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Front Cover: Close view of the inflorescence on the new species *Cryptanthus robsonianus.* Photo by Elton Leme. *Story* starts on page 150.

Back Cover: One of many bromeliad arrangements in Lyn Wegner's garden. Photo by Lyn Wegner. Story starts on page 166.

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President's Message

Jay Thurrott

Sadly, the World Bromeliad Conference of 2014 is over and we have to wave a fond farewell to "Bromeliads in Paradise". For those of us who were fortunate enough to attend, this was truly a week in paradise. Congratulations and a heart-felt "mahalo" to our hosts, the Hawaii Bromeliad Society. Thank you!

Special thanks to conference chair Lynette Wageman, the dynamic force behind this conference and to BSI vice president Bonnie Boutwell for the countless hours she devoted to making this conference the success that it truly was. You both did an outstanding job of pulling everything together for a wonderful conference and we just can't thank you enough for making the 21st World Bromeliad Conference truly memorable!

Congratulations are also in order to Nat DeLeon, winner of the 2014 Wally Berg award. Terrie Bert announced this year's winner at the opening ceremonies for the conference and newly elected BSI director Barbara Partagas accepted the award on Nat's behalf. This award was begun in 1999 to honor the late Wally Berg of Sarasota Florida. Wally was a tireless supporter of the BSI, a collector of bromeliads and was well known for his excellence in bromeliad horticulture. Previous recipients of this award have included some of the top names in the bromeliad world including John Anderson, Don Beadle, Dennis Cathcart, Harry Luther, and Sam & Hattie Lou Smith.

Lynette, greeting everyone at the entrance to the Wednesday Luau at the Willows in Honolulu. Photo by Calandra Thurrott

As soon as work on one conference is complete, work on another begins and the members of the Houston Bromeliad Society have extended

an invitation to all for the 22nd BSI World Bromeliad Conference, to be held in Houston, Texas during June 13-19 of 2016. They assure us that this will be the best time of the year to visit Texas and that their members "are some of the friendliest and most welcoming hosts you will ever meet!" (that's funny, those are the exact same words that I would use to describe the members of the Hawaii Bromeliad Society!). Mark your calendars and begin making plans now to attend this event where we are promised to experience "bromeliads Texas style". Details will be posted on the BSI website as they become available, so check the website often.

NOTICE REGARDING THE JOURNAL OF THE BROMELIAD SOCIETY

With this third issue of Volume 64, we have published a total of 216 pages in the Journal this year. A final issue of 72 pages will be published near the beginning of 2015 to carry us to our goal of 288 pages per volume. This is the same number of pages printed as when we published a volume in 6 issues of 48 pages each. The change in format will lead to the replacement of 2 sets of Front Covers, Back Covers and Table of Contents page with additional articles. It is my job to replace these pages with articles that are at least as meaningful as the photos used on the outside of each cover.

To complete Volume 63, we will also publish a 96 page 'double issue' later this year.

ERRATA

Some errors that escaped detection during the editing process in previous issues should be noted.

64(1) - In the article 'Preserving our Past', the caption for Figure 4 (page 36) contains an incorrect identification. The plant identified as *Guzmania vittata* should be corrected to *Guzmania bismarkii*.

64(2) - In the article 'A new variety of *Tillandsia edithiae*', the specific epithet was misspelled throughout the article (through no fault of the author, this was a mistake by the editor). Whenever '*edithiae*' appears in the article, it should have been written '*edithae*'. In particular, the new combination on page 77 should have been written:

Tillandsia edithae Rauh var. ***araucariifolia*** Gouda, var. nov. (fig. 3, 4)

A New Species of *Cryptanthus* from Espírito Santo, Brazil

Elton M. C. Leme[1]

In the Bromelioideae volume of Smith & Downs (1979) monograph, the genus *Cryptanthus* Otto & Dietrich comprises 20 recognized species. However, in the past 35 years this number almost quadrupled, and today there are 76 known species. Despite this, the current number of species is far from representing the real richness of this Brazilian endemic genus and novelties continuously come to light. An example is the ornamental new taxon proposed below.

Cryptanthus robsonianus Leme, sp. nov.

This new species is closely related to *C. argyrophyllus* Leme (Leme 2001), differing by the leaf blades without a thicker median zone, and adaxially glabrescent towards the apex, inflorescence many flowered with a central conspicuous head of 20–30 staminate flowers arranged along a slightly elongate axis and distinctly visible above the leaves, larger bracts in the fascicles, longer flowers in the fascicles, and petals of the perfect flowers larger and shortly connate at the base.

Figure 1. *Cryptanthus robsonianus* in pre-floral growth stage in its habitat. Photo by Elton Leme.

Type:—BRAZIL. Espírito Santo: Jaguaré, Palmitinho, Mussununga Córrego do Mosquito, near Fazenda Alegre, 15 m elevation, 19° 00' 55.4" S, 39° 51' 16.4" W, 20 June 2014, E. Leme 8895, R. Lopes & V. Leme (holotype RB!, isotype HB!).

Plants terrestrial, flowering ca. 8 cm tall, stemless, propagating by short basal shoots. Leaves 6–10 in number, spreading, forming a lax oval rosette, coria-

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Figure 2. Flowering specimens of *Cryptanthus robsonianus*. Photo by Elton Leme.

ceous; sheaths subreniform, ca. 2.5 × 4 cm, greenish toward the base, dark purplish-wine colored near the apex, corrugate, glabrous toward the base, abaxially white lepidote at distal end, margins densely spinulose at distal end; blades narrowly oblanceolate, acute

Figure 3. Details of the well developed central head of staminate flowers of *Cryptanthus robsonianus*. Photo by Elton Leme.

to acuminate, shortly caudate, distinctly narrowed toward the base but not petiolate, 18–35 × 4.5–7 cm, slightly canaliculate toward the base, nearly flat toward the apex, without a thicker median zone, prevailingly dark purplish-wine colored, sometimes dark green near the middle, adaxial and abaxial sides not at all contrasting, adaxially densely and coarsely white lepidote near the base and glabrescent toward the apex, abaxially densely white lepidote, trichomes not at all obscuring the color of the blades, distinctly nerved, margins slightly if at all undulate, densely spinose (Fig. 4A); spines 0.5–1 mm long, 1–5 mm apart, spreading to slightly antrorse. Inflorescence sessile, many flowered, 5–6 cm long, ca. 3.5 cm in diameter (not including the primary bracts); with a conspicuous central head of 20–30 staminate flowers (Fig. 3), 4–5.5 × 3 cm, flowers densely arranged along a slightly elongate axis and distinctly visible above the leaves; primary bracts foliaceous to subfoliaceous, spreading; lateral fascicles inconspicuous, 2–4 in number, flabellate, 4 × 1.5–2 cm (excluding the petals), 2–3-flowered (Fig. 4B); floral bracts acute to acuminate, membranaceous, subdensely and coarsely white lepidote mainly toward the apex, nerved; those within the lateral fascicles ovate, distinctly carinate, 22–25 × 12–15 mm, white to greenish-hyaline, entire, slightly exceeding the ovary, with fimbriate white trichomes along the margins; those within the central head of staminate flowers lanceolate, ecarinate, 19–27 × 5–8 mm, reddish-hyaline to red, reaching 1/2 of the sepal length, densely to subdensely spinulose; flowers slightly fragrant, sessile, the inner staminate ones 41–44 mm long, the perfect ones in the lateral fascicles 50–60 mm long; sepals of the perfect flowers 17–19 mm long, equally connate at the base for 9–11 mm, lobes ovate, caudate, erect to suberect, 8–10 × 4–4.5 mm, subdensely and coarsely pale brown lepidote, greenish-white toward the apex, the adaxial ones carinate,

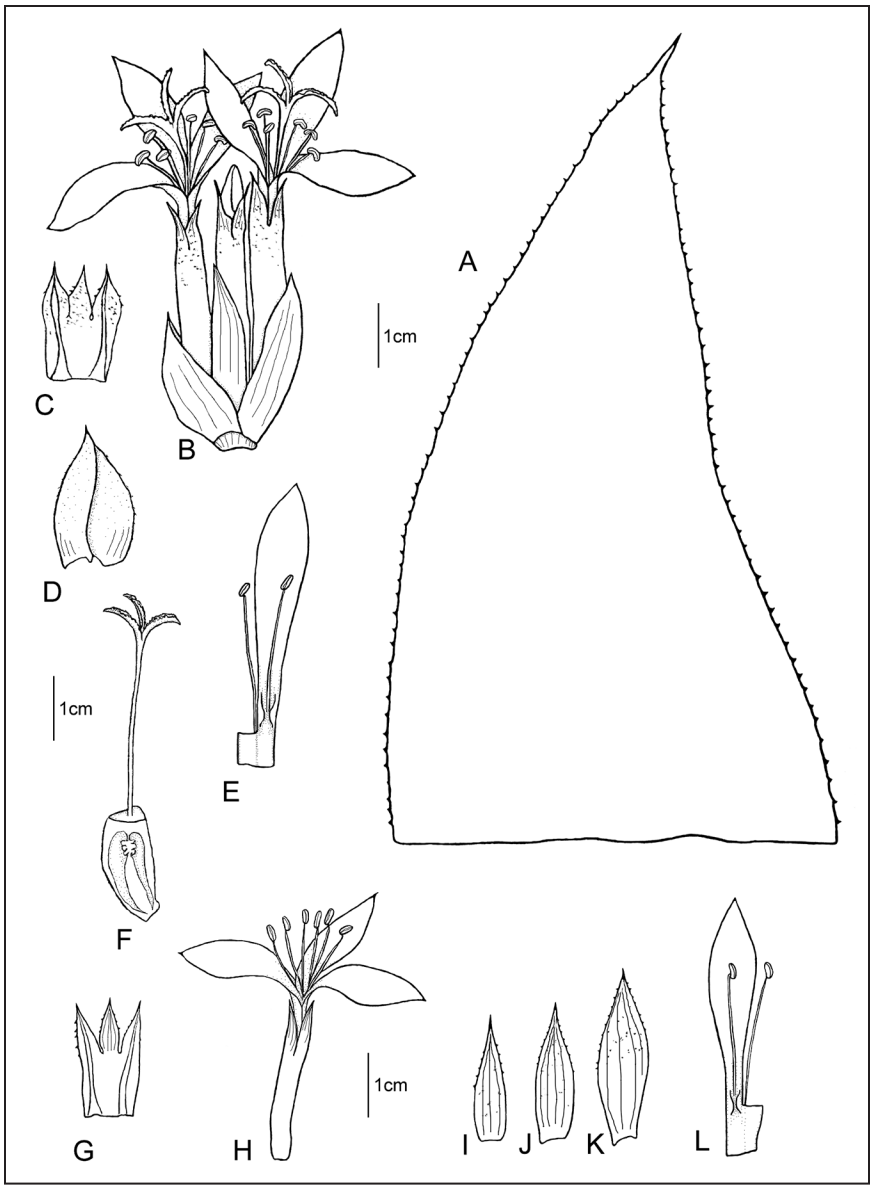

Figure 4. *Cryptanthus robsonianus*. A. Apex of the leaf blade. B. Basal fascicle with perfect flowers. C. Sepals of a perfect flower. D. Bracts of one fascicle. E. Petal and stamens of a perfect flower with one antesepalous and one antepetalous stamen each. F. Longitudinal section of the ovary, style and stigma. G. Sepals of a staminate flower. H. Staminate flower. I-K. Floral bracts from the central head of staminate flowers. L. Petal and stamens of a staminate flower with one antesepalous and one antepetalous stamen each. Figure prepared by Elton Leme.

