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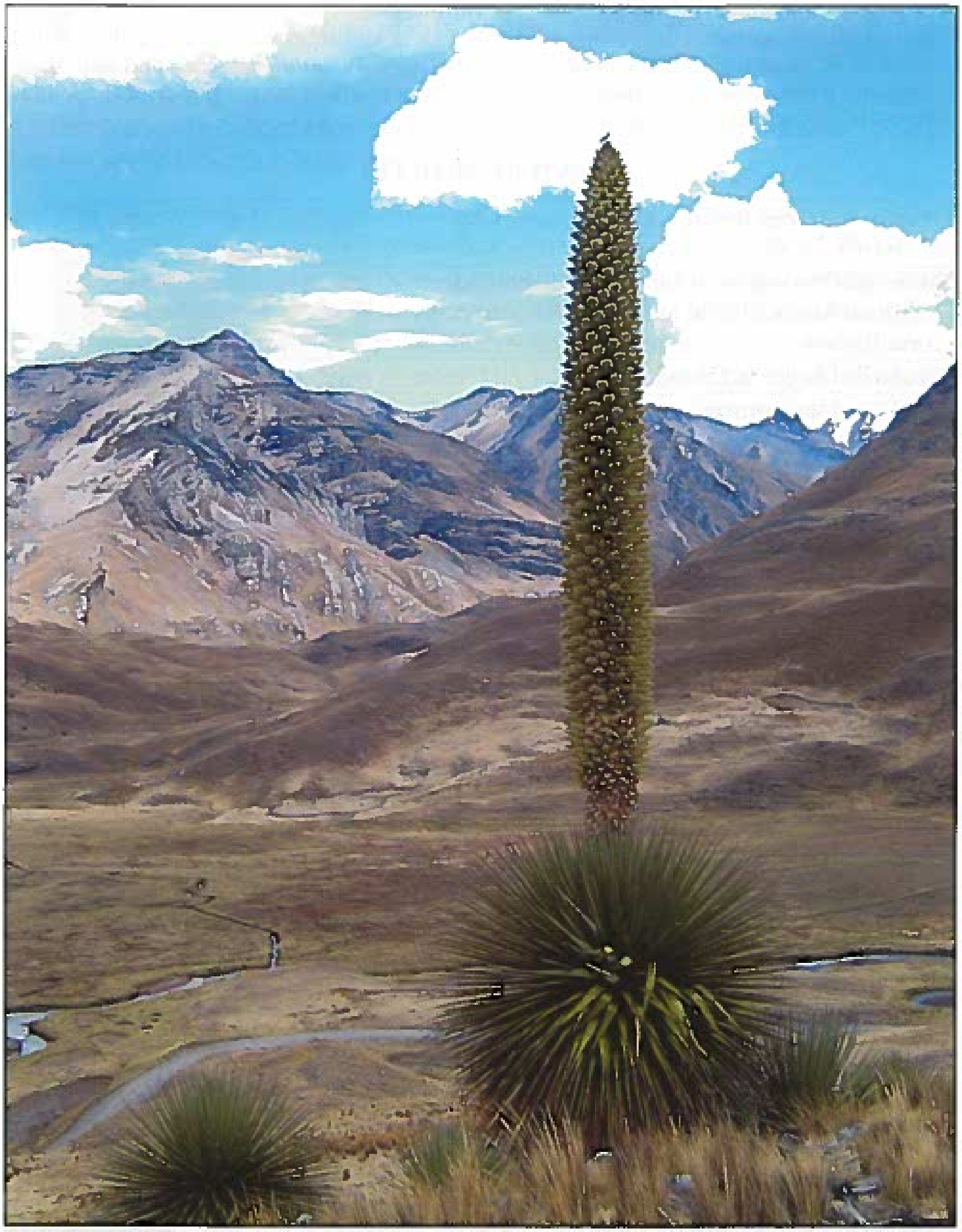

Journal of the Bromeliad Society
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Cover photographs. Front: The spectacular *Puya raimondii* adorns the high mountains of the Peruvian and Bolivian Andes. Claudia Hornung-Leoni and Victoria Sosa explore the many uses of this largest of all bromeliads. Photograph by Claudia Hornung-Leoni. Back: A blend of science and show. In this issue, Walter Till discusses the finer points of a molecular investigation into the relationships of the genera of the subfamily Tillandsioideae which resulted in the renaming of *Tillandsia insignis*, now *Werauhia insignis*, and Ken Marks recounts a fascinating story from childhood to present about his memories of the famous Plant Hall at the Field Museum in Chicago.

FEATURE ARTICLES

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Uses of the Giant Bromeliad, *Puya raimondii*

Claudia Hornung-Leoni[1] & Victoria Sosa

The most remarkable species in *Puya*, a genus almost exclusive of the Andes Mountains, is undoubtedly *Puya raimondii* Harms. This species is the largest bromeliad in the world, reaching 8-10 m tall (Raimondi 1874, Foster 1950) or even to 12 m (Hornung and Sosa, pers. obs.). It was named by Antonio Raimondi as the "queen of the puna," because it is the most conspicuous plant in this habitat (Raimondi 1874). Puna is a dry habitat of high elevations (3600-4200 m above sea level) in the South American Andes with predominantly herbaceous plants (Rivera 1992). *Puya raimondii* has a restricted distribution; it is found in a few scattered locations in northern and southern Peru and in the east of Bolivia (Smith & Downs 1974) (FIGURE 1). The National Park of Huascarán in Peru, holds the largest number of populations, some of which have almost 150 individuals.

Of all the species in Bromeliaceae, *P. raimondii* produces the highest number of flowers per inflorescence (Foster 1950). Plants of *Puya raimondii* consist of an erect stem, a rosette and a large inflorescence with 8000 to 10,000 floral buds (Varadarajan 1988, Müsch 1997) (FIGURES 2, 3, 4). *Puya raimondii* is hapaxantic (produces inflorescences and fruits only once in its life, after which it dies) (Foster 1950, Rauh 1966, Benzing 2000). It has been documented that 80 to 150 years are necessary for plants to flower (Foster 1984, Benzing 2000), but perhaps more than 100 hundred years is exaggerated (Rauh 1973). *Puya raimondii* flowered after only 28 years in cultivation at the UC Berkely Botanical Garden in California (Lineham 1987).

Figure 1. Distribution of *Puya raimondii* in Peru (left) and Bolivia (right)

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Usually, in a population only a few plants produce flowers, but the climatic phenomenon known as "el Niño" has an effect on the plants in that more individuals produce flowers and do so earlier in the blooming season (Venero 2001). After plants die, the desiccated stem, foliage, and racemes with capsules remain for a few years (FIGURE 8); in some cases the seeds are held on inflorescences and remain viable.

Puya raimondii is widely used by inhabitants of the Andes because it is the most conspicuous plant in the habitat, and populations in some places have an enormous number of individuals where the plants are very large. Both living or desiccated parts of the plant are used. Following are described the various uses of this species recorded during field work in central Peru, plus information compiled from bibliographic references.

Figure 2. *Puya raimondii* and the authors of this paper shown for scale in the National Park Huascarán, Peru.

Common names

Puya raimondii is known by such names as "cunco" and "santón" in the locality of "Callejón de Huaylas" in Peru. In Ancash, Peru, it is known by the Quechua or Aymara name of "cuncosh". "Ticanca" or "titanca" are the names in Ayacucho (Peru) and "tica-tica" in Puno (Bolivia). In the province of Junin in Peru this species is known as "cara" or "ckara". In Canta, Peru, *P. raimondii* is called "yichancana" or "achancana" (Rivera 1985). Another name for this plant is "Ch´unchujachu-palla" in Lares, Calca, in Peru (Venero 1984).

Uses

Human consumption. In Chumbivilcas, Peru, the ash of burned inflorescence core is prepared with sugar and it is known as "tocra" or "illipta". The mix is used by coca-leaf consumers. In some places inhabitants dry out the center of the inflorescence and the powder is used for flavouring (Leiva et al. 1991). In Huarochirí and Huascarán, Peru, the pulp of the inflorescence is roasted and fermented to prepare a beverage called "chicha" (Leiva et al. 1991, Hornung and Sosa, pers. obs.). This beverage is traditionally consumed during special occasions.

Animal Fodder. As in other Bromeliads, the inflorescence of *Puya raimondii* is eaten by animals. For example, the inflorescences are consumed by the Andean bear called in some places "oso frontino" (*Tremarctos ornatus*) (Goldstein & Salas 1993, Chung 2004). In the District of Salpo in Peru, the tender young leaves of *Puya raimondii* are used as fodder for cattle and sheep (Venero 1984, Leiva et al. 1991).

Ceremonial uses. In the area of Huascarán, Peru, the dried inflorescences of *Puya raimondii* are used as torches only in some important festivities such as "Fiesta de las Cruces" during the month of May (Hornung and Sosa, pers. obs.).

Figure 3. Inflorescence of *Puya raimondii.*

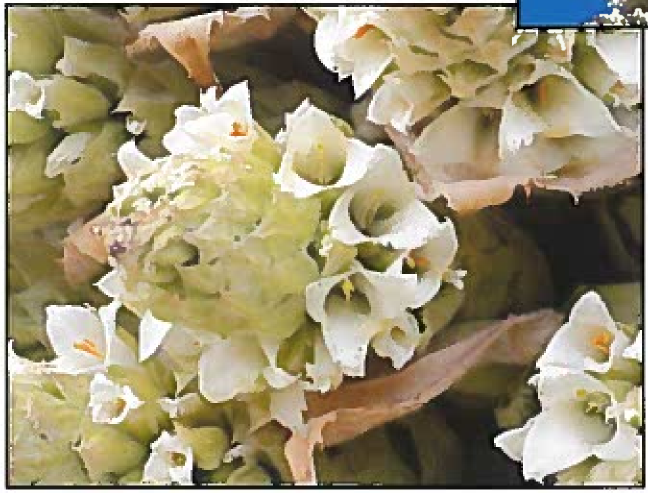

Figure 4. Flowers of *Puya raimondii.*

Fuel. In the area of Lares, Calca, in Peru, inhabitants use the dry parts of the plant as fuel (Venero 1984). The authors also observed this use in Peru, in Huascarán, in the Cordillera Negra and in Chanchamayo. According to our observations, all parts of this plant contain flammable resins.

Construction. In Huascarán, Peru, the dry leaves of *Puya raimondii* are used as fences to keep cattle apart (FIGURE 5), or in some other cases for shelters (FIGURE 6). Dry leaves are also used in roofs of houses or they are even mixed with grass (FIGURE 6). The central part of the inflorescence is sliced in small fragments and used in the base of the beds as an insulating material. The dry stems are used as seats (FIGURE 7). After plants produce capsules and release the seeds, the rosette is burnt and the rachises of the inflorescences are left outdoors to completely dry. The rachis is then cut into fragments to make the seats (Leiva et al. 1991). These seats are used in households or even in public places or offices. Resin gives a polished appearance to the seats (Villiger 1981). Dry inflorescences are cut in vertical sections and used together with other materials to construct walls because they are good for insulating houses (Villiger 1981). In Huascarán inhabitants cut the dry stems and inflorescences in small pieces and use them as beds. In Calca, Peru, vertical sections of inflorescences are used to build doors (Venero 1984).

Figure 5. Fence made with leaves of *Puya raimondii* in Huascarán National Park, Peru.

Figure 6. Shelter made with parts of *Puya raimondii* in Huascarán National Park, Peru.

Other uses

In Checayani, Peru, the thin roots of dry plants are used to make tool bases (Leiva et al. 1991). In Ancash, Peru, the resin is used for gluing wool hats (Leiva et al. 1991).

Acknowledgments

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Figure 7. Seat made with the scape of *Puya raimondii.*

Figure 8. Dry inflorescence of *Puya raimondii.* It flowered the previous flowering season.

Molecular Phylogeny in Subfamily Tillandsioideae (Bromeliaceae) Based on Six cpDNA Markers: An Update

Michael Barfuss[1], Mary Rosabella Samuel and Walter Till

Presented by Walter Till at the 2002 World Bromeliad Conference, St. Petersburg, FL

Abstract: Tillandsioideae is the largest of the three subfamilies (approx. 1300 spp.) in the Bromeliaceae, comprising *Alcantarea, Catopsis, Glomeropitcairnia, Guzmania, Mezobromelia, Racinaea, Tillandsia, Vriesea,* and *Werauhia*. Morphological characterization of these genera is inadequate for a natural grouping of the taxa, especially for species within the big genus *Tillandsia* (about 550 spp.). The first part of the study included about 50 taxa representing all nine currently accepted genera plus five outgroup taxa from Pitcairnioideae. The second part concentrated on the groups which were poorly resolved in the first part. To solve existing problems in the delimitations of genera, two coding (*rbcL* and *matK* gene) and four non-coding (*atpB-rbcL* intergenic spacer, *trnL* intron and *trnL-trnF* spacer, *rps16* intron) plastid markers (a total of more than 5000 base pairs) were used. Individual analyses of each marker show that *matK* has the best resolution, followed by *rps16* intron, *atpB-rbcL* intergenic spacer and *trnL* intron and *trnL-trnF* spacer. In general, *rbcL* gene shows poor resolution. The position of some selected species and the obvious paraphyletic and polyphyletic groups are discussed. The combined analysis of 108 taxa (including five outgroup taxa from Bromelioideae and Pitcairnioideae) using four plastid markers resolves the major grouping at generic level and also indicates some geographic correlations, but further study is necessary for a proper taxonomic grouping of Tillandsioideae. Comparison of the extensive morphological data with the combined molecular data will show agreements and conflicts of both datasets. No formal rearrangements at the generic level are recommended here, but one new combination in *Werauhia* is proposed.

