sold at the Marina. There is also a campground, but diehard campers that we are, we have never been able to pitch our tent and actually camp there. We tried once, but that is another story.

Upon arrival, we checked out the first visitor center and were amazed at how large it was with nice exhibits and a bookstore. A boardwalk extends along the back of the center and overlooks a pond. There is also a pond in front, and if you look closely, you're likely to see an alligator-we did. In fact, there are quite a few places to stop and hike along trails, walk by the water and view the wildlife, of which there is a great deal.

Since we were limited to two areas for seed collecting, we stopped to check these out. The first site had nice trails, and the mosquitoes didn't know we were there yet. There were quite a few mangrove trees along the path, which was on the edge of a small lake. We got all excited when we finally saw some bromeliads with seeds. Unfortunately, these were growing on trees in mangroves at least 12 to 15 feet away from the boardwalk-strike one.

After checking in at the cottage, we decided to go on several more trails just as tourists, rather than seed collectors. The rainy season, which normally starts in May, had started the week before we arrived, and the mosquito population was just beginning to build. We would drive along the road, just enjoying the view while looking for bromeliads, and when we saw something from the car, we would pull over and take a closer look, and maybe take some pictures. One of these stops was pretty-beautiful clear water was streaming out from under the road into a marsh with crinum lilies and other aquatic plants, while many small trees made it nice and shady. We pulled the car over, walked up to the water, and all of a sudden a very large splash scared the life out of us. You never know where you are going to find alligators.

On Saturday, we went to the second collecting site where we found quite an assortment of *Tillandsia flexuosa*. We didn't see any of these in seed, but there were many gorgeous specimens. There were also *T. utriculata*, *T. fasciculata*, and *T. paucifolia*. We were searching for *Catopsis berteroniana* at this site, as well as any other *Tillandsia* seeds that were on our approved to collect list. Dr. Howard Frank from the University of Florida told us these *Catopsis* were numerous in the 80's, but they hadn't been seen in recent years, and he had asked us to see if we could find any. The last sighting was in a somewhat marshy area across the parking lot by a lake. Most of the plants in this area were mangroves but the ground was somewhat bare because of, we assume, the rise and fall of the water table. It was a rainy day, and we wore our ponchos as we climbed in and out of the mangrove roots. We also climbed up the mangroves to get some of the seeds of *T. pruinosa* and *T. balbisiana*. After searching this area thoroughly, we did find two small *C. berteroniana*.

On the other side of this parking lot, on a tree, we noticed several tillandsias in bloom as well as a sizeable *Catopsis*, which appeared to have numerous seeds. However, this plant was on a branch over the water, and it was not one I could climb to get at, so I decided to try to reach it from the water. Off came the shoes and poncho and in I went. It didn't seem too deep until I got in. The *Catopsis* was some 20 feet from the shoreline, and as I inched my way into the water, it got deep quickly-I was only about four feet out, and the water was four feet deep. Normally, I would have tried to just hold onto the branch and make my way out to the end, or maybe swim out, but there was a rookery of cattle egrets on the other side of the lake, and I remembered hearing that alligators like to hang out in places like that, eating any of the babies that might fall out of the nest. Needless to say, I didn't want to be on an alligator's menu as a fallen egret, so I chickened out.

We were surprised that there were no other *Catopsis* anywhere around. We were successful in collecting seeds from several species of *Tillandsia*, but unfortunately not the *Catopsis*. We plan on going back in spring to see what we can find and look forward to another adventure.

Our seed collection venture is part of a project involving the Florida Council of Bromeliad Societies (FCBS) to save Florida's native bromeliads from destruction by a non-native weevil, *Metamasius callizona*, the Mexican bromeliad weevil. The FCBS, whose membership includes twelve bromeliad societies in Florida, has dedicated thousands of dollars and countless volunteer hours to the conservation of these native epiphytic plants. Through collaboration with the University of Florida and the Florida Department of Agriculture and Consumer Services/Division of Plant Industry, the FCBS has been involved in supporting research on management

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of the weevil through biological control and in organizing a seed collection project to save the seeds of bromeliads at risk before their populations are destroyed. As part of the seed collection project, individuals obtain State and Federal permits to collect endangered *Tillandsia* seeds. After the seeds are collected, they are sent to volunteer growers with the intent to cultivate the seeds and eventually return the plants to the areas from which the seeds were collected.

Figure 14. The Giant Airplant, or *Tillandsia utriculata* is the favorite native bromeliad of the Mexican Weevil. Here it is growing on a buttonwood tree with Spanish Moss.

Figure 15. *Tillandsia balbisiana* forms a handsome colony on a pond apple (*Annona squamosa*). Florida's butterfly orchid (*Encyclia tampensis*) can be seen to the right.

Conference Report: Bromeliads Auckland 2003

Gerry Stansfield[6]

I have heard that a bromeliad conference is the best place to find the who's who in the bromeliad world, and it would have to be said that Bromeliads Auckland 2003, held this past March 7-10, was no exception. It was even a bit overwhelming for me, as I had never been to a bromeliad conference before. There were so many people not only to meet, but also talk to, that I had only read about in the past. The knowledge, understanding, and friendships that were made leave an ever-lasting impression and enhance this wonderfully great sense of knowledge about our beloved Bromeliaceae.

The Venue: Waipuna Hotel and Conference Centre. The Centre is situated on the edge of the Tamaki Basin. This is a very large tidal estuary that is used for leisure boating activities during the summer such as water skiing, windsurfing, etc. The scenery is conducive to total enjoyment at all times. The auditorium is professionally laid out in theatre form with overhead projection lighting and speaker system. This allowed our speakers to present their lectures on stage in a well-lit environment, while the rest of the theatre was in darkness.

Bromeliads Auckland 2003 was our first bromeliad conference, and one would have to say that we were blessed with an outstanding array of top bromeliad growers and people of world renown.

Figures 16 and 17. Displays from Bromeliads Auckland 2003. Photos courtesy Bromeliad Society of New Zealand.