Figure 5. General view of the Mussununga forest where *Cryptanthus robsonianus* lives. Photo by Elton Leme.

margins inconspicuously spinulose to entire (Fig. 4C); sepals of the staminate flowers ca. 18 mm long, equally connate at the base for 9–10 mm, lobes narrowly ovate, caudate, erect to suberect, 8–9 × 2.8–3 mm, sparsely and coarsely pale brown lepidote, greenish-white to reddish toward the apex, margins entire (Fig. 4G); petals narrowly subspathulate, white except for the greenish-white apex, apex acute, connate at the base for 5–6 mm, distinctly longer than the stamens but spreading at anthesis and exposing them, bearing 2 conspicuous longitudinal callosities 7–8 mm above the base; petals of the perfect flowers ca. 45 × 8 mm (Fig. 4E); petals of the staminate flowers 41–44 × 7 mm long (Fig. 4L); filaments ca. 30 mm long, the antepetalous ones adnate to the petals for 8–9 mm, the antesepalous ones adnate to the petal tube; anthers 2–2.5 mm long, dorsifixed near the base, base bilobed, apex obtuse; style distinctly surpassing the anthers; stigma conduplicate-patent, white, margins distinctly scalloped, with blades 5–6 mm long; ovary of the perfect flowers 16–17 × 7–8 mm, trigonous, white, pale castaneous lepidote, epigynous tube lacking; ovules obtuse; placentation apical. Fruits subglobose, 15–16 × 14–15 mm, greenish-white.

Additional specimen examined (paratype):—BRAZIL. Espírito Santo: Jaguaré, Palmitinho, Mussununga Córrego do Mosquito, near Fazenda Alegre, 15 m elevation, 19° 00' 55.4" S, 39° 51' 16.4" W, 20 June 2014, E. Leme 8896, R. Lopes & V. Leme (RB!).

This new species is named after the biologist and conservationist Robson Lopes, who resides in Jaguaré, Espírito Santo, and has contributed a lot to the knowledge of

the biodiversity of the local ecosystems, which comprise Tableland Atlantic Forest, Restinga, Mussununga and Campos Nativos.

Cryptanthus robsonianus is closely related to *C. argyrophyllus,* but differs from it by the leaf blades without a thicker median zone (vs. ca. 3 mm thick along a slightly protruded central zone), adaxially glabrescent towards the apex (vs. densely and coarsely cinereous-lepidote throughout), inflorescence many flowered (vs. few-flowered), with a central conspicuous head of 20–30 staminate flowers arranged along a slightly elongate axis and distinctly visible above the leaves (vs. without a distinct central head of flowers), larger floral bracts of the fascicles (22–25 × 12–15 mm vs. ca. 15 × 6 mm), longer flowers of the fascicles (50–60 mm vs. ca. 45 mm), larger petals of the perfect flowers (ca. 45 × 8 mm vs. ca. 36 × 6 mm), that are shortly connate at the base (5–6 mm vs. ca. 10 mm).

Cryptanthus robsonianus is a terrestrial species on sandy soils from near sea level areas, growing in shady and humid sites of forests of Mussununga (Fig. 5), with scattered individuals around its area of occurence. Mussununga is a peculiar kind of vegetation typical of the of north region of Espírito Santo state, comprising herbaceous and shrub formations or occurring as thinned forests usually on sandy soil and with circular form, surrounded by Restinga vegetation and Tableland Atlantic Forest (Floresta de Tabuleiro). Usually, the bromeliad species found in Mussununga areas are typical of the neighboring Restinga or Tableland Atlantic Forest. Some of the species observed sharing the habitat with *C. robsonianus* are *Aechmea multiflora* L.B.Sm. *A. patentissima* (Mart. ex Schult. & Schult. f.) Baker, *A. victoriana* L.B.Sm., *Bromelia binotii* E. Morren ex Mez, *Billbergia tweedieana* Baker, *Pseudananas sagenarius* (Arruda) Camargo, and *Tillandsia globosa* Wawra, to name a few.

This new *Cryptanthus* is a distinctly ornamental new species which calls attention by its large size and broad, dark colored leaf blades. However, its striking feature is the conspicuously elongated central head of numerous staminate flowers, the largest structure of this kind ever observed in the genus.

Acknowledgments

I thank Eric Gouda and Alan Herndon for their revisions and valuable suggestions during manuscript preparation; Robson Lopes and Vanessa Leme for their support and companionship during field activities.

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The Secrets of Night-Blooming Bromeliads and Bats

Pedro Adrián Aguilar-Rodríguez[1,*], *Thorsten Krömer*[1] *and M. Cristina MacSwiney G.*[1]

Introduction

Unlike working with plant species that open their flowers during the day, studying night-blooming bromeliads requires extensive field work under poor visibility conditions. The nocturnal ("night-shift") pollinators, including bats and moths, are very different in behavior and biology in comparison to their diurnal ("day-shift") counterparts, such as hummingbirds and bees (i.e., different physiological needs, attraction to different floral traits, duration of visits; Willmer 2011). Furthermore, the need for special equipment to record nocturnal pollination may explain why night-blooming bromeliads are less studied than the day-blooming species.

Among angiosperms, bromeliads are remarkable for their floral biology, since most of the species appear to be primarily pollinated by vertebrates, rather than insects (Krömer et al. 2006). Most other animal-pollinated plants, including the orchids, are pollinated largely by insects. In the Neotropics, where almost all bromeliad species occur, hummingbirds and bats are the most important vertebrate pollinators (Fleming et al. 2005). Hummingbirds are the most frequently reported bromeliad-pollinators (Kessler & Krömer 2000; Carranza-Quiceno & Estévez-Varón 2008), resulting in a ratio of up to 20 bird-pollinated ("ornithophilous") to one bat-pollinated ("chiropterophilous") species (Sazima et al. 1999). Here, we present a brief overview of the knowledge about bat-pollination in Bromeliaceae, with special focus on a recent study carried out by our own working group.

Bat-Pollination Syndrome

In general, animal pollination syndromes are sets of floral characteristics that are shared by unrelated plant species that are pollinated by a particular kind of animal. The main groups of pollinators are bees, bumblebees, beetles, butterflies, hummingbirds, and bats or other mammals (Willmer 2011). These floral characteristics include flower morphology (size, shape, color, and marks in the perianth), floral rewards (nectar, pollen, oils, resins, volatile compounds), and floral phenology. In particular, the bat-pollination syndrome is a phenomenon generally restricted to the tropics and subtropics in the Old and New World (Fleming et al. 2009). According to the literature, the most important floral traits associated with bat-pollination are: 1) nocturnal or crepuscular anthesis (e.g., the flowers open at night or in the period of reduced light during the transition between day and night); 2) pale or dullish colors in the petals (mostly white, pale green/yellow,

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or creamy colors); 3) flagelliflory (flowers suspended on long stalks, away from the tree branches); 4) cauliflory (flowers located directly on large branches or tree trunks); 5) tubular or radially symmetrical flowers that act like a "mask" on the bat snout, but also brush-type inflorescences with many smaller flowers that open near simultaneously; 6) musty, "onion"-like flower odors, sometimes with sulphur-compounds; 7) diluted nectar (up to 17% of sugar); and 8) hexose-rich nectar (e.g., low sucrose content, but high levels of glucose and fructose).

These floral traits probably evolved in most plant families as a modification to an already existing pollination syndrome, such as the moth-pollination or even the hummingbird-pollination syndrome (von Helversen 2003). Although some authors have criticized this generalized concept, because most flowering plants appear to be pollinated by more than one "type" of pollinator, it remains true that bat-pollinated species share morphological characteristics in their flowers, which distinguish them from other plants. In fact, the floral characteristics associated with bat-pollination have evolved in at least 67 plant families around the world, including about 360 plant species pollinated by the nectarivorous bat species that occur in the Neotropics, and belong almost exclusively to the Phyllostomid family (Fleming et al. 2009).

Bat-Pollination And Bromeliads: Early Observations

Considering only floral traits, German biologist Fritz Müller (1897) noted that the yellowish flowers of the Brazilian *Vriesea jonghei* (Libon ex K. Koch) E. Morren opened at night, and emitted "an opossum-like scent," producing copious nectar (Sazima et al. 1995). This anecdotal remark constitutes the first observation of a bromeliad species with the putative bat-pollination syndrome. However, the first formal hypothesis on bat-pollination among bromeliads came from Otto Porsch (1932), an Austrian biologist who suggested that bats might pollinate some species within the genera *Vriesea*, *Thecophyllum* (whose species are now placed in the genera *Guzmania* and *Werauhia*) and *Alcantarea*, based solely on the nocturnal anthesis and the dull colors of their flowers.

Several decades later, Stefan Vogel (1969) made the first confirmed report of bat-pollination in bromeliads from Brazil. Like his predecessors, he used the floral morphology to predict that at least 14 species of *Vriesea* (most of them now classified as members of *Werauhia*) would be pollinated by bats. However, Vogel was also the first to conduct mist-netting near flowering individuals of the endemic *V. morrenii* Wawra, capturing two individuals of the glossophagine bat *Anoura caudifer* Geoffroy with bromeliad pollen on their fur. In this way, Vogel initiated the path to more detailed studies that shed light into one of the most overlooked plant-animal interactions.

After the publication of Vogel's observations, the studies of bat-pollination in bromeliads during the 70´s and early 80´s were limited. The study of Salas (1973) realized in Costa Rica on *Vriesea ororiensis* (Mez) L.B. Sm. & Pittendr. was the only contribution on bat-pollination in bromeliads for nearly a decade. However, the observation of

chiropterophily seems doubtful and should be confirmed as the species has red bracts and thus fits better within the hummingbird-pollination syndrome.

In the mid-1980's, a couple of German scientists, Otto and Dagmar von Helversen, both scholars in bioacoustics and bat ecology, made observations in another Brazilian bromeliad, *Vriesea bituminosa* Wawra, that was visited by the same glossophagine bat species observed earlier by Vogel (Dobat & Peikert-Holle 1985: 236). Considering these observations, the von Helversen's took living plants of *Werauhia gladioliflora* (H. Wendl.) J.R. Grant and *W. rugosa* (Mez & Wercklé) J.R. Grant all the way to Germany, where their floral nectar was used as food for the captive nectarivorous bat species *Glossophaga soricina* Pallas and *Anoura geoffroyi* Gray (Sazima et al. 1989).

Overview Of Current Knowledge

Since then, our knowledge about bat-pollination in bromeliads has continuously grown. Bat-pollinated bromeliads have been studied in five countries: Brazil, Costa Rica, Venezuela, Bolivia, and recently, Mexico. However, most of the studies were carried out in Brazil, especially by the working group of Ivan and Marlies Sazima, and Silvana Buzato. Furthermore, Otto von Helversen contributed to the ecological knowledge in cooperation with Marco Tschapka.

Currently, it is presumed that, like in other plant families, bat-pollination in bromeliads is a derivative pollination syndrome, evolved from the basal hummingbird-pollination syndrome (Benzing 2000; Kessler & Krömer 2000), and is reported mainly from medium to high altitudes (i.e., Bolivian Andes region, ca. 1150-2400 m asl), but evidence also exists for a lowland species (*Werauhia gladioliflora* in Costa Rica, 40-60 m.a.s.l.; Tschapka & von Helversen 2007).

Figure 1. Inflorescence of *Guzmania calothyrsa* Mez. Photo by Thorsten Krömer.

It is interesting to note that many neotropical nectar-feeding bats can be found in countries with a high bromeliad diversity, like Brazil and Bolivia, but most of the documented examples of bat-pollinators belong to only one genus, the tail-less bats of the genus *Anoura*, which are common at medium to high elevations (Koopman 1981). We know that bat pollination in bromeliads, at least in Bolivia, is related to mid-elevations, and common in humid montane forests with high trees (Kessler

Figure 2. Inflorescence of *Puya ferruginea* (Ruiz & Pav.) L.B. Sm. Photo by Thorsten Krömer.

& Krömer 2000), where bats of this genus are abundant.

As mentioned above, the greatest number of documented cases of bat-pollination can be found within *Vriesea* and *Werauhia* (Grant 1995). In fact, *Werauhia*, including about 93 species of which 80 occur in Costa Rica and Panama (Krömer et al. 2007), could be entirely bat-pollinated, and thus, demonstrate the importance of bats as pollinators and selective agents in the evolution of bromeliads. In earlier studies, these species now placed in *Werauhia* were usually treated as belonging to *Vriesea*.