Introduction

In recent years an increasing number of bromeliad students have queried the classification of subfamily Tillandsioideae as proposed in Flora Neotropica (Smith and Downs 1977). The same holds true for the other two subfamilies and is mirrored by numerous changes and additions at generic level. Generic boundaries based on presence or absence of petal appendages and of petal connation are now considered inadequate to define natural genera. Filament plication and positions of stamens and styles respective to the corollas are likely to be adaptations to pollinators and obviously have evolved several times.

Modern morphological studies of seeds (Gross 1988), septal nectaries (Böhme 1988), stigmas (Brown and Gilmartin 1984, 1989), pollen (Halbritter

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1988, 1992) and petal appendages (Brown and Terry 1992) all are in conflict with the generic concepts of Tillandsioideae in Flora Neotropica, and the need for a modern classification is evident. However, no single character could be used unambiguously to redefine the accepted genera. Nevertheless, three additional genera have been established or restored: *Racinaea* (Spencer and Smith 1993), *Alcantarea* and *Werauhia* (Grant 1995). Within the existing genera different species and species groups have been realigned but a general consensus has not been achieved.

With the rapid development of molecular techniques to reconstruct the phylogenies of living organisms, powerful tools are available to botanists. Results on molecular phylogeny of Tillandsioideae have been published (Terry and Brown 1996; Terry et al. 1997a, b) using the *ndhF* gene from the chloroplasts. Both studies place *Catopsis* and *Glomeropitcairnia* at a basal position in the subfamily, and *Glomeropitcairnia* provides weak resolution for the "core group" composed of *Guzmania*, *Mezobromelia*, *Tillandsia* and *Vriesea*. A recent study (Horres et al. 2000) used the trnL (UAA) intron sequences to reconstruct phylogenies for the entire Bromeliaceae. For subfamily Tillandsioideae the position of *Catopsis* and *Glomeropitcairnia* was corroborated, but resolution of the "core group" was insufficient except for the separate position of a clade with *Alcantarea regina* and *Vriesea racinae*.

These results encouraged us to design the following project. Our goals were many: 1) To combine DNA sequence variations from both chloroplast and nuclear genome; 2) To use several genomic regions to minimize the possibility of artificial results; 3) To greatly increase the number of taxa in the study [this was clear from the ovbiously insufficient sampling of the previous studies and was also recommended by Terry et al. (1997b) and Horres et al. (2000)]; and 4) To combine molecular and morphological data to determine characters suitable to define the genera phylogenetically.

Technical problems with nuclear markers such as ITS forced us to restrict our investigation to the chloroplast genome and therefore, the number of cpDNA genomic regions was increased to six markers. The first auther gave a preliminary report on about 50 taxa using six cpDNA markers at the 3rd Biennial Meeting of the Systematics Association in London (Barfuss et al. 2001). The results of the nearly full analysis comprising four markers (*rbcL* and *matK* genes, *trnL* intron and *trnL-trnF* spacer) and 108 taxa are briefly reported here and the final analysis will be published at a later date. The combined analysis of molecular and morphological data has not yet been conducted.

Results and Discussion

The bootstrap value is a statistical means to indicate how certain any grouping is. A a value of 50 merely means "can be or cannot be" while a value of 100 means "the data only allow this single interpretation." For convenience we interpret values from 50 to 74 as weakly supported, from 75 to 89 as moderately supported, and from 90 to 99 as strongly supported. Sister position means that any two clades, at any hierarchical level within the cladogram, have the same common ancestor. FIGURE 9 is the bootstrap consensus tree of 108 taxa using four cpDNA markers. Combined analysis showed much better resolution than in previous studies (Terry et al. 1997a, b; Horres et al. 2000) and bootstrap values corroborate some very robust clades.

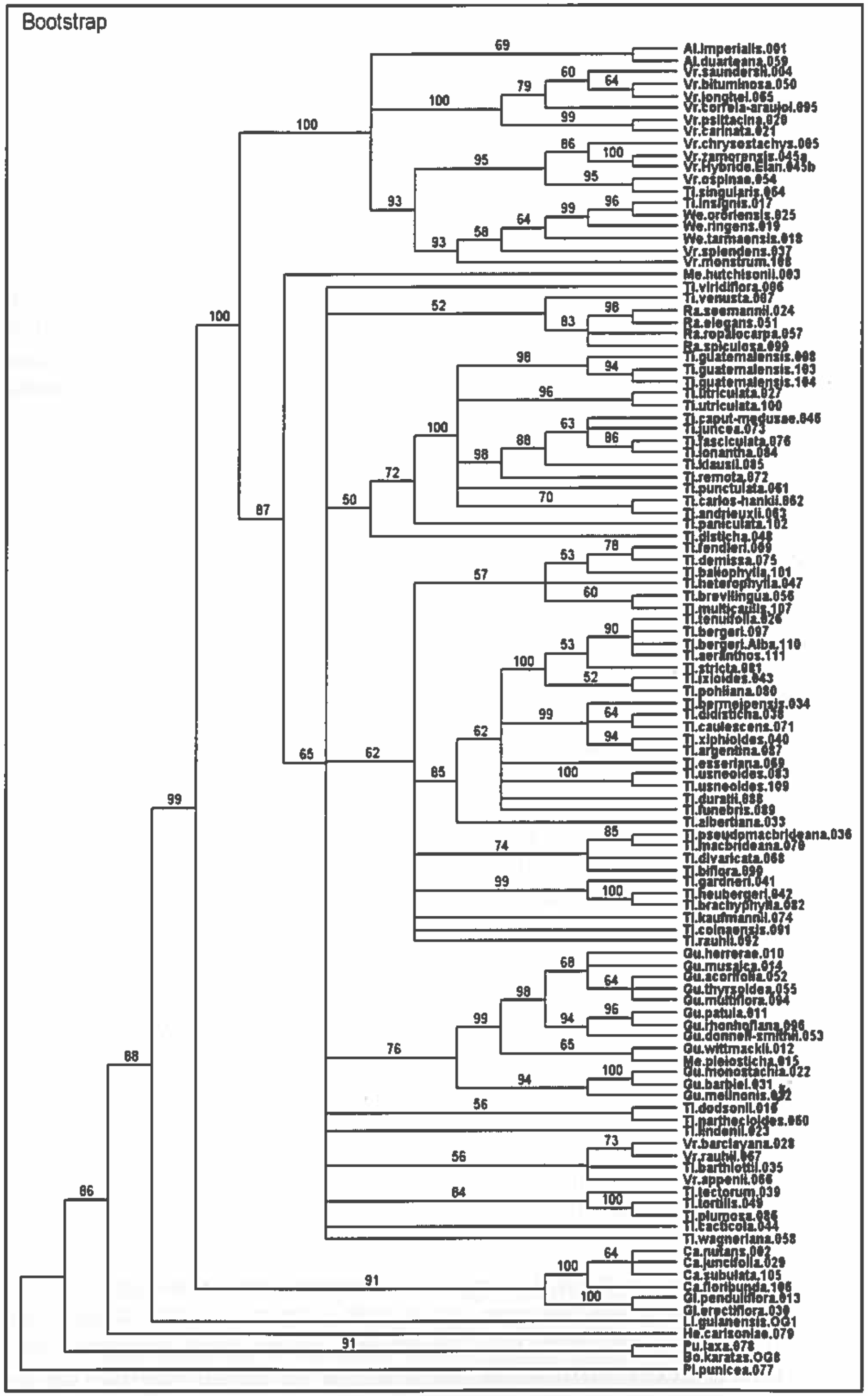
Subfamily Tillandsioideae is strongly supported as a monophyletic clade. Even more valid is the sister position of *Catopsis* and *Glomeropitcairnia* to the rest of the subfamily, or the "core group." Both *Catopsis* and *Glomeropitcairnia* are monophyletic but their position as sister taxa on a common branch is due to a phenomenon called "long branch attraction" which means that for the analyzing program the two long individual branches are more similar to each other than to any other group within the whole cladogram. Morphologically, however, *Catopsis* and *Glomeropitcairnia* are dramatically separated in the position of the ovaries, in fruit, ovule, seed, pollen, and stigma morphology.

Within the "core group," *Alcantarea*, *Vriesea* (except for the xeric Andean members), and *Werauhia* form a monophyletic group which is sister to the rest of the "core group". Internal resolution is not perfect but at least four strongly supported clades can be recognized: 1) *Alcantarea*, 2) *Vriesea* from Eastern Brazil (*Vriesea sect. Vriesea* and *sect. Xiphion* in part), 3) Andean members of *Vriesea sect. Xiphion* in part including *Tillandsia singularis*, and 4) *Werauhia* including *T. insignis* and having *V. monstrum* and *V. splendens* at basal positions.

Analysis shows that *Mezobromelia hutchisonii* is moderately supported as sister to *Guzmania*, *Tillandsia*, and *Racinaea* but remarkably separated from its congener, *M. pleiosticha*. These Mezobromelias represent two different morphological groups, the former with widely expanded inflorescence, the latter with compact and abbreviated inflorescence branches. *M. pleiosticha* is consistently nested within *Guzmania*. *Mezobromelia* is very likely not monophyletic. The compact inflorescence group, including the type, probably needs to be merged with *Guzmania* while the expanded inflorescence group seems closely related with and basal to *Guzmania*.

Guzmania forms a monophyletic group when *Mezobromelia pleiosticha* is included. *G. herrerae* and *G. musaica* are sisters to each other in terminal position but do not form a separate clade. Recognition of *Sodiroa*, essentially being a group of *Guzmania* with highly connate sepals, therefore seems not to be justified. The *Guzmania* clade is moderately supported and the internal major branches are strongly supported. Although not separated as a clade in the bootstrap tree (FIGURE 9), but according to the strict consensus tree (not shown here), *Guzmania* seems to be sister to *Tillandsia* and *Racinaea* and to be closely related to them.

For the moment *Tillandsia* remains an unresolved assemblage of several distinct groups which may turn out as well supported clades when more genetic characters and more taxa are studied. In the strict consensus tree (not shown here) *Tillandsia viridiflora* is sister to the rest of



Tillandsia/Racinaea but this position is collapsing in the bootstrap analysis. *Racinaea* forms a moderately supported clade with *T. venusta* at its base. The clustering of *Racinaea* together with different members of mesic *Tillandsia* subgen. *Phytarrhiza* is remarkable but bootstrap support is still low. *Tillandsia cacticola, T. dodsonii. T. narthecioides, T. lindenii,* and *T. wagneriana* form separate clades and their positions within the unresolved *Tillandsia/Racinaea* clade are not yet established.

Tillandsia subgenus *Tillandsia* forms a strongly supported clade with *T. guatemalensis* and *T. remota*. The basal position of *T. paniculata* is weakly supported, and the position of *T. disticha* is very unstable in different analyses and is currently not interpreted.

Members of *Tillandsia* subgenera *Allardtia*, *Anoplophytum*, xeric *Phytarrhiza* and *Diaphoranthema* form the largest but unresolved group within *Tillandsia* s. l. However, three strongly supported clades out of members of subgenus *Anoplophytum* can be recognized: 1) a southeastern Brazilian clade, 2) an eastern Brazilian clade, and 3) an Andean clade. Further analyses will split this large group into several more definite groups.

Tillandsia plumosa and *T. tortilis* form a strongly supported clade with *T. tectorum* at its base. Support for the position of the latter is moderate.

Xeric members of *Vriesea* form a very weakly supported clade with *Tillandsia barthlottii* included. While the general position of this xeric *Vriesea* group within *Tillandsia* seems out of debate, its exact position remains unclear. The present phylogenetic analysis of subgenus Tillandsioideae demonstrates the enormous progress which has been made by combining several cpDNA markers and by studying many more taxa. However, sampling is insufficient in *Vriesea* and *Guzmania* (including *Mezobromelia*) and basal resolution of the *Tillandsia/Racinaea* clade is lacking. The authors are optimistic that with the addition of nuclear markers and of more taxa these problems can be solved. Therefore, taxonomic and nomenclatural changes at the generic level should not be made before these additional studies have been conducted and overall higher resolution is achieved.

