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Editor: Andrew Flower, PO Box 57-021 Mana, Porirua 5247, New Zealand
tel: +64 4 2399-659, fax: +64 4 2399-671, email: editor@bsi.org
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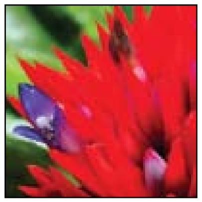
p. 154


p. 171


p. 186

CONTENTS

Covers

Front— Aechmea saxicola: probably our first picture of this Brazilian native, mentioned in our 1958 issue as having survived a hard freeze in Florida where temperatures fell to 24F (-4C) for two nights running!. Photographed by Elton Leme.

Back— Unidentified tillandsia or vriesea clinging to a sheer clifff face in Peru. Photographed by Michael Romanowski.

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Editorial

My Vision for the BSI

Jay Thurrott, President.

Sixty years ago a group of individuals who shared a common interest in bromeliads put aside their differences long enough to form what we know today as the Bromeliad Society International. I often wonder what they would think of today's organization. It has certainly grown in membership since those first days.

Yes, today's economic climate is at least partly responsible for a decline in membership renewals in recent years, but interest in the organization is high and I'm looking for membership to begin increasing once again. The membership, in turn, has truly made BSI an international organization, as evidenced by attendance at the recent New Orleans World Conference from Canada, India, South America, Australia, the Bahamas, New Zealand, and a newly affiliated group of dedicated enthusiasts from South Africa (if I've overlooked other countries of origin, please forgive me - it wasn't intentional). BSI has also grown in service to its members since those first days when its founders labored over the organization's by-laws. Who would have guessed that members could be served by something called a 'website' or that a world class scientific publication called the BSI Journal could be produced by its members for the interests of its members?

Times have certainly changed in the last 60 years and they will undoubtedly continue to change. What direction will the organization take in the future? Service and communication will be our goals.

(1.) First and foremost I see a need to continue to develop and provide service to the membership. The Cultivar Registry is just one example of an outstanding resource that will not be just for our members, but for all of the public. Look for this soon on the website. The Affiliates Chair is working with the affiliated societies, but that's not enough. There is a significant portion of our membership that is not affiliated with any society and their needs must be recognized and addressed. We're working on this and you will be seeing more details as plans are further developed.

(2.) The BSI website is a great resource and an invaluable means of connecting with our members. We need to make better use of this to reach out to our members and expand the number of features provided.

(3.) We're in the 21st century – we no longer need to be restricted by the great distances separating our Directors in handling business associated with the BSI. Electronic media capabilities exist so that communications can easily be distributed to Board members for review and comment. Voting can take place on issues affecting the membership in a much more timely manner than in the past. There will be increased use of these tools and, as a result, the organization will become more responsive to issues of general concern when they arise.

Sixty years ago a group of individuals who shared a common interest in bromeliads put aside their differences to form the BSI. There's a lesson to be learned in that. There are some decided differences among us, but we are all in this organization because we share a common interest. If we can put differences aside, there is no limit to what we can accomplish.

In This Issue

Scientific

Some species have a history of being re-named multiple times by taxonomists, and one of these started "life" 180 years ago as *Hohenbergia capitata* before being "*Aechmea aquilegia*", then "not *A. aquilegia*", also spending some time as a "*Gravisia*"before Elton Leme has now restored it to *Hohenbergia capitata*. On page 158 Manzanares and Till describe three new racinaea species from Ecuador, including two named for current taxonomists Eric Gouda and Jason Grant. Harry Luther has sent us a nice new photo of *Aechmea andersonii* flowering at Selby Gardens in Florida, see page 170.

Cultivation

We have two articles on growing bromeliads in the USA: Dan Kinnard's *Bromelia serra* in Southern California (p. 171) and Jay Thurrott on *Ananas comosus* v. *bracteatus* in Florida (p. 179). Michael Dorris works in micropropagation of bromeliads at a commercial USA nursery (his comments on micropropagation in non-US countries are made with this bias), and gives an overview of plant tissue culture (p. 172). Articles from Mike on germinating tillandsia pollen to check viability, and cloning a dyckia will follow.

General Interest

Derek Butcher has never been one to shy away from controversy (even silent ones), and he leads on page 182 with a review of recent evidence suggesting the bromeliacea should be categorised in eight subfamilies instead of the current three (Pitcairnioidea, Tillandsioideae and Bromelioideae). Hopefully this will generate at least some comment from professionals working in the bromeliad science field.

Reports are appearing again from affiliate shows, and new Shows Chair Charles Birdsong has sent in a report from the Caloosahatchee Society 2009 Show (p. 186). Finally in this issue, Gene McKenzie reminds us of the beginnings of our society (p. 187).

Membership Dues to increase

See page 180 for new rates (due to postal rate increases) to apply for future renewals and new memberships. Most categories increase by $5 per year but dual membership has gone up by $20 per year (households with dual memberships do, of course, have the option to renew on a single membership when the time comes.)

Call for Nominations for BSI Directors, 2011-2014 Term

Dr. Larry Giroux

Each year as Directors' terms expire, the BSI Nominations Chair asks BSI members to nominate eligible BSI members to serve as BSI Board of Directors representatives from their respective regions. If more nominations are made than are open positions for a region, the BSI members in that region are asked to vote on the nominees. The first important step is to nominate people for the directors' open positions. Below is the list of open positions for the 2011-2014 three-year term (per a change in the By-laws, terms for Directors and Officers begin at the end of the Annual Board Meeting). If you are a member of a district with an open position, please help your district by finding a willing person to nominate for your district's open Directorship. Instructions regarding who can be nominated and how to nominate follow.

The regions for which Directors are up for re-election or there are new vacancies for the 2011-2014 term and the numbers of directors needed are as follows:

International	2 directors
Florida	3 directors
Australia	2 directors
Northeast	1 director
California	1 director
New Zealand	1 director
Central	1 director
South	1 director

In general if there is more than one new nominee, there will be an election between the new nominees and the incumbent. Any new nominees for the Australian positions will be running against the incumbents, who are up for re-election for second terms. Any new nominees for the California position will be running against the incumbent, who is up for re-election for a second term. Any new nominees for the Florida positions will be running against the incumbents, who are up for re-election for a second term. Any new nominees for the Northeast position will be running against the incumbent, who is up for re-election for a second term The names of current Directors can be found on the inside back page of this Journal.

Nominations to serve on the BSI Board of Directors for the three-year 2011-2014 term will open January 1, 2011. Serving on the BSI Board is both fun and interesting. The Board makes decisions that influence the direction and activities of the BSI. Board meetings are held annually, usually sometime during the northern hemisphere's summer. Board members, except International Directors, are expected to attend these meetings and do so at their own expense. The cost need not be prohibitive because Board members can share hotel rooms. One of the Board's activities is to actively participate in the semiannual World Bromeliad Conferences. All BSI members are encouraged to participate in the nomination and election process for Board members.

Who may nominate?

Any voting member of the BSI who resides in a region for which there is an opening may nominate a candidate for an opening in that region.

Who may be nominated?

A nominee must have the following credentials:

(1) be a voting member of BSI and have been a voting member for the three consecutive years prior to nomination;

(2) reside in the region for which he/she has been nominated;

(3) not have served two consecutive terms as a director immediately preceding nomination;

(4) agree to being nominated; and

(5) agree to serve as a director if elected and to remain a member of the BSI for the duration of his/her term.

Procedure for nominating:

(1) obtain the consent of the prospective nominee and verify compliance with the qualification criteria;

(2) mail or email nominations to the Chairman of the Nominations Committee between January 1, 2011 and March 15, 2011, inclusive. (Nominations must reach the Chair of the Nominations Committee by March 18, 2011.) Nominations by telephone will be accepted through March 15, 2011, but must be confirmed in writing within two weeks;

(3) supply with each nomination the full name, address and telephone number and e-mail address, if applicable, of the nominee, the position for which the nomination is being made, the local society affiliation, and a brief "bromeliad biography" of the nominee.

Please mail nominations to:

Dr. Larry Giroux, BSI Nominations Chair
3836 Hidden Acres Circle N
North Fort Myers, Florida 33903 USA
239-997-2237/ 239-850-4048
or email to: nominations@bsi.org or DrLarry@comcast.net

Re-establishing *Hohenbergia capitata*

Elton M. C. Leme[1]. photos by E.M.C. Leme

Taxonomic history

Hohenbergia capitata Schult. & Schult. f. was described 180 years ago, on the basis of an epiphytic specimen collected in 1818 by Martius in the state of Bahia, Brazil, it was not accurately understood as the result of the unavailability of other specimens for comparison.

Morren (1879) referred to *Hohenbergia capitata* as a synonym of his *H. exsudans* (Lodd.) E. Morren, which is a synonym of *Aechmea aquilega* (Salisb.) Griseb. Baker (1879) transferred the taxon to *Aechmea* Ruiz & Pav. and keep it as a distinct species, but 10 years latter he included it in the synonym of *A. exsudans* (Baker, 1889), under the influence of Morren (1879). Mez (1892), included *H. capitata* in the synonymy of *Gravisia exsudans* (Lodd.) Mez (synonym of *A. aquilega*), but Smith (1941) revalidated the taxon under the genus *Gravisia* Mez and did not change his point of view in his subsequent work (Smith, 1955). However, Smith & Downs (1979) submerged *Gravisia* under the synonym of *Aechmea* and adopted Baker's (1879) proposition for the species. When revising the "*Aechmea/Gravisia* complex", Read & Luther (1991) reduced *H. capitata* to a synonym of *Aechmea aquilega* (Salisb.) Griseb., as proposed by Morren (1879), stating the putative differences between them are an artifact of environmental conditions and intraspecific variation.

During the study of the bromeliads of the Atlantic Forest fragments of Northeast Brazil, specifically on *Aechmea aquilega*, Leme & Siqueira-Filho (2006) excluded *H. capitata* from *A. aquilega* complex, then keeping the concept for the species adopted by Baker (1979) and Smith & Downs (1979). However, a deeper investigation on the taxon, based on living specimens that flowered in cultivation, make possible the understanding of the true identity of this species and suggested the need of revalidation of the concept of *H. capitata* as originally proposed in its protologue.