Up to now, bat-pollination in Bromeliaceae is reported or suggested in seven genera and 24 species, within the 58 genera and about 3352 reported bromeliad species (Luther 2012). Thus, only about 0.8% of all bromeliad species have been proposed to be bat-pollinated, with current reports in *Encholirium* (*E. glaziovii*, *E. vogelii*), *Guzmania* (*G. calothyrsa*[Fig. 1], *G. danielii*, *G. killipiana*, *G. morreniana*, *G. retusa*, *G. sphaeroidea*), *Pitcairnia* (*P. brongniartiana*, *P. trianae*), *Puya* (*P. ferruginea* [Fig. 2]), *Tillandsia* (*T. heterophylla*, *T. macropetala*; Fig. 5 and 6), *Vriesea* (*V. bituminosa*, *V. gigantea*, *V. longicaulis*, *V. longiscapa*, *V. morrenii*, *V. platynema*, *V. sazimae*), and *Werauhia* (*W. gladioliflora*, *W. kupperiana*, *W. ororiensis*, *W. rugosa*; Fig. 3) (Krömer 2003; Fleming et al. 2009; Krömer et al. 2012; Christianini et al. 2013; Aguilar-Rodríguez et al. 2014; in press). Nevertheless, all of the more than 90 species of *Werauhia* share characteristics that suggest they might be chiropterophilous, in addition to one species of *Billbergia* (Krömer et al. 2006, Krömer et al. 2008). In this manner, chiropterophily

Figure 3. Flowers of *Werauhia noctiflorens* T. Krömer, Espejo, López-Ferr. & Acebey. Photo by Thorsten Krömer.

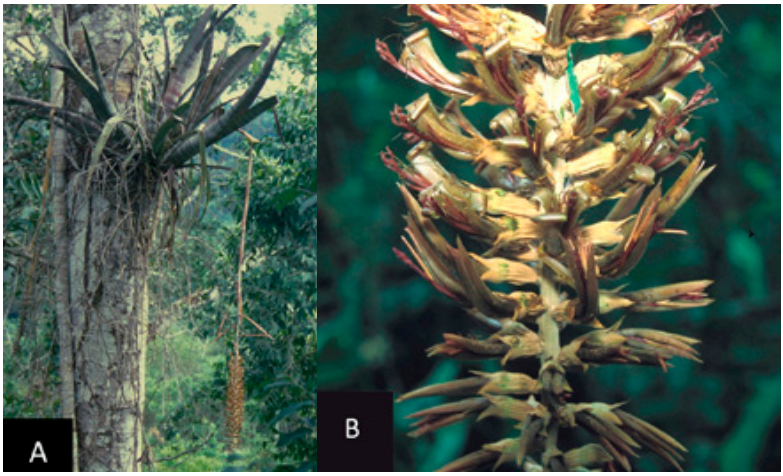

Figure 4. A. *Billbergia robert-readii* E. Gross & Rauh in habitat B. Inflorescence of *Billbergia robert-readii*. Photos by Thorsten Krömer.

has been confirmed in two out of eight subfamilies of the bromeliads, although most frequently in Tillandsioideae. If *Billbergia robert-readii* E. Gross & Rauh (Fig. 4) is indeed pollinated by bats, it would constitute the first report within Bromelioideae.

Most of the bat-pollinated bromeliads studied have zygomorphic bisexual flowers. In addition, excluding some *Vriesea* species with reddish petals (Sazima et al. 1995), most of them have pale green, yellow, or whitish petals and, in most cases, the floral bracts form a "dish" that helps to accumulate the relatively large quantities of nectar produced by their flowers. The flowering pattern is similar among species of different genera, being most common to open only one or two flowers per night, during a long period. Furthermore, nectar traits, mainly sugar composition and concentration are within the range of those present in bat-pollinated species in other families, offering diluted nectar and with more glucose and fructose over sucrose (Krömer et al. 2008).

Figure 5. *Tillandsia macropetala* in habitat. Photo by Thorsten Krömer.

Also, most bat-pollinated bromeliads are epiphytes, and thus may be more accessible to a nectarivorous bat with hovering flight. However, *Encholirium* species are exceptional among chiropterophilous bromeliads, because they

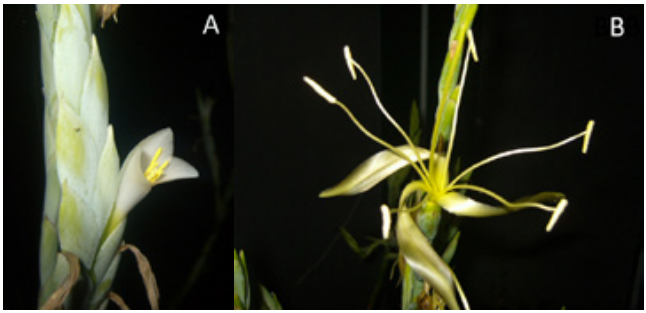

Figure 6. A. Flower of *Tillandsia heterophylla* E. Morren. B. Flower of *Tillandsia macropetala* Wawra. Photos by Pedro Aguilar.

are mainly terrestrial, and with a racemose or brush-like inflorescence bearing many open flowers each night, in contrast to the spike-like inflorescences and epiphytic habit of most other bat-pollinated bromeliads.

The best-documented case of bat-pollination among bromeliads however comes from Costa Rica and the species *Werauhia gladioliflora*. Contrary to other works, this bromeliad has been studied in tropical lowland rainforest of La Selva biological station, where it receives visits by at least four different bat species. It is known that this bromeliad is important to the local nectarivorous bats, providing a valuable resource in the form of nectar and pollen almost all year around (Tschapka & von Helversen 2007).

Figure 8. The nectarivorous bat *Anoura geoffroyi* pollinating a flower of *Tillandsia macropetala*. Photo by Pedro Aguilar.

A Case Study: Bat-Pollination In Mexican Tillandsias

In this final section we will present our ongoing work on a rare case of bat-pollination in *Tillandsia*, the most species-rich genus within the Bromeliaceae. *Tillandsia* comprises about a third of all bromeliads, and most studies report hummingbirds as the main pollinators. However, members of the subgenus *Pseudoalcantarea* have been proposed to be pollinated by nocturnal animals, because of their night-blooming flowers (Benzing 2000).

In a comprehensive study of nectar traits among bromeliads (Krömer et al. 2008), two Mexican species, *Tillandsia macropetala* Wawra (Fig. 6 and 7); which was re-

Figure 9. *Anoura geoffroyi* Gray, the bat-pollinator of *Tillandsia macropetala* and *T. heterophylla* in Veracruz, Mexico. Photo by Pedro Aguilar.

cently recognized as a species distinct from *T. viridiflora* (Beer) Baker (Krömer et al. 2012) and *T. heterophylla* E. Morren (Fig. 3), showed sugar constituents and concentration similar to other bat-pollinated bromeliads, in addition to pale green or white petals and crepuscular blooming. This suggested a probability that those species could be, in fact, bat-pollinated, unlike any other *Tillandsia* species studied before (Gardner 1986).

This hypothesis remained untested until the Master thesis of the first author confirmed that in the endangered humid montane forests of central Veracruz, both species are pollinated by the tail-less nectarivorous bat, *Anoura geoffroyi* (Fig. 8 and 9). This was supported by nocturnal camera recordings, direct captures of bats near inflorescences with fresh flowers, and the presence of bromeliad pollen on the fur of the captured bats (Aguilar-Rodríguez et al. 2014). It is worth noting that in the case of *T. macropetala*, its flowers do not fit the conventional bat-pollination syndrome (Fig. 6B): it has a faint sweet odor (without the sweat/onion-like scent present in *Werauhia*), and an actinomorphic helicoiform corolla, with band-like petals (unlike members of *Vriesea* and *Werauhia*). Whereas *A. geoffroyi* was the only pollinator recorded for *T. macropetala*, the study of *T. heterophylla* interestingly also revealed diurnal pollinators, such as hummingbirds and bees, as its flowers remain open until the next afternoon and their visits produce fruits (Aguilar-Rodríguez et al. *in press*).

This brief overview shows that most of the information on bat-pollination in bromeliads is relatively recent, and still scarce. We hope to continue our work in Mexico, in other locations and with different species of *Tillandsia*, in order to determine the entire range of this previously undescribed interaction. Documenting these plant-pollinator interactions may provide information necessary for the implementation of conservation strategies, and thus we hope to help to secure the survival of both, bromeliads and their bat-pollinators.

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My Bromeliads - Part 2

Lyn Wegner

Figure 1. *Tillandsia* and *Neoregelia* work well together when mounted on wood. Photo by Lyn Wegner.

Tillandsia are also everywhere! Mounted (Fig. 1), hanging in baskets, a few potted and many attached to the trees in our garden. I have some hooked onto trellises attached to some of our boundary walls. Between the tills on the trellises I have added mounted mini neos for colour. Each plant is labeled. Some grow in shady positions (Fig. 2) and some in much more sun. The *T. tectorum* are in full sun and grow and bloom extremely well. Trevor makes a variety of interesting wire holders (Fig. 3) including baskets in five sizes, *T. fuchsii* var *fuchsii* looks beautiful in the smallest basket. I have beautiful *T. ionantha* and *T. schiedeana* balls. *T. capitata* 'Marron' is a beauty even when not in bloom. I love the twisted, curly

Figure 2. Even in more shady areas of the garden, *Tillandsia* specimens are usually kept high above the ground using a variety of metal supports. Photo by Lyn Wegner.

Figure 3. Many of my *Tillandsia* species are in baskets on galvinised metal stands, with some growing happily in full sun Photo by Lyn Wegner.

form of *T. duratii* and the scent of the inflorescence is heavenly as is the sweet smelling *T. crocata* which have formed nice clumps. The orange *T. crocata*, and *T.* 'Copper Penny' seems to grow more slowly. I love *T. funckiana* and have the giant form too! *T. linearis* is in a large wire basket, it has grown into a nice specimen and is blooming now. The dainty *T. bandensis* is another favourite, so pretty to see a nice clump full of tiny, scented, lilac flowers beautifully displayed in a variety of hanging wire baskets and other interesting holders. *T. remota* might be considered rather plain but I am very fond of it. Mine grows well in a semi-shady area and copes without too much water. It looks spectacular! *T. complanata* does well. It is potted and growing in semi-shade positioned in a metal stand. *T. somnians* is happy climbing up a tree in a shady part of the garden. *T. fasciculata* 'Tropiflora' grow and bloom beautifully in sunny spots as does *T. novakii*, *T. streptophylla* and *T. xerographica*. It's a beautiful sight to have a tangle of *T. caerulea* and the blue-flowered form of *T. mallemontii* in bloom. The white *T. mallemontii* doesn't grow as prolifically as the blue variety unfortunately. I grow them in a bright shady spot in open wire baskets. *T. tricholepis* does well. I like it. *T. narthecioides* blooms well and is growing in a wire basket in the shadehouse. I am excited to have a variegated *T. latifolia* var. *divaricata gayi*. I was surprised to discover that *T. rothii* is developing a flower spike, my first! It is grown in a pronged metal stand in almost full

Figute 4. A really large piece of wood can provide a home for many different bromeliads. Photo by Lyn Wegner

sun. I was excited to discover *T*. 'Creation' is also forming a spike, also a first for me! I bought this plant at the Cairns Conference in 2008 in bloom. It is potted and growing in my shadehouse which used to house our orchid collection. I sold most of the orchids but have some mounted in the garden. I have had *T. marconae* for many years and it has never bloomed. I wonder if it ever will! I have just lost *T. kegeliana* again, damn! They seem difficult. I will be sensible (not easy when it comes to broms!) and not import any more. I have to accept that I can't grow it. *T. roland-gosselinii* doesn't do well for me either. I have lots ands lots of *T. ionantha* varieties. *T. magnusiana* is said to be difficult to grow but luckily mine do well. I think if you read that a particular plant is a difficult grower you will probably struggle with it and probably kill it by fussing too much. Sometimes the less you know the better! *T. gardneri* grows prolifically and has seeded itself on anything and everything! I have some *T. disticha*,*T. ionantha*, *T. seleriana*, *T. neglecta* and *T. rodrigueziana* growing on rocks as well as *T. aizoides* and *T. peiranoi* but these two species are extremely slow growers.