[6] Auckland, New Zealand

Coming from Florida were Dennis and Linda Cathcart of Tropiflora. Dennis opened the conference sessions with some amazing slides of tillandsias in the rain forests, and of the many pitfalls both he and Linda have encountered on their travels. Elton Leme, of Brazil, provided a wonderful overview of *Neoregelia*. I videotaped the complete talk. His almost clinical approach was extremely easy to follow, and I enjoyed all of his talks. Then we had Pamela Koide of Bird Rock Tropicals in California, who presented, "Discovering new Tillandsias in Mexico," and also spoke about her work at Bird Rock. Others in attendance were Joyce Brehm from the BSI International and, of course, Ed and Moyna Prince. In fact, Ed, Moyna, and Pamela were our judges in the Bromeliad competition. I had heard of Ed and Moyna and had received seeds from Moyna, but I had not met them, so it was a very nice surprise to finally meet and talk with them. Margaret and I were both very touched by their warmth and friendliness. One other very talented lady I was thrilled to meet was Sharon Peterson, who works with David Shiigi in Hawaii. In Australia, just prior to the conference, I was privileged to have a sneak preview of many of Sharons latest *Neoregelia* hybrids such as *Neoregelia* 'Beach Party', 'Crimson Lace', 'Screaming Tiger', 'Strawberry Jamboree' and of course, many others.

The Australian Contingent: From the attendance list, I counted 40 Australians, but I believe there were a few more than that, and for our first conference, that was just great. It was wonderful to see Grace Goode, who needs no introduction to the World of Bromeliads. Margaret and I met Grace on our first trip to Brisbane four years ago, and have continued to call her each year. Arno King (ex Kiwi), a landscaper and architect of some repute, gave the talk, "Growing Bromeliads Epiphytically in the Garden." Bill and Margaret Paterson were there, and Margaret, a well-known *Neoregelia* hybridist, enthralled us with her new hybrids. Derek (it wouldn't be a show without him) and Margaret Butcher attended, and Derek talked to us about his role as Cultivar Registrar for the BSI. Finally, Yves Daniel of Danny and Lindsay fame from Buderin, Queensland spoke on "Landscaping with Bromeliads on the Sunshine Coast."

I have only mentioned a few of the 40 Australian attendees, but as one may guess, there were many more, like Keith and Ruby Ryde, Len and Olive Trevor, Shane Zaghnin, John and Eileen Killingley, Keith Golinski, Lynn and Bob Hudson, Ralf Schenk, Cheryl Basic, and the list goes on. We were so grateful for all those people that helped to make our first conference the success it was.

The one and only New Zealand speaker was Andrew Flower from Wellington who gave the very interesting talk, "Bromeliad Nutrition."

The general feeling by all the attendees was that the Bromeliads Auckland 2003 conference was a great success and a credit to all those who had worked tirelessly behind the scenes, and there is no doubt that New Zealand will be included again when it is next our turn.

Variegation With Tobacco Mosaic Virus

By Jonathan Kajiwara[7] Photographs by Larry Giroux

Introduction

The tobacco mosaic virus (TMV), which is known to be present in raw, green tobacco was tested on several specimens of bromeliads. In nature, certain types of variegation develop due to viral infections. Researchers at the University of Hawaii have reported that aphids and leafhopper insects transmit potato, cucumber, and papaya mosaic virus to other field crops. Other studies have shown that cigarette smokers have inadvertently transferred TMV while transplanting tomato plants.

Materials and Methods

During 1997, thirty bromeliads were selected and divided into three groups of ten each. Each group consisted of *Neoregelia sapiatibensis* (2), *Neoregelia correia-araujoi* X *Neoregelia* 'Oeser #100' (5), *Neoregelia* 'Red Gold' (1), *Tillandsia capitata* (1) and *Nidularium rutilans* (1). The bromeliads varied in age from two to six months.

Each plant was potted in an "Ultra 60", six inch, green plastic pot. The medium consisted of redwood bark 30%, Canadian peat 60% and perlite 10%.

Subsequently the plants were grown in a shade house built of untreated California redwood, located in the backyard of a home in Honolulu, Hawaii. The home is approximately five miles north of the Honolulu International Airport. 48% sun filter, black cloth, hung horizontally about 4 feet above the plants, shaded all subject plants. There was no additional shading by buildings or trees during the day.

Rainfall averages eighteen inches per year in this location. The weather is generally sunny with temperatures ranging from 70-84 degrees F. Additional watering is derived from artesian wells located in Halawa Valley, Honolulu, ten miles away. The City and County of Honolulu operate the water distribution system. The water is rated as "soft" and free of organic and inorganic contaminants such as chlorine and bacteria.

Since TMV is also found in the tobacco of cigars, cigars were selected for the source of the TMV for this test. The brand of cigar chosen was Wm. Penn Perfecto, manufactured by the Wm. Penn Company, P.O. Box 670, Dothan, AL 36302. The cost was $2.50 for a box of five.

Each potted plant of the first group was exposed to one inch of cigar per month. Each one inch segment was broken apart and spread evenly over the medium. The shredded cigar was watered and kept moist, but not soggy. Plastic gloves were used for this operation.

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[7] Honolulu, Hawai'i

Figure 18. Untreated *Neoregelia correia-araujoi* X *N.* 'Oeser #100'.

Figure 19. Fourth generation progeny of treated *Neoregelia correia-araujoi* X *N.* 'Oeser #100' demonstrating variegated borders of a wide paler leaf center.

Figure 20. Fifth generation progeny pup of treated *Neoregelia correia-araujoi* X *N.* 'Oeser #100' clearly showing the variegation throughout the leaves.

Figure 21. New variegation in the leaves of *Nidularium rutilans* resultant from TMV infection and passed on to offsets.

Figure 22. Variegated form of *Tillandsia capitata* produced after exposure to Tobacco Mosaic Virus.

Figure 23. Normal untreated *Tillandsia capitata*.

Figure 24. Normal untreated *Neoregelia sapiatibensis*.

Figure 25. Third generation progeny of treated *N. sapiatibensis* with yellow variegation lines in the newly developing leaves.

The second group was treated with an equal volume of small pieces of variegated leaves of *Neoregelia carolinae* 'Tricolor' and *Neoregelia* 'Kahala Dawn' also on a monthly basis.

The control group remained untreated. Each of the group of plants was grown separated from each other. The project dates spanned January thorough December 1997. Please note that the experimenter is a non-smoker.

Results and Discussion

After one year, four of the five types of bromeliads in the group treated with monthly cigar tobacco demonstrated varying degrees of variegation. Only *Neoregelia* 'Red Gold' did not show variegation in the central emerging leaves. Of the four types of bromeliads, which had changes, *Neoregelia correia-araujoi* X *Neoregelia* 'Oeser #100' was the most promising.

Subsequently, the variegation in *Neoregelia correia-araujoi* X *Neoregelia* 'Oeser #100' progressed in the first and second generations of progeny to the point where they resembled the ordered variegation of *Neoregelia carolinae* 'Tricolor'. Five years later, the third and fourth generations of progeny have stabilized in appearance with the variegation generalized throughout many of the leaves (see photo). The plant is attractive and significantly different from the initially treated clone. While the issue of commercial value is subjective, this new cultivar has good color, a large size, variegation, vigor, adaptability to full sun in the Hawaiian landscape and pups profusely before and after flowering.