At the species level, however, we propose one new combination in *Werauhia* which is not only obvious from the very strong bootstrap support of the present analysis but also from the strong overall morphological resemblance (BACK COVER):

Werauhia insignis (Mez), W. Till, Barfuss & R. Samuel, comb. nov.

Basionym: *Guzmania insignis* Mez, in C. DC., Monogr. phan. 9: 916. 1896 (Lectotype: Pfau 229, LG).

Figure 9 (left): Bootstrap consensus tree of the four cpDNA markers: *rbcL* and *matK* genes, *trnL* intron and *trnL-trnF* spacer. Values are included above the branches. Numbers after the taxa names are laboratory sample references.

Thecophyllum insigne (Mez) Mez, Bull. Herb. Boissier, ser. 2, 3: 131 (1903);

Tillandsia insignis (Mez) L. B. Sm. & Pittendr., J. Washington Acad. Sci. 43: 402 (1953).

Acknowledgments

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Terry, R.G., G.K. Brown, and R.G. Olmstead. 1997a. Examination of subfamilial phylogeny in Bromeliaceae using comparative sequencing of the plastid locus *ndh*F. Americal Journal of Botany 84: 664-670.

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Annex 1:

List of species from subfam. Tillandsioideae to be used in the present project. Underlined taxa are generic or infrageneric types. Names in parentheses are infrageneric taxa used or mentioned (e. g., *Sodiroa*) in Smith and Downs (1977). Unless otherwise stated vouchers are in the herbarium of the Insititute of Botany in Vienna, Austria (WU). Numbers before taxa names are laboratory sample references.

59 *Alcantarea duarteana* W.Till 11052
1 *Alcantarea imperialis* W.Till 11112
106 *Catopsis floribunda* Vienna Bot. Gard. B176/80
29 *Catopsis juncifolia* W.Till 15050
2 *Catopsis nutans* Vienna Bot. Gard. B5/95
105 *Catopsis subulata* Vienna Bot. Gard. B98B207-1
30 *Glomeropitcairnia erectiflora* Vienna Bot. Gard. B206/96
13 *Glomeropitcairnia penduliflora* W. Till 12012
52 *Guzmania acorifolia* Vienna Bot. Gard. B18/84
31 *Guzmania barbiei* E. Leme 3263
53 *Guzmania donnell-smithii* Vienna Bot. Gard. B165/96
10 *Guzmania (Sodiroa) herrerae* Vienna Bot. Gard. B98B168-1
32 *Guzmania melinonis* W.Till 3041
22 *Guzmania monostachia* Vienna Bot. Gard. B204/91
94 *Guzmania multiflora* Vienna Bot. Gard. B228/95
14 *Guzmania (Massangea) musaica* Vienna Bot. Gard. B194/96
11 *Guzmania patula* Vienna Bot. Gard. B76/80
96 *Guzmania rhonhofiana* Vienna Bot. Gard. B224/80
55 *Guzmania thyrsoidea* W.Till 7062
12 *Guzmania wittmackii* Vienna Bot. Gard. B163/92
3 *Mezobromelia hutchisonii* Vienna Bot. Gard. B99B76-1
15 *Mezobromelia pleiosticha* Vienna Bot. Gard. B492/96
51 *Racinaea elegans* F. Hase s.n.
57 *Racinaea ropalocarpa* Vienna Bot. Gard. B256/96
24 *Racinaea seemannii* W.Till 13095
99 *Racinaea spiculosa* W.Till 16111
33 *Tillandsia (Allardtia) albertiana* Vienna Bot. Gard. B387/90
87 *Tillandia (Allardtia) argentina* Vienna Bot. Gard. B135/88
34 *Tillandsia (Allardtia) bermejoensis* W.Till 144
35 *Tillandsia (Allardtia) barthlottii* Vienna Bot. Gard. B265/96
90 *Tillandsia (Allardtia) biflora* Vienna Bot. Gard. B266/96
56 *Tillandsia (Allardtia) brevilingua* W.Till 2097
71 *Tillandsia (Allardtia) caulescens* E. Vitek 120882-72/1
91 *Tillandsia (Allardtia) coinaensis* E. Zecher 21/76
75 *Tillandsia (Allardtia) demissa* Vienna Bot. Gard. B131/87
38 *Tillandsia (Allardtia) didisticha* W. Till 10130
68 *Tillandsia (Allardtia) divaricata* W. Till 13069
9 *Tillandsia (Allardtia) fendleri* H. & L. Hromadnik 2382
8 *Tillandsia (Allardtia) guatemalensis* Vienna Bot. Gard. B260/96
103 *Tillandsia (Allardtia) guatemalensis* H. & L. Hromadnik 14257
104 *Tillandsia (Allardtia) guatemalensis* H. & L. Hromadnik 15127
74 *Tillandsia (Allardtia) kauffmannii* Vienna Bot. Gard. B97/89
70 *Tillandsia macbrideana* Vienna Bot. Gard. B249/87
36 *Tillandsia (Allardtia) pseudo-macbrideana* W. Rauh 53774
72 *Tillandsia (Allardtia) remota*

Vienna Bot. Gard. B231/93
39 *Tillandsia (Allardtia) tectorum* W. Till 13081
40 *Tillandsia (Allardtia) xiphioides* var. *xiphioides* F. Strigl FO275
111 *Tillandsia (Anoplophytum) aeranthos* coll. M. Barfuss s. n.
97 *Tillandsia bergeri (Anoplophytum)* Vienna Bot. Gard. B191/93
110 *Tillandsia bergeri* cv. *Alba* coll. M. Barfuss s. n.
82 *Tillandsia (Anoplophytum) brachyphylla* Vienna Bot. Gard. B99B16-1
41 *Tillandsia (Anoplophytum) gardneri* var. *gardneri* W. Till 11134
42 *Tillandsia (Anoplophytum) heubergeri* Vienna Bot. Gard. B389/96
43 *Tillandsia (Anoplophytum) ixioides* G. Neuhuber GN96-936
80 *Tillandsia (Anoplophytum) pohliana* W. Till 11004
81 *Tillandsia (Anoplophytum) stricta* var. *stricta* Vienna Bot. Gard. B245/87
26 *Tillandsia (Anoplophytum) tenuifolia* var. *tenuifolia* W. Till 131
44 *Tillandsia (Xeric Phytarrhiza) cacticola* W. Till 2133
88 *Tillandsia (Xeric Phytarrhiza) duratii* W. Till 5072
89 *Tillandsia (Diaphoranthema) funebris* Vienna Bot. Gard. B35/94
83 *Tillandsia (Diaphoranthema) usneoides* G. Palim s. n., Venezuela
109 *Tillandsia (Diaphoranthema) usneoides* coll. M. Barfuss s. n.
16 *Tillandsia (Phytarrhiza) dodsonii* W. Rauh 34183
69 *Tillandsia (Phytarrhiza?) esseriana* Vienna Bot. Gard. B342/90
23 *Tillandsia (Phytarrhiza) lindenii* Vienna Bot. Gard. B91/80
60 *Tillandsia (Phytarrhiza) narthecioides* Vienna Bot. Gard. B8/90
7 *Tillandsia (Phytarrhiza) venusta* Vienna Bot. Gard. B98B136-1
58 *Tillandsia (Phytarrhiza) wagneriana* Vienna Bot. Gard. B222/93
76 *Tillandsia (s. str.) fasciculata* (Gardner group 1(1)) W. Till 7050
61 *Tillandsia* (s. str.) *punctulata* (Gardner group 1(2)) Vienna Bot. Gard. B126/95
62 *Tillandsia* (s. str.) *carlos-hankii* (Gardner group 1(3)) H. & L. Hromadnik 15169
73 *Tillandsia (s. str.) juncea* (Gardner group 1(4)) W. Till 7033
46 *Tillandsia* (s. str.) *caput-medusae* (Gardner group 1(5) W. Till 7117
84 *Tillandsia (s. str.) ionantha* var. *ionantha* (Gardner group 1(6)) Vienna Bot. Gard. B320/82
85 *Tillandsia* (s. str.) *klausii* (Gardner group 1(7)) Vienna Bot. Gard. B87/87
63 *Tillandsia* (s. str.) *andrieuxii* (Gardner group 1(8)) Vienna Bot. Gard. B256/95
27 *Tillandsia (s. str.) utriculata* (Gardner group 2) Vienna Bot. Gard. B98B33-1
100 *Tillandsia (s. str.) utriculata* (Gardner group 2) W. Till 17007
47 *Tillandsia* (s. str.) *heterophylla* (Gardner group 3) B229/91 = H. & L. Hromadnik 15191
107 *Tillandsia multicaulis* H. & L. Hromadnik 1087
92 *Tillandsia* (s. str.) *rauhii* (Gardner group 3) Vienna Bot. Gard. B64/92
48 *Tillandsia disticha* (Gardner group 4) Vienna Bot. Gard. B212/90
86 *Tillandsia plumosa* (Gardner group 5) R. & K. Ehlers EM881905
49 *Tillandsia tortilis* (Gardner group 5) Vienna Bot. Gard. B218a/88
101 *Tillandsia (Pseud-Alcantarea) baliophylla* W. Till 17025
102 *Tillandsia (Pseud-Alcantarea) paniculata* W. Till 17057
6 *Tillandsia (Pseud-Alcantarea) viridiflora* Vienna Bot. Gard. B87/80
17 *Tillandsia insignis* W. Till 15027
64 *Tillandsia singularis* W. Till 15023
66 *Vriesea (Xiphion) appenii* H. & L. Hromadnik 2162
50 *Vriesea (Xiphion) bituminosa* W. Till 4110
5 *Vriesea (Xiphion) chrysostachys* W. Till 3035

65 *Vriesea (Xiphion) jonghei* E. Leme 2275
108 *Vriesea (Xiphion) monstrum* Vienna Bot. Gard. B113/96
54 *Vriesea (Xiphion) ospinae* Vienna Bot. Gard. B96/96
37 *Vriesea (Xiphion) splendens* Vienna Bot. Gard. B176/96
45a *Vriesea (Xiphion) zamorensis* Vienna Bot. Gard. B278/95
45b *Vriesea* cv. Elan Vienna Bot. Gard. B99B118-1
28 *Vriesea* (s. str.) *barclayana* Vienna Bot. Gard. B518/96
21 *Vriesea (s. str.) carinata* Vienna Bot. Gard. B132/80
95 *Vriesea* (s. str.) *correia-araujoi* Vienna Bot. Gard. B121/95
20 *Vriesea (s. str.) psittacina* Vienna Bot. Gard._

Affilates in Action

Gene Schmidt, BSI Affiliated Societies Chair

The BSI is pleased to announce the latest affiliated society, the San Fernando Valley Bromeliad Society (CA). This bromeliad society has been active since 1971, and currently has about 25 active members. The BSI wishes continued success to the SFVBS and its current president, Frank Hayen; and looks forward to meeting with their representative at this year's world conference.

Surrounded by concrete, close by the Miami Beach (FL) Convention Center, there's a little tropical oasis. It's the Miami Beach Botanical Garden (FIGURE 10), owned by the city of Miami Beach and operated by the Miami Beach Garden Conservancy. Just 4.5 acres, the garden has a noteworthy orchid and bromeliad collection, and displays include Japanese, herb, and butterfly gardens. The budget barely qualifies as shoe-string, and the staff consists of just three people: the director, the horticulturist, and one gardener. Katherine Maidman, formerly of Fairchild Tropical Garden, is the horticulturist and would be interested in hearing from those interested in helping with this project. Another garden to support is the Wilson Botanical Garden, in San Vito, Costa Rica, now owned and operated by the Organization for Tropical Studies. OTS, a consortium of 64 universities and research institutions in the USA, Costa Rica, Peru, Canada, Mexico, South Africa, and Australia and provides leadership in education, research, and the responsible use of natural resources in the tropics. The OTS is supported by grants and donations. To make a donation, and thereby support the Wilson Garden, send your check, payable to Organization for Tropical Studies, to Box 90630, Durham, NC 27708-0630. The garden is open to the pub-

Figure 10. *Alcantarea regina* at the Miami Beach Garden Conservatory. Photograph by Moyna Prince.

lic and reservations may be made for overnight stays. *(The Bromeliadvisory, The Bromeliad Society of South Florida, Vol. 46, No.'s 7 & 8, September & October 2003)* Moyna Prince, editor of this publication for the past nine years has stepped down as of December; with Nicolas Crespo III taking over as editor. He can be reached at **Bromeliad@timewolf.net**. Moyna is to be commended for her many years of effort on this fine publication.