Trevor helps me foliar feed every two weeks in the growing season. Currently we are using a combination of Phostrogen, a tomato food, and Epsom Salts (magnesium sulphate). I am not too clued up about all this fertilizing stuff but it excites me when

Figure 5. A section of the succulent bromeliads, mostly *Dyckia*, in my collection. The golf balls are in memory of my horticulturist Dad, who taught me to love plants at a young age. Photo by Lyn Wegner.

I see healthy new roots developing!

The *Deuterocohnia lorentziana* have formed nice 'pin cushions' and they are blooming now, interesting little greenish inflorescences. They are grown in 6 inch pots & I use the same potting soil (supplied by a nursery) that I use for all my plants. I have a good *Dyckia* collection and some *Orthophytum* and *Hechtia* too (Fig. 5). They all bloom regularly. I love the tall branched flower spike of *Hechtia guatemalensis*, also the pink succulent foliage of *H. rosea*. *Hechtia texensis* is going to be a beauty. *Orthophytum* 'Shooting Stars' makes quite a display with all its 'shooting stars'. It is also positioned in a stand in lots of sun. I struggled with *O. navioides* but my final attempt, a DeRoose clone, is growing! I find some of the *Orthophytum* really need to be grown in hanging baskets as they can take up a lot of space and look a bit messy. I have lots of nice *Dyckia* but some were just getting too big. I had potted them on & on & on! I find it too difficult to divide most of the clumps. I made the painful! decision to part with the green varieties and then planted five large colourful clumps, such as *Dyckia* 'Big Black' and the beautiful silver bigeneric x*Puckia* 'Sparkle' into a small bed with *Aechmea* 'Suenos' and *A.* 'Phoenix' squeezed in between! It won't be too long before I have a space problem!

I have some very nice bigeneric bromeliads. The x*Neophytum* are planted in 6 inch pots, which are positioned in stands in a sunny bed. They display well and I can plant underneath them. x*N.* 'Galactic Warrior' and x*N.* 'Lisanne Kiehl' are looking spectacular. x*Quesmea* 'Dart' has a beautiful pendulous flower spike. *Quesnelia edmundoi* x *A. orlandiana* has spectacular dark foliage which I would say is black it is so dark. I have one growing mounted in harsh sun and another in very little sun, also mounted but both have the same black foliage. x*Neotanthus* 'Cardboard' is aptly named. The attractive foliage is very cardboard-like. I like the mini x*Neomea* 'Munchkin' and x*N.* 'Dotty'. Of course there are many more that I like!

I have quite a collection of foliage *Vriesea* (Fig. 6) and they grow and bloom well. Most of them grow in a pretty shady area of the garden in pots but I plan to move some into brighter light which I know will enhance the foliage. I just have to find a space! I am slowly planting these directly into the garden. I find the plants get really big in the pots and the soil becomes very wet and muddy and I'm nervous they could rot. They have been growing like this for years but I don't want to risk losing any! I don't have too many of the pinks which are my favourite (I think!) There are many other beautiful *Vriesea* growing in the garden and shadehouse such as *V.*'Galaxy', *V.* 'White Zombie' , *V.*'White Cloud' and *V.* 'Margarita'. I have a variety with pendulous inflorescences and love the 'powdery' look of the inflorescence of *V. pardalina*. *Vriesea philippo-coburgii* and the variegated form *V.*'Rafael' grow in bright light and are potted although I have recently put a clump up in a tree. I was excited when they bloomed for the first time a couple of years ago. Spectacular flower spikes that I enjoyed watching develop.

I love *Guzmania* too! Most of the *Guzmania* are in pots in the garden, in shade (Fig. 7), with a few in a shadehouse (Fig. 8). Blooming now is *Guzmania monostachia*, *G.* 'Fortuna' and various other *G. lingulata* forms, as well as many of the 'torch' inflo-

Figure 6. A group of *Vriesea fosterianus* hybrids. It is hard to imagine more spectacular foliage plants. Photo by Lyn Wegner.

rescence varieties such as the beautiful variegated *G.* 'Georgia'. *G. acorifolia* recently bloomed for the first time.

Some other genera growing in the shadehouse include *Nidularium*, *Canistropsis*, and *Catopsis*. Also *Lymania*, *Araeococcus* and *Ronnbergia* but these three are not doing well.

I have two *Fosterella micrantha* which I have had for years. They grow in the shadehouse but their very soft leaves are now looking tatty and very nibbled. I presume the snails like them. They bloomed a few years ago.

Nidularium looking spectacular and blooming now are the huge *N. innocentii* 'Bahia variegated' (Fig. 9) and *N. innocentii* yellow variegated. I love the colour of the flower of *N. antoineanum*. Is it bluey lilac? I also like *N. campos-portoi* very much. I have the giant form too which is about to bloom for the first time.

I grow both the *Acanthostachys* species, *A. strobilacea* and *A. pitcairnioides* successfully. I read somewhere these two are difficult to grow. They are potted and positioned in stands in full sun. They don't get much water.

I don't feel confident about growing *Pitcairnea*. *Pitcairnea integrifolia* is blooming again now and I don't struggle with this one. It was unnamed until Harry Luther and Uncle Derek identified it for me. It has a beautiful large orange flower. The leaves are long and quite smooth edged except towards the base of the leaf where they are quite

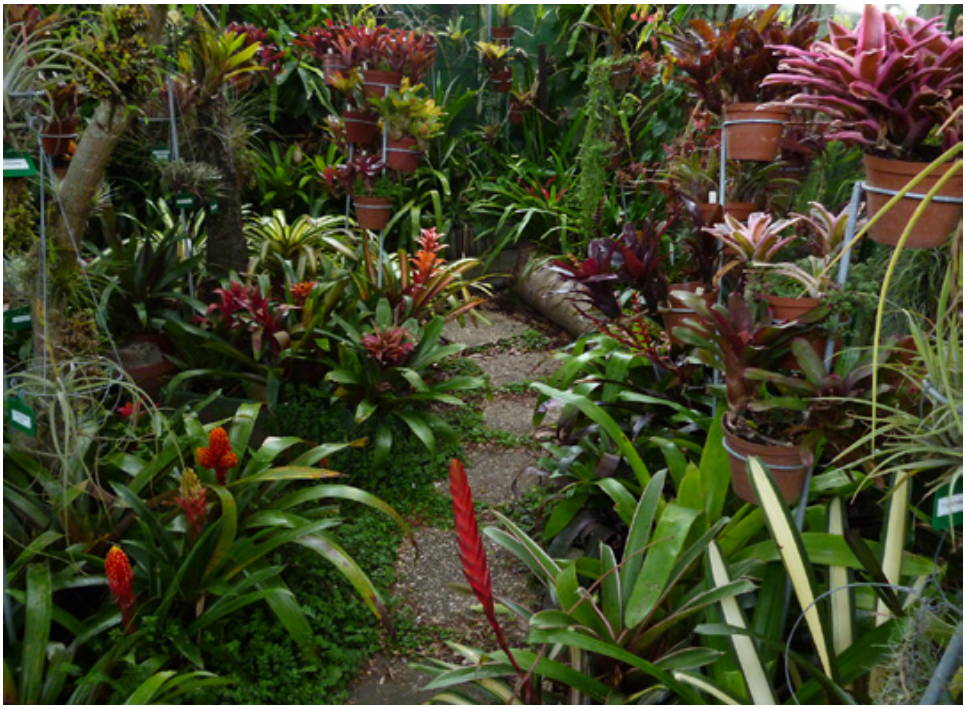

Figure 7. Low light plants, including *Guzmania*, *Nidularium* and *Vriesea*, growing in a shady part of the garden. Photo by Lyn Wegner.

spiny. It was potted until about a year ago and it is now planted in the garden in a shady spot with some light early morning sun. I try to keep them well watered. I was hoping it would give me more than one flower this time as it is a nice clump. I recently added *Pitcairnea burle-marxii*, *P. echinata* and *P. funkiae* to my collection. They don't look very happy! I'm sort of ignoring them and hoping for a miracle! It works sometimes!

I struggle with *Ananas* too. East London is pineapple growing country so I would expect to do better with them! I grow them in a sunny position, some potted but I don't really fertilise them which could be part of my problem. I have decided I don't need to have them in my collection!

Neoglaziovia does well and has bloomed. It is potted and grows in full sun.

I have a few *Portea alatisepala*, both the green and purple foliaged varieties. A very pretty site when they all bloomed in a shady corner.

Hohenbergia castellanosii grows and pups well in lots of sun but it is completely green with no sign of red on the foliage unfortunately. I don't think I like it. *Hohenbergia catingae* and *H. ramageana* also bloom & pup freely but they don't excite me, also in a very sunny spot. *H. correia-araujoi* are planted in tall pots so their lower leaves can be displayed. They grow well and flower too in plenty of sun. *H. stellata* is a beauty and blooms freely in a bright shady spot. *Hohenbergia burle-marxii* which has beautiful

mottled foliage, has a flower spike developing for the first time. It is potted and grows in lots of sun. *Hohenbergia disjuncta* is mounted in a sunny spot. It blooms regularly and I find it's bright pink 'flags' are eye catching. I am very fond of it. [Editor's note: This species was recently moved into the genus *Aechmea*, and is considered to be a member of the *Aechmea orlandiana* complex by Elton Leme.]

Figure 8. Shade-loving plants, mostly *Guzmania* species and hybrids growing in the shadehouse. Photo by Lyn Wegner.

I needed to split *Bromelia* 'Que Sera' (of course, that should say Trevor needed to split!) which looks like it is thinking about blooming as it has a faint pink blush. Great excitement! It is potted to try to restrict its growth. It consisted of two main plants and two pups with lots of stolons so I will have more problems soon! Trevor survived the separating ordeal but I don't think he will be in a hurry to repeat that prickly procedure. I had lots of *Bromelia balansae* which filled quite a big area and I decided to give them away to whoever was brave enough to remove them. It then gave me a new space to fill with bromeliads, mainly *Aechmea*, *Alcantarea* and *Neoregelia*. Of course this space is now choc a bloc too!

I used to feel a desperate need to replace any plant that died but I have calmed down over the years and accepted (almost!) that I don't have to have every bromeliad available.

I envy growers who can restrict themselves to one or two genera but I am disappointed that most growers, I think, seem to focus on *Neoregelia* only, with *Tillandsia* a close second. There are so many other exciting genera. I have realized I am very lucky to have such an ideal climate for growing bromeliads. I can't imagine what it must be like worrying about hurricanes, cold temperatures, frost and even snow. In East London we have a mild winter and summer rainfall with plenty of humidity too. Some parts of South Africa experience snow, frost,cold and wet Winters or very hot dry Summers.

A question I am often asked is whether I do any hybridizing. Strangely it has never interested me although it must be exciting to see the results. I think space is probably my main concern and then the time you need, from pollinating to record keeping plus the whole process takes quite a long time before you have results. Another huge problem for me would be culling plants before they have reached their potential. I suppose this is something you learn as you become more experienced. There are quite a few hybridizers in South Africa and I'm sure their plants will be in demand in the coming years.

Bromeliad judging does interest me, I think! I say I think, as I don't know what it entails. Of course a huge problem and pity is that the judging school is held only in the USA which is a big problem for anyone living outside of the USA.

I enjoy my numerous bromeliad books and journals and refer to them often. It would be nice if someone could publish a book similar to Baench's Blooming Bromeliads which was published a long time ago, in 1994, as many more species have been discovered and there are so many more hybrids.