The plants of *Neoregelia sapiatibensis*, *Tillandsia capitata*, and *Nidularium rutilans*, which also demonstrated variegation, have varying intensity of green lines and would have doubtful commercial value.

The second group of plants treated with chopped leaves of variegated neoregelias showed no development of variegation. This group was included to test for a possible "persistent" viral infestation of variegated plants, which might "infect" other plants and produce the desired variegation. No obvious changes were noted during the test period in this second group.

The control group and their subsequent progeny showed no changes in leaf pattern during or after the completion of the study.

Summary

The tobacco of cigars was an economical and convenient source of TMV for this project. Virus can be transmitted to the growing meristem of bromeliads when tobacco is spread over the potting medium and watered. While the mechanisms of the virus infection remain uncharted, the results of this study indicate it is possible to produce variegation in a non-variegated bromeliad and give birth to an attractive neoregelia with commercial potential.

Two New Species of *Hohenbergia* from Bahía, Brazil

Elton M. C. Leme[8]

The genus *Hohenbergia* has 52 recognized species (Luther 2002) in two subgenera. The subgenus *Hohenbergia*, with 31 valid species and four varieties, is almost exclusively Brazilian (except for *H. stellata* which is found north to Trinidad and Tobago), with a major center of distribution in northeastern Brazil, mainly in the state of Bahía. The subgenus *Wittmackiopsis* consists of the remaining taxa, and they occur in the region of the Greater Antilles.

Despite the great diversity of *Hohenbergia* species concentrated in northeastern Brazil and the great potential for studies in the area, very few contributions to a better understanding of the genus have been published. The most recently described new Brazilian taxa (*H. burle-marxii*, *H. hatschbachii*, *H. itamarajuensis*, and *H. undulatifolia*) were published after 1996, and before that the publications date back to 1980 (*H. correia-araujoi*, *H. estevesii*, and *H. lanata*) and 1983 (*H. oxoniensis*, and *H. pennae*).

The relatively few publications compared to the richness of Brazilian bromeliad diversity causes difficulty when determining taxonomic status of some key species (e. g., *Hohenbergia catingae* and its varieties, *H. eriantha*, *H. vestita*) to which most of the newly investigated taxa are related according to the identification key by Smith & Downs (1979). Some of these key species are still imperfectly known and poorly represented in herbaria, with many data lacking, e.g., leaf conformation, floral morphology, and average variation in field populations, which makes species delimitation a very complex task. However, from time to time it is still possible to find some unusual unpublished species with a peculiar set of morphological characteristics, as described below.

Hohenbergia conquistensis Leme, sp. nov. **Type:** Brazil. Bahía: Vitória da Conquista, Serra do Periperi, field collected Nov. 2000 by *R. F. Reis Júnior & J. C. M. Falcon s.n.* and flowered in cultivation July 2002, *E. Leme 4990* (Holotype: HB). FIGURES 26-30

A *Hohenbergia. vestita* L.B. Sm., cui affinis, foliis subduplo brevioribus, laminis foliorum dense spinosis, spinis plerumque antrorsis, bracteis scapalibus distincte brevioribus, bracteis floriferis altitudinem sepalorum brevioribus et sepalis longioribus, apice mucronulatis differt.

Plant flowering ca. 90-100 cm tall, propagating by basal stout stolons ca. 15 cm long. ***Leaves*** 10 to 15 in number, forming a broadly tubular to narrowly funnelform rosette; ***sheaths*** broadly elliptic, 18 x 12 cm, chartaceous, nerved, subdensely pale-lepidote on both sides, dark brown; ***blades*** linear, nearly erect, 20-25 x 6-7.5 cm, apex narrowly acute and ending in a stout cusp ca. 1 cm long, apex, subdensely but inconspicuously white-

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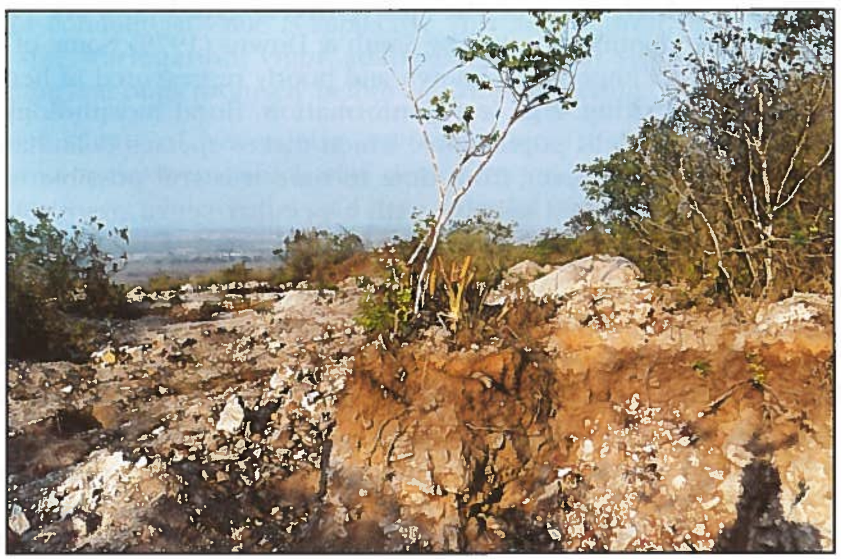
Photograph by R.F. Reis Jr.

Figure 26. *Hohenbergia conquistensis* in its habitat at Serra do Periperi, Vitória da Conquista, Bahia State.



Photograph by R.F. Reis Jr.

Figure 27. Illegal sand extraction at Serra do Periperi is drastically changing the natural scenery of the habitat of *Hohenbergia conquistensis* and represents a serious threat to its survival.

Figure 28. Floral detail of *Hohenbergia conquistensis.*

Photograph by E. Leme

Figure 29. Type plant of *Hohenbergia conquistensis* which flowered in cultivation.