Taxonomic Treatment

Hohenbergia capitata Schult. & Schult. f., in Roem. & Schult., Syst. veg. 7 (2): 1252. 1830. Type: Brazil, Bahia, Almada, Dec. 1818, Martius s. n. (Holotype, M; photo HB).

Synonyms: *Aechmea capitata* (Schult. & Schult. f.) Baker, J. Bot. 17: 167. 1879.

Gravisia capitata (Schult. & Schult. f.) L. B. Sm., Arq. Bot. Estado São Paulo 1: 57, pl. 73, fig. 2. 1941.

1 Herbarium Bradeanum, Rio de Janeiro, Brazil; leme@tjrj.jus.br.

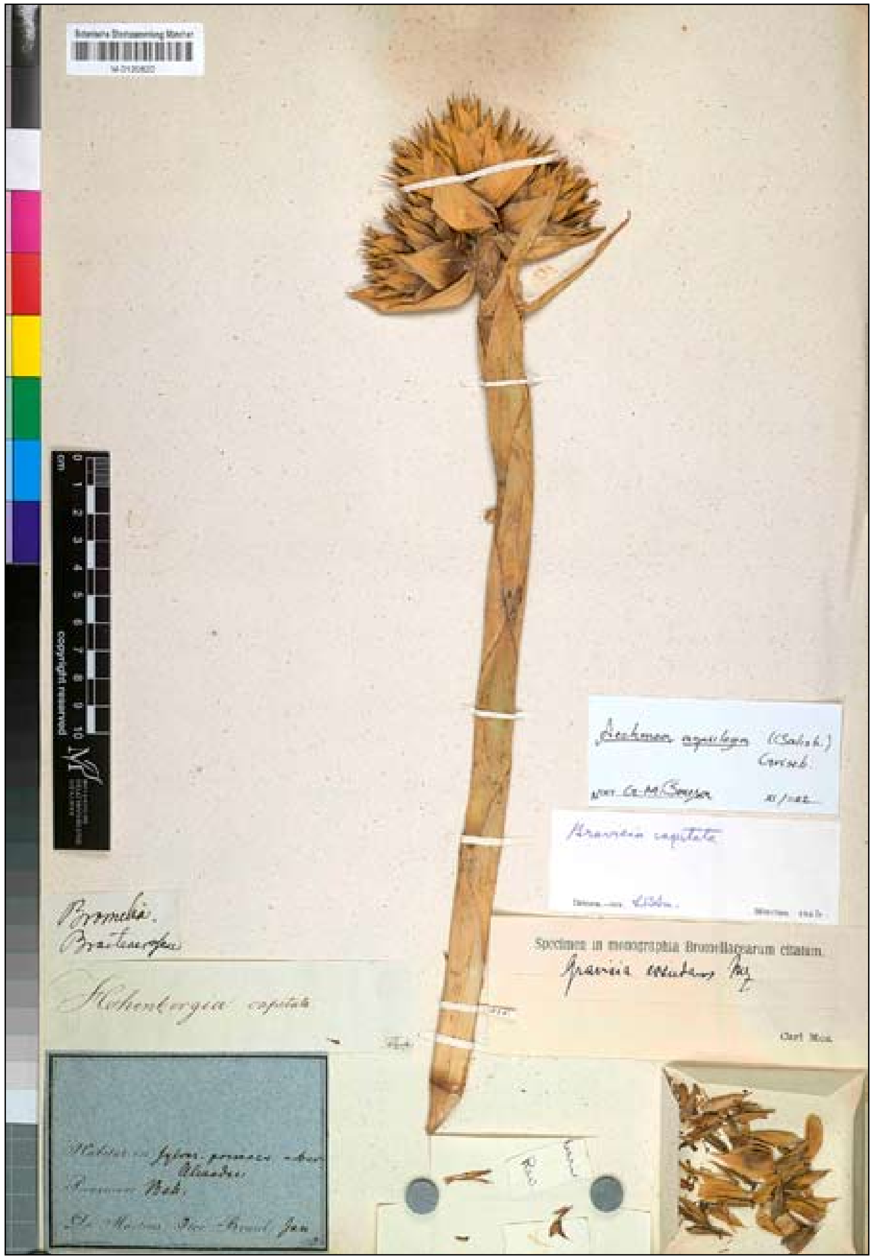

Figure 1. Holotype of *Hohenbergia capitata* deposited in the herbarium of the Botanische Staatssammlung München (M), Germany.

Plant epiphytic, flowering ca. 50 cm tall. Leaves ca. 30 in number, thinly coriaceous, forming a broadly funnelform rosette; sheaths broadly elliptic, ca. 13 x 9.7 cm, densely brown lepidote on both sides, dark castaneous toward the base, coarsely spinose at the apex; blades sublinear, slightly narrowed toward the base, suberect-arcuate, 22-30 x 4.7-5 cm, inconspicuously and sparsely white-lepidote near the apex to glabrescent, green, lustrous mainly abaxially, apex acuminate and apiculate, margins densely and coarsely

Figure 2. Habit of *Hohenbergia capitata* which flowered in cultivation (Leme 3038 et al.)

spinose at the base with spines 2-5 x 1.5-2 mm, narrowly triangular, dark castaneous, straight to retrorse-uncinate, 4-8 mm apart, margins toward the apex laxly spinose, spines triangular, prevailing retrorse-uncinate, 1-2 x 1 mm, 7-15 mm apart. Peduncle erect, stout, ca. 32 cm long, ca. .8 cm in diameter, green, white lanate; peduncle bracts ovate-lanceolate, acuminate and apiculate, erect, densely imbricate, 4.5-6 x 2.8-3 cm, exceeding the internodes, greenish or the upper ones reddish toward the apex and apical margins, nerved, sparsely white lanate near the base and at the apex to glabrescent, inconspicuously denticulate neat the apex to entire, the upper peduncle bracts involucrate and resembling the primary bracts. Inflorescence globose-capitate, corymbose,

Figure 4. Close up of the inflorescence of *Hohenbergia capitata* which flowered in cultivation (Leme 3041 et al.)

tripinnate, 5.5-7 cm long, ca. 6.5 cm in diameter; primary bracts suborbicular subacute to obtuse and apiculate, suberect, distinctly shorter than to nearly equaling the fascicles, cymbiform, entire, red, nerved, inconspicuously and sparsely white lepidote to glabrous, 3.5-4.7 x 3-4.3; primary fascicles 5 to 8 in number, suberect to erect, densely aggregated, 4-4.7 x 2-3 cm (not including the petals), pulvinate, subflabellate, shortly stipitate, stipes 0.7-1 x 8-1.3 cm, sparsely castaneous lepidote, with 2 to 4 subsessile secondary

fascicles densely arranged; secondary bracts resembling the floral bracts but slightly larger, 2.8-3 x 2-2.3 cm, about equaling the secondary fascicles, thinly subcoriaceous toward the apex, pungent, carinate, red toward the apex, glabrescent, suberect; secondary fascicles obovoid, pulvinate, subsessile, ca. 3 x 1.5 cm (not including the petals), 2 to 4-flowered; floral bracts ovate-subtriangular, long acuminate-spinescent, suberect, exceeding the sepals, equaling to shorter than the petals, 28-30 x 15 mm, including the apical spines ca. 9 mm long, red near the apex and white toward the base, glabrescent, nerved, entire, carinate, convex, pungent. Flowers 27-35 mm long, sessile, densely and polystichously arranged, erect, odorless; sepals oblong-subobovate, asymmetric with the lateral membranous wing distinctly shorter than the apical mucro, 14 x 6-7 mm, apex obtuse, bearing a mucro ca. 1 mm long, free, glabrous, white except for the red apex, the adaxial ones carinate with keels decurrent on the ovary, the abaxial one obtusely if at all carinate; petals narrowly lanceolate, apex acuminate to acute, suberect at anthesis, 18-25 x 4 mm, free, purple, bearing 2 irregularly digitate-lacerate appendages 6-8 mm above the base. Stamens included; filaments complanate, lilac toward the apex, the antepetalous ones adnate to the petals for 6-8 mm, the antesepalous ones free; anther base obtuse-sagittate, apex apiculate, apiculus nigrescent, dorsifixed above the base at 1/3 of its length; pollen globose, diporate, exine psillate; stigma conduplicate-spiral, ellipsoid-capitate, lilac-purple, margins crenulate-lacerate; ovary obconic, trigonous, 8-9 mm long, 6-7 mm in diameter at the apex, white, glabrous, bearing inconspicuous longitudinal sulcus; placentation apical; ovules shortly caudate; epigynous tube inconspicuous, ca. 0.5 mm long. Fruits unknown.

Material examined: Bahia: Una, road São José to Una, km 9, 500-600 m elev., 7 Apr. 1995, E. Leme 3038, A. Amorim, L. A. Mattos-Silva & J. C. da Silva (HB); ibidem, E. Leme 3041 et al. (RB).

Discussion

Based on the original description and the photo of the type specimen deposited in the herbarium of the Botanische Staatssammlung München (M), Germany, it was possible to state that the examined living specimens cited above fit in all aspects in the concept of H. capitata and allowed the elaboration of the expanded description provided above. According to the protologue, its bracts are rose, which is not the color pattern of the species of the A. aquilega complex, but is undoubtely related to members of the H. stellata complex, like H. belemii L. B. Sm. & Read, which is the closest relative of H. capitata.

Hohenbergia capitata also shares the same pollen morphology with many other species of Hohenbergia, in which the pollen grains are usually diporate or sometimes 3 to 6-porate, with exine often psilate, sharply contrasting with the typical pollen grains of the members of the “Gravisia complex”, which are distinctly pantoporate, usually bearing over 8 pores distributed more or less regularly over the whole surface, with a broadly reticulate exine.

Figure 5. Terrestrial habit of *Hohenbergia belemii*, in the transitional forest in the coastal region of Itacaré, Bahia.