One of the participants in the building of the Wilson Botanical Gardens, John Hall, died in November. Eloise Beach of the Bromeliad Society of Central Florida, includes an article in the *Orlandiana*, originally from the *A.M. Costa Rica* newspaper and forwarded via Chester Skotak and Moyna Prince, which chronicles the life of one of the society's founding members, as John attended the organizational meeting of the BSCF on October 30, 1972. He was a leading tropical plant expert and illustrator, and was well known for his sense of design and eye for ecological development. The Environmental Design Group headed by Hall received many conservation awards for their innovative designs, and Hall's work in sand dune conservation has formed the backbone of the Florida law on the subject. Hall, who lived in Costa Rica since 1971, was considered one of the leading authorities on the plants of Central America and the Amazon. *(Orlandiana, Newsletter of the Bromeliad Society of Central Florida, Vol. 29, Issue No. 12, December 2003)*

At the May 2003 meeting of the Bromeliad Society of New Zealand Inc. Len Trotman (FIGURE 11), was elected a Life Member, for his long service to the BSNZ. To most members Len needs no introduction, as there would be few that he has not helped with his advice and general willingness to pass on all he knows about the plants we all love so much. He has held the executive positions of president and secretary in this society, as well as committee member. Len has had, and is still, having a very successful time in judging. He holds a judging certificate from the NZ Institute of Horticulture on general judging qualifications and he is one of the principal judges for this bromeliad society. He looks forward to many more enjoyable years in the society, and cherishes the many wonderful people he has met. We all wish Len Trotman well for the future. (From the editorial team of the *Journal of the Bromeliad Society of New Zealand Inc., Vol. 43, No. 6, June 2003*)

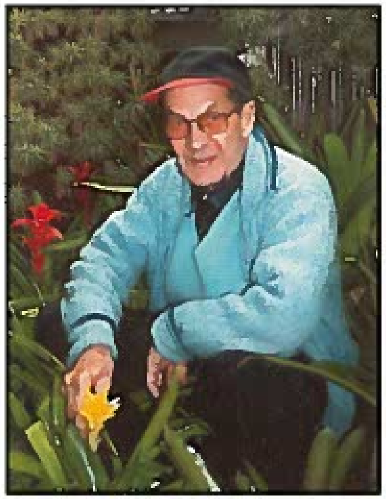

Figure 11. Len Trotman. Photograph by Gerry Stansfield.

The Bromeliad Society of New South Wales Inc. (AUS) is pleased to advise of the formation of the Merv Henderson Encouragement Award. It was always a wish of the late Merv Henderson (one of the original founders of the society) to encourage younger members to become more involved in bromeliad study and culture. Some years ago, with this in mind, he donated moneys to be put to this purpose. The award is to be presented to a member under the age of 30, with the highest aggregate of points gained in the Society Plant of the Month competition as well as showing involvement in the day to day workings of the society. Also, the society has completed their web site at **www.bromsocnsw.org.au** and would like to thank Paul Watson for his work on the site. *(Bromeliad Newsletter of the Bromeliad Society of New South Wales Inc., Vol. 21, No.'s 8 & 10, August and October 2003)*

The October meeting of the Saddleback Valley Bromeliad Society (CA) included an appearance by Gary James, a tour leader for Natural History Tours. Mr. James taught Biology at Orange Coast College, becoming head of the Biology department until his recent retirement. To those attending, he introduced the Auyán-tepui region of Venezuela (FIGURE 12), with pictures from less visited areas of Venezuela that made even the most traveled members of the group want to hit the road. The Auyán-tepui is an area of sandstone mountains that rise up to 4,000 feet out of the jungle, home for many species of exotic plants and wildlife. *(Pup Talk, Saddleback Valley Bromeliad Society, Vol. 10, No.'s 10 & 11, October & November 2003)* The web site for the Greater New Orleans Bromeliad Society (LA) can be found at **http://www.geocities.com/bsgcmail/** . *(Potpourri, Vol. 25, No. 9, Sept. 2003)*

Figure 12. Auyán-tepui, Venezuela. Photograph by Bruce Holst.

Bob Wright, editor of the South Bay Associates Newsletter, writes that he and Steve Ball attended the 20th Annual Succulent Symposium at the Huntington Botanic Garden, with this year's theme being South America. At the noon break they were given a tour of a section of the Desert Garden, which has never been open to the public. A lot of work is being done to make it accessible, and one of the very interesting things to see will be a large collection of Puyas which were planted in 1936, after being donated by T. Harper Goodspeed, who wrote a famous book called *Plant Hunter in the Andes*. Bob adds that you may want to mark your calendar for this April and visit when all those Puyas are in bloom, and not to forget your camera. *(South Bay Bromeliad Associates Newsletter, October 2003)*

The July meeting of the Bromeliad Society of San Francisco (CA) found president Carl Carter showing beautiful habitat slides of plants you can find in the Fahkahatchee Strand of the Everglades. He was wading through the swamp in water up to his knees and was able to find several bromeliads as well as orchids. Among the bromeliads he found were *Guzmania monostachia* var. *variegata*, *Tillandsia fasciculata*, *Tillandsia flexuosa*, and *Tillandsia pru-*

inosa. He was also looking for the ghost orchid (*Dendrophylax lindenii*) and found one, but it was not in flower. Carl's only complaint was about the bloodthirsty mosquitoes. For more on the Fahkahatchee Strand please see the August 2003 magazine issue of *The Smithsonian. (Newsletter of the Bromeliad Society of San Francisco, Sept. 2003)*

John Higgins, president of The Bromeliad Society of Queensland Inc. (AUS), comments on the upcoming Bromeliads XIII Conference. "A successful conference is measured in many ways: by the numbers of delegates attending, the quality of the formal lectures and presentations, the diversity of venues to be visited, etc. Not least will be the informal periods where old friends can meet and renew friendships and new friendships will be made that will stand the test of time. This aspect has become a valued part of the activity and we hope that a good number of our new members will join with us and share in these activities in October 2005." The venue will be the Conference Centre at Bardon, one of the inner suburbs of Brisbane. This venue has a tiered lecture theatre and a full range of facilities with on-site accommodation in a bushland setting. As of the second conference newsletter, Bruno Rezende Silva, Director of the Neotropicum Botanical Gardens, had agreed to be one of two international speakers. Please address inquiries to: Bromeliads XIII Conference Committee, c/o Bromeliad Society of Queensland Inc., PO Box 565, Fortitude Valley, QLD, 4006. *(Bromeliaceae, The Bromeliad Society of Queensland Inc., Vol. XXXVII, No. 6, & Vol. XXXVIII, No. 1, Nov/Dec 2003 and Jan/Feb 2004)*

Two BSI affiliated societies to celebrate their 40th Anniversaries are the New York Bromeliad Society (NY) and the Bromeliad Society of Australia. Of the first, Herb Plever, editor of the *Bromeliana*, writes this of their earlier days, "In October, 1963, the organizing meeting of our society was held in the Queens apartment of the late Dr. George Milstein, who was largely responsible for the formation of our group. An astounding fifty people attended this organizing meeting which was addressed by Mulford B. Foster, the great explorer, hybridizer, collector, naturalist, and discoverer who flew up from Orlando, Florida, to greet and encourage us." *(Bromeliana, New York Bromeliad Society, Vol. 40, No. 6, October 2003)*. Ken Woods, past president of the Bromeliad Society of Australia Inc., was asked to prepare a presentation on the history of their society and wrote that one of the society's major achievements was the publication in 1988 of the book "Growing Bromeliads". This coincided with the celebration of the 25th Anniversary of the society. It was the first book of its kind since the 1970's and the first of its kind outside the USA and European countries. Current life members are: Olwen Ferris, Grace Goode, Doreen Johnston, Helen Shepherd, Bill Morris, Joan Williams, Marjory McNamara, Ruby and Keith Ryde. The Charter of the affiliation with the BSI is dated 6th April, 1963, and is on display for those who wish to view it. *(Bromeletter, Journal of the Bromeliad Society of Australia Inc., Vol. 41, No. 4, July/August 2003)* Congratulations to these societies, as we wish them many years of continued growth and success.

Bromeliad Relics in Chicago

Ken Marks, BSI Webmaster **Photographs by the Author**

I grew up in Chicago, but as a kid I did not appreciate that Chicago is home to some world class museums. Although I didn't know how lucky I was to have access to these museums, my grandfather, who lived with us, did. Nearly every Sunday my grandpa and I would walk to the CTA (Chicago Transit Authority) bus stop near our house and take it all the way downtown. A few transfers later and we might find ourselves at the Museum of Science and Industry, the Field Museum of Natural History, the Adler Planetarium, or even the John G. Shedd Aquarium. Once or twice he tried to broaden my horizons at the Art Institute of Chicago - but I never cared as much for art as I did for nature and science.

Last June my wife Tammy and I were back in Chicago for the annual BSI Board Meeting. While there, we took advantage of the trip to visit with family, eat a lot of great food (Chicago has a great variety of ethnic cuisines), we even dropped in on the Bromeliad Society of Greater Chicago for their monthly meeting held at the Chicago Botanic Garden. For some reason I had never been to the garden when I lived there - but what an incredible place to discover years later. It's not like this is an insignificant garden that I could have overlooked. It spans 385 acres with 23 different gardens, 81 acres of waterways, 9 islands, 6 miles of shoreline, 15 acres of prairie and 100 acres of woods. We enjoyed the place so much that we returned a couple of days later with my grandmother and great aunt to take in more of the sights. I expect one could spend a month of Sundays there and always see something new - something different in bloom.

Later in the week, Tammy and I picked up our two nieces and went down to the Field Museum, since I had not been back there for a few years. An interesting historical side note is that the museum had its start as the Palace of Fine Arts built for the World's Columbian Exposition of 1893. That building was later restored (in 1933) and went on to become the Museum of Science and Industry. The Field Museum, named for Marshall Field (founder of the Chicago based Marshall Field & Company department store chain, and one of its major benefactors), was moved to its present site (in 1921) where it forms part of the lakefront Museum Campus along with the Shedd Aquarium and Adler Planetarium.

While Tammy took Amanda and Allison off to see Sue, the world's largest, most complete, and most famous *Tyrannosaurus rex*, I dawdled in the Hall of Plant Life. Upon passing through the main entrance to the hall, you are greeted with a model of a pineapple plant in flower (FIGURE 13, BACK COVER). This life-like and life-size model of the most well-known and most economically important bromeliad, sits where it has been for more than a half century in its wood and glass display case. I stood, possibly in the exact same spot where I had three decades earlier, and gazed at the model. Thirty years earlier

Figure 13. Detail of the inflorescence on a life-like model of a pineapple (*Ananas comosus*) in the Hall of Plant Life.

I was probably more intrigued in learning how one of my favorite fruits grew - not hanging from a tree like most fruits I knew - but as the pinnacle of a rather odd looking plant, quite foreign to the colder latitudes of my upbringing. Now I see the plant through different eyes. Having twisted the tops off of many store-bought pineapples and having planted them in my backyard in South Florida, I have watched the tiny tops grow into large plants over the course of a few years. Occasionally, if I've managed to beat the raccoons to the prize, I've also had the pleasure to taste these home-grown pineapples. In a quirky application of the words of the songwriter Jimmy Buffet, "changes in latitude, changes in attitude," my move to a more tropical clime has allowed me to see this pineapple replica in a new light. No longer a botanical oddity as it must still seem to the thousands of Chicagoans that see it each day, I now see it as an incredibly detailed work of art.

A second exhibit containing bromeliads is what is known as the Ant Garden (FIGURE 14). This model is located further along in the Hall of Plant Life at the corner of this great L-shaped hall. As a kid I'm sure I was probably more impressed with the fact that tropical ants could create this huge sphere-shaped mud nest high up in a tree. As a general rule, boys love bugs - but those little toy ant farms, where the ants excavate their network of tunnels between two clear panes of plastic could not compete with this myrmecological metropolis. But once again, my perceptions have been altered. Living in the sub-tropical climate of South Florida means sharing your home with dozens of varieties of ants all year round, including such nasties as fire ants, all of which tends to diminish your appreciation of them. Now, having traveled to countries and having seen actual examples of these nests in the wild, I'm struck by the amount of work that must have gone into the creation of this exhibit. Growing in and around the mud ant nest are a variety of epiphytic orchids, aroids, cacti, and what appears to be a couple of *Aechmea tillandsioides* (a species commonly found growing from ant and termite nests). It is no wonder that such detailed, labor-intensive models are not found in newer museum displays these days. New exhibits seem to have a need to make noises, have flashing lights or include touch screen multimedia presentations to cater to our ever decreasing attention spans.

Figure 14. Ant Garden display in the Hall of Plant Live demonstrating the orchids, aroids, cacti, and bromeliads that can be found in association with such nests.

There was also an incredibly life-like model of a *Tillandsia fasciculata* on display (FIGURE 15). This plant might not stand out from among the other wonderfully recreated plant models in the same display case. That is, unless you are interested in bromeliads. My property has hundreds of fasciculatas growing in the trees around my house. I see these plants every day and I can tell you honestly that were this plant to be hidden among these live fasciculatas, it would be difficult if not impossible to pick out.