Photograph by E. Leme

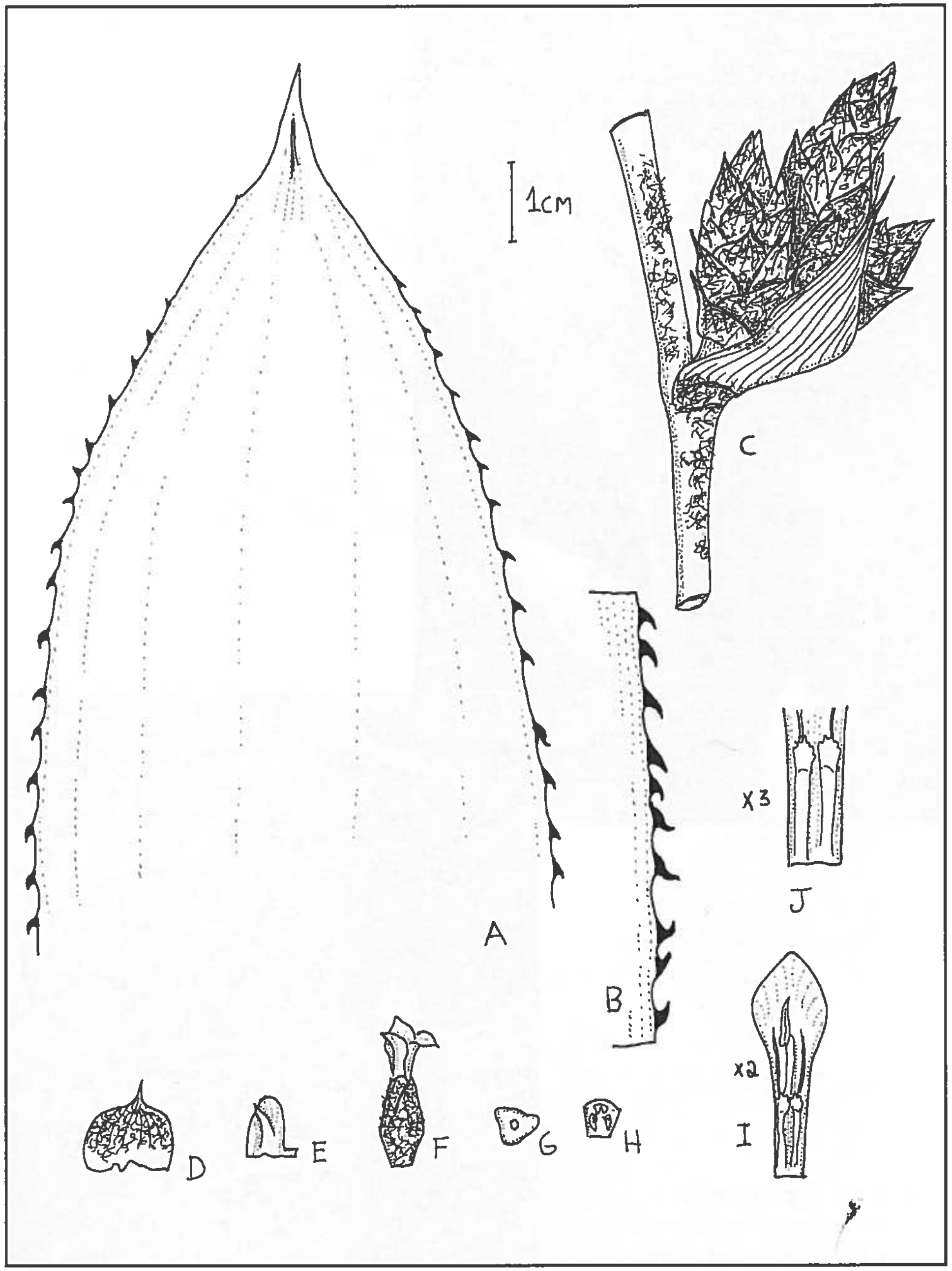


Figure 30. *Hohenbergia conquistensis*: A. Leaf apex. B. Margin of the basal portion of the leaf. C. Basal branch. D. Floral bract. E. Sepal. F. Flower. G. Cross-section of the ovary. H. Longitudinal section of the ovary. I. Petal. J. Petal appendages. Illustration by E. Leme.

lepidote, coriaceous, yellowish-green or reddish toward the apex, margins densely spinose, spines nearly black, flat, 2-4 mm long, 1-2 mm wide at base, 3-8 mm apart, prevailing retrorse-uncinate, but the basal or the apical ones varying in part from straight to antrorse; ***scape*** erect, ca. 64 cm long, 0.5-0.6 cm in diameter, bright red, white-lanate but soon glabrous; ***scape bracts*** narrowly lanceolate, acuminate, entire, erect, shorter than the internodes, stramineous, papyraceous, distinctly nerved, inconspicuously white-lanate but soon glabrous, ca. 6 x 1.7 cm. ***Inflorescence*** subcylindric, laxly tripinnate toward base and densely bipinnate at apex, erect, ca. 17 cm long, ca. 6 cm in diameter, densely pale-lanate at anthesis except for the petals, distinctly exceeding the leaves; ***primary bracts*** resembling the upper scape bracts but shorter, 2-4 x 1-1.2 cm, suberect, about equal to distinctly shorter than the branches; ***primary branches*** sessile or nearly so, suberect, the basal ones laxly arranged with 2 to 3 secondary branches, the apical ones densely arranged on the main axis, subcylindric, acute, densely flowered, 4-4.5 cm long, 1.3-1.5 cm in diameter; ***secondary bracts*** resembling the floral bracts; ***secondary branches*** resembling the apical primary branches, 2-4 cm long; ***floral bracts*** suborbicular, broadly acute and mucronate, suberect, 10-12 x 11-13 mm, including the yellowish, 3 mm long mucro, green, nerved, glabrous inside, densely pale-lanate outside, strongly convex, ecarinate or the basal ones obtusely carinate, shorter than the sepals, margins entire to inconspicuously and irregularly crenulate or spinulose. ***Flowers*** 18-19 mm long (including the petals), sessile, densely and polystichously arranged; ***sepals*** strongly asymmetric with the lateral membranaceous wing distinctly surpassing the midnerve, ca. 8 x 5 mm, minutely mucronulate at apex, free or nearly so, green, densely pale-lanate, the posterior ones obtusely carinate, the anterior one ecarinate; ***petals*** subspatulate, apex acute, ca. 15 x 5 mm, free, lilac, suberect-recurved at apex at anthesis, bearing two sublinear, ca. 5 x 1 mm, appendages at base, with free lobes ca 1.5 mm long, subacute and irregularly denticulate; ***filaments*** slightly complanate, ca. 10 mm long, the antepetalous ones adnate to the petals for ca. 5 mm, the antesepalous ones free; ***anthers*** ca. 3 mm long, base sagittate obtuse, apex acuminate, recurved toward apex, fixed at 1/3 of its length above the base; ***stigma*** subglobose, conduplicate-spiral, white, blades crenulate; ***ovary*** ca. 4 mm long, ca. 5 mm in diameter, subtrigonous, green, pale-lanate; placentation apical; ovules obtusely apiculate; epigynous tube inconspicuous. ***Fruits*** unknown.