It was a dream of mine for many years to attend one World Conference. I have now attended four, Cairns, Australia 2008, 2010 New Orleans, 2012 Orlando, 2014 Hawaii as well as the New Zealand Australasian Conference in March 2013. This will probably be my last due to the costs involved, in particular the air flights. Strangely the highlights for me seem to be the people more than the plants (of course I love the plants too). I think being with so many brom enthusiasts, hybridizers, nursery people, book authors from all over the world is a really special experience. The garden visits are another highlight. I am always looking for new ways to display plants in my garden.

Figure 9. *Nidularium innocentii* 'Bahia variegated' in full bloom. Photo by Lyn Wegner.

I know I am lucky to have Trevor tolerate my obsession with broms. It's not easy living with a brom addict! He is always willing to 'come and have a look' at whatever I want to show him and responds enthusiastically! He has even just recently again tried to cross-pollinate two billbergia. I cut off his previous attempt by mistake! We may have another Don Beadle in a couple of years!

Our garden is open to the public and although Trevor is not a plant person I have heard him giving advice and info on bromeliads to visitors when I am busy! I am really proud of him!

I am very grateful to Michael's Bromeliads & Tropiflora for exporting bromeliads to South Africa, in particular. Dennis has actually visited our garden, wow! and I'm waiting for Michael to visit! Thank you too to all the other wonderful brom suppliers, hybridisers and authors of my precious bromeliad books. I have been excited to meet many of you at the conferences.

I become more passionate about bromeliads every day! You might have heard me say that for knowledge I could maybe get 6 out of 10, but for passion I get 10 out of 10, and a heap of gold stars!

PS There are many more broms in my garden I haven't mentioned, but that doesn't mean they aren't very special to me too!

Studies on *Orthophytum* - Part XII: rediscovering *Orthophytum duartei*

Elton M. C. Leme[1]

After the publication of the last article of the series entitled "Studies on *Orthophytum*" (Leme & Fontana 2010) we interrupted this series to wait the conclusion of the taxonomic revision of the genus accomplished by the Brazilian botanist Rafael Louzada in 2012 (Louzada, 2012). Despite the huge contribution provided by Louzada in his revision, some gaps on the knowledge of *Orthophytum* remained. One of these is related to *O. duartei* L. B. Sm.

Orthophytum duartei was named after its collector, the botanist Apparicio Pereira Duarte (1910–1984) from Rio de Janeiro Botanical Garden, Brazil. According to the protologue of the species (Smith 1966), Duarte collected the holotype specimen in 1953, as a rupicole, forming gregarious colonies or sometimes associated with other Bromeliaceae and Velloziaceae, between the north of Espírito Santo and the county of Nanuque, Minas Gerais State. The paratype specimen was also found by Duarte in 1953, at the same region, forming small groups of plants on rocky outcrops near the margins of Itauna river, but without indication of precise locality.

The region where the type specimens were collected is characterized by low elevation flatlands, originally covered by Atlantic Forest, but mostly deforested in past decades mainly by cattle ranching activities. Only small, disturbed fragments of the original forest remain. The altitude is about 50 to 150 m, but there are isolated rocky outcrops of different dimensions. The larger ones form inselbergs of 200 to 460 m elevation. Since the precise locality of the collections was neither provided for the holotype nor for the paratype, we speculate *O. duartei* lived on those isolated rocky outcrops, in altitudes of 200 to 460 m. However, the species has never been recollected in the type region, despite the efforts to find it.

The postulated habitat preference of *O. duartei* was strongly reinforced by the discovery in 2006 of a new subpopulation located 200 km southward, in the county of Santa Teresa, Espírito Santo, in an area about 330 m elevation. More recently, another subpopulation was found at the same county, about 10 km distant in straight line, living in identical ecological conditions. Flowering specimens from new subpopulation led to the expanded description of the species presented below.

Orthophytum duartei L.B. Sm., Phytologia 13: 462, pl. 1, figs. 21, 22. 1966.

Type:—Brazil: Espírito Santo, north of Espírito Santo and Nanuque, Minas Gerais, 10 November 1953, A.P. Duarte 3910 (holotype US!, isotype RB!).

Plant terrestrial, flowering 18–36 cm tall, stemless, stoloniferous; stolons slender, 8–20 × 0.2–0.3 cm, bearing laxly arranged cataphylls; cataphylls oblong to suborbicular, acute, green, irregularly spinulose near the apex, 10–13 × 8–11 mm, recurved, distinctly

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Figure 1. A-D. *Orthophytum duartei* (Duarte 3910). A. Holotype (US). B. First exsiccate of the isotype (RB). C. Second exsiccate of the isotype (RB). D. Third exsiccate of the isotype (RB). E. Paratype of *O. duartei* (Duarte s.n.; RB). Figure prepared by Elton Leme.

Figure 2. Region of Nanuque, north of Minas Gerais, with partial view of an inselberg and the flatlands along Mucuri River. Photo by Elton Leme.

shorter than the internodes, disintegrating with age. *Leaves* 5–12 in number, spreading to arcuate, thinly coriaceous, forming a distinct rosette before anthesis, the upper ones not distinguishable from the basal peduncle bracts due to the elongation of the stem at anthesis; sheaths inconspicuous; blades linear to sublinear-lanceolate, ending in a caudate apex, 15–25 × 2–3 cm, slightly narrowed and canaliculate toward the base, without a distinct thicker median zone, flat toward the apex, green, upper and lower sides slightly if at all contrasting, abaxially subdensely to densely white lepidote and distinctly nerved, adaxially inconspicuously and sparsely to subdensely white lepidote near the base and glabrous toward the apex, margins undulate, densely to subdensely spinose; spines 0.5–2.5 mm long, 3–10 mm apart, nearly straight to antrorsely uncinate, green. *Peduncle* 5–7 cm long, 0.7–0.8 cm in diameter, green, densely whitish lepidote; *Peduncle* bracts foliaceous. *Inflorescence* fasciculate, elongate, erect, 12–25 cm long; main axis straight to slightly flexuous, smooth, terete, densely cinereous lanate; primary bracts foliaceous to subfoliaceous, spreading-recurved, distinctly exceeding the fascicles; fascicles 6–9 in number, laxly arranged, 2–4 cm apart, subflabellate, 18 × 10–14 mm (excluding the petals), 2–3-flowered; floral bracts narrowly subtriangular-lanceolate, acuminate, 10–16 × 7–8 mm, green, nerved, submembranaceous toward the base and along the margins, densely white lepidote toward the apex, slightly shorter to equaling the sepals, entire, carinate. *Flowers* sessile, 2.6–2.7 cm long, lacking fragrance; sepals narrowly ovate-lanceolate, acute and long apiculate-caudate, 10–12 × 3.5–4 mm, free,

Figure 3. General view of the habitat of *Orthophytum duartei* in Santa Teresa, Espírito Santo, where it was found in 2006. Photo by Elton Leme.

entire, nerved, green, subdensely white lepidote toward the apex, the adaxial ones carinate with keel decurrent on the ovary, the abaxial one ecarinate. *Petals* spathulate with a narrow base and a broadly elliptic to suborbicular blade, rounded, 20–21 × 6 mm, free, white, distinctly exceeding the stamens, blades spreading at anthesis, bearing at the base 2 appendages as well as 2 longitudinal callosities equaling the anthers; appendages thick with membranous, subentire to dentate margins, ca. 7 mm above the base; filaments the antepetalous ones ca. 13 mm long, adnate to the petals for ca. 8 mm, the antesepalous ones 14–15 mm long, free; anthers ca. 1.5 mm long, dorsifixed near the base, slightly complanate laterally, base obtuse, apex apiculate; pollen ellipsoid, sulcate, reticulate to microreticulate, lumina subrounded, muri slightly thickened; style about equaling the anthers; stigma conduplicate, white, blades suborbicular, suberect, ca. 1.5 mm in diameter, margins subentire; ovary ca. 5 × 4 mm, trigonous, greenish-white, glabrous; epigynous tube inconspicuous; placentation apical; ovules greenish, obtuse to obtusely apiculate. *Fruits* obovoid, greenish-white, ca. 7 × 5 mm; seeds numerous, 1.2–1.5 × 0.9–1 mm.

Additional specimens examined:—BRAZIL. Espírito Santo: Rio Itaúnas, 1953, A.P. Duarte s. n. (paratype RB!); Santa Teresa, Vale do São Brás, Escola Federal Agrotécnica de Santa Teresa, 330 m elevation, 19° 47.97' S, 40° 41.68' W, 29 September 2006, E. Leme 6911, L. Kollmann, A.P. Fontana & M. Zanoni (RB!); ibidem, E. Leme 6912, L. Kollmann, A.P. Fontana & M. Zanoni (RB!); Ibidem, Vinte e Cinco de Julho, 316

Figure 4. First subpopulation of *Orthophytum duartei* found in 2006. Photo by Elton Leme.

m elevation, 19° 49' 46.2" S, 40° 36' 26.5" W, 22 June 2014, E. Leme 8919, L. Kollmann, & V. Leme (RB!).

In the two subpopulations of Santa Teresa, *O. duartei* forms small groups of individuals growing on shallow organic soils accumulated on inclined rocky outcrops partially shaded by short trees, in the transition zone to the full exposed rocky environment, which explains its comparatively delicate leaf texture, an adaptation to such a mild habitat condition. On the basis of the criteria "B1a" and "B2a" of IUCN (2010), *O. duartei* must be considered a critically endangered species.

Orthophytum duartei was associated in its protologue (Smith, 1966) to *O. foliosum* L.B. Sm. (Smith, 1941), but differences of *O. foliosum* are striking, e.g. distinctly larger size, coriaceous leaves, much larger and many-flowered fascicules, which are densely arranged toward inflorescence apex, tubular corolla, and it can not be considered even a close relative. Louzada (2012) recognized some morphological similarities to *O. fosterianum* L.B.Sm. (Smith, 1958), which grows in the same region, but differences put them very far apart, like propagation by means long slender stolons in *O. duartei* (vs. short shoots produced at the base rosette and at the apex of the inflorescence), leaves lepidote (vs. sublanate with filamentous trichomes), leaf blades with undulate margins (vs. straight margins), inflorescence 12–25 cm long (vs. ca. 5 cm long), with laxly disposed fascicles (vs. fascicles densely disposed and inflorescence simple toward the apex), primary bracts foliaceous to subfoliaceous, distinctly exceeding the fascicles (vs. slightly exceeding to equaling the flowers), petals with suborbicular blades, spreading at

Figure 5. Second subpopulation of *Orthophytum duartei* found in 2014. Photo by Elton Leme.

anthesis (vs. elliptic, erect or suberect) and twice broader, petal appendages thick with membranous, subentire to dentate margins (vs. distinctly fimbriate), to name a few.

In its general appearance, *O. duartei* can be easily confused with some species of *Cryptanthus* subg. *Hoplocryptanthus* from the mountains of Espírito Santo state, due to

Figure 6. Habit of *Orthophytum duartei* in bloom (Leme et al. 6911). Photo by Elton Leme.

the comparatively soft leaves with slightly undulate margins, the inconspicuous fascicles of flowers and the broad-bladed, spreading petals. However, the reduction of the number of leaves per leaf-rosette by the strong elongation of the stem/scape/inflorescence at anthesis, its free sepals and petals (vs. distinctly connate in *Hoplocryptanthus*), the presence of well developed petal appendages (vs. naked petals in all *Cryptanthus*), and the laterally complanate anthers (vs. not complanate in *Cryptanthus*) make comfortable the inclusion of this taxon in *Orthophytum*. In fact, the combination of characteristics exhibited by *O. duartei* separate it widely from all other species of *Orthophytum* and gives it a unique position in the genus yet to be clarified in further studies of phylogeny involving the Cryptanthoid complex (i.e., *Cryptanthus*, *Lapanthus* and *Orthophytum*).

Acknowledgments

I thank André P. Fontana, Ludovic J. C. Kollmann, Marcos Zanoni and Vanessa Leme for their support and companionship during field activities and for providing some of the specimens and field information used in this study.

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Figure 7 (left). Details of the floral fascicles of *Orthophytum duartei* (Leme et al. 6911). Photo by Elton Leme.