After an enjoyable (and filling) visit to Chicago (did I mention that Chicago has great food?), we returned home to Florida. There I started work on a project I had proposed during the BSI Board Meeting. My goal was to check into the feasibility of converting the entire set of issues of the *Journal of the Bromeliad Society* into an electronic form, so that they could be accessed from the BSI website (for which I am the Webmaster). I borrowed a nearly complete set of the Journals from my friend (and long time BSI member) Polly Pascal. As I read through the early Journals from the 1950s, the history of the BSI unfolded like seedling developing into a mature plant. This metaphor obviously occurred to the founders of the BSI as well since the "Message From the President" in the first issue of the Journal in 1951 began with the words, "The Seed has Germinated! A new horticultural society has been born."

Continuing on through the first volume (issue 4) of the Journal (called the Bulletin back then), I came across this astonishing editor's note from Mulford Foster:

> Mr. Emil Sella, Curator of Exhibits, and his assistant at the Chicago Natural History Museum, recently visited the Bromeliarium in Orlando and selected a fine flowering specimen of *Tillandsia fasciculata* which

> will be completely reproduced in a model. Represented during the flowering period, it will be made of various materials including glass, plastic, wax and others. When completed the reproduction will he added to the synoptic exhibit of families of flowering plants in the Hall of Plant Life there in the Museum.
>
> A model of a pineapple plant is already completed and it is planned to include Spanish Moss for contrast. In the near future it is planned to send another species from the Bromeliarium to complete the group. This will be a striking aechmea or billbergia.
>
> Mr. Sella's work is masterfully executed and the Hall of Plant Life is a marvelous instructive exhibit which every plant lover should see.

What a coincidence! I had just been marveling at these very same models, and without the least bit of laborious research, I had stumbled onto the information about their creation. Still more exciting was the fact that the *Tillandsia fasciculata* which is now immortalized in that very life-like model had come from the home of the Fosters - a mere 200 miles from where I sat. Although the species and its place of origin were familiar to me now, the time period of its collection was quite alien in a number of ways. The most personally profound difference was that I wasn't even around back then. On a broader scope, five decades ago, there were no bromeliad societies in Florida, the BSI was a fledgling society barely a year old, and the only bromeliad that the general public was familiar with came in rings or chunks, packed in tin cans from Hawaii. Today, you might still get a blank stare if you were to ask someone when was the last time they ate a bromeliad. And true, I still occasionally get asked questions about bro-ma-LAIDS (I tell them that's something you take for an upset stomach). Even so, the last 50 years have made quite an impact in the popularization of our favorite plant family (however you choose to pronounce it). There is no doubt that the Fosters were visionaries who believed strongly in the horticultural merit of bromeliads, but I doubt they could have foreseen a time where they were being sold from coast to coast at discount retailers like Wal-Mart.

Searching through the next couple of volumes of Journals revealed many interesting and humorous articles locked away inside this time-capsule of green binders. In the issues from 1956, I hit the motherlode. In Volume 6(issue 1) I found an article by Emil Sella, the Curator of Exhibits from the Field Museum, the very one who had visited the Fosters to select the representative fasciculata. As I read the article on the creation of the model reproduction, I was amazed at the description of the methods and effort that went into its construction:

> Because of frequent variations in plant structure, form and texture, the preparation of realistic models for botanical exhibits has become a more or less involved technique. Among the variety of materials used in the process, such mediums as glass, wax, celluloid and other newer plastics are usually employed in reproducing leaves, buds, and flowers, etc.

> The forming or casting of the various parts may be obtained through the use of molds, dies, or by hand modeling. The entire procedure is quite slow and laborious, suited only where accurate reproductions are desired.
>
> For instance, the preliminary preparations for the model of *Tillandsia fasciculata* as shown, included besides the necessary photographs and color notes, a series of about a dozen plaster molds of selected leaves and flower bracts from the original plant.
>
> Each of these molds were later used as patterns for the metal dies, which were necessary, in order to cast the plastic leaf models under pressure and heat. After the leaf casts were made they had to be trimmed and later colored. This required several coats of oil color applied with an air brush, all the spots and blemishes painted by hand. The finished leaves were then faintly covered with a final coating of bloom.
>
> The small but showy purple flowers of the Tillandsia with their definitely visible stamens were reproduced in glass. On a blue flame gas torch, rods were drawn down to the tiny stamen's natural size and each topped with two pollen-sacs welded to the filament. Six of these stamens were then fused at the base surrounding a similar glass rod shaped to represent the pistil. The rolled petals also of glass, preformed and colored, were then slipped over the stamens and cemented together. This type of minute work, usually done by hand, demands constant attention to form, size and proportions.
>
> After all these individual operations, came the important task of assembling, fitting and carefully fastening all the various parts in their proper places and sequence. All this in a manner which would not readily reveal itself at close inspection and yet retain for the model a growing or natural appearance.
>
> With an occasional last minute adjustment here or there and the final attachment of the model to its original supporting branch, the Tillandsia was considered completed, with a hope that future Museum visitors with their comments and acceptance would justify the time and efforts invested.

I returned to Chicago last December for my annual inoculation of snow and cold weather which serves to remind me why I moved to Florida. Before arriving in Chicago this time, I had contacted Michael O. Dillon, Curator & Head of Phanerogams in the Botany Department of the Field Museum. I wanted to meet with him, talk plants, and try to get some pictures of the models on display at the museum for an article idea that had been forming in my mind. We met up with Michael on a bitterly cold Chicago morning at the museum. We thawed out in Michael's office upstairs in the working part of the museum. While Michael and I ranted and raved about hunting for bromeliads in the field, the work he was doing in the neotropics, and the sys-

Figure 15. *Tillandsia fasciculata* var. *densispica* modeled on a plant selected from the Foster's collection in Orlando, FL.

tematic investigations of the flowering plants of Andean South America in Chile and Peru, Tammy let me indulge my pseudo-scientistic tendencies unimpeded. We learned from Michael that the Hall of Plant Life had recently lost floor space to an expanded exhibit of dinosaurs. Plants may have outlived the dinosaurs in the real world but they had the upper hand at the moment in terms of museum real estate. The purchase of what is arguably the world's most famous (and contentious) dinosaur, the *T. rex* named Sue, as well as Jurassic Park and its series of sequels led to a resurgence of Dino-mania and the creation of the Elizabeth Morse Genius Dinosaur Hall which was carved out of space surrendered from the Hall of Plant Life.

While the pineapple and ant garden displays were easy to find (but tricky to photograph in the subdued lighting of the exhibit hall), the *Tillandsia fasciculata* model was nowhere to be seen. Michael pointed out the ongoing construction of a new elevator shaft beginning on the ground level, piercing through the Hall of Plant Life on the second level, and terminating among the offices on the top floor. During this construction, a number of display cases had been displaced. Up against one wall were stacked several of these long wall displays, packed front to back - their lights unplugged, their contents hidden. I'm sure Foster's *fasciculata* is buried somewhere in this catacomb of cases. I can only hope that by the next World Conference in August that the new elevator disruption has passed and that most, if not all, of the display cases are returned to their rightful places along the walls of the hall.

Postscript

While talking with Michael Dillon about the upcoming World Conference in Chicago, I raised the idea of a guided tour of the Hall of Plant Life as one of the BSI organized Tours. Michael concurred that this would be a great idea and should also include a behind-the-scenes tour of the research facilities on the top floor where the museum's botanists (and other scientists) do their work. A special treat will be a visit to the museum's herbarium where thousands of pressed plants have been classified and organized. These herbarium sheets are made available to visiting taxonomists and are shipped to institutes doing systematic research around the world. There are quite a few bromeliad type specimens included among the many sheets in the herbarium.

I've also heard that Michael Dillon will be giving a presentation on some of the interesting bromeliads to be found in the coastal deserts of Peru and Chile as part of the scientific seminars during the conference itself. If you haven't made plans yet to be in Chicago for the World Conference, time is running out. Make your reservations and sign up for the conference. Be dazzled by the show plants on display, grow your collection with additions from the sales area and the rare plant auction, and join us on a hunt for relics at the museum.

Cultivar Corner

Derek Butcher, BSI Cultivar Registrar

It is odd how some names persist for years even though the grower believes them to be incorrect. One example is *Aechmea fulgens* var. *discolor* 'Variegata'. I shudder at the improper usage of the Latin term variegata instead of variegated but that is another story.

Eleven years ago, Harry Luther pointed out in this journal [JBS 42(1): 8. 1992] that true *Aechmea fulgens* and *A. miniata* are rare in cultivation, but their hybrids abound. In 2003, Helga Tarver, one of my keen investigative colleagues on the Cultivar front, pointed out that *A. fulgens* var. *discolor* 'Variegata' was clearly of hybrid origin because it had an inflorescence which was branched to the top. It needed a cultivar name!

Reference to the Bromeliad Cultivar Registry revealed a plant that could well be linked to our problem. I contacted Reginald DeRoose who confirmed that 'his' plant could well be the plant in question. He sent me a photograph of *Aechmea* 'Reginald' (FIGURE 16), which will become part of the on-line Bromeliad Cultivar Registry. This agrees with the plant that Helga grows and the plant that is being grown in Australia as *A. fulgens* var. *discolor* 'Variegata'.

If you have information that refutes this, please advise, otherwise I suggest you change the name on your label to *Aechmea* 'Reginald'.

Figure 16. *Aechmea* 'Reginald'. Photograph by Reginald DeRoose.

Bromeliad Endophytes and the Serendipity of Science

Dorothy E. Tuthill[3] and Gregory K. Brown

Sometimes a research endeavor can lead in unexpected ways to a completely different field of research. This is the story of one such serendipitous find involving bromeliad *endophytes*—fungi that grow within living leaf tissue without causing apparent harm.

As regular readers probably know, the focus of our lab group's research is to help define the natural groupings of the genera and species in the subfamily Bromelioideae, using both morphological and molecular (i.e., DNA) data. Before I became an official member of the team, I was hired temporarily by the lab group to generate more DNA data for the systematic studies. We hoped to get this data from a region known as the internal transcriber spacer (ITS), a length of DNA located between the genes for the large and small ribosomal units (FIGURE 17). To explain, ribosomes are large molecules made of RNA, and are the site where the information coded into DNA is de-coded and translated into protein. Since this translation is a fundamental process for life, all organisms have ribosomes, and, in fact, have many, many copies of the ribosome genes. The ribosome genes are said to be "conserved," meaning that they are similar across large groups of organisms, because any changes in the genes that would make ribosomes non-functional are quickly eliminated from the gene pool.

The ITS region is a different story. Its DNA does not code for anything, so mutations that occur within that region do not affect an organism's survival. Therefore, the DNA sequence can change relatively rapidly, and significant differences can be found among closely related species. For that reason, ITS is often chosen for molecular systematic studies involving rapidly evolving groups, of which Bromelioideae is a good example.

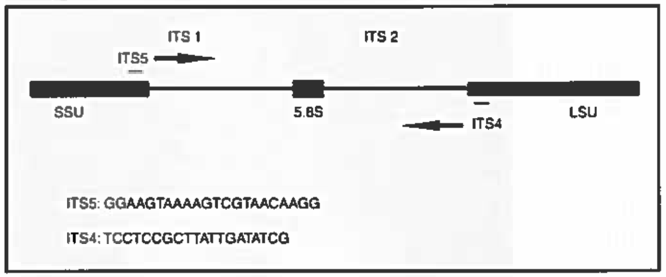

Figure 17. Schematic diagram of the internal transcribed spacer (ITS) region. The ITS is flanked on either side by the conserved ribosome genes "LSU" and "SSU". A third ribosome gene, called "5.8" is located in the middle of the ITS region and separates ITS1 and ITS2. The two primers, ITS4 and ITS5 (indicated as arrows), attach to the ends of the ribosomal genes. It is the DNA between the two primers that is amplified during PCR and then sequenced.

The procedure for getting a DNA sequence is not complicated. The first step is to extract the DNA from the organism of interest; in our case this means grinding up a healthy-looking leaf, centrifuging to remove proteins and cell debris and precipitating out the DNA with salt and ethanol. A small amount of the DNA is added to tubes that also contain the raw materials and enzyme required to make more DNA. Also necessary are primers, small pieces of man-made DNA that match specific places on either side of the region of interest (ITS4 and ITS5, FIGURE 17). These tubes are then placed into a machine that rapidly repeats a cycle of high, low and medium temperatures that allows the primers to attach to the organism's DNA and the enzyme to build new DNA starting at the primer attachment sites. Each time this process, known as the polymerase chain reaction (PCR) is repeated, a piece of DNA is made that is complementary to the original DNA, and with each repeat of the cycle the amount of DNA is doubled. After about 25 cycles there is plenty of DNA for the sequencing reactions that follow.