This new species is closely related to *Hohenbergia vestita* L.B. Sm. but it differs by the leaves about two times shorter (38-43 cm long vs. ca. 70 cm), leaf blades densely spinose (spines 3-8 mm apart vs. 10-22 mm), spines prevailing retrorse (vs. prevailing antrorse), scape bracts distinctly shorter than the internodes (vs. distinctly exceeding the internodes and imbricate, despite exposing the scape) floral bracts shorter than the sepals (vs. equaling the sepals), and by the sepals mucronulate (vs. unarmed).

Photograph by E. Leme

Figure 31. Habit of *Hohenbergia sandrae* in cultivation.

Hohenbergia conquistensis was found growing terrestrially in the sandy soil of Serra do Periperi, situated north of Vitória da Conquista, Bahía state, at about 1000 m altitude. Nowadays the habitat of this new species in Serra do Periperi is covered by a vegetation mosaic of sclerophyllous savanna (caatinga), grasslands on rocky soils, and riparian forest (Soares Filho & Mantovani 2000), which is dramatically disturbed by sand extraction, making uncertain the future survival of this species. As a heliophyte or semi-heliophyte, *H. conquistensis* forms dense and large populations at the top of Serra do Periperi.

Hohenbergia sandrae Leme, sp. nov. **Type:** Brazil. Bahía: Maracás, field collected Feb. 1997 by *S. Linhares s.n.* and flowered in cultivation Dec. 2001, *E. Leme 3786* (Holotype: HB; Isotype: CEPEC). FIGURES 31-33

A *Hohenbergia blanchetii* (Baker) E. Morren ex Mez, cui affinis, scapo rubro, bracteis floriferis roseis vel rubris, lepitotis, marginibus lanatis, floribus longioribus, sepalis longioribus et intense roseis, obtusis et muticis vel remote apiculatis differt.

Plant terrestrial, flowering ca. 150 cm tall. ***Leaves*** ca. 20 in number, strongly coriaceous, forming a broad funnelform rosette; ***sheaths*** broadly elliptic ca. 22 x 17 cm, very densely brown-lepidote on both sides, dark castaneous, coarsely spinose toward apex; ***blades*** linear, suberect at anthesis, not narrowed at base, 55-65 x 9-10 cm, densely but inconspicuously white-lepidote on both sides, green, greenish-yellow or sometimes reddish

along the margins, margins densely spinose toward the base and irregularly and subdensely to laxly spinose toward apex, spines prevailing retrorse, triangular-uncinate, 3-6 mm long, 2-4 mm wide at base, nearly black, apex acuminate, ending in a black, stout, pungent spine. ***Scape*** suberect, stout, ca. 80 cm long, 1.2-1.7 cm in diameter, red, densely white-lanate; ***scape bracts*** sublinear-lanceolate, acuminate, 12-15 x 2-3.5 cm, pale-stramineous, papyraceous, finely nerved, entire, imbricate, distinctly exceeding the internodes and completely covering the scape, inconspicuously white-lepidote to glabrescent. ***Inflorescence*** laxly paniculate, broadly pyramidate, 4-pinnate at base, tripinnate to bipinnate at apex, ca. 65 cm long, 55 cm in diameter at base, suberect to erect, rachis white-lanate to glabrous, bright red; ***primary bracts*** resembling the upper scape-bracts, but smaller, spreading, about equaling to exceeding the basal sterile peduncle; ***primary branches*** near spreading, the lower ones 22-32 cm long, peduncle 3.5-6 cm long, 0.5-0.7 cm in diameter, slightly complanate, red, inconspicuously white-lanate to glabrous, with 12 to 17 short-pedunculate to sessile secondary branches laxly arranged at base and subdensely to densely arranged toward apex, the median primary branches 8-12 cm long, basal peduncle 2-3 cm long, ca. 0.3 cm in diameter, with 5 to 9 subsessile to sessile secondary branches, the upper primary branches 3-6 cm long, resembling the secondary branches; ***secondary bracts*** narrowly lanceolate, acuminate-caudate, exceeding the basal peduncle but shorter than the spikes, stramineous, finely nerved, entire, ecarinate; ***secondary branches*** the basal ones pyramidate, 4-5 cm long, 4-5 cm wide at base, with 3 to 5 densely arranged strobiliform spikes, shortly pedunculate, the upper secondary branches (strobiliform spikes) ellipsoid to subcylindrical, subsessile to

Photograph by E. Leme

Figure 32. Floral detail of *Hohenbergia sandrae*.