Figure 8 (Right). Details of the flower of *Orthophytum duartei* (Leme et al. 6911). Photo by Elton Leme.

Tillandsia werner-rauhiana, A Spectacular New Species from Western Mexico

Pamela Koide-Hyatt

Thirty years ago, in May of 1984, I collected an unidentified *Tillandsia* species from the state of Jalisco, Mexico, with a large pendent pink inflorescence. I knew that it was different, as the nearly six foot pendent inflorescence was not like anything that I had encountered before. The other large pendent *Tillandsia* species from Mexico that I was familiar with were *T. eizii* L.B.Sm. (Smith 1974) and *T. prodigiosa* (Lem.) Baker (Baker 1888). These are quite different from this species in Jalisco. It was early in my years of exploring Mexico, and I was not experienced enough to make the diagnosis. In 1985, my friend, Bill Baker, introduced me to Professor Werner Rauh who was the keynote speaker at the biennial convention of the Cactus and Succulent Society of America, held in San Diego. I invited Professor Rauh to visit my nursery and this was the beginning of a friendship that lasted until the end of his life in 2000.

When Professor Rauh arrived at my nursery this unidentified species was in full bloom (Fig. 1a). He was quite surprised to see the large hanging inflorescence with long exserted stamens, which did not resemble any Mexican *Tillandsia* species. He stated that it reminded him of *T. clavigera* Mez (1896), a South American species. He later determined the species was new to science and named this new species *T. pamelae* Rauh (Rauh 1986).

Over the years, I have returned to the type locality and surrounding areas in search

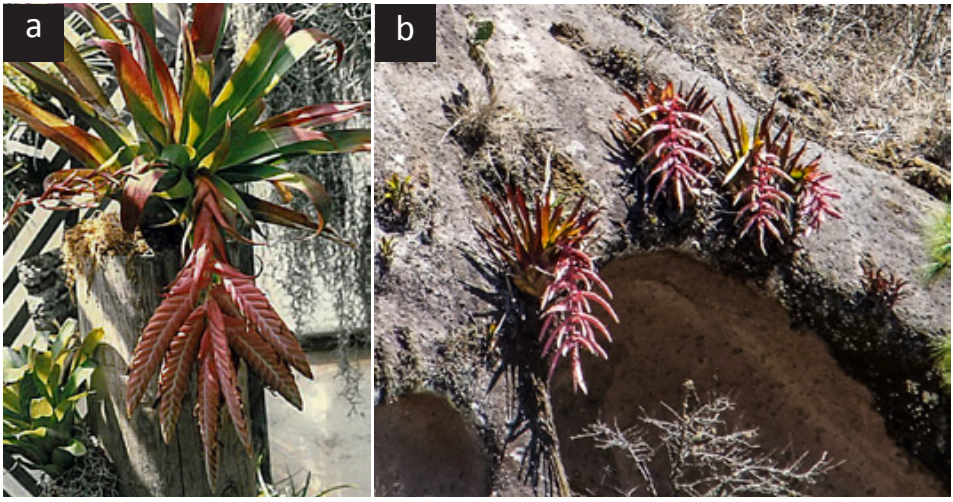

Figure 1. a. *Tillandsia pamelae* in bloom at the time of Dr. Rauh's visit to the author's nursery in 1985. Photo by Pam Koide-Hyatt. b. The population at Quila El Grande with many plants in bloom. Photo by Andy Siekkinen.

Figure 2. Population of *Tillandsia pamelae* at Quila La Grande in 1982. In addition to the scattered seedlings of *T. pamelae*, a single plant of the the new *Tillandsia* species can also be seen if you know what to look for (see Fig. 4 for a closer view). Photo by Pam Koide-Hyatt.

Figure 3. A seedling of *Tillandsia werner-rauhiana* in the wild. Photo by Pam Koide-Hyatt.

of other populations of *T. pamelae*. In 1993, in nearby Quila El Grande, I found another lithophytic population of *T. pamelae*. (Fig. 1b) It was growing side by side with another distinct species, which was not in bloom, and I could not identify (Fig. 2, 3 and 4).

This distinct species (Fig. 3) had significant differences from *T. pamelae* (Fig. 4). The leaves were similar in texture but more narrowly triangular and nearly filiform attenuate. The *T. pamelae* leaves are ligulate and acuminate. Now with 13 years of field experience, I was able to recognize that this was perhaps a new species. I collected a few of the plants with these characteristics and continued to grow them until the first one bloomed in early 2000. I first exhibited a blooming specimen at the San Francisco

Figure 4. A *Tillandsia werner-rauhiana* seedling (lower and to the left) growing near a *Tillandsia pamelae* seedling (slightly above and to the right). Photo by Pam Koide-Hyatt.

World Bromeliad Conference in June, 2000.

I often thought of an article by Miguel Cházaro-Basañez (1994), who stated that *T. pamelae* was occasionally epiphytic (growing on trees). I have never seen this species growing epiphytically, but wondered, if it was growing in trees, what was growing with it? Was it possible that this unidentified species was in fact a natural hybrid with *T. pamelae* as one of the parents?

In 2003, Hiroyuki Takizawa and I returned to the locality of this unidentified species to verify that this new plant was indeed a new species and not of hybrid origin. After exploring the nearby region, we were unable to locate any other species that might have had the opportunity to naturally hybridize with *T. pamelae*. We were also searching for the epiphytic population of *T. pamelae*, but were unable to locate any plants growing on trees.

Tillandsia werner-rauhiana P. Koide-Hyatt & H. Takizawa, sp. nov.

TYPE: Mexico, Estado Jalisco, Quila El Grande, Feb. 1993, W. Schuster & P. Koide s.n., legit; flowered in cultivation 2000, P. Koide s.n. (Holotype:SEL, Isotype:MEXU)

A *T. pamelae* Rauh, cui affinis, foliis magnis expansisque non erectis, anguste triangularibus, inflorescentia erecta ad arcuata non pendula differt.

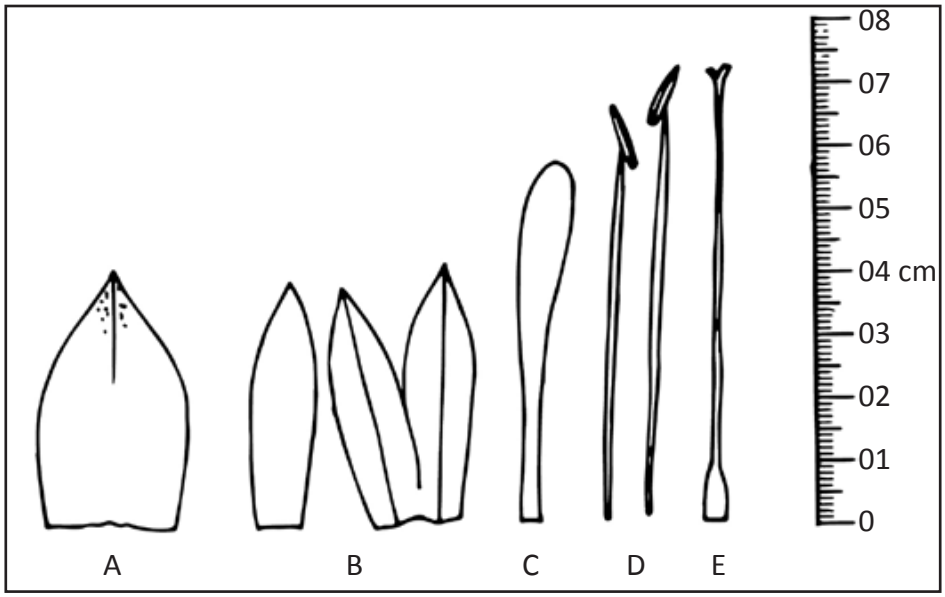

Figure 5. Floral parts of *Tillandsia werner-rauhiana*. A. Floral bract, B. Sepals, C. Petal, D. Anthers and filaments and E. Ovary, style and stigma. Figure prepared by Hiroyuki Takizawa.

Plant a lithophyte, flowering 1 - 1.2 m tall. Leaves densely rosulate, spreading to recurving, 60 - 90 cm. long, coriaceous, grey-green. Leaf sheaths elliptic, 18 - 22 cm x 10 -12 cm, castaneous, finely appressed-lepidote. Leaf blades narrowly triangular, filiform-attenuate, 7 - 8 cm wide, channeled, very finely appressed-lepidote especially abaxially, appearing glabrous, glaucous. Peduncle erect to arching, 40 - 60 x 3 - 4 cm., nearly glabrous, glaucous. Peduncle bracts narrowly triangular, erect, densely imbricate, nearly glabrous adaxially, finely appressed-lepidote abaxially. Inflorescence erect to somewhat arching and ascending, once-branched, 90 - 100 x 40 - 50 cm., with 20 to 30 lateral branches. Primary bracts: the lowest narrowly triangular, subfoliaceous and exceeding the branches, the upper much reduced, elliptic, acute, rose and grey-green or completely rose. Branches 3 - 5 cm. apart, the stipe 15 - 20 mm, spreading at 60 - 90° from the axis at maturity, the upper 20 - 25 x 4 - 5 cm, distichously 20 to 25 flowered. Floral bracts elliptic, acute, 3.8 – 4.5 cm x 2.2 cm, somewhat nerved, carinate and lepidote toward the apex, remaining imbricate, pale green to rose, glaucous. Flowers sessile, opening during the day. Sepals narrowly elliptic, acute, 3.5 cm x 9 mm, nerved, the adaxial pair carinate and short-connate (ca. 5 mm). Corolla erect, tubular. Petals linear-ligulate, broadly acute, 5 – 5.5 x 0.7 cm(see fig. 5) naked, violet. Stamens exserted, 5.5 – 5.8 cm long; filaments violet distally, white proximally; anthers versatile, yellow. Style exserted, 55 mm long, violet distally, white proximally. Ovary 7 x 5 mm, conical, green.

Figure 6. The author standing immediately behind a flowering plant of *Tillandsia werner-rauhiana* for scale. Photo courtesy of Pam Koide-Hyatt.

Figure 7. Close-up of some flowering branches on *Tillandsia werner-rauhiana* showing off an open flower. Photo by Pam Koide-Hyatt.

Tillandsia werner-rauhiana (Figs. 6, 7 and 8) differs from *T. pamelae* (Fig. 9) by being much larger in size, with a larger, more spreading leaf rosette. The leaf-sheaths are larger, castaneous; the leaves are narrowly triangular, nearly filiform at the apex. The inflorescence is arcuate (arched) to erect, never pendent. The basal primary bracts distinctly longer; lower spikes distinctly stipitate. Floral bracts are light rose to rose colored near the base, pale green and glaucous near the apex. Petals are violet, and somewhat shorter (Fig. 8). Details of the floral parts are shown in Figure 5. It can be cultivated in the same manner as *T. pamelae* and will begin to produce adventitious offsets when it has reached one half of its mature size. It also occasionally pups after blooming.

We name this new species *Tillandsia werner-rauhiana*, to honor Professor Werner Rauh (1913-2000). Professor Werner Rauh was the director of the Heidelberg Botanical Garden from 1960 until 1982. His career included numerous expeditions between 1950 and 1994. He traveled extensively throughout South America and Africa, with an emphasis on Madagascar. During these field trips he discovered and or described more than 1200 plant species, subspecies and varieties. His herbarium collection includes 80,000 vouchers, mostly collected by Werner Rauh. His published works include more than 300 items; articles, journals and books on Bromeliads, Cactus and Succulents, and thousands of excellent photographs. His work in Madagascar culminated with the two volumes of Succulent and Xerophytic Plants of Madagascar, (1995 &1998). Werner Rauh left behind his 78 field notebooks with a total of 8,812 handwritten pages, which are now archived in Bonn, and are part of the Werner Rauh Heritage Project at Heidelberg Botanical Garden and Herbarium (Koch et al. 2013). The goal of this project is to create a relational database to store all of the information found in these field books, as well as to link this information to actual taxonomy and to the botanic garden's existing database. More information about this project can be found at: http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_enews/newsletter/issue41/bibliography/A_treasure_trove_of_plant_biodiversity.PDF

We are delighted to honor Professor Werner Rauh by naming this impressive *Tillandsia* species after him. Another very large, saxicolous species with a semi-pendent inflorescence was also named in his honor over 50 years ago: the Peruvian *T. rauhii* L.B.Smith (Smith, 1958). His name is also found in species among many other genera of bromeliads (and succulents). The Tillandsioid genus *Werauhia*, also named in his honor, contains over 90 known species at present. These names serves as a constant reminder of the important role Professor Rauh played in advancing our knowledge of bromeliads and succulents over his long career.