Hohenbergia capitata looks very similar to H. belemii and can be easily confused with it, and this may be happening in herbaria. However, H. capitata differs from it by the suborbicular primary bracts (vs. ovate-lanceolate), the basal ones distinctly shorter than to equaling the fascicles (vs. distinctly exceeding the fascicles), inflorescence densely globose-capitate with the fascicles completely hiding the rachis (vs. more or less elongated with the lower fascicles subdensely aggregated and exposing the rachis), and by the longer floral bracts (28-30 mm vs. 15-22 mm long).

Both species are endemic to the Atlantic forest domain in the state of Bahia. While H. capitata lives off shore inland as an epiphytic species in montaine Atlantic Forest over 500 m elevation, H. belemii inhabits sea level habits, closer to the ocean, where it can be usually observed as a terrestrial in sandy soils, inside the transitional Restinga-Atlantic forest vegetation.

Figure 6. Holotype of *Hohenbergia belemii* in the United States National Herbarium, Smithsonian Institution, Washington, DC.

Acknowledgements

The author sincerely thanks the Curators of the herbarium of the Botanische Staatssammlung München (M), Germany, and the United States National Herbarium, Smithsonian Institution (US), Washington, DC, for kindly providing the photos of the types used in this study.

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Three new Species of *Racinaea* (Tillandsioideae: Bromeliaceae) from Ecuador

José M. Manzanares & Walter Till. Illustrations by the authors.

Abstract

Whilst researching "Jewels of the Jungle, Bromeliaceae of Ecuador, Part III Tillandsioideae", we had the opportunity to study specimens at the Missouri Botanical Garden (MO) and at the Herbario del Museo de Ciencias Naturales in Quito (QCNE) which have turned out to be three novelties in *Racinaea* M. A. Spencer & L. B. Sm. The new taxa are described here as *Racinaea gentryana* Manzanares & W. Till, *R. goudae* Manzanares & W. Till, and *R. grantii* Manzanares & W. Till, all from Ecuador.

Key Words: Bromeliaceae, Tillandsioideae, *Racinaea*, Ecuador.

Abstracto

Durante la elaboración de "Joyas de la Selva, Bromeliaceae del Ecuador, Parte III Tillandsioideae", hemos tenido la oportunidad de estudiar especímenes en el Missouri Botanical Garden (MO) y en el Herbario del Museo de Ciencias Naturales en Quito (QCNE), las mismas que han revelado tres especies nuevas de *Racinaea* M.A. Spencer & L.B. Smith. Las nuevas especies son descritas como *Racinaea gentryana* Manzanares & W. Till, *R. goudae* Manzanares & W. Till, y *R.grantii* Manzanares & W. Till, todas del Ecuador.

Palabras Clave: Bromeliaceae, Tillandsioideae, *Racinaea*, Ecuador.

Introduction to *Racinaea gentryana.*

During the study of specimens of Racinaea at the Missouri Botanical Garden (MO) in June 2002, one specimen of Racinaea collected by Alwyn Gentry (deceased) in the Cordillera del Cóndor, an area now covered with mines, caught my (JMM) attention. The specimen had been studied by Harry Luther in June 1995, who came to the conclusion that it is a new species related to R. homostachya (André) M. A. Spencer & L. B. Sm. and R. monticola (Mez & Sodiro) M. A. Spencer & L. B. Sm.

We requested from MO the loan of the specimen and it arrived at QCNE in 2003. We studied it and came to the same conclusion as Harry Luther: a new species.

However, more material was needed to complete the description, especially because the rosette did not show whether it is a caulescent or acaulescent plant. The needed material was obtained during a trip through Ecuador together with Dr. Eric Gouda when the species was observed in the montane forest between Sigsig and Chigüinda, in fruiting stage but with sufficient details to complete the description.

Figure 1. Habitat of *Racinaea gentryana*.

Racinaea gentryana Manzanares & W. Till, sp. nov. **Type:** Ecuador. Morona Santiago: crest of Cordillera del Cóndor, ridge top 15 km ENE of Gualaquiza, high montane forest and bromeliad sward, 03º22´S 78º20´W, 2,500 m, 26 July 1993, Alwyn Gentry 80474 (Holotype: MO). Other material examined (Paratypes). Ecuador, Morona Santiago: between Sigsig and Chigüinda, 03º11´39´´S 78º46´31´´W, 2,951 m, 26 November 2005, José M. Manzanares & Eric Gouda 8170 (QCNE); Zamora Chinchipe: area of Estación Científica San Francisco, Cerro del Consuelo, 03º58´S 79º04´W, 3,050 m, 25 September 2005, F. A. Werner 1789 (LOJA, SEL).

A *Racinaea monticola* (Mez & Sodiro) M. A. Spencer & L. B. Sm., cui affinis, modo vivendi terrestre, habitu caulescente, caule 15-20 cm longo, vaginis foliorum non pseudobulbum formantibus, laminis foliorum triangularibus apice attenuates, bracteis florigeris sepala celantibus, erectis et sepalis 5 mm longis, oblongis, apice rotundatis et apiculatis differt.

Plant terrestrial, 100-130 cm including the inflorescence, caulescent, stem 15-20 cm long. ***Leaves*** numerous, coriaceous, forming a dense rosette, leaf sheaths not forming a pseudobulb, the old dry leaves remaining along the stem and covering it; ***sheaths*** ca. 18 cm long, ca. 8 cm wide, elliptic, conspicuous, lepidote, brown-castaneous, erect; ***blades*** 10-11 cm long, ca. 3 cm wide, triangular, with an attenuate apex. ***Inflorescence*** 45-50 cm long, ca. 6 cm wide, 2 times branched, lax, bearing 9 to12 branches ca. 3 cm apart , with 5 to 6 spikes at the apex, ca. 1.5 cm apart, yellowish-green , cylindric, erect,

Figure 2. Detail of the cushions made by *Racinaea gentryana*.

slightly lepidote. ***Peduncle*** 80-90 cm long, 0.4 cm wide, erect, exceeding the leaves, slightly lepidote; ***peduncle bracts*** the lower ones foliaceous, the upper ones 4-10 cm long, 1.5-2 cm wide, elliptic, attenuate and with a recurved apex, with hyaline margins, the lower ones imbricate, the upper ones exposing the peduncle, erect, slightly lepidote, nerved; ***Inflorescence: primary bracts*** ca. 3 cm long, ca. 1 cm wide, the lower ones elliptic with an attenuate apex, the upper ones ovate with an acuminate apex, ecarinate, exceeding the stipes, shorter than the spikes, slightly lepidote, spreading, nerved; ***branch*** ca. 3 cm long, ca. 2 cm wide, spreading with secund spikes, yellowish-green, stipes ca. 1 cm long, without sterile bracts; ***spikes*** 2-3 mm long stipitate (without sterile bracts), 1.5-2.5 cm long, ca. 0.9 cm wide, sublax, complanate, with 8 to14 distichously arranged flowers ca. 2 mm apart, rachis strongly geniculate and quadrangular, slightly lepidote; ***floral bracts*** ca. 7 mm long, ca. 8 mm wide, ovate, acuminate and incurved at the apex, slightly cucullate, erect, yellowish-green, carinate near the apex, nerved, longer than the sepals, not concealing the rachis, glabrous. ***Flowers*** sessile, divergent and not secund; ***sepals*** ca. 6 mm long, ca. 4 mm wide, free, obovate, obtuse at the apex, strongly asymmetric, one side alate, not carinate, glabrous; ***petals*** ca. 7 mm long, yellow, the spreading blades showing only the apex.

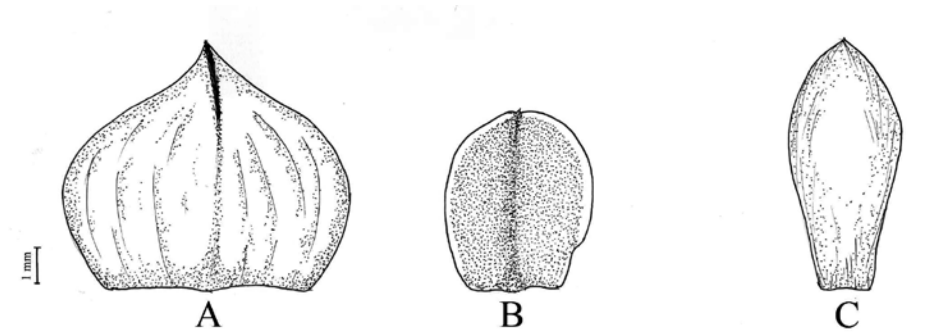

Figure 3. *Racinaea gentryana*. A. Flower; B. Floral bract; C. Sepal; D. Petal.

Racinaea gentryana resembles *R. monticola* but differs from this species by its terrestrial growth, caulescent habit with a stem 15-20 cm in lenght (vs. epiphytic and acaulescent), leaf sheaths not forming a pseudobulb (vs. leaf sheaths forming an ellipsoid pseudobulb); leaf blades triangular with an attenuate apex (vs. leaf blades oblong, abruptly acute); floral bracts concealing the sepals, erect (vs. floral bracts exposing the sepals, suberect or spreading), and sepals 5 mm long, oblong, round at the apex and apiculate (vs. sepals 6 mm long, obovate and not apiculate).

This racinaea is named in honor of Alwyn Howard Gentry (1945-1993), a renowned botanist from Missouri Botanical Garden and one of the most knowledgeable botanists of tropical America in the 20th century, who lost his life on August 3, 1993, nine days after collecting this new species. He died in an airplane crash in Ecuador while on a mission to assist in the conservation of the forests of that country.

Introduction to *Racinaea goudae*.

For several years this new species has been confused with many other members of *Racinaea*, especially with a small form of *Racinaea riocreuxii* (André) M. A. Spencer & L. B. Sm. We have studied this plant for several years and have now enough evidence that it is a new species.

Most of the material studied has been collected between Papallacta and Cuyuja, in the province of Napo situated in the mountains towards the Amazon basin. With Eric Gouda during his trip through Ecuador in 2005 we have observed a particularity of the fruits during maturity with most of them in the spikes are turning upwards, contrary to the usual downward orientation.