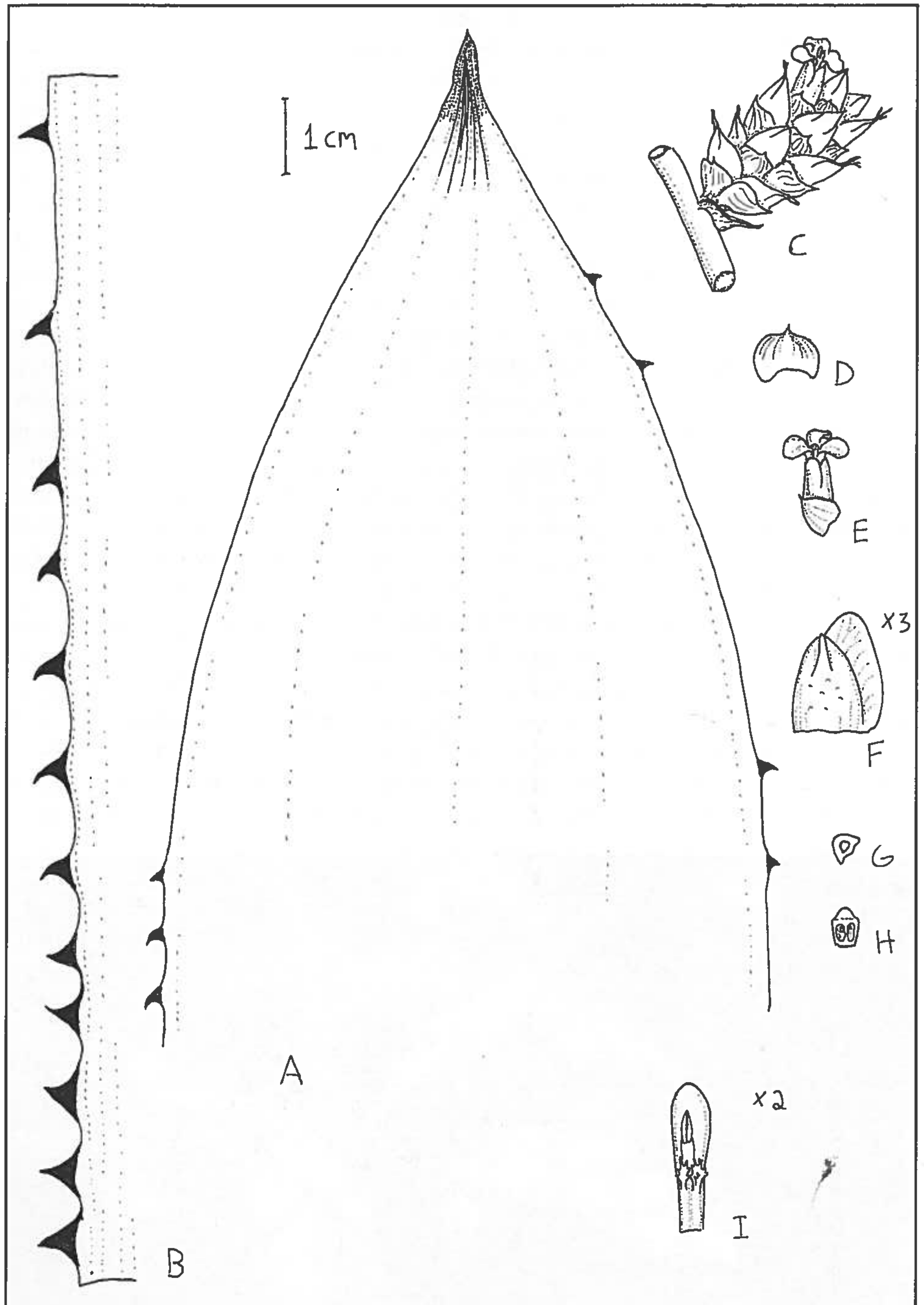


Figure 33. *Hohenbergia sandrae*: A. Leaf apex. B. Margin of the basal portion of the leaf. C. Upper secondary branches (strobiliform spikes). D. Floral bract. E. Flower. F. Sepal. G. Cross-section of the ovary. H. Longitudinal section of the ovary. I. Petal. Illustration by E. Leme.

sessile, subspreading, 2.5-3 x 1.5 cm, with 10 to 16 flowers; ***floral bracts*** subreniform to suborbicular, obtuse and shortly mucronulate, suberect with the flower, about equaling to slightly exceeding the ovary, ca. 5 x 8 mm, rose to red, white-lepidote except for the white-lanate margins, but soon glabrous, nerved, entire, ecarinate, strongly convex. ***Flowers*** ca. 14 mm long, sessile, densely and polystichously arranged, suberect; ***sepals*** suboblong, strongly asymmetric, ca. 5 x 4 mm, obtuse and muticous to remotely apiculate due to the decurrent midnerve on the apex, subfree, remotely rugulose, glabrous except for the slightly white-lepidote apex, entire, bright rose, the posterior ones obtusely carinate, the lateral membranaceous wing distinctly exceeding the midnerve, narrowly rounded; ***petals*** subspatulate, apex rounded and slightly cucullate, ca. 10 x 3.5 mm, free, lilac, bearing 2 obovate, irregularly dentate to lacerate appendages 4-5 mm above the base; ***stamens*** included; ***filaments*** complanate and dilated toward the apex, the antepetalous ones adnate to the petals for ca. 3 mm, the antesepalous free; ***anthers*** ca. 2 mm long, base obtuse, apex acute, fixed at middle; ***stigma*** conduplicate-spiral, ellipsoid, slightly longer than the anthers, white, blades fimbriate; ***ovary*** 3-4 mm long, ca. 3.5 mm wide, glabrous, green, placentation apical, ovules caudate; epigynous tube inconspicuous. ***Fruits*** slightly enlarged from the ovary, purple toward apex, including the persistent calyx.

This new ornamental *Hohenbergia* is a heliophyte which was found growing terrestrially in thorn scrub (caatinga vegetation) in the region of Maracás, Bahía. It is closely related to *H. blanchetii* (Baker) E. Morren but can be distinguished from it by its red scape (vs. pale green), rose to red floral bracts which are white-lepidote except for the white-lanate margins (vs. pale green and glabrous), flowers longer (ca. 14 mm long vs. 8-10 mm), sepals longer (ca. 5 mm long vs. 3.5 mm), brightly rose (vs. greenish), obtuse and unarmed or remotely apiculate (vs. emarginate).

Hohenbergia sandrae honors the bromeliad collector from Salvador, Bahía, Sandra Linhares. She has contributed a great deal of botanical material for cultivation, which is bringing to light many new taxa of Brazilian Bromeliaceae.

Acknowledgments

The authors thank the bromeliad collectors Raymundo Fernandes Reis Júnior, José Carlos Martinez Falcon, and Sandra Linhares, for their generous gifts of living specimens used in this work.

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Bromeliad Dwellers: Summary and Insight from an Online Database

Dorothy E. Tuthill and Gregory K. Brown[9]

Epiphytic bromeliads play a crucial role in the neotropical forest canopy. In what would otherwise be a fairly dry environment, tank bromeliads impound fresh water, creating pools called phytotelmata, and their roots and leaves accumulate organic material, creating soil far above the ground. Fish (1983, cited in Benzing 2000) estimated 50,000 liters of water were suspended per hectare in a Colombian cloud forest, and Paoletti et al. (1991) estimated the amount of suspended soil to exceed 100 kg per hectare in a Venezuelan cloud forest. These arboreal systems have been likened to swamps (Picado 1913) or islands (Paoletti et al. 1991) where diversity is high and organisms are densely concentrated. In dry regions, terrestrial bromeliad tanks play an equally important role, since they may be the sole source of water for the local biota. For these reasons, bromeliads are considered to be keystone species, species that attract or harbor many other species, and are therefore essential for maintaining biological diversity.