Acknowledgments

We would like to thank the late Harry E. Luther, former Director of the Mulford B. Foster Bromeliad Identification Center for his assistance and advice in the prepara-

tion of the plant description. We are very grateful to Walter Till, Eric Gouda and Alan Herndon for their valuable comments and constructive reviews of this manuscript. Bruce Holst of Marie Selby Botanical Gardens uncovered the material of this species originally sent to Harry Luther, and converted it into a proper type specimen.

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Figure 8 (above). Flowering plant of *Tillandsia werner-rauhiana*. Photo by Pam Koide-Hyatt.

Figure 9 (right). Flowering plant of *Tillandsia pamelae* for comparison with *T. werner-rauhiana* in Fig. 8. Differences in rosette and leaf shape are clearly seen, with the widely spreading rosette of *T. werner-rauhiana* having leaves narrowly triangular as compared to the more erect leaf blades that remain wide nearly to the tip on *T. pamelae*. Aside from the stark contrast between the pendulous inflorescence of *T. pamelae* and the ascending inflorescence of *T. werner-rauhiana*, you can also see the difference in inflorescence color and the greater degree of separation between the floral bracts on *T. pamelae*. Photo by Pam Koide-Hyatt.

Return to Panama - Part 2

Bruce Dunstan

On the second leg of our expedition. Carla and I headed to Cerro Chucante (Fig. 1) and a privately owned mountain top forest reserve. It is in a very isolated range called the Serrania de Maje, which has the only tall mountains on the Pacific side of Panama between Panama City and the Darien. I was particularly interested in seeing if the mountain contained any locally endemic plants of which Panama has a few.

We had booked our accommodation and guide in the weeks before the trip but only got confirmation when we came back into phone range after getting out of the Darien. After a quick stop to buy food and supplies and another stop at the Fronterizo to get our details recorded again, we met our guide, Luchio and the horses that were going to carry all our gear and us up the mountain.

Figure 1. Cerro Chucante. Photo by Bruce Dunstan.

Once again we were close to sea level and although it was the start of the wet season the temperature was hot with hardly a cloud in the sky. We had about 1000 m altitude to gain and a 4 hour horse ride to endure. As we gained altitude thankfully it cooled off a little and the forest duly changed. We were lucky to ride right under a group of black spider monkeys as they jumped energetically from tree to tree. From the forest above we could also hear the roaring of howler monkeys as they called out to each other. The other sound that dominated was that of chainsaws. All the surrounding hills were being logged and cleared for cattle. The new settlers in this part

of Panama have come from the Azuero Peninsula, one of the driest parts of Panama and they know how to clear forests as none remain in Azuero anymore. When the land reserve was purchased, Guido the new owner, then had to buy the logging rights for the mountain. This cost $12 per tree deemed big enough to be worth logging. Money well spent about 10 years ago.

The remote location means there are some very interesting heliconias growing in the forest that Carla had found 6 years ago when she visited. After getting our gear and food stored Carla and I headed up the trail to look for more plants.

The main trail that is maintained is a loop track that takes you up to the peak and across the ridge then back down. This track takes 8 hours as it is quite steep getting up to the peak and ridge and very steep coming back down. My toes had settled down but an infection on my instep caused by constant rubbing was making walking painful still. Carla and I headed up the very steep side hoping to get to as much altitude as quickly as possible. We could see what we thought was the summit through the forest but it turned out to be the edge of the forest reserve with a border of forest meeting a farmer's cleared land. Onwards we went, upwards, until we decided we weren't going to make it in the remaining daylight and we turned for home making the descent much quicker than the uphill climb.

Waking up to howler monkeys is quite a surreal experience, better than a clock-radio alarm, but still a little disturbing for an urban dweller like myself. After breakfast we headed back up the mountain but, this time, via the slightly easier route. As we climbed once again we saw more interesting plants, stopping for calatheas, anthuriums and renealmias. I couldn't get over the number of frogs we saw. Obviously the chytrid fungus that has wiped out huge numbers of frogs around the world hasn't made its way to Cerro Chucante. The number of turquoise and black poison arrow frogs (Fig. 2) was wonderful as I generally had only been able to spot the odd individual on previous

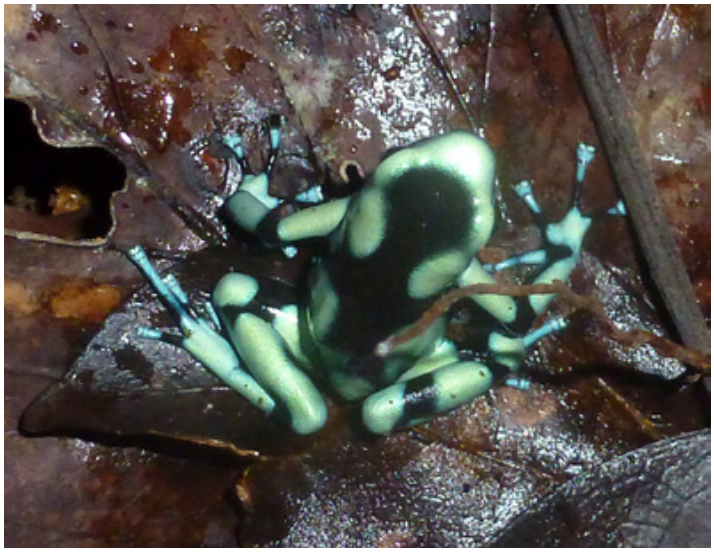

Figure 2. Poison Arrow Frog (*Dendrobates auratus*) is common on Cerro Chucante. Photo by Bruce Dunstan.

Figure 3. *Tillandsia anceps* in the forest on Cerro Chucante. Photo by Bruce Dunstan.

trips in Panama. Getting further up the hill we spotted what appear to be *Tillandsia tricolor* that had fallen out of the tall trees along with *T. anceps* (Fig. 3) and *T. bulbosa*. A little higher and we were starting to see *Guzmania* species with *G. glomerata* (Fig. 4), *G. butcheri* (Fig. 5) and what may be *G. circinnata*. We stopped to photograph a *Heliconia spathocircinata* and, while we were engrossed in doing that, a coati, a raccoon relative, climbed down one of the adjacent trees and ambled around completely ignoring us and then wandered back up the same tree. Once again the remote location was allowing us

Figure 4. *Guzmania glomerata* on Cerro Chucante. Photo by Bruce Dunstan.

Figure 5. *Guzmania butcheri* growing wild on Cerro Chucante. Photo by Bruce Dunstan.

Figure 6. *Guzmania* sp. aff. *mitis* as seen on Cerro Chucante. The inset in the upper right corner shows a closer view of the inflorescence. Photos by Bruce Dunstan.

Figure 7. *Guzmania circinnata* or an undescribed species previously found by Chester Skotak in the Serrania de Jungurudo. This plant seen on the trek down Cerro Chucante Photo by Bruce Dunstan.

to see wildlife we generally don't see.

Higher up we found a green *Guzmania* that resembles *G. mitis* (Fig. 6) but has some varying characters. As we reached the peak we spotted large numbers of *G. elvallensis*. Originally *G. elvallensis* was thought to be only found at El Valle in Panama but I have seen it growing at El Cope to the west of El Valle and now way down on the Panama/Darien province border. We also saw what will probably turn out to be *Guzmania circinnata* flowering up in the trees (Fig. 7), but Chester Skotak holds out some hope it might be a new species he found way down in the Serrania de Jungurudo near the Colombian border and one of the reasons I was keen to go to Cerro Sapo. [Editor's Note: For a light-hearted report on this earlier expedition see Chester Skotak's article, "Darien on the Sambu" in Journal of the Bromeliad Society 53(3). May-June 2003] At the top we could see out across the cleared plains right to the Pacific Ocean (Fig. 8). For the wet season we were having fantastic luck with the weather. Also growing up on the wet ridge was *Guzmania darienensis* (Fig. 9), another species we saw on Cerro Sapo.

As we climbed along the ridge the trees shrank and turned into the low twisted canopy of elfin cloud forest. Once again we started to have to climb in, around and through the trees, finding ourselves up in the rocks and trees again. Also growing

along the wet ridge was a different *Werauhia* (Fig. 10, 11) with grey foliage tipped with pinkish fingernails and a club like inflorescence. Orchids, cyclanths, ferns, utricularias, peperomias, dwarf anthuriums, a pretty bright fuchsia and pink psychotria made up a strange collection of plants growing along this wet ridge. The ridge seemed to go on forever as we made our way along and ever so slowly we started to lose altitude on the way down. We wandered past the remains of two American helicopters that crashed into the mountain back in the '60s that are slowly being taken over by the forest. A *Guzmania* was growing happily on what would have been the fuselage of one of them. As we headed downhill closer to our lodgings we noticed cat tracks on the path that weren't there yesterday. They were only 50mm wide so not big enough for jaguar or puma, more likely an ocelot or margay. Still, very exciting to see them on this path and even more exciting when we realised it must have walked right past our cabins in last night's darkness.

The next day my foot was very painful and some hot compresses were used to try to get the swelling down on my instep. The thought of trying to get it into my rubber boot was not a pleasant one. As we had done the only trail the day before and we were still getting over our Darien adventures we decided to spend the day bird watching and cleaning seed while we sat on the veranda of the lower house and looked out across to the peak and ridge that we had climbed yesterday. Filling up a bird feeder with sugar

Figure 8. The view from Cerro Chucante down to the coast and the Pacific Ocean. Photo by Bruce Dunstan.

Figure 9. *Guzmania darienensis* in bloom on Cerro Chucante. Photo by Bruce Dunstan.

Figure 10. *Werauhia* sp. seedlings Cerro Chucante. Photo by Bruce Dunstan.

Figure 11. Closer view of some seedlings shown in Figure 10. Photo by Bruce Dunstan.

and water was quickly rewarded with an emerald green hummingbird making plenty of visits during the afternoon. Carla also spotted howler monkeys in the adjacent trees pulling up the flowering racemes of mucuna vines to eat the flowers while I had a well-deserved siesta.The next morning was time to leave so everything was once again loaded on our horses and we were off down the hill. Carla and I decided to walk for the first part through the forest rather than slip and slide down the muddy trail on the back of our horses. About an hour into our downhill journey the heavens opened in a huge rainstorm complete with lightning and thunder (Fig. 12). Carrying my lucky umbrella, which comes with me on my trips and generally does a good job of avoiding rain, suddenly didn't feel such like a good idea with lightning thundering down around us.

We struck trouble when the little brown mare carrying our bags trapped a rear hoof between two long tree branches that had been laid down to improve the muddy trail. Luchio and the boys weren't carrying a machete, which was a very un-Panamanian thing Carla thought, as they seem to be a necessity to any working man, so we had to dig with our hands and some sticks to free the mare (Fig. 13). Luckily for her she was only bruised above her hoof and by the time she walked down without her load she seemedto have recovered from what was a very scary situation.

We dropped our guides at the local store with a little spending money in their pockets and started back up the Interamerican Highway towards the capital city. I had seed to clean and prepare and needed some air conditioning to help dry out my seed as well as all my gear. This was by far the hardest trip I have had in Panama. As Carla said to me in the planning phase, 'Well, you've done all the easy places we can do from a car on the side of the road.' We figure if we are to go to even newer places or up mountains again we'll need to take some camping gear and stay out in the forest to be able to find new areas and plants.