Racinaea goudae Manzanares & W. Till, sp. nov. **Type:** Ecuador. Napo: Quijos, entre Papallacta y Cuyuja, 00º21´56´´N 78º02´55´´W, 2,461 m, 17 August 2001, José M. Manzanares, Margaret Case, Eduardo Gutierrez, Manuel Medina & Rebeca Manzanares 7431 (Holotype: QCNE, MO).

Figure 4. Habitat of *Racinaea goudae*.

Figure 5. Detail of the flower of *Racinaea goudae*.

Figure 6. Detail of the infrutescence of *Racinaea goudae* with the fruits turning upwards .

Other material examined (Paratypes). Ecuador, Napo: Quijos, Papallacta, 00º17´S 78º10´W, 2,400 m, October 1989, José M. Manzanares & K. Bracke 5298 (MO, QCNE); Quijos, Cordillera de los Guacamayos, 00º39´S 77º50´W, 2,000 m, 1992, José M. Manzanares 5464 (QCNE); Archidona, Sumaco Napo-Galeras National Park, volcan Sumaco, 00º36´S 77º38´W, 2,600, 16 March 1996, John L. Clark 2245 (QCNE); Tena, Cordillera de los Guacamayos, Chacana Urcu, 2,200 m, 8 June 1996, José M. Manzanares 5655 (QCNE); Tena, Cordillera de los Guacamayos, Chacana Urcu, 2,200 m, 8 June 1996, José M. Manzanares 5656 (QCNE, WU); Tena, Cordillera de los Guacamayos, Chacana Urcu, 2,200 m, 8 June 1996, José M. Manzanares 5657 (QCNE); Tena, Cordillera de los Guacamayos, Chacana Urcu, 2,200 m, 8 June 1996, José M. Manzanares 5658 (QCNE); Tena, Cordillera de los Guacamayos, sendero Huicundo Loma-Piguiyacu, 2,100 m, 8 June 1996, José M. Manzanares 5707 (QCNE); Cuyuja, 00º20´S 78º01´W, 2,000 m, 14 Feb 1997, José M. Manzanares & W. Till 6229 (QCNE); Quijos, Reserva Ecológica Antisana, Cordillera de los Guacamayos, entre el Río Vinillos y El Mirador, 00º38´S 77º51´W, 2,280 m, 3-5 Jan 1999, H. Vargas & E. Narváez 3339 (MO, QCNE); Quijos, Reserva Ecológica Antisana, Cordillera de los Guacamayos, entre El Mirador y camino de La Virgen, 00º38´S 77º51´W, 2,300 m, 12-14 January 1999, H. Vargas & E. Narváez 3500 (MO, QCNE); Napo: Quijos, carretera Quito-Baeza, 00º24´16´´S 78º02´41´´W, 2,498 m, 19 November 2005, José M. Manzanares & Eric Gouda 7788 (QCNE, WU, U).

A *Racinaea riocreuxii* (André) M. A. Spencer & L. B. Sm., cui affinis, habitu minore inflorescentia inclusa 30-50 cm alto, laminis foliorum flexilibus, 1.5 cm latis, inflorescentia 20-30 cm longa, bracteis florigeris ovatis, acuminatis, apice incurvatis, carinatis et floribus non secundis differt; a *Racinaea subalata* (André) M. A. Spencer & L. B. Sm., cui similis, habitu minore inflorescentia inclusa 30-50 cm alto, vaginis foliorum brevioribus , laminis foliorum flexilibus, 1.5 cm latis, inflorescentia 20-30 cm longa, simpliciter ramose vel rariter bi-ramosa in parte inferiore, arcuata, sepalis ecarinatis et petalis atroluteis recedit.

Plant an epiphyte, 30-50 cm tall including the inflorescence, forming dense groups; rosette funnelform, erect, the leaf sheaths forming a subfusiform pseudobulb. ***Leaf sheaths*** 7-9 cm long, 4-5.5 cm wide, ovate, densely lepidote, brown, in the upper part with irregular red spots. ***Leaf blades*** 15-21 cm long, 1.5 cm wide, triangular, apex attenuate and incurved, light green, covered with irregular red spots, lepidote. ***Inflorescence*** 13-30 cm long, 5-6 cm wide, once branched or rarely two times branched in the lower part, lax, bearing 6 to 11 spikes 2-2.5 cm apart, yellow-green, complanate, lepidote, slightly curved, distichous, spikes slightly nodding; ***peduncle*** 15-20 cm long, ca. 0.4 mm wide, erect or slightly curved, exceeding the foliage, dark violet, lepidote; ***peduncle bracts*** not foliaceous, 4-5 cm long, 1 cm wide, elliptic, apex apiculate or attenuate, longer than the internodes, nerved, lepidote, brown, papyraceous; ***primary bracts*** 2-2.5 cm long, ca. 1.1 cm wide, ovate, the upper ones acuminate and the lower ones attenuate at the apex, exceeding the stipes of the branch or spikes, brown, lepidote, dry during anthesis; ***branch*** ca. 7 cm long, withca. 2 spikes, stipe 0.8-1.4 cm long, with 1 to 2 sterile bracts; ***spikes*** 4-5.5 cm long, 1 cm wide, their stipes 0.5-1 cm with or without sterile bracts, yellow-green, dense, distichous, complanate, with 10 to14 flowers, sometimes with sterile bracts at the apex forming a claw; rachis geniculate, quadrangular and lepidote, slightly downwardly curved; ***floral bracts*** ca. 1.1 cm long, ca. 0.9 cm wide, ovate, apiculate, with an incurved apex, cucullate, in the upper part hyaline and with slightly undulate margins, slightly lepidote, green with irregular red spots, imbricate during anthesis, carinate, nerved in the lower part, erect, covering the sepals. ***Flowers*** sessile, erect, emerging at the upper side of the spikes, not secund; ***sepals*** ca. 0.7 cm long, ca. 0.5 cm wide, free, obovate, obtuse at the apex, strongly asymmetric, ecarinate, lepidote, brown except for the translucent margins; ***petals*** yellow,

ca. 1 cm long, blades forming a tube; ***ovary*** ca. 2 mm long, ca. 1.5 mm wide, round; style ca. 1 mm long, stigma ca. 1 mm long; ***stamens*** slightly longer than the stigma; ***filaments*** ca. 4 mm long; ***anthers*** ca. 2 mm long, joining together and forming a tube around the stigma. ***Capsules*** mostly turning upwards.

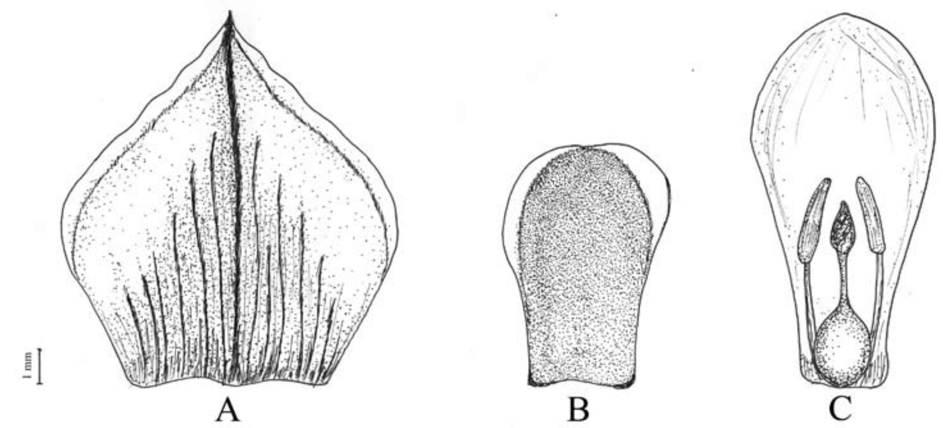

Figure 7. *Racinaea goudae*. A. Flower; B. Floral bract; C. Sepal; D. Petal, stamen, pistil and ovary.

According to the key of Smith & Downs (1977) this new species is related to *Racinaea riocreuxii* from which it can be distinguished by: smaller stature, 30-50 cm including the inflorescence (vs. 80-130 cm); leaf blades flexible and 1.5 cm wide (vs. coriaceous and 2-4 cm wide), inflorescence 20-30 cm long (vs. 35-60 cm); floral bracts ovate, acuminate and incurved at the apex, carinate (vs. suborbicular, obtuse and not incurved at the apex, ecarinate) and the not secund flowers (vs. secund flowers). When compared to *R. subalata* this new species can be distinguished by: smaller stature, 30-50 cm including the inflorescence (vs. 70 cm including the inflorescence); leaf sheaths 7-9 cm long (vs. 10-14 cm); leaf blades flexible and 1.5 cm wide (vs. coriaceous and 2-3 cm wide); inflorescence 13-30 cm long, once branched or rarely 2 times branched in the lower part, and slightly hanging (vs. 40-60 cm long, 2 times branched and erect); sepals ecarinate (vs. carinate), and petals deep yellow (vs. light yellow).

The general appearance is similar to *Racinaea homostachya*, from which can by distinguished by: leaf blades triangular, 1.5 cm wide, apex attenuate (vs. lanceolate, 3.5 cm wide, apex acuminate), primary bracts ecarinate (vs. strongly carinate), floral bracts 0.8-1.1 cm long and carinate (vs. 0.8 cm long and ecarinate), and deep yellow petals (vs. light yellow).

This Racinaea is named in honor of Eric John Gouda, a botanist at the Herbarium and curator of the Botanical Garden of the University of Utrecht (U), The Netherlands.

Introduction to *Racinaea grantii*

This new species was discovered during the expedition of E. Patterson, J. Raack, E. Doherty, M. Navarro and J. M. Manzanares in April 1997 in the province of Azuay, southern Ecuador. The goal of this expedition was to study the genus Puya in the South of Ecuador (provinces Azuay and Loja). The first to discover this bromeliad was Mónica de Navarro, expert in orquids. Jerry Rack made a dried specimen (J. Raack 3, SEL) and sent it to H. Luther, who identified the specimen as a robust form of *Racinaea euryelytra* J. R. Grant due to the damage of the specimen (over dried).