In order to appreciate this diversity of bromeliad-associated organisms, members of our lab have been compiling a database that we hope will eventually include all organisms reported to dwell in or on bromeliads or rely heavily on bromeliads for sustenance, shelter or courtship. The database can be accessed through the Florida Council of Bromeliad Societies web page at http://www.fcbs.org/, clicking on the database button to the left and then Bromeliad Tank Dwellers Database. It now contains more than 3300 reports from 42 countries, garnered from nearly 200 published references dating from 1878 to 2003. Bromeliad hosts have been identified in 107 species in 23 genera, but many (38%) of the citations do not include host taxon names, so the bromeliad diversity may actually be much higher. The most commonly reported host species are members of *Tillandsia*, not surprising given that *Tillandsia* is geographically widespread and highly diverse. Also well represented are *Aechmea* and *Vriesea*, again widespread and diverse.

Taxon names for both the host and the associated organisms are reported in the database as they appeared in the cited publication. However, in order to provide a consistent taxonomic scheme for sorting and searching the database, phylum, class and order names were added or changed to reflect a single, current concept. For the most part, the scheme of Barnes (1998) was adopted, especially for protists and animals. A few long recognized terms, like Insecta and Arachnida, were retained in the database, even though they are not used in the scheme of Barnes, because most users of the database are more familiar with them than the alternative terms.

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Organisms belonging to each of the five kingdoms have been recorded from bromeliads (TABLE). Relative representation in the database does not necessarily reflect the relative abundance of the different taxonomic groups in bromeliads, but rather the interests of the investigators.

The largest organism associated with bromeliads, and the only mammal in the database, is the spectacled bear, *Tremarctos ornatus* (Peyton 1980). Members of Bromeliaceae make up the most important food source for this bear, which consumes fruits or the succulent rosette hearts of at least 22 species in the genera *Puya*, *Tillandsia* and *Pitcairnia* throughout its range in Peru. Moreover, bromeliads may be valuable sources of water to the bears, important in the scrub desert and steppe habitats where the bears live (Peyton 1980).

A number of birds also utilize bromeliads for feeding (Sillett 1994, Sazima & Sazima 1999). Many bird species have been documented to forage in bromeliads, but *Pseudocolaptes lawrencii* (buffy tuftedcheek ovenbird) was the most specific feeder found, spending three-quarters of its time foraging in epiphytic bromeliads (Sillett et al. 1997). It consumed adult insects and arachnids but not aquatic insect larvae. The banaquit (*Coereba flaveola*) also utilizes bromeliads, but in this case it forages in the flowers for nectar. Although considered a nectar robber, it may play a role in pollination of the flowers (Sazima & Sazima 1999). Of course, most bromeliads are pollinated by hummingbirds; and though clearly associated with bromeliads, hummingbirds have not been included in this database.

By far the most abundant chordates recorded in bromeliads are the Amphibia, including both frogs and salamanders (FIGURE 1). Because they require water for their eggs and juveniles, amphibians are often dependent on the water stored in tank bromeliads. The small volume of water available in bromeliad leaf axils has led to some interesting adaptations in frogs, including small clutch size, elongate shape of the tadpoles and rapid development (Krügel & Richter 1995). As well as limiting the number of tadpoles that will grow in each small reservoir, small clutch size allows for more exposure of each egg to oxygen, important in the oxygen-depleted tank environment. To provide nourishment for tadpoles in food-limited phytotelmata some frogs provide unfertilized eggs for tadpoles to feed on; others invest in yolk-rich eggs, so that the juveniles needn't feed at all (Lannoo et al. 1987).

Some frogs are particular about which bromeliad they select: *Osteopilus brunneus* was found only in *Hohenbergia fawcettii* and never in *Guzmania fawcettii*, though both of these large-sized plants formed large arboreal clusters in the study area (Lannoo et al. 1987). This preference, however, does not hold throughout the frogs' range, since *H. fawcettii* is not present in much of the range. Other frogs are much less particular, and may utilize a variety of bromeliads or even artificial bromeliads provided by investigators (e.g. *Syncope antenori*; Krügel & Richter 1995).

As with frogs, adaptation to the leaf-axil habitat has had a profound effect on the only crab that breeds there, *Metopaulias depressus* (Diesel 1989, 1992). The ancestral home of crabs is marine, and most crabs still live there. Larvae hatch from eggs and simply float with the plankton for several weeks before developing into adult-like forms. In freshwater and terrestrial environments mother crabs may invest significant energies into care of their young, and the larval stage is either absent or greatly shortened. For *M. depressus*, mothering begins before the eggs are laid, when she cleans selected leaf axils by removing litter and any competitors for the space. Then, for the next four months, she stands guard over her eggs, larvae, and juveniles, bringing them food and chasing away predators, behavior completely unknown to other crabs (Diesel 1989, 1992).

Arthropods constitute the bulk of the tank-dwellers database, making up over two-thirds of all records, and insects alone comprise over half of the entries. Not surprising to those familiar with bromeliads, Diptera (the order that includes flies and mosquitoes) are most commonly reported. The relationship of mosquitoes to bromeliad tanks has been of significant economic concern, because of the role of mosquitoes as vectors of human diseases (e.g., Chadee et al. 1998, Forattini et al. 1998, Frank & Curtis 1981). The second most commonly reported insect order are the beetles (Coleoptera), the most diverse of all animal groups.

Other bromeliad-associated arthropods include arachnids (spiders, mites, scorpions, pseudoscorpions and harvestmen) and myriapods (millipedes and centipedes). Spiders are the most commonly reported arachnids. Lucas (1975) found that spiders outnumbered all other animals in *Catopsis hahnii*, and Oliveira et al. (1994) found spiders to be the most abundant animals in *Neoregelia cruenta*. Spiders are predators and may use bromeliads primarily for hunting, but one tarantula, *Pachistopelma rufonigrum*, has never been found outside of tank bromeliads (Santos et al. 2002). Like spiders, centipedes are predators, probably attracted to bromeliads for the other animals, but millipedes are predominantly herbivorous, feeding on the decaying vegetation that accumulates in leaf axils.

The kingdom with lowest representation in the database is, rather ironically, Plantae. The majority of records are bryophytes, both mosses and liverworts. The liverwort genus *Bromeliophila* is found exclusively in bromeliad tanks, as its name implies (Gradstein 1997). There are only two records of flowering plants in bromeliads. Seeds and seedlings of *Erythroxylum ovalifolium*, a close relative of coca, have been seen in *Neoregelia cruenta* (Fialho & Furtado 1993), the seeds presumably left by birds or tree frogs. The other flowering plant is *Utricularia reniformis* (Hoehne 1951), commonly known as bladderwort, a small plant that traps and digests insects in underwater, bladder-like sacs.

No doubt one reason for the poor representation of plants in the database is the prevalence of zoologists among bromeliad tank researchers.

TABLE. Summary of some selected organisms reported in the tank-dweller database (http://www.fcbs.org/), as of June 2003. Entries in parentheses are included in the count for the taxon above.