I'm encouraging Carla to think about taking groups of people on trips as she knows exactly where to see amazing plants (right next to the road!) and also knows where you can stay as well as where the best cheap food is found. When more details become available I'll pass them on as I can recommend her services as being a fantastic guide and travel companion over the years I have travelled with her.

For me, I'm already thinking about doing another 'softer' driving trip in the western range of Colombia with Emilio and no horses.

[Editor's Note: A previous version of this article was published in **Bromeliaceae** volume 47 4th Quarter 2013 and volume 48 1st Quarter 2014. Some photographs used in the previous version do not appear in this version, and some photographs used in this version do not apear in the previous version.]

Figure 12. The walk down from Cerro Chucante in a wild thunder storm. Photo by Bruce Dunstan.

Figure 13. The brown mare with her hind hoof stuck in the rough track, just prior to her being released unscathed. Photo by Bruce Dunstan.

Dan Kinnard - Honorary BSI Trustee

Robert Kopfstein

It is no accident that Dan Kinnard has been involved with plants for his entire life. Born in Sherman, Texas, north of Dallas, he grew up on a farm that raised a variety of crops and animals.

When he attended Austin College, a 4-year Liberal Arts College located in Sherman, he dual-majored in business administration and accounting/economics. Upon receiving his BA he moved to Dallas where he took a job as a computer programmer.

Changing jobs was to alter his life. His new employer, British/American Producing Co. was soon bought out by Gulf Oil, and Dan was transferred to Tulsa, Oklahoma. Once established in the city, Dan got involved in a group called Glasshouse Gardeners. With fond memories of his grandmother's extensive collection of house plants he built two greenhouses on his property—Dan has never been known to do things by halves. And following the parameters of the society he grew everything tropical except orchids.

At one of the society meetings in the late 1960's Kathy Dorr from Lakewood, California gave a talk on bromeliads; Dan was hooked, and he joined BSI hoping to make connections with growers who had plants for sale. At that time bromeliad nurseries and bromeliad societies were scarce commodities in Tulsa, and nationally, exotics like

Dan Kinnard in his shadehouse, surrounded by bromeliads. Photo by Robert Kopfstein.

Billbergia pyramidalis 'Kyoto' were advertised for $120. Kathy Dorr heard that Dan was interested, so she sent him one with a one word note: "Enjoy."

It was not long before both of the Tulsa greenhouses were filled with plants. But there was another change in the works. In 1976, Gulf Oil informed Dan of an interview opportunity in Florida for a position; no one seemed to be exactly sure what it was, but Dan had not seen Florida, so he decided to go.

As it turned out, the job was in Venezuela, and the start time was immediately. Leaving his plants and his life in Tulsa behind, Dan went to South America, which turned out to be a ten year adventure. On the job Dan set up computer programs for Gulf that served both the U.S. and Venezuelan systems. He learned Spanish and began a whole new life, and because he lived in a small apartment he made many trips to the countryside to enjoy the abundant flora of the region with the Audubon group which he had joined. On a six week vacation he toured Peru, Ecuador, Panama, and Guatemala and his enthusiasm for the Bromeliaceae continued to grow.

When the Venezuelan economy tanked in 1986, Dan returned to the U.S., accepting a job in Connecticut. But when he saw how few bromeliads were thriving there, he left for a job in computers with the aerospace industry in southern California, birthplace of the BSI. He soon found the Saddleback Valley Bromeliad Society and eventually served as president and newsletter editor.

In 1994 he helped with the World Bromeliad Conference in San Diego. Since then he has attended nearly every BSI conference as well as the local conference in New Zealand. Shortly after 1994, Dan joined the BSI board, and he worked on a website, becoming the first webmaster. From 2004-2012 he served as Membership Secretary and set up a consistent data base to keep track of the membership.

In 1997, Dan and his partner in plants Eloise Lau bought 3.6 acres in Bonsall, California. They built a house and a separate structure to house his extensive collection of botanical books as well as a 3000 square foot shade structure. The house and library were designed by a local artist James Hubbell. Currently Dan and Eloise care for more than 2000 bromeliads as well as certified organic orchards that produce guavas, citrus, avocados and more.

He and Eloise, now members of the San Diego Bromeliad Society, have traveled extensively, including two trips with Pamela Koide-Hyatt in Mexico to study variations in species and natural hybrids of the genus *Tillandsia*.

Besides being involved in the bromeliad society—Dan will be the SDBS newsletter editor next year—he and Eloise also belong to the California Rare Fruit Growers, The San Diego Horticultural Society, the San Diego Cactus and Succulent Society (plus the Cactus and Succulent Society of America), the Huntington Library and Botanical Gardens, The San Diego Zoo, The San Diego Museum of Art, and the San Diego Mingei Museum. And when he and Eloise are not attending meetings, Dan cooks—but never doing anything by halves—Dan cooks gourmet. His zest for life extends to everything he encounters.

2014 San Diego Bromeliad Society Show

Nancy Groves

What a spectacular show! The San Diego Bromeliad Society held a BSI Standard Show June 28-29, 2014. There were 197 entries of which 74 were judged worthy of the Award of Merit ribbon and an additional 85 were awarded blue ribbons. The Mulford B. Foster Award for the best plant entered in the Horticultural divisions went to the stunning *Tillandsia edithae* grown by Jim Wright (Fig. 1). The Morris Henry Hobbs Award for the best entry in the Artistic Divisions went to *Tillandsia streptophylla* x *chiapensis* entered by David Kennedy (Fig. 2).

Figure 1. *Tillandsia edithae* Photo by Scott Sandel.

This *Tillandsia edithae* clump was started 30 years ago with one plant and now has, at best count, 80 mature plants with 10 bright red, open inflorescences. The clump now measures 36 inches

Figure 3a. A range of plants from different Mexican locations belonging to the *Tillandsia fasciculata* complex. Photo by Anthony Allen Photography.

Figure 2. *Tillandsia streptophylla* x *chiapensis.* Photo by Scott Sandel.

in length and 24 inches wide and is mounted on flat cork base. It has been grown in San Diego under 50% shade cloth and watered with tap water three times a week in summer and one to two times a week in winter.

The *Tillandsia streptophylla* x *chiapensis* was a flawless specimen entered in the Decorative Container division by David Kennedy who was also the Sweepstakes winner with 35 plants earning Award of Merit or Blue ribbons.

A wonderful educational exhibit including 21 species from the "*Tillandsia fasciculata* complex" was entered by one of our judges, Pam Koide-Hyatt of Bird Rock Tropicals. Each species was

Figure 3b. *Tillandsia fasciculata* varieties and several species originaly considered to be forms of *T. fasciculata* but now recognized as separate. Photo by Anthony Allen Photography.

identified with country of origin, locality and a brief description. On the right side of the display (Fig. 3b) were the true known *T. fasciculata* varieties from the Caribbean, Jamaica, Guatemala, the Yucatan and Florida. There were also examples of Mexican species thought to be in *T. fasciculata* group - but later described as: *T. jalisco-monticola*, *T. grossispicata*, *T. inopinata*, *T. magnispica*, *T. compressa*, *T. flavobracteata* and *T. rotundata*. The left side of the display (Fig.3a) showed the diversity of the complex with examples of '*Tillandsia fasciculata*' from different localities in Mexico. These plants were all in spike at the same time so visitors could appreciate the differences in inflorescence shape and coloration. Clearly, there is still work to do in this complex.

The descriptive panel that accompanied the display gives the following concise summary of our current state of understanding in this group.

"*T. fasciculata* complex, a confusing group of tillandsias – by Pam Koide-Hyatt, Bird Rock Tropicals"

"The true *T. fasciculata* species are identified from the Yucatan and the Caribbean. Many forms are found throughout Mexico, and these are all lumped together as *T. fasciculata* var. *facsiculata*. For years, I have done the same, although I do keep populations separated by giving each an individual ID number. Both taxonomists and hobbyists have difficulty determining the differences between the species. Therefore, the complex has been basically ignored. Recently, some of the Mexican taxonomists have taken a more serious look at the complex and new species are being described. This exhibit shows the diversity and range of the Mexican *T. fasciculata* complex and the newer species that were once thought to be part of this complex. Perhaps in the near future the complex will be looked at and more new species will be described."

Blooms Gone Wild

Alan Herndon

Most bromeliads follow a straightforward pattern. Flowers are produced on an inflorescence; offsets are produced from leaf axils in the rosette and the two don't mix. Furthermore, the apical meristem producing cells to build the inflorescence has a limited life span. When the inflorescence ceases growth, there is nothing left to support further vegetative growth. Most *Ananas* and many species of *Orthophytum* are, of course, exceptional in regularly producing offsets at the terminal ends of inflorescences (or inflorescence branches), but you can see tens or hundreds of thousands of blooming bromeliads from other genera without ever seeing anything similar. Still, there are many, many bromeliads in cultivation world-wide, and many people who care enough about them to notice rare events.

Figure 1 is from a plant grown by John and Beth Bethell in the Bahamas. You can see a full, post-flowering inflorescence with immature fruit, and a small offset developing at the terminal end. Figure 2 is a more formal portrait of the offset.

Perhaps less rare, but still hardly ever reported, cases are known where the basal portion of an inflorescence develops normally, but reverts to vegetative growth before any flower buds or branches are produced. No more dramatic example can be found than an *Alcantarea imperialis* seen in a planting along the streets of Honolulu (Fig. 2) during the 2014 World Bromeliad Conference. This plant, photographed by Lisa and Michael of LM Botanicals, has a terminal offset that appears to be larger than I would be interested in lifting. The inflorescence stalk is undeniably hefty but its ability to hold such a large, water-holding plant erect so far above the ground without being straight is nothing short of amazing.

Figure 1. *Aechmea lueddemanniana* grown by John and Beth Bethell of the Bahamas. The lower section of the infloresecence is normal for the species, but there is a small vegetative offset at the tip. Photo by John and Beth Bethell.

Figure 2. Later photo of the plant shown in Fig. 1. Here the upper portion of the inflorescence with the terminal offset is shown along with some rosette leaves. Photo by John and Beth Bethell.

Figure 3. *Alcantarea imperialis* in a landscape planting along a Honolulu street. The offset at the top of the inflorescence stalk has taken the place of the branches and flowers normally seen. Photo by LM Botanicals.

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Events Calendar

18-19 Oct 2014 - Bromeliad Society of Australia, Spring Show.

19 Oct 2014 - Dutch/Belgian Bromeliad Society (BCG), second standard show of 2014. Normally there is also a plant Auction or Lottery. Utrecht University Botanic Gardens, Budapestlaan 17, Utrecht, Netherlands.

25-26 Oct 2014 - The Southwest Bromeliad Guild, 36th Annual Show and Sale at the DoubleTree by Hilton Hotel Houston Intercontinental Airport, 15747 John F. Kennedy Blvd., Houston, TX 77032.

7-9 Nov 2014 - Sarasota Bromeliad Society, annual show and sale, Southgate Community Center, 3145 Southgate Circle, Sarasota, FL 34239

21-23 Feb 2015 - The Bromeliad Society of New Zealand, annual competitive show and sale, at the Mt. Eden War Memorial Hall 487 Dominion Rd Balmoral Auckland.

16-19 April 2015 - Bromsmatta: 18th Australasian Bromeliad Conference, Parramatta, Sydney, Australia. (www.bromeliad.org.au for full details)

18-19 Apr 2015 - Bromeliad Society of South Florida Show and Sale, Fairchild Tropical Botanic Garden, 10901 Old Cutler Road, Coral Gables, Florida (bssf-miami.org for details and updates)

26 Sep 2015 - Bromeliads in the Magic City (Bromeliad Extravaganza), Double Tree by Hilton Hotels and Miami Airport Convention Center. (www.bssf-miami.corg for details and updates)

13-19 June 2016 - World Bromeliad Conference, Houston, Texas.

Web sites listed under individual shows will contain the most detailed and latest information. You may also look for additional details and updates for any of these shows on the home page of the BSI website (www.bsi.org). Look under under the events tab for the events calendar tab. Be sure to check periodically for updates.

The Bromeliad Society International

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

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