The species was identified at QCNE as *Racinaea quadripinnata* (Mez & Sodiro) M. A. Spencer & L. B. Sm., but during the studies of the genus Racinaea it turned out to be a new entity.

Racinaea grantii Manzanares & W. Till, sp. nov. **Type**: Ecuador. Prov. Cuenca: Cuenca, carretera de Cuenca a Oña, km 41, 03º11´S 79º02´W, 3,150 m, 6 April 1997, José M. Manzanares, E. Girko, J. Raack, E. Doherty & M. Navarro 6281 (Holotype: QCNE). Other material examined (Paratypes). Ecuador, prov. Azuay (original spelling "Loja"): in Páramos (original spelling "Paraimo"), Cuenca to Loja road, 10,399 feet elev. 5 April 1997, J. Raack 3 (SEL); 36 km south of Cuenca on highway to Loja, 03º23´99´´S 79º57´60´´W, 28 October 2002, J. R. Grant, A. Roguenant & A. Raynal-Roques 02-4234 (MO).

> A *Racinaea quadripinnata* (Mez & Sodiro) M. A. spencer & L. B. Sm., cui affinis, stipitibus ramorum 3 cm longis, bracteis florigeris 0.8 cm longis, 0.8 cm latis, ovatis, acutis et apice incurvatis, percarinatis, indumento ferrugineo obtectis, corollas flavis et sepalis 0.7 cm longis, 0.4 cm latis, obovatis, apice rotundatis et apiculatis, percarinatis, abaxialiter indumento ferrugineo toto obtectis (vs. 0.5 cm longis, apice rotundatis, ecarinatis, glabris) differt.

Other material examined (Paratypes). Ecuador, prov. Azuay (original spelling "Loja"): in Páramos (original spelling "Paraimo"), Cuenca to Loja road, 10,399 feet elev. 5 April 1997, J. Raack 3 (SEL); 36 km south of Cuenca on highway to Loja, 03º23´99´´S 79º57´60´´W, 28 October 2002, J. R. Grant, A. Roguenant & A. Raynal-Roques 02-4234 (MO).

Plant epiphytic or terrestrial, 60-80 cm tall including the inflorescence, forming dense groups, the older ones remaining in the lower part of the group. ***Leaves*** numerous, ascending, coriaceous, subglabrous, yellow-green with irregular red spots, forming a large ellipsoid pseudobulb; ***sheaths*** ca. 14 cm long, ca. 8.5 cm wide, elliptic, coriaceous, adaxially violaceous, abaxially brown, ventricous, conspicuous; ***blades*** ca. 17 cm long, ca. 5 cm wide, lingulate-triangular, attenuate at the apex, yellow-green with irregular red spots, subglabrous. ***Inflorescence*** ca. 48 cm long, ca. 10 cm wide, 2-3 times branched, lax, densely covered by a ferrugineous indument with the exception of the petals, with 10 to 14 brown, ascending, spreading, ellipsoid branches 3,5-4 cm apart and with 4-6 terminal spikes; ***peduncle*** ca. 30 cm long, ca. 0.6 cm wide, erect, exceeding the leaves,

Figure 8. Habitat of *Racinaea grantii*.

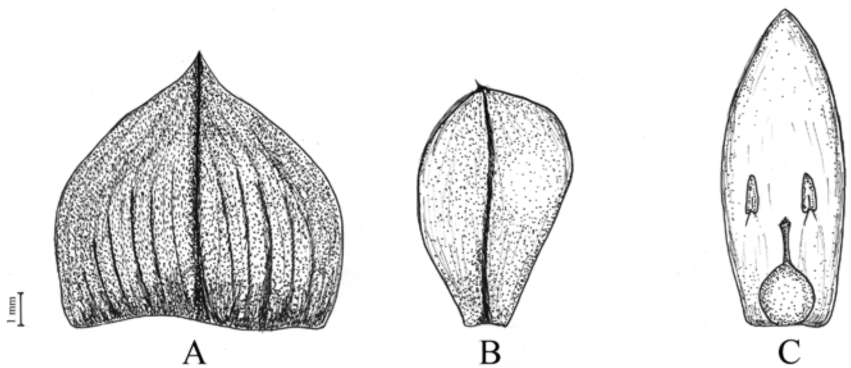

Figure 9. *Racinaea grantii.* A. Flower; B. Floral bract; C. Sepal; D. Petal, stamen, pistil and ovary.

lepidote; ***peduncle bracts*** the lower ones foliaceous, 7-9 cm long, ca. 1.7 cm wide, elliptic, attenuate at the apex, longer than the internodes, imbricate, brown, erect, lepidote, nerved; ***primary bracts*** 2-8 cm long, ca. 1.2 cm wide, lanceolate, acuminate at the apex, exceeding the stipes, shorter than the branches, lepidote, papyraceous, spreading; ***stipe*** of the branches ca. 3 cm long, without sterile bracts (naked?), flat, branches 6-8 cm long, ca. 5 cm wide, spreading, ascending, dark brown axis, spikes brown cream, 2-3 basal branches with 2-3 lateral spikes, and 3-5 upper spikes, axis totally covered by a ferrugineous indument. ***Spikes*** 1-2.5 cm long, ca. 0.8 cm wide, their stipes very short, brown-cream during anthesis (brown in dried specimens), lanceolate, subdense, with 12 to 14 flowers, distichous, complanate; rachis geniculate, quadrangular and exposed, totally covered by a ferrugineous indument; ***floral bracts*** ca. 0.8 cm long, ca. 0.8 cm wide, ovate, apex acute and incurved, adaxially glabrous, abaxially covered by a ferrugineous indument, brown, not imbricate during anthesis, exposing the rachis, longer than the sepals, coriaceous, strongly carinate, nerved. ***Flowers*** sessile, not secund; ***sepals*** ca. 0.7 cm long, ca. 0.4 cm wide, obovate, apex round and apiculate, strongly carinate, free, asymmetric, coriaceous, adaxially glabrous, abaxially totally covered by a ferrugineous indument; ***petals*** yellow, ca. 1.1 cm long, blades spreading.

The morphological characters that distinguish this new species from *Racinaea quadripinnata* are: stipes of the branches 3 cm long (vs. 1-1.5 cm long); floral bracts 0.8 cm long, 0.8 cm wide, ovate, acute and incurved at the apex, strongly carinate, covered by a ferrugineous indument (vs. 0.5 cm long, 0.7 mm wide, subreniform, retuse apex, occasionally slightly carinate and more frequently not carinate, lepidote), sepals 0.7 cm long, 0.4 cm wide, obovate, round and apiculate at the apex, strongly carinate, abaxially totally covered by a ferrugineous indument (vs. 0.5 cm long, round apex, ecarinate, glabrous), and yellow petals (vs. cream).

This new species also resembles the recently published *Racinaea pattersoniae* (Manzanares & W. Till, 2007), from which it can be distinguished by the longer floral bracts

(0.6 cm vs. 0.4 cm long) with an acute and incurved apex (vs. apiculate) which are longer than the sepals (vs. shorter than), and the sepals are 0.7 cm long, obovate and strongly carinate (vs. 0.4 cm long, ovate and ecarinate). In general the inflorescence is totally covered by a ferrugineous indument (vs. cinereous indument) and the plants are forming dense groups (vs. individual plants).

This Racinaea is named in honor of Jason Randall Grant, a botanist at the University of Neuchâtel, Switzerland.

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Manzanares, J. M. and W. H. Till (2007). "A New Species of Racinaea (Bromeliaceae) from the Province of Loja, in Southern Ecuador." *J. Bromeliad Soc.* **57**(5): 198-203.

Authors

José M. Manzanares: Herbario Nacional del Ecuador, Museo Ecuatoriano de Ciencias Naturales (QCNE), Casilla Postal 17-09-7518, Quito, Ecuador. manzanar@interactive.net.ec

Walter Till: Herbarium, Fakultätszentrum für Biodiversität, Universität Wien

Rennweg 14, A-1030 Wien, Austria. walter.till@univie.ac.at

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Aechmea andersonii (H. Luther and Leme, 1998)

This ornamental Aechmea from Bahia in Brazil was described in 1998. It was named for John Anderson of Corpus Christie, Texas. The illustration here is of the plant flowering in Marie Selby Botanic Garden, Florida USA. Photo by Vern Sawyer, kindly sent to us by Harry Luther.

Literature Cited

Luther, H. and E. M. C. Leme (1998). "A Beautiful New *Aechmea* from Bahia, Brazil." *Journal of the Bromeliad Society* **48**(3): 127-129.

Growing *Bromelia serra* in Southern California

Dan Kinnard. Photograph by the author.

The *Bromelia sera* forma *variegata* pictured here was removed from the shade house because it took up a lot of space, saying nothing of being the cause of much blood-loss. It was relegated out to the property line, way down the slope and into a ½ barrel with the bottom removed. We were already wise to the fact that its growth habit is a tendency to send out runners with mean pups rather like bamboo but heavily armed. The ½ barrel forces the runners to grow up and over the edge making removal of the pups possible with minimal blood loss to prevent a carpet of the vicious creatures from forming. It grows well in full inland-Southern-California sun with once-a-week watering; the soil is mostly decomposed granite (fast draining but retaining a some moisture). The bloom spike grew rapidly -- from notice of first color to the blooms opening in about ten days. The plant is almost two meters wide and the bloom spike is over a meter high.

What is Plant Tissue Culture?

Michael Dorris. Photos by the author, captions by the editor.

Plant tissue culture is known internationally as micropropagation and is the multiplication of plants under sterile conditions with some sort of nutrient solution or medium.

A brief history:

Beginning with the 1838 Schleiden and Schwann's cell theory stated that the cell was the basic unit of life, it was then realized that a cell is capable of autonomy and totipotent, or a cell can give rise to the whole organism.

It was not until the early 20th century that progress was realized using very simple media like cooked oats to grow the plants and was aimed at basic scientific work in plant physiology.

As the 20th century continued the media began to change from being undefined material such as oat meal, banana, coconut water or potatoes where the quality changes with every batch to something resembling fertilizers of known amounts.