When I followed this standard procedure to amplify the ITS regions from selected Bromelioideae, I got more than one product from most leaves. I know this because the PCR products were placed into an agarose gel and an electric current was run through it, the standard method (called electrophoresis) for separating fragments of DNA of different lengths (FIGURE 18). To have more than one band of DNA showing up on the gel (termed length polymorphism), while not a "good" thing, was certainly interesting. To find out why, I cut the different bands from the gel, and had each one sequenced separately.

The goal of sequencing is to determine the exact order of the nucleotides in the DNA. There are four nucleotides that make up the "letters" of the DNA code, usually called by their abbreviations A, C, G and T. The procedure for sequencing involves more PCR reactions using fluorescent ingredients, and a large machine that reads the results. In our case, sequencing was done by a commercial sequencer (Davis Sequencing, Davis, CA). When the sequences were returned to me, I compared each one to all of the sequences available on GenBank, a huge, internet-available database of DNA sequences maintained by the National Center for Biotechnology Information, a branch of the National

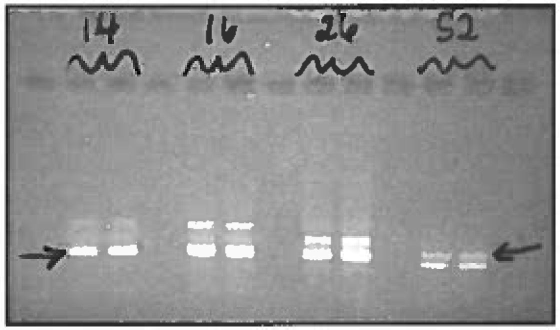

Figure 18. Agarose gel showing multiple PCR products. PCR products from individual plants were placed into the wells (shown as dark rectangles) at the top of the gel. Products were separated by size, with shortest DNA fragments moving farthest toward the bottom of the gel. Arrows indicate bands of approximately 600 nucleotides in length. Numbers at the top refer to host plants: 14 = *Aechmea organensis*, 16 = *A. nudicaulis*, 26 = *A. gamosepala*, 52 = *A. perforata*.

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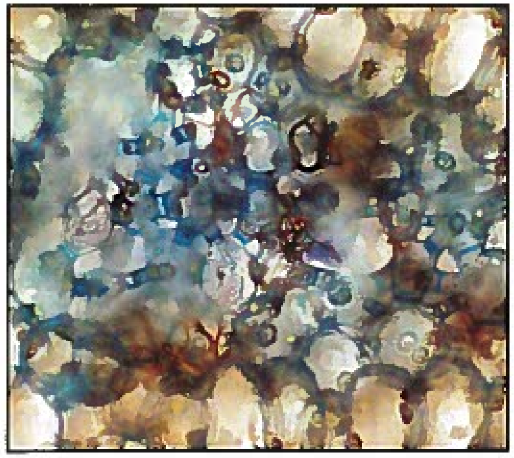

Figure 19. Fungal filaments, stained red, are visible in the internal leaf tissue of *Aechmea microcephala.* Photo by Rachel Schmidt.

Institutes of Health (http://www.ncbi.nlm.nih.gov/). What I found was that not one of my sequences came from a bromeliad-I had amplified ITS DNA from a variety of fungi and even a ciliated protist!

This same problem has, in fact, led some unwary botanists astray. For example, a phylogenetic study of spruces based on ITS sequences (Smith & Klein 1994) turned out to have been based on fungal sequences, apparently from fungi living within the needles (Camacho et al. 1997). Similarly, a study on bamboo relationships yielded far more length polymorphism than expected for ITS fragments, leading the researchers to suspect, and demonstrate, contamination by 29 different fungi (Zhang et al. 1997).

There are sound reasons for why this happens: 1. The primers are designed to attach to the ends of the ribosome genes and, because those genes are conserved, will attach to DNA from fungi and protists as well as from plants. 2. No leaf consists totally of plant material, but is instead a community of organisms, including fungi that live both inside (FIGURE 19) and on the surface, protists and algae that live in the film of water on the leaf surface, and sometimes even other plants, especially liverworts and mosses, that set up housekeeping on the surface (FIGURE 20). In grinding up a leaf for DNA extraction, I ground up and extracted DNA from all of these diverse organisms. I cannot say why I never succeeded in amplifying even one bromeliad ITS, except that my mycological training may have denied me the proper botanical karma. However, these results, though unintended, have been the motivation to look further into the realm of bromeliad-associated fungi.

Endophytes have been found in every plant sampled. We know that the location of the plant, i.e., the amount of rainfall, wind, or sunlight that it receives, plays an important role in determining the composition of the endophyte community (Carroll 1995, Cannon & Simmons 2002, Arnold & Herre 2003). There is also evidence that these fungi are specific to particular hosts, at least in temperate regions (Carroll 1995). In tropical ecosystems the evidence is conflicting, though one study showed that the fungi grew better in the presence of host plant extracts than in their absence (Arnold & Herre 2003). One authority (Hawksworth 1991) found that for every plant species there are six associated fungal species. If that holds true for bromeliads, there may be as many as 17,000 currently undocumented bromeliad fungi!

Figure 20. Liverworts and fungi (arrows) leading happy lives on the leaf surface of *Aechmea victoriana.* Photo by Rachel Schmidt.

The "function" of these fungi is a question still open for debate. Some endophytes appear to deter insect herbivores and pathogens, including bark beetles and gall wasps (Carroll 1995). A very recent study of endophytes of cacao (*Theobroma cacao*) indicated that endophytes protect leaves from infection by *Phytophthora*, a fungal pathogen that has been responsible for major economic losses (Arnold et al. 2003). Any plant-protective value provided by these fungi is probably a by-product of their own attempts to control leaf territory and repel or inhibit the growth of other fungi. From the fungal perspective, they may be doing nothing more than waiting for the leaf to suffer stress, when they may cause disease symptoms, or death, when they can start to degrade the leaf tissue. To a fungus, a single plant leaf is a large and valuable resource, full of carbohydrates. Any fungus that can be present at the time of leaf senescence is in a much better position to claim that resource than a fungus that doesn't arrive until after the leaf has died. The fact that no plant has been found to lack endophytic fungi suggests a long and successful co-evolutionary association between these two kingdoms.

The fungi identified from this study (TABLE 1) included both saprotrophs (living on dead tissue) and pathogens (causing disease), even though DNA was always extracted from healthy-looking leaves. For example, both *Verticillium* and *Entyloma* species cause diseases in many plants, *Cladosporium* species are extremely common decomposers, and *Kockovaella* and *Ceramothyrium* species are found on leaf surfaces but do not cause apparent harm. Most fungi were found only once, suggesting that their distribution may be restricted to certain hosts, or simply that they are rare enough to have been found only once in this small survey. *Aechmea gamosepala* and *A. ramosa* both hosted very closely related species of *Capronia* and *Exophiala*. One fungus was found in three plants, but has not been identified; it is known in GenBank only as "basidiomycete from a bamboo." It was found associated with *Aechmea perforata*, *A. sphaerocephala*, and *Streptocalyx poeppigii*.

The results of this unintentional examination of bromeliad endophytes has led to a larger, intentional study of the fungi inhabiting Bromelioideae leaves. The approach for the follow-up study was much more direct: leaves, collected at The Marie Selby Botanical Garden, Sarasota, FL, were cut into small pieces to allow the fungi to grow out onto an agar medium. These results will be described in an upcoming article. There is far more to any bromeliad than the beautiful plant that meets the eye!

TABLE 1. Fungi from bromeliad leaf tissue, identified by GenBank search of ITS DNA sequences. E is an expectation value given by the search program. Low E values indicate a close match and high E values indicate a relatively poor match between the queried sequence and the identification.

Ascomycetes		Basidiomycetes	
Capronia masonii (= Exophiala sp.)	$E = 0.0 - e^{-149}$	*Clavicorona taxophila*	$E = 5e^{-59}$
Ceramothyrium carniolicum	$E = 0.0$	*Entyloma* spp.	$E = 5e^{-70}$
Cladosporium oxysporium	$E = 0.0$	*Kockovaella schimae*	$E = 3e^{-73}$
Verticillium clamydosporium	$E = e^{-100}$	"basidiomycete frombamboo"	$E = 2e^{-70}$

Acknowledgments

This work was funded by a grant from the National Science Foundation (DEB-0129446) to G.K.B. We also thank The Marie Selby Botanical Gardens and Harry Luther for access to plant material.

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Events Calendar

Asia

July 24-27, 2004. *SECOND PHILIPPINES BROMELIAD CONFERENCE.* Dept. of Agriculture and the Northern Mindanao Ornamental Horticulture Foundation, including the Greater Northern Mindanao Bromeliad Society. Cagayan de Oro City, northern Mindanao. Conference venue: Grand Caprice Hotel at the Limketkai Center. Guest speakers, exhibits and displays, bromeliad sales, rare plant auction, collection tours in a tropical Summer. For more information, contact Ruben Diaz Snr., Beebai's Garden, Purok 10, Baloy, Cagayan de Oro City 9000, Philippines. Email: rubencdiazsr@yahoo.com Phone: 0011-63-8822-733079.

Australia

June 12-13, 2004. *BROMELIAD SOCIETY OF QUEENSLAND AND CACTUS AND SUCCULENT SOCIETY OF QUEENSLAND COMBINED SHOW*, Displays and Plant Sales. Mt. Coot-tha Botanic Gardens Auditorium, Brisbane, Australia. 8-4:30. For more information, contact Phone 07-38002561. Website: http://bsq.org.au.

Sept. 9-12, 2004. *CENTRAL COAST NSW BROMELIAD SOCIETY SHOW.* Central Coast New South Wales Bromeliad Society. For more information, contact Fay Hagan, fayhagan@tac.com.au

United States

May 1-2, 2004. *JEWELS OF THE JUNGLE - ANNUAL MAY SHOW AND SALE.* Greater New Orleans Bromeliad Society.

May 1-2, 2004. 26TH ANNUAL BROMELIAD SHOW AND SALE. Bromeliad Society of South Florida. Fairchild Tropical Garden, 10901 Old Cutler Rd., Coral Gables, Miami, Fl)orida, USA. 9:30-4:30.

May 7-9, 2004. *29TH ANNUAL BROMELIAD SOCIETY OF CENTRAL FLORIDA SHOW & SALE.* Bromeliad Society of Central Florida. The Florida Mall, 8001S. Orange Blossom Trail, Orlando, FL. Fri. & Sat. 10-9:30, Sun. 11-6. Exhibitors will be competing for many awards, including the prestigious Best of Show awards sponsored by the BSI. Hundreds of colorful and unusual plants also for sale. Members will be on hand to answer questions and distribute free information. For more information, contact Betsy McCrory 407-348-2139 or betsymccrory@aol.com.

May 14-15, 2004. *STANDARD JUDGED BROMELIAD SHOW AND SALE.* Bromeliad Society of Houston. Houston Arboretum and Nature Center, 4501 Woodway, Houston, Texas, USA. Sales: Fri. 12-5, Sat. 9-5, Sun. 10-4. Show: Sat. 2-5, Sun. 10-4. Odean Head will present seminars on both days. For more information, contact Allyn Perlman (713-772-7831 or deliboys@houston.rr.com).

June 17, 2004. *BOCA RATON BROMELIAD SHOW*. Boca Raton Bromeliad Society. For more information, contact www.bsi.org/webpages/boca_raton.html.

June 25-27, 2004. *SARASOTA BROMELIAD SOCIETY SHOW AND SALE*, Judged Show, hundreds of bromeliads will be displayed and available for purchase. Marie Selby Botanical Gardens, located at US 41 and S. Palm Ave. in downtown Sarasota. 10-5 each day. Show only on Saturday and Sunday. Banquet and rare plant sale Saturday night. Admission to the show and sale included with regular admission to Selby Gardens. For more information, contact Rob Branch 941-358-4953, or Inez Dolatowski idolatow@tampabay.rr.com.

July 31-August 1, 2004. 2004 *BROMELIAD SHOW & PLANT SALE*. South Bay Bromeliad Associates. Rainforest Flora (new location), 19121 Hawthorne Blvd., Torrence, California, USA. Sales: Sat. & Sun. 10-4:30. Show: Sat. 12-4:30, Sun. 10-4:30. Admission, show plant entry, and parking free. For more information, contact Bryan Chan, 10571 Odessa Ave, CA 91344 (818-366-1858 or bcbrome@aol.com).

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

Aug. 11, 2004. *SCHOOL II OF THE WORLD CONFERENCE BROMELIAD JUDGES SCHOOL SERIES*. World Bromeliad Conference, Chicago, IL. 8-5. There is a nominal fee and you must be registered for the school one week prior to the conference. For more information, contact Betty Ann Prevatt, 2902 Second St., Ft. Myers, FL 33916. Phone 239-334-0242 or e-mail bprevattpcc@aol.com.