Kingdom / Phylum / Class / Order	Common name	No. reports
Bacteria		41
Protoctista	Protists	
Rhizopoda	Amoebae	25
Bacillariophyta	Diatoms	102
Gamophyta	Desmids	41
Chlorophyta	Green algae	50
Plantae		10
Fungi		
Zygomycota		5
Ascomycota	Sac fungi	128
Basidiomycota	Mushroom fungi	5
Animalia		
Rotifera	Rotifers	30
Platyhelminthes	Flat worms	23
Annelida	Segmented worms	64
Crustacea		128
Arthropoda		
Insecta	Insects	1861
Diptera	Flies	822
Coleoptera	Beetles	381
Arachnida	Arachnids	324
Araneae	Spiders	184
Myriapoda	Centipedes and millipedes	54
Chordata		
Amphibia		223
Anura	Frogs	108
Caudata	Salamanders	115
Aves	Birds	17
Reptilia		21
Mammalia		4

However, it must also be due in part to the low light conditions where bromeliads often grow. Laessle (1961) and Frank (1983) noted that algae are uncommon in shaded bromeliads because light levels are insufficient for photosynthesis to occur, and this must hold true for plants as well. In these conditions the food web is based on carbon from detritus (decaying plant and animal remains) rather than from photosynthesis. Animals play an important role in breaking detritus into small pieces, and thereby increasing its surface area, but the real work of decomposition and nutrient cycling is performed by microscopic members of the phytotelm community: bacteria, fungi and protists.

Only a single study has looked specifically for bacteria (and then only for coliforms; Hagler et al. 1993) present in bromeliad tanks, and only three studies included cyanobacteria ("blue-green algae") in their inventories (Lourenço de Oliveira et al. 1986, Pedraza-Silva 1992, Sophic 1999), though bacteria may in fact be the most abundant organisms in bromeliad tanks as they are elsewhere. Tank water-associated fungi have been investigated only twice (Araujo 1998, Hagler et al. 1993) revealing numerous ascomycetous yeasts and a few Basidiomycota, also yeast-like. The majority of these fungi have been previously found in association with rain forest trees. Aquatic fungi are abundant in stream and lake systems, and may be present in bromeliad tanks, but have not been looked for yet. A single investigation of bromeliad insect-associated Trichomycetes (Zygomycota) yielded a number of new species (Lichtwardt 1994), suggesting that further investigation could not only expand the diversity of bromeliad organisms, but of fungi as well.

Protists have received slightly more attention than bacteria or fungi. As mentioned previously, the presence of green algae is associated with increased light (FIGURE 2), but the abundance of other, non-photosynthesizing protists (flagellates, ciliates, etc.) appears to be positively correlated with densities of rotifers and macroinvertebrates (Carrias et al. 2001). The same study found that flagellates and ciliates were present in tank waters at approximately the same densities as in fresh water systems. Thus they are no doubt important consumers of bacteria in bromeliad tanks and probably contribute more significantly to nutrient remineralization than do animals (Carrias et al. 2001).

Much work still needs to be done to inventory all organisms, especially microscopic ones, in bromeliad tanks. Above and beyond that, the ecological studies necessary to understand the interactions of those organisms and the flow of energy and nutrients through phytotelm systems have not even been begun. Surely we can all appreciate that bromeliads are extremely important contributors to biological diversity in neotropical regions, and a greater understanding of how tank ecosystems function will further heighten our appreciation.

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Events Calendar

Nov. 7-9, 2003. *CALOOSAHATCHEE BROMELIAD SOCIETY'S STANDARD BSI SHOW AND SALE*. Caloosahatchee Bromeliad Society. Terry Park, 3410 Palm Beach Blvd., Ft. Myers, FL. Judging Nov. 7, open to the public Nov. 8, 9-5; Nov. 9, 10-4. For more information, contact Larry Giroux (239-997-2237) or Brian Weber (239-591-4268).

Nov. 15, 2003. *ANNUAL FLORIDA COUNCIL OF BROMELIAD SOCIETIES EXTRAVAGANZA*, Sales, seminars, workshops, rare plant auction, banquet. Bromeliad Society of South Florida. Miccosukee Resort and Gaming, 500 S.W. 177th Ave., Miami, FL. For more information, contact Karl Green (305-255-4888) or visit www.fcbs.org.

August 10-15, 2004. *WORLD BROMELIAD CONFERENCE*. Bromeliad Society International/Bromeliad Society of Greater Chicago. Rosemont, Illinois, USA.

The Bromeliad Society International

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

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World Bromeliad Conference 2004: Chicago

The Bromeliad Society of Greater Chicago and the Bromeliad Society International invite you to register for the 2004 World Bromeliad Conference at the Westin Hotel in Rosemont, Illinois, USA. Chicago is "Your Kind of Town" and has something to offer everyone. The conference begins with the Board Meeting on August 10th and concludes on August 15th.

The Conference will feature a new seminar presented by several Bromeliad members on "How to Grow Bromeliads in a Northern Climate. Bus tours include a trip to the Chicago Botanic Garden which is renowned for its 385 acres of specialty gardens from woodland, prairie, Japanese, English walled garden, fruit and vegetable, and rose to the Great Basin garden. Harry Luther will once again convene a scientific seminar that features bromeliad experts from around the world. The lectures presented at the seminar are geared towards the scientific community but are open to all conference attendees and are a great way to learn about the latest in bromeliad research.

The host hotel was renovated just this year with "Heavenly Beds and Baths." The 2003 BSI Board Meeting was held there June 14th and the Board members were pleased with the accommodations. The hotel is beautiful and easy to get to, and the area has many good restaurants and shopping. It is only 5 minutes from the airport by shuttle and approximately 2 blocks from a train that goes downtown where museums and more shopping and restaurants abound. To make a hotel Reservation, call the Westin after August 1 at 888-627-8517 and be sure to mention that you will be attending the 2004 Bromeliad Conference in order to get the special rate.

Please consider donating your time, bromeliads for the auction, items for the raffle or money for the scientific seminars. The contact people may be reached at the following: Jack Reilly, 248 Lawrence St., Illiopolis, IL 62539. Phone 217-486-5874. E-mail jar56@dtnspeed.net, or Wally Fox, 33 W. Higgins Road, Suite 2090, South Barrington, IL 60010. Phone 847-836-9331. E-mail wallythefox@hotmail.com.

More information, including a registration form, can be found on the BSI website at www.bsi.org. or in the May-June issue of the Journal.

Martha Goode