The oldest media still in use is Knudson B orchid media from 1925, it has about 7 ingredients depending on where you find the formula as there are about 5 reformulations. Knudson - C from 1946 is more well known and was designed for Cymbidiums.

The middle 20th century saw great advances in the understanding of plant hormones and resulted in the herbicide industry of today but it was work done by Murashige & Skoog that made the biggest change. Skoog did work in plants hormones and was interested in plant tissue culture in general, Murashige was the graduate student under Skoog and both worked on a basic media for a number of plants, especially tropical house plants later on. The Murashige & Skoog medium was published in 1962 with 22 ingredients, originally it was for tobacco which was the "guinea pig" of plant research at the time. This media and 30 or so modifications of it for other plants and uses became the basis of the tissue culture industry as it could be made in large quantities and sold, however that took decades as the number of labs had to increase to the point where it was economical for producers to make the formulations.

Murashige & Skoog also published a formate that has been used to describe a plant in tissue culture, Stage 1: cleaned of microbes, Stage 2: Plant multiplying, Stage 3: plant rooting but in the lab, Stage 4: plant fresh from the lab in the greenhouse. Each stage could use a slightly different tissue culture medium. The first stage is the most difficult

Figure 1. A "laminar flow cabinet" in the transfer room. Sterile air is blown over the bench to prevent contamination when steralised containers are opened.

for almost all plants and very much the case for bromeliads; I know someone who got a Masters on initiation of bromeliads into plant tissue culture. The reason Stage 1 is difficult is because any aggressive microbe will feast on the medium and pollute it with waste products killing off the newly initiated plant, known as an "explant".

Within a decade researchers had made advances over the Murashige & Skoog media by noting, for example, instead of adding KCl why not just KNo3 as the plant needs both K and No3 and you don't have an excess of Cl ions that can cause problems but this economic use of chemicals seems to be rare and used mostly in woody plant medias, but could be used with everywhere.

A number of labs started up in the 1970s and continued to grow in size and number with small labs and backyard labs making up the majority.

Bromeliad micropropagation also began in the 1970s as the foliage plant industry began to grow. Bromeliads in the foliage industry are typically selections that can not be easily propagated from seed so are ideal plants to tissue culture. As the industry matured more exacting standards began to be observed in the competitive market and plant tissue culture became critical.

By the 1990s with the rising cost of labor and the emergence onto the world stage of overseas cheap labor in India, SE asia and now China the tissue culture industry moved over seas as it was unprofitable to do much in tissue culture in the US and Europe unless you are doing niche products. (The drastic drop in the price of Phalaenopsis orchids over the past 5 years is the result of off-shore labs)

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A drawback of off-shore labs can be the lack of or enforcement of laws regarding propagation of material. Its somewhat common for breeders to find their plants cloned by labs beyond the reach of international law, or the cost of protecting even a patented plant could be too high to pursue lawbreakers. This lawlessness and fuel prices have brought back some US labs but being labor intensive, labs suffer from out of date ideas on the proper use of labor; the idea should be minim wage attracts minim skills and so waste.

Media:

Any tissue culture media has all the ingredients we think a plant needs to survive. The scientist making the medium should have run experiments to find the correct chemicals and concentrations needed in the media, its not guessing.

Medias are mostly water, plus sugar to feed that plant as it does not depend on sunlight. Then fertilizer, the standard NPK (nitrogen, potassium, phosphorous) and lesser know elements, then trace elements, then vitamins to encourage growth, and hormones if we want the plant to do something it not doing. This mix must have its pH adjusted; if its too low a number of chemicals can't be taken up by the plant, if too high another group can't be taken up, a balance is needed. Then this whole mix is usually suspended in a matrix so the plant does not drown.

Enzymes are chemicals that lower the energy needed for a reaction to happen so they speed up reactions.

Macro nutrients are needed by the plant in reasonably large amounts.

Nitrogen, N is needed to makes protein, often a yellow plant is low in nitrogen.

Phosphorus, K a critical element in plant structure, energy and part of the DNA, the lack makes plants purple.

Potassium, P is involved in enzymes.

Magnesium, Mg is part of what makes plants green.

Calcium, Ca, is involved in a large number of processes and helps keep plants green and blooming.

Sulfur, S, another element needed in protein and involved with energy production.

Micro nutrients are needed in lesser amounts then above and are not commonly a problem in soil.

Figure 2.Culture growing room. Plants are grown under fluorescent lights, in a clean, warm room.

Iron, Fe is involved in a number of subcelluar processes such as chloroplast functioning.

Manganese, symbolized as Mn is involved in enzymes and is found in lots of places such as in root development.

Trace elements are not always in fertilizers but need to be in media. They are normally found in ample quantities in water and soil and as they are needed in such small amounts, too much can act like a poison; any of the below can kill or damage

Figure 3. Bromeliad cultures in sterile container.

bromeliads easily in small amounts but are needed in parts per million amounts.

Zinc, Boron, Copper, Iodine and Molybdenum. Molybdenum is needed by the nitrogen fixing bacteria and found in the roots of some plants. Vitamin B12 has Molybdenum.

Vitamins: there are 1 to 5 vitamins found in medias, mostly types of vitamin B. Oddly enough plants seldom overdose on vitamins even at doses of 10X recommended. Biotin, inositol, nicotinic acid, pyridoxine and thiamine are common whereas thiamine seems to be the critical vitamin for plant growth. All vitamins are enzymes or co-enzymes.

Hormones are chemicals that cause some sort of reaction in the cells of the plant, such as expansion or division, and are used as herbicides in much large concentrations. A number of plant hormones are actually part of the DNA and RNA replication process and are used in milligrams per liter (which is parts per million) in the lab.

Types of hormones:

Cytokinins, basically make shoots.

BA or BAP, (N6-Benzyladenine). I regard Ba as a standard Cytokinin, lets rate it as a 1 in shoot making ability. BA is used a lot in the greenhouse to finish plants by increasing flower count and keep leaves green and on the plants when it gets old.

Meta-topolin, (6-(3-Hydroxybenzylamino)purine) is like BA that does not retard

Cultivation What is Plant Tissue Culture?

rooting but rates a 1/2.

2 IP, (N6-[2-Isopentyl]adenine Dihydrochloride) used a lot with woody plants or where BA is toxic to the plant like blueberries; it rates a 1/10 so us 10 X the amount to get to 1 unit of BA.

Kinetin, (6-Furfurylaminopurine) rates a 1/4 but mixes well with Ba. Oddly the common name of this chemical is the name applied to any chemical that makes cells divide, and does show up in rooting formulations in the greenhouse.

Thidiazuron, (1-Phenyl-3-(1,2,3-thidiazol-5-yl)urea) rates a 20 and can cause problems like uncontrolled cell growth.

Zeatin, (2E)-2-methyl-4-(1H-purin-6-ylamino)-2-buten-1-ol). Rates a 2 but seems to cause problems in some plants, mostly a water imbalance that makes the plant brittle and glassy.

Auxins, basically make roots.

They include 2,4-D (2,4-Dichlorophenoxyacetic acid) but the more common IBA (Indole-3-butyric acid) of greenhouse propagation is here, a man made form of IAA (Indole-3-acetic acid), a light sensitive natural chemical. Naa (Naphthaleneacetic acid) is here too which is 10X the strength of IBA.

Gibberllins (GA) do a few things, if the plant is mature they can make it bloom, a small plant however will elongate. Gibberllins are used in greenhouses to induce flowering and in fruit production to get elongated grapes and the classic apple shape in apples. Anti gibberllins are used more and more to make compact plants as in Easter lilies and mums.

Other chemicals that are listed under hormones: this is a catch-all list of chemicals that alter chromosome counts or turn a plant in to a lump of cells. They are used for specific things like trans-cinnamic acid which is used to make roots on orchid spikes and does smell like cinnamon.

Hormones are used sparingly and reduced once the plant is doing what you want it to. Hormones can be thought of as instructions to the plant, you just have to know how to spell in these chemicals. If you want shoots, you need a Cytokinins but with that alone you get just shoots and more shoots, its better to give the plant the idea you want shoots but we will be rooting soon so 1mg/L Ba and .25mg/L of Iba will make lots of shoots and some roots so when the plants goes to the greenhouse they are prepared to root and don't need time on a pure auxin medium.

Gelling agents: basically keep the plants from drowning in the medium and need not be used for a number of plants such as bromelaids or when agitation is used to get oxygen into the medium. Cotton, paper or polyester has also been used to support plants in tissue culture but can get immeshed in such.

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Brom-L is the WWW Bromeliad Society, started in 1993. It has the largest bromeliad seedlist and several other activities like the floraPix Bromeliad Gallery, plant ID pages and an email discussion list. Membership is free, but you can also participate without membership.
http://brom-l.florapix.nl/
email: info@floraPix.nl

Agar is a chemical derived from seaweed and in the processing can absorb a great deal of salt which is not good for any plant. Agar can be washed with distilled water, the agar settles out of the water easily, Agar in water should not have electrical conductivity, conductivity is from salts. Agar makes media slightly cloudy and yellow.

Gel or gel gum is produced from the bacterial fermentation of *Sphingomonas elodea*, a gram negative non-pathogenic bacterium. This polysaccharide makes media glass clear, tends to be harder at lower concentrations then agar also tends to cause problems so is not always used alone. Gel need not be washed. Also gel or gel gum is what is in number of food products.

In the end bromeliad propagation by way of tissue culture is combining the above elements to achieve the desired results. The draw back of the tissue culture industry currently is its competitive nature so sharing details is discouraged even if having an exact formulation is in no way a guarantee of success as markets, plant choice, fad and chance play there parts even when all goes well.

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Suppliers:

http://www.sigmaaldrich.com/life-science.html
Phytotechnologies laboratory at http://www.phytotechlab.com/

Editor's note: A basic introductory book I found very helpful is *Plants from Test Tubes: An Introduction to Micropropagation* by Lydiane Kyte & John Kleyn. Timber Press, Portland, Oregon.