Aug. 21-22, 2004. *SEMINOLE BROMELIAD SOCIETY DISPLAY AND SALE*. Sanford Garden Club, 200 Fairmont Drive, Sanford, FL. 9-4. For more information, contact hallnan2039@cfl.rr.com, shipsley@msn.com.

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

Grace M. Goode, Order of Australia Medal Recipient

Bob Reilly[4]

Grace Goode, an honorary trustee of the Bromeliad Society International (BSI), was awarded Order of Australia Medal (OAM), by the Australian Government, on 26 January 2004. The medal was awarded for Grace's efforts in growing and hybridising bromeliads. Such an award has never been made in connection with bromeliads before, and is very rarely made for any horticultural-related activity.

The Illawarra Bromeliad Society initiated the process for obtaining the Award for Grace, and sought the support of other Australian bromeliad societies for this endeavour. Many Australian bromeliad growers helped in preparing the extensive documentation needed to support Grace's nomination.

The OAM is the latest recognition of Grace's efforts in growing and, in particular, hybridising bromeliads. For example, Grace is also an honorary trustee of The Cryptanthus Society, and has been elected a life member of the Bromeliad Society of Australia, Cairns Bromeliad Society, Bromeliad Society of Queensland, and the Sunshine Coast Bromeliad Society.

Most people know Grace through her hybrids. She started hybridising in the early 1970s, largely in response to the very limited number of bromeliads available then in Australia. Initially, she concentrated on neoregelias. Some of her earlier hybrids are: 'Sheer Joy,' 'Little Joy,' 'Blackie,' 'Red Plate' and the well known 'Amazing Grace.' Her best known hybrid is probably 'Charm,' which is a cross between *Neoregelia marmorata* and *N. chlorosticta*. As a matter of interest, Grace considers 'Charm' is exactly the plant she was trying to produce from this cross, as it combines the form (conformation) of *N. marmorata* and the colouration of *N. chlorosticta*.

Another major area of hybridisation activity has been with cryptanthus. Some of her early hybrids are: 'Misty Charm,' 'Misty Dawn,' 'Misty Glow,' and 'Misty Flame.' Bob Whitman brought many of Grace's cryptanthus hybrids to the United States of America (USA). They included: 'Melanie,' 'Seven Veils,' 'Black Mood,' 'Hells Bells,' and 'Spellbound.' She also sent hybrid cryptanthus seed to the USA, from which have been produced plants such as: 'Fond Memory,' 'Happy Thoughts,' 'Texas Star,' and 'Crown Jewels.' Grace has produced over 800 named hybrids. As well as neoregelia and cryptanthus hybrids, she has produced aechmea, billbergia, nidularium, and tillandsia hybrids. She has also made several bigeneric hybrids, with perhaps the best ones being *X Niduregelias* 'Something Special' and 'Vision Splendid.'

At 86 years old, Grace is still actively producing hybrids. Recent outstanding neoregelia hybrids include: 'Amen,' 'Africa,' 'Alley Cat,' 'Mandela' and 'One and Only.' Grace has been generous with financial and other contributions (such as her hand-made rugs used as raffle prizes), to help fund activities such as conferences, undertaken by various Australian and overseas bromeliad societies.

Figure 21. Grace Goode. Photograph by Keith Dawson.

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From my viewpoint though, I consider one of Grace's greatest contributions over the last 30 years to be the support and friendship she has given (and continues to give) to bromeliad growers throughout the world. Many Australian collectors, including myself, started their bromeliad (especially neoregelia) collections with plants and advice from Grace. On behalf of the many people bitten with the bromeliad "bug," I thank Grace for her past efforts, and wish her many more productive years to come.

Acknowledgments

I wish to thank Derek Butcher and Geoff Lawn for their help in preparing this article.

Studies on *Orthophytum*, an Endemic Genus of Brazil - Part I

Elton M. C. Leme[1] **Photographs and Illustrations by the Author**

Introduction

Orthophytum is medium-sized genus of the subfamily Bromelioideae, comprised of 34 species and 7 varieties (not including the species described below). It is endemic to Brazil and lives in rocky habitats that stretch from the central-north region of Espírito Santo state, southeastern Brazil (the southernmost limit, with 6 species) to the northeastern states of Alagoas, Pernambuco and Paraíba (the northernmost limit, with 2 species).The center of diversity of the genus occurs in the northeastern-southeastern states of Bahia (16 species) and Minas Gerais (12 species).

The species of *Orthophytum* are exclusively terrestrial and saxicolous, living mostly in sun exposed areas on rocky escarpments in the region of the Atlantic Forest or more often in the grasslands on rocky soils, on quartzite and sandstone outcrops that form the usually high-altitude landscape of the Serra do Espinhaço range, standing out from the savannas domain.

Taxonomic knowledge of *Orthophytum* is rudimentary. There are basic questions to be answered on the identity of some important historical species, as well as which morphological characteristics should be used for delimitation of the taxa. However, on the basis of the current knowledge on the genus, as well as field observations, it is possible to begin to organize complexes and subcomplexes using some outstanding features, as presented below.

1. Complex with sessile inflorescence

a. "Subcomplex amoenum" - plants stemless, inner leaves and primary bracts becoming bright colored at anthesis in contrast with the outer leaves, petals mostly white or pale colored. (6 species).

b. "Subcomplex supthutii" - plant stemless, color of the inner and outer leaves similar at anthesis, petals bright yellow. (1 species).

c. "Subcomplex vagans" - plant long-caulescent, petals green except for the apical white margins, forming a somewhat clavate corolla, apex obtuse-cucullate. (1 taxon).

2. Complex with scapose inflorescence

a. "Subcomplex disjunctum" - leaves forming a distinct rosette before and at anthesis, petals forming a tubular corolla toward base, except for the suberect apex, apex obtuse to acuminate, not cucullate. (26 taxa).

b. "Subcomplex mello-barretoi" - leaves forming a distinct rosette before and at anthesis, petals forming a clavate corolla, apex obtuse-cucullate. (2 taxa).

c. "Subcomplex leprosum" - leaves not forming any rosette neither before anthesis nor during it, and not distinguishable from the scape bracts, or leaves absent even before anthesis. (4 taxa).

There are other features which can possibly be used in dividing groups of *Orthophytum* taxa more naturally.A good example is the vegetative propagation mechanisms already described. Some species propagate by means of short basal shoots only (e.g., *O. burle-marxii*). Another group of species, besides the short basal shoots, concommitantly develops shoots from the inflorescence base, on the apex of the lateral strobilate fascicles, or a single terminal shoot at the inflorescence apex (e.g., *O. disjunctum*, *O. magalhaesii*, *O. sucrei*), as in some *Ananas* species. This may suggest an adaptation to growing conditions of nearly bare rocky surfaces. Finally, some species propagate by means of long, sometimes slender basal rhizomes, and in this case it apparently is not occurring with the concommitant production of shoots from the inflorescence (e.g., *O. compactum*, *O. glabrum*).

This is the first paper of a study on *Orthophytum* species with the intent of analyzing some problematic taxa and describing new ones, such as the two members of the "disjunctum subcomplex" presented below.

Species

When *Orthophytum fosterianum* var. *estevesii* was conceived by Rauh (in Rauh & Gross 1991) the typical variety of *O. fosterianum* L. B. Sm. was considered an imperfectly known taxon.According to Luther (1991), *O. fosterianum* was described on the basis of a depauperate specimen producing a simple or barely branched inflorescence; however, vigorous plants produce up to seven branches. Besides the recognized improvement on the concept of *O. fosterianum*, Luther (1997) also described *O. sucrei*, including in its synonymy *O. fosterianum* var. *estevesii*. However, after comparing type descendants of *O. sucrei* and *O. fosterianum* var. *estevesii* maintained in cultivation, as well as the holotype of the latter, it became clear that there are important morphological differences between them, which are consistent enough to justify the elevation of var. *estevesii* to the species rank, as proposed below.

Orthophytum estevesii (Rauh) Leme, stat. nov. (FIGURES 22, 24, 25).

Basionym: *Orthophytum fosterianum* L. B. Sm. var. *estevesii* Rauh, *Trop.*

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Subtrop. Pflanzenwelt 79: 27-29, figs. 14,15. 1991. Type: Brazil. Minas Gerais: between Mantena and Palmeira, 29 Apr. 1986, *E. Esteves Pereira s.n.* (Holotype: HB). Clone of the living type plant: *E. Esteves Pereira s.n.*, flowered in cultivation Nov. 2002, *E. Leme 1906* (HB).

Plant saxicolous, stemless, 12-30 cm high, propagating by short basal shoots and by shoots originating from the inflorescence base and a single terminal one from the inflorescence apex. ***Leaves*** 7-10, rosulate, subdensely arranged and forming a distinct rosette; ***sheaths*** inconspicuous; ***blades*** narrowly-triangular, 9-20 cm long, 1.5-2.2 cm wide at base, ca. 2 mm thick near the base, subcoriaceous to coriaceous, arcuate, distinctly channeled with a semicircular curve in cross-section, light green, glabrous on both sides except for the inconspicuously white lepidote base and basal margins, abaxially distinctly nerved, apex long attenuate-caudate, margins densely to subdensely spinose, spines triangular at base with an acicular apex, nearly straight to distinctly uncinate, prevailing antrorse, decreasing in length from base to apex, 2-4 mm long, 1.5-2 mm wide at base, 4-10 mm apart. ***Scape*** erect, 6-17 cm long, 0.4-0.7 cm in diameter, densely white-lanate, green; ***scape bracts*** foliaceous and similar to the leaves but the upper ones gradually reduced in size, glabrous except for the white-sublanate base, exposing the scape, subspreading to suberect-arcuate. ***Inflorescence*** simple, densely capitate-rosulate, 8 to 10-flowered, erect, 2.5-3 cm long, the sterile bracteate apex continuing to grow and forming a vegetative shoot after anthesis; ***floral bracts*** narrowly ovate, apex acuminate-spinescent, distinctly canaliculate, but not carinate, and strongly recurved, exceeding the sepals, green, inconspicuously nerved, thin in texture, glabrous, 30-42 x 10-18 mm, densely to subdensely and coarsely spinose, spines acicular to uncinate, straight to strongly curved at apex, prevailing antrorse, 1.5-2.5 mm long, 2-5 mm apart, the basal sterile bracts bearing vegetative buds; ***flowers*** 30-32 mm long (including the petals), sessile, densely arranged, odorless; ***sepals*** subsymmetrical, narrowly triangular-ovate, attenuate toward apex, apex slenderly acuminate-caudate, 18-20 x 3-4 mm, free, entire, light green, finely nerved, thin in texture to submembranaceous, glabrous, the posterior ones carinate with keels decurrent on the ovary, the anterior one ecarinate; ***petals*** sublinear-spatulate, apex rounded, 24-27 x 4-5 mm, free, erect at anthesis except for the suberect apex, white toward apex and along the margins, with a pale green central zone, bearing 2 densely scalloped-lacerate appendages ca. 3 mm above the base, as well as 2 conspicuous longitudinal callosities which nearly equal the filaments; ***filaments*** greenish toward apex, the antepetalous ones ca. 16 mm long, adnate to the petals for ca. 10 mm, the antesepalous ones ca. 18 mm long, free, plicate after anthesis; ***anthers*** 2-2.5 mm long, base obtuse, apex obtuse and minutely caudate, slightly compressed laterally, dorsifixed at middle; ***stigma*** simple-erect, ca. 2 mm in diameter, blades recurved, white, margins fimbriate; ***ovary*** ca. 4 mm long, 5-6 mm wide at apex, subtrigonous; epigynous tube inconspicuous; placentation apical; ovules obtuse, greenish-white. Fruits unknown.

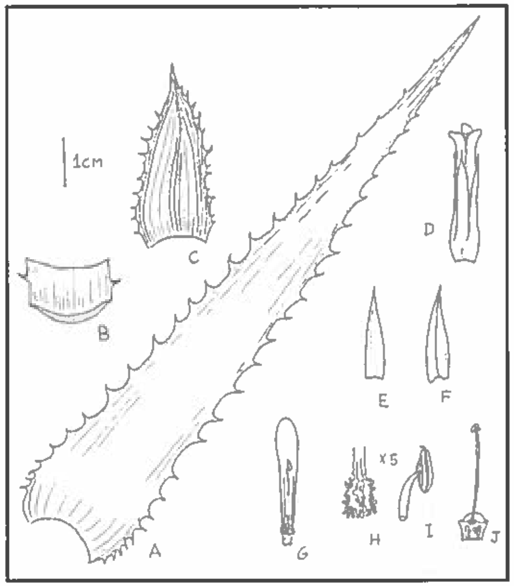

Figure 22. *Orthophytum estevesii.* A. Leaf. B. Cross section of the basal portion of the leaf. C. Floral bract. D. Flower. E. Anterior sepal. F. Posterior sepal. G. Petal. H. Petal appendages. I. Anther, side view. J. Longitudinal cross-section of the ovary and style. (Drawn from *Leme 1906*).

Additional material examined: BRAZIL. Espírito Santo: Colatina, Maquigi, Aug. 1999, field collected by *J. Gastin & E. Colnago s.n*, and flowered in cultivation Nov. 2002, E. Leme 4722 (HB); Colatina, Itapina, ca. 500 from Rio Doce bank 15 Aug. 2003, *E. Leme, M. Zanoni & E. Colnago 5923* (HB).

Orthophytum estevesii is closely related to *O. sucrei* H. Luther (FIGURES 26, 27), but can be distinguished from it by the light green, distinctly canaliculate leaves (vs. reddish and inconspicuously canaliculate to flat leaves), leaf blades with larger and more sparsely arranged marginal spines (2-4 mm long and 4-10 mm apart vs. 1.5-2 mm long and 2-4 mm apart), scape densely and conspicuously white-lanate (vs. subdensely white-lanate), floral bracts green (vs. orange-red toward apex), with longer and sparsely arranged marginal spines (1.5-2.5 mm long and 2-5 mm apart vs. 0.5-1 mm long and 1-2 mm apart), sepals light green (vs. orange-red), petals white except for a central very pale green zone (vs. completely green toward the apex), stigma white (vs. green), and anthers bearing a minutely caudate apex (vs. remotely apiculate apex). On the basis of the differences presented here, the elevation of *O. estevesii* to species rank is well supported.

Rauh & Gross (1991) indicated that the origin of *Orthophytum estevesii* was the region between Mantena and Palmeira, Espírito Santo State. However,The locality of Mantena is situated in the State of Minas Gerais, near the border of Espírito Santo State, and there isn't any locality in Espírito Santo called "Palmeira;" this justifies the correction of the type origin. On the other hand, there are two other collections of this taxon from the region of Colatina, Espírito Santo, about 50 km from the Minas Gerais border, and about 130 km from Mantena.This collection pushed the geographic range of *O. estevesii* further southeast.

In its habitat, *Orthophytum estevesii* forms dense, medium-sized populations on slightly inclined rocky surfaces, partially covered by a thin layer of organic soil, completely exposed to sunlight, or sometimes having some shade protection by nearby shrubs. Its habitat is situated in the Atlantic Forest and the three known collections of *O. estevesii* indicate that it is an endemic species.

Orthophytum horridum Leme, sp. nov. Type: Brazil. Minas Gerais: Pedra Azul, Feb. 1993, field collected by *P. Nahoum s.n.* and flowered in cultivation, Nov. 2002, *E. Leme 2051* (Holotype: HB; Isotype: SEL). FIGURES 23, 28

A *O. alvimii* W. Weber, cui affinis, laminis foliorum arcuatis, utrimque perdense lepidotis, marginibus spinis basalibus longioribus, inflorescentia 50-53 cm longa et petalis brevioribus, apice rotundatis differt; a *O. lymanianum* E. Pereira & Penna, cui proxima, laminis foliorum arcuatis, utrimque perdense lepidotis, marginibus revolutis, spinis basalibus longioribus, bracteis scapi subpatentibus arcuatis, inflorescentia 50-53 cm longa et sepalis longioribus differt.

Plant saxicolous, stemless to short caulescent before anthesis, 120-140 cm high at anthesis, propagating by rigid basal rhizomes, ca. 30 cm long, 0.5-0.8 cm in diameter, shoots originating from the inflorescence not seen at least at anthesis. ***Leaves*** ca. 12, subdensely rosulate and forming a distinct rosette before anthesis, at anthesis the upper leaves not distinguishable from the scape bracts due to the elongation of the stem, the remaining basal leaves ca. 7, forming a lax rosette; ***sheaths*** inconspicuous; ***blades*** sublinear-attenuate, long-caudate, 65-75 cm long, 4-5 cm wide at base, ca. 3 mm thick near the base, strongly coriaceous, strongly arcuate, distinctly channeled mainly under water stress, ferruginous colored, not lustrous, densely adpressed white-lepidote on both sides, trichomes persistent, somewhat obscuring leaf color, but not forming an evident membrane, finely nerved abaxially, margins revolute, densely spinose toward base, spines uncinate-triangular, flattened, antrorse, ferruginous, densely white-lepidote except for its yellowish extreme apex, 4-5 mm long, 3-4 mm wide at base, 3-10 mm apart, laxly spinose toward apex, spines ca. 3 mm long, ca. 3 mm wide at base, 15-30 mm apart. ***Scape*** erect, greenish to bronze colored, white-lanate to glabrescent with age, 1-1.8 cm in diameter; ***scape bracts*** foliaceous and not distinguishable from the leaves, slightly reduced in size toward apex. ***Inflorescence*** bipinnate or inconspicuously tripinnate at base, cylindrical, erect, 50-53 cm long, fascicles laxly arranged, 3.5-6 cm apart, except for the subglobose, 3-4 x 3-5 cm head of ca. 4 fascicles at extreme apex, rachis 0.7-1 cm in diameter, slightly flexuous, smooth to inconspicuously sulcate, terete to slightly

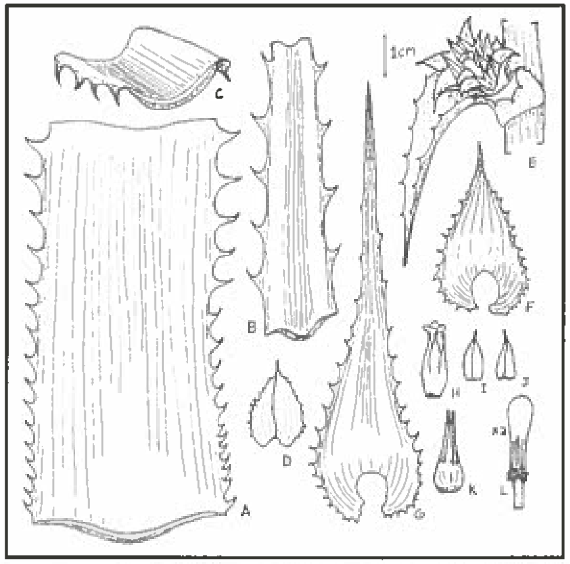

Figure 23. *Orthophytum horridum*. A. Basal portion of the leaf. B. Apical portion of the leaf. C. Cross section of the median portion of the leaf. D. Floral bract. E. Median fascicle. F. Upper primary bract. G. Basal primary bract. H. Flower. I & J. Sepals. K. Fruit. L. Petal. (Drawn from *Leme 2051*).

Figure 24. Habit of *Orthophytum estevesii* in bloom in cultivation under similar conditions as habitat.

Figure 25. Close up of inflorescence of *Orthophytum estevesii* in cultivation.

Figure 26. Habit of *Orthophytum sucrei* in cultivation in simulated natural habitat conditions.

Figure 27. Close up of inflorescence of *Orthophytum sucrei* in cultivation.

Figure 28. Habit of *Orthophytum horridum* in cultivation in simulated natural habitat conditions.

angulose near the apex, greenish, white-lanate to glabrescent with age; ***primary bracts*** strongly reflexed-recurved, distinctly canaliculate, the basal ones subfoliaceous and resembling the scape bracts, distinctly exceeding the fascicles but gradually reduced in size toward the inflorescence apex, the upper ones ovate-triangular, acuminate, 2.5-5 x 2-2.5 cm, equaling to distinctly exceeding the fascicles, densely white-lepidote on both sides, greenish, distinctly nerved abaxially, densely to subdensely spinulose, spines triangular, ca. 2 mm long, ca. 1.5 mm wide at base, 2-6 mm apart, the basal ones retrorse-uncinate, the upper ones straight to slightly antrorse; ***fascicles*** 13 to 14, subdistichously disposed, suberect, sessile, subglobose-strobilate, rosulate, 2-2.5 cm long, 2.5-3 cm in diameter (including the floral bracts), 15 to 25-flowered; ***floral bracts*** broadly ovate-triangular, acute and long-apiculate, densely spinulose, spines ca. 1 mm long, carinate to ecarinate but v-shaped and centrally sulcate adaxially, slightly shorter to equaling the sepals but very strongly recurved toward apex, green, finely nerved, inconspicuously white-lepidote to glabrescent, 18-20 x 12-15 mm; ***flowers*** 18-20 mm long (including the petals), sessile, densely arranged, odorless; ***sepals*** narrowly ovate to subelliptic-ovate, apex softly caudate, 14 x 4.5-5 mm, free, entire, green except for the hyaline margins, submembranaceous, sparsely and inconspicuously white-lepidote to glabrescent, the posterior ones alate-carinate toward base with keels decurrent on the ovary, slightly asymmetric; ***petals*** subspatulate, rounded but bearing at apex a very inconspicuous and tenuous apiculous, apical margins remotely crenulate, 13-15 x 3 mm, free, erect at anthesis except for the suberect apex, base whitish, central portion green, and apex white, bearing 2 densely and downwardly scalloped-fimbriate appendages 3-5 mm above the base, as well as 2 conspicuous longitudinal callosities which nearly equal the anthers; ***filaments*** terete, greenish, the antepetalous ones 6-7 mm long, adnate to the petals for 4-5 mm, the antesepalous ones 8-9 mm long, free; ***anthers*** green, ca. 2.5 mm long, laterally complanate, base obtuse and apex apiculate, dorsifixed nearly 2/5 of its length above the base; ***stigma*** simple-erect, ca. 1 mm in diameter, white, blades obtuse, distinctly recurved; ***ovary*** 3-4 mm long, subtrigonous and slightly complanate, inconspicuously white-lepidote tomentose; epigynous tube inconspicuous; placentation apical; ovules obtuse, numerous. ***Fruits*** slightly enlarged from the ovary, ca. 7 mm wide, lacking mucilagenous material, greenish-white; ***seeds***, subpyramidate base acuminate, apex obtuse, ca. 1.5 mm long, finely sulcate.

Orthophytum horridum can be distinguished from the morphologically similar *O. alvimii* by the leaf-blades arcuate (vs. suberect), densely white-lepidote on both sides (vs. glabrescent adaxially), margins with longer basal spines (4-5 mm long vs. 2.5 mm), inflorescence distinctly longer (50-53 cm long vs. 18 cm), and petals shorter (13-15 mm long vs. 20 mm) with rounded apex (vs. acuminate). It also resembles *O. lymanianum*, but may be separated by the leaf-blades arcuate (vs. suberect), very densely white-lepidote on both sides (vs. glabrous adaxially), margins revolute, with longer basal spines (4-5 mm long vs. ca. 3 mm long), scape bracts subspreading-arcuate (vs. suberect), inflorescence longer (50-53 cm long vs. 30 cm long), and sepals longer (ca. 14 mm long vs. ca. 10 mm).

This new species was encountered growing on thin organic soil accumulating on inclined rocky surfaces in, where it forms medium-sized populations under direct sunlight. In comparison to the known taxa, *Orthophytum horridum* can be considered a large species, and one of the tallest of the genus when in bloom, with very pronounced spines which inspired its name.

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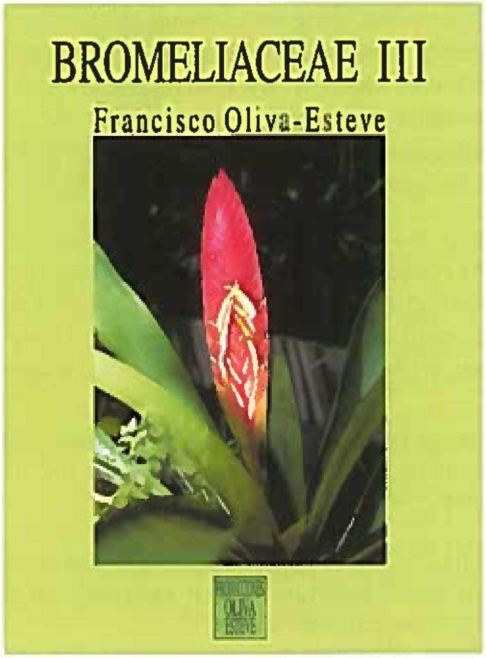

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Figure 29. *Werauhia insignis.* Monte Verde Forest Reserve at about 1500 m in montane rainforest. Photograph by Walter Till.

Figure 30. Model of the cultivated pineapple (*Ananas comosus*) on display in the Hall of Plant Life, Field Museum, Chicago. See the article by Ken Marks in this issue for an intersting story on these models and how they relate to the upcoming World Bromeliad Conference.

Notice of the Annual Meeting of the Bromeliad Society International, Inc., and the Members of the Board of Directors

Tom Wolfe, BSI President

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If any member has any business for the board to transact or any proposed business requiring a vote should be submitted in writing to the President not less than 60 days before the meeting.