Pineapples in Florida

Jay Thurrott

Ananas comosus var. *bracteatus*. Typical pink fruit of this variety of pineapple. Note the development of offsets near the base as well as at the crown of leaves on top of the fruit. Photo by Matthias Asmuss, Brasil 2004.

There are pineapples and…then there are pineapples. Many years ago (that would have been in the early to mid-70s) I met a couple by the name of Blanche and Jesse Johnson in New Smyrna Beach. Blanche was a long-standing member of a bromeliad society in the Central Florida area, but because I had no familiarity with bromeliads at that time, if she had mentioned the name of the society, it didn't mean anything to me and I have long since forgotten it. My guess is that it was the Seminole Bromeliad Society.

At any rate, Blanche had an extensive collection of bromeliads in her yard as well as in a small greenhouse and she was always happy to show me around her yard to point out whatever plants happened to be in bloom and to answer my numerous questions about her collection. That's when I first became interested in bromeliads.

One of the first plants that I was given by Blanche was an offset from *Ananas comosus* var. *bracteatus* ("*A. bracteatus"* at that time). She said that she had grown it in her yard for at least 10 years and that it was a "Florida native pineapple". Of course there are no pineapples native to Florida or anywhere else in North America and I suspect that some of her other comments regarding bromeliads were also less than accurate, but at least one statement that she made regarding this plant has since proven to be quite true: It is extremely cold-hardy.

This bromeliad shrugs off cold weather with little to no ill effects. Since that time, we have experienced some very cold (for Florida) weather starting in the late 1970's when temperatures plunged into the teens (-10C), froze and split water meters, well pumps and outside plumbing and killed all of the mangroves on the Florida east coast north of Merrit Island. Then there was the freeze in the 1980s that killed many citrus trees and other ornamentals in the area as well as a large number of fish in the local creeks. Through all of this my *A. comosus* v. *bracteatus* has not only survived, but has proven to be a reliable pineapple producer. Pineapples from this Ananas are gourmet table fare but not in the usual sense – that is, they're not very palatable, but instead make a very attractive table decoration - usually at their peak development in time for Thanksgiving.

In 2010, following a spell of prolonged cold temperatures one of my *A. comosus* v. *bracteatus* plants bloomed quite early and produced a pineapple that instead of the usual tuft of leaves at the top, sprouted 12 individual plants from its tip. Unable to resist the opportunity to enter this in a show with the title of "cheaper by the dozen" I was surprised and pleased to find it awarded an award of merit at the 2010 World Conference in New Orleans. Equally surprising, I have since divided that pineapple top into 12 plants and all have survived and developed into healthy new plants.

Before those reading this rush to purchase examples of this plant with the expectation that it will survive short spells of very cold weather, I should emphasize that my original plant was an offset from a lineage that may have developed additional cold resistance by being exposed to cold weather over many generations and generations following that plant have also had to contend with cold weather. I have a similar story to tell of an *Aechmea blanchettiana* that appears to have a much greater degree of cold hardiness than is typical for this species. This also is a plant that had been grown as a landscape plant for many generations that had been exposed to and survived occasional very cold temperatures.

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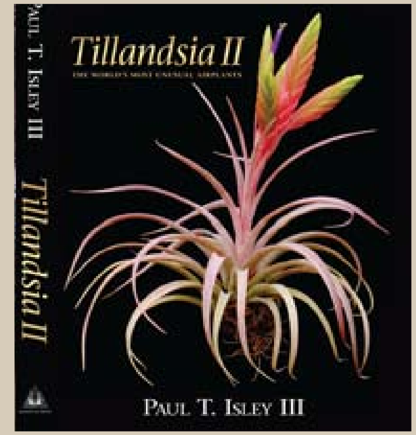

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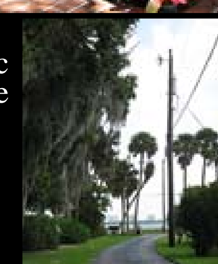

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Bromeliaceae and its Eight Sub-families

Derek Butcher

Yes, you thought there were only three, namely Pitcairnioideae, Tillandsioideae, and Bromelioideae, known by their winged seeds, plumose seeds, and fleshy fruits, respectively. But for the last 10 years much research has been conducted to test whether this classification reflects actual evolutionary history, as reconstructed based on variation in the DNA carried by their chloroplasts.

Things are now taking shape and you should be aware of where things are heading. Thomas Givnish and his team at the University of Wisconsin recently published a paper in 2007 in Aliso, where the proceedings of the Third International Congress on Monocot Evolution (held in California nearly five years ago) have appeared in two special issues.

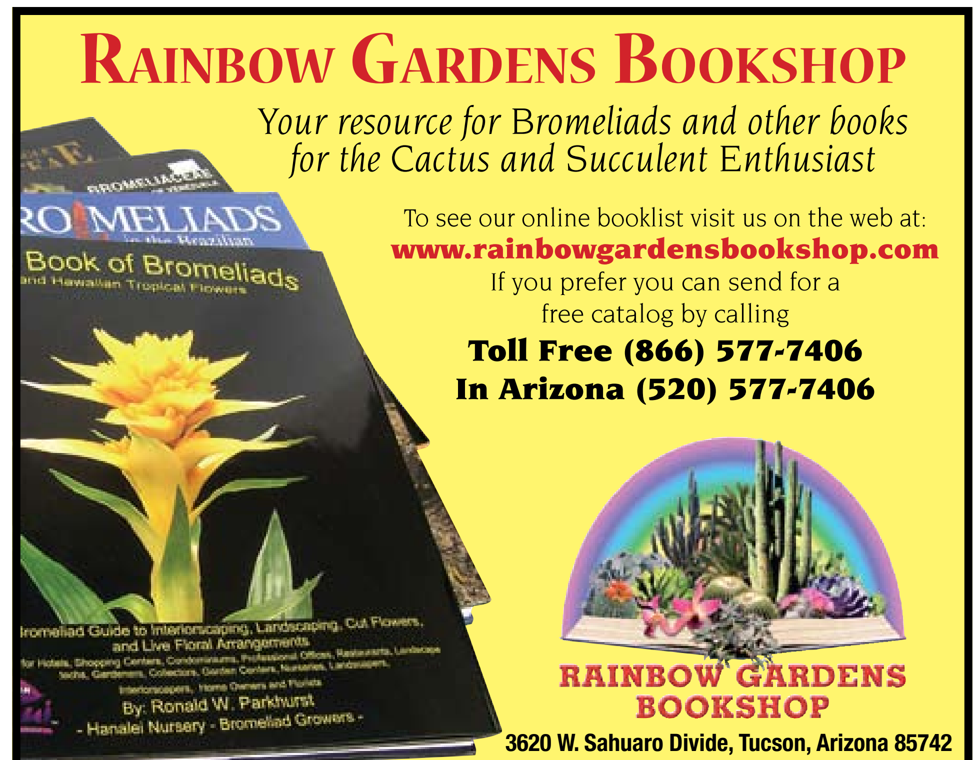
Remember we are considering how bromeliads evolved millions of years ago, when North and South America were separated, when the Venezuelan highlands were lowlands ready to be pushed up, and when the Amazon drained through Lake Maracaibo!

Givnish and his colleagues sequenced ndhF, a rapidly evolving gene found in the chloroplast, in 35 bromeliads and 16 closely related monocots to infer relationships among present-day bromeliad genera. They found that the long-recognized subfamilies Tillandsioideae and Bromelioideae were each monophyletic – that is, each subfamily included all the descendents of a single ancestor. Surprisingly, however, Givnish et al. showed that the subfamily Pitcairnioideae was strikingly paraphyletic, with both tillandsioids and bromelioids arising from within it. Given the ladder-like family tree the investigators recovered, they found it necessary to recognize EIGHT subfamilies, if each were to be properly monophyletic and easily diagnosed in terms of recognizable morphological characters.

As a result, they described four new subfamilies, recircumscribed Pitcairnioideae and Navioideae, sunk Ayensua into Brocchinia, and described a new genus Sequencia (named after it having been recognized initially based on its DNA sequence). The subfamily Brocchinioideae is basal-most, sister to all other subfamilies, followed Lindmanioideae; both of these groups are restricted to the ancient Guayana Shield of northern South America. Above these subfamilies is an unresolved, three-way branch involving Hechtioideae (from Central America), Tillandsioideae, and the remaining bromeliads (involving subfamilies Navioideae, Pitcairnioideae, Puyoideae, and Bromelioideae, in their respective order of branching).

Based on the extent of genetic divergence found among present-day bromeliads, calibrated against the amount of such divergence among various groups of monocots, Givnish and his colleagues inferred that bromeliads arose roughly 70 million years ago, as terrestrial plants with C3 photosynthesis, on moist infertile sites in the Guayana Shield. Subsequently, they spread centifugally in the New World, and reached tropical West Africa (in the form of Pitcairnia feliciana) via long-distance seed dispersal some 10 million years ago.

Modern genera and subfamilies began to diverge from each other 19 million years ago, implying a great deal of evolution (and most likely, a lot of extinction) during the 51 million years of time since the ancestor of all bromeliads (and only bromeliads) arose 70 million years ago. Bromeliads appear to have begun invading drier areas in Central and South America beginning roughly 15 million years ago, at the same time as bromeliads underwent a major adaptive radiation involving the repeated evolution of epiphytism, CAM photosynthesis, impounding leaves, several features of leaf and trichome anatomy, and an accelerated rate at which new genera subsequently appeared. Givnish and his team call this the "bromeliad revolution", and it appears to have occurred just after the uplift of the northern Andes and the shift of the Amazon to its present course. They suggest that epiphytism may have accelerated speciation by increasing the ability of bromeliads to colonize along the length of the Andes, allowing bromeliads to occupy a cloud-forest landscape punctuated frequently by drier valleys.



Avian pollination (mainly by hummingbirds) appears to have arisen at least twice about 13 million years ago, at about the time hummingbirds themselves were diversifying; insect-pollinated, relatively small flowers (like those in Brocchinia or Lindmania) were ancestral. Despite their representing three different lineages, members of Hechtia, of Puya, and of Abromeitiella-Deuterocohnia-Dyckia-Encholirium have evolved a suite of several different leaf and trichome traits in parallel, apparently as convergent adaptations to drought.

The new subfamilies with their genera are as follows:

Brocchinioideae Givnish, subfam. nov.-TYPE: Brocchinia J. H. Schultes.
Included genus: Brocchinia
Lindmanioideae Givnish, subfam. nov.-TYPE: Lindmania Mez.
Included genera: Connellia, Lindmania
Hechtioideae Givnish, subfam. nov.-TYPE: Hechtia Klotzsch.
Included genus: Hechtia
Puyoideae Givnish, subfam. nov.-TYPE: Puya Molina.
Included genus: Puya
Navioideae, descr. emend.
Included genera: Brewcaria, Cottendorfia, Navia, Sequencia, Steyerbromelia
Pitcairnioideae, descr. emend.
Included genera: Abromeitiella, Deuterocohnia, Dyckia, Encholirium, Fosterella, Pitcairnia

Key to Bromeliad Subfamilies

l. Fruits indehiscent, baccate	Bromelioideae
Fruits dehiscent, capsular	2
2. Seeds plumose-appendaged	Tillandsioideae
Seeds winged or naked	3
3. Flowers dioecious, plants of Central America	Hectioideae
Flowers perfect, or rarely monoecious or polygamodioeious, or dioecious and plants of the Brazilian Shield	4
4. Petal blades showy, tightly spiralled after anthesis, broad and distinct from claws	Puyoidea
Petal blades remaining free after anthesis, or if slightly coiled, then not clawed	5
5. Petals large and conspicuous or, if minute, then sepals imbricate and anthers basifixed, linear	Pitcairnoideae
Petals minute and sepals cochlear, or petals and bracts various and sepals convolute	6
6. Sepals convolute	Lindmanioideae
Sepals cochlear and petals minute	7
7. Leaves entire, stellate chlorenchyma abundant	Brocchinioidea
Leaves toothed, stellate chlorenchyma absent	Navioideae

General *Bromeliaceae* and its Eight Sub-families

Am I being premature in bringing these proposed changes to the notice of the layman? I think not, even though the study of DNA is in its infancy it is revealing some interesting results that we should all be aware of. I have used these findings to create a new Key to the Bromeliaceae genera on http://bsi.org which these days seems to be a yearly chore because of changes. In fact it is a never-ending story. Currently, an international consortium involving labs in the US, Austria, Germany, England, Panama, and Australia are compiling data on several different chloroplast genes and nearly 100 bromeliads to test the new classification.

Acknowledgments

The author would like to thank Tom Givnish in helping him try to understand the technical parts and present it in a more readable form!

Literature cited

Givnish, T. J., K. C. Millam, et al. (2007). "Phylogeny, adaptive radiation, and historical biogeography of Bromeliaceae inferred from ndhF sequence data." *Aliso* **23**: 3-26.

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Alcantarea *glaziouana*
Billbergia *kuhlmanii* • *rosea*.
Dyckia *chhoristaminea* • platyphylla.
Hohenbergia *penduliflora*.
Neoregelia *cruenta*
Pepina *armata* • *caricifolia*
Pitcairnia *xanthocalyx* • **Puya** *mirabilis*.
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Caloosahatchee Bromeliad Society Show 2009

Charles Birdsong, Affiliated Shows Chair.

Orthophytum vagans exhibited by Steve Hoppin.

Cryptanthus 'Ruby Star' featured in Steve Hoppin's winning entry in the Morris Henry Hobbs Best of Show, artistic section.

The show, held on December 6 2009 in Fort Myers (Florida) had 125 entries from 24 exhibitors. The Mulford B. Foster Best in Show winner was a large multiple Orthophytum vagans variegated exhibited by Steve Hoppin. The Morris Henry Hobbs Best of Show, artistic was also won by Steve Hoppin and was three Cryptanthus 'Ruby Star' plants placed in a clear, pink and green lucite container. The plants were in winter coloration of white, green and rose colors.

A Little Bit of History

Gene McKenzie

For many years the bromeliad co-existed with the human, floral and animal inhabitants of the lush, tropical environment of the Americas. Each took advantage of what the other had to offer.

Bromeliad history tells us that Christopher Columbus sailed the ocean blue and bumped into a new world. With his boat filled with goodies form the tropics, Columbus sailed the ocean again and managed to bump into his homeland, Spain. His Queen sent him back to the new world and on his return trip he took a vicious looking plant with long, spiny leaves and a luscious, sweet fruit growing from the center of the leaves. Our Chris brought his Queen a pineapple. The first bromeliad to leave the new world?

Other adventurers and explorers followed and returned to their homeland with wonders never seen before. Some of the wonders were tropical plants and many of them became known as bromeliads. Thus, the Bromeliacea family was described; and slowly over the years, its popularity invaded the United States.

Wishful thinking about a bromeliad society began in 1948 when Mr. Joseph Schneider of San Gabrial, California asked the organizer of Round Robins for the *Flower Grower* if she could get a group together who were interested in bromeliads. She placed a call for members of her Round Robin which brought an immediate response from Miss Victoria Padilla and Mrs. Sue Hutchinson who were soon followed by seven others and they, in turn brought four more.

This group formed a Round Robin, exchanging their experiences with bromeliads by correspondence with one another for approximately two years. In the spring of 1950 a call was sent out to all members of the Round Robin and others interested in bromeliads to attend a pot luck dinner at the home of Mrs. Dorothy Behrends in Los Angeles, California on May 21st to discuss the suggestion made by Mr. Schneider that a "Bromeliad Society" be organized. There were fourteen enthusiastic bromeliad people in attendance. The meeting was called to order by Victoria Padilla. It was decided to hold an organizational meeting the following September.

The September 17, 1950 meeting was held on a Sunday afternoon in the home of Mr. and Mrs. Frank Overton in Glendale, California. Twenty one prospective members attended with a surprise guest, Mr. Mulford Foster of Orlando, Florida. This group organized not just a local society, but an international society for the benefit of bromeliad enthusiasts all over the world.

The first officers elected were: President – Mulford Foster; First Vice President – David Berry, Jr.; Second Vice President – Russell J. Seibert; Secretary – Victory Padilla; and Treasurer – Frank H. Overton. In addition to the officers, Lyman B. Smith, H.B. Trau, Elmer J. Lorenz and Morris Schick were asked to serve on the Board of Directors. A Board of Honorary Trustees was elected, all of them from different countries.

This meeting was a fire of enthusiasm. In a very short time, the membership grew from less than thirty local Californians to an international group of nearly 100 charter members representing the following countries: Argentina, Australia, Belgium, Brazil, Canada, Canal Zone, Costa Rica, France, Great Britain, New Zealand and the USA.

This first year was used to establish By-laws, goals, to build a membership and a treasury. The first Life Member of this new society was Franklin M. DeVoe of Gulf Hammock, Florida.

In January 1951, less than a year later, President Mulford Foster became editor of the first *The Bromeliad Society Bulletin*, a bi-monthly publication to be sent to all members. Annual dues for membership remained $3.50 until March-April, 1963 when the dues were increased to $4.00. In November, 1951 a local group organized the Southern California Bromeliad Society and became the first "affiliate" of The Bromeliad Society.

Early in 1953, The Bromeliad Society announced that it had been duly incorporated under the laws of the State of California as a non-profit organization. The March-April 1954 issue of The Bromeliad Society Bulletin announced that The Louisiana Bromeliad Society had applied for affiliation with The Bromeliad Society. Upon being accepted, this would be the second Bromeliad Society affiliate. The November-December 1955 bulletin acknowledged the third affiliate – the Florida West Coast Bromeliad Society and in the May-June 1959 Bulletin, the South Florida Bromeliad Society was reported established, with Nat DeLeon President.

In the ten year period, The Bromeliad Society had grown to a membership of over 400 - 100 of which were members living in countries other than the United States. In the United States three states led in membership and activity: Florida (90 members), California (80 members) and Louisiana (30 members). There were four affiliates – 2 in Florida, one in California, and one in Louisiana.

In the ensuing years The Bromeliad Society followed the rugged path of progress. Victoria Padilla became the editor of The Bromeliad Society Bulletin, and color pictures were introduced in 1960. In 1964 all cover pictures of the Bulletin were presented in color. In 1971 *The Bromeliad Society Bulletin* was given a new name: *Journal of the Bromeliad Society*. Victoria Padilla continued as editor.

Bromeliad societies organized across the country and became affiliated with The Bromeliad Society. Societies split into smaller groups or disorganized completely and the membership in The Bromeliad Society fluctuated yearly at the whims of the affiliate societies. But the faithful remained steady and The Bromeliad Society continued to push forward.

Societies began to have local bromeliad shows and the popularity of bromeliads began to grow by leaps and bounds. In 1970 plans were made for a 20th birthday celebration to be held in Southern California and hosted by the five affiliates in the Los Angeles area. It was to feature an "all bromeliad show". This celebration led to future Bromeliad World Conferences.

The Bromeliad Society has sponsored and funded many exceptional improvements to the future of bromeliads and strives to ever improve the knowledge and appreciation of bromeliads for its members and the general public.

A small, nicely scented hybrid: *Tillandsia* 'White Spice' (*T. xiphioides* X *T. diaguitensis*). Photo by Andrew Flower.

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April 9-10, 2011. Bromeliad Guild of Tampa Bay Show and Sale. 2629 Bayshore Boulevard, Tampa, Florida. Contact Tom Wolfe (813) 961-1475.

May 7-8, 2011. La Ballona Valley Bromeliad Society, 56th Annual Show & Sale at the Culver City Veterans Complex, 4117 Overland Ave., Culver City CA 90230. Show hours: Sat. 10-5, Sun 10-4. FREE admission & parking.

November 4-6, 2011. Florida East Coast Bromeliad Society hosting the Florida Extravaganza at the Plaza Spa and Resort in Daytona Beach. The Cryptanthus Society's International Show will be held at the same venue on the same dates.

The Bromeliad Society International

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

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A study in survival.

Bromeliad living on the edge near Cajamarca, Peru. Photograph by Michael Romanowski.