FLAAR
MESOAMÉRICA

BRIGHT RED & YELLOW BROMELIAD FLOWERS

Aechmea tillandsioides

Biotopo Chocón Machacas

Livingston, Izabal

NICHOLAS **HELLMUTH**

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Aechmea tillandsioides

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Livingston, Izabal

NOVEMBER **2020**

FLAAR MESOAMÉRICA

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Aechmea tillandsioides

Photo by: Vivian Díaz, FLAAR Mesoamerica, Feb. 14, 2020. Livingston, Izabal, Guatemala.

Camera: Google Pixel 3 XL.

PHOTO FROM TITLE PAGE
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Photo by: Vivian Díaz, FLAAR Mesoamerica, Feb. 14, 2020. Livingston, Izabal, Guatemala.

Camera: Google Pixel 3 XL.

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INTRODUCTION TO BROMELIADS **IN GUATEMALA**

Bromeliad flowers are popular around the world. Every major botanical garden is filled with bromeliads and orchids. There are bromeliad societies in many major cities.

In Guatemala your eyes will be overwhelmed by the flowering bromeliads, orchids, and vines in the humid mountain areas of Alta Verapaz. We at FLAAR Mesoamérica have driven the back roads of Alta Verapaz with 4-wheel drive, and hiked to areas not even reachable by 4WD, so have experienced lots of bromeliads in Alta Verapaz.

***Aechmea tillandsioides* Baker.**

Photo by: Victor Castillo, FLAAR Mesoamerica, Feb. 14, 2020. Río Chocón Machacas, El Golfete, Livingston, Izabal, Guatemala.

Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS.
Settings: 1/640 sec; f/6.3; ISO 2,000.

At Parque Nacional Yaxha, Nakum and Naranjo, coordinated by the park administrators of IDAEH and CONAP, and with the assistance of the park rangers, we also learned a lot about bromeliads there in Petén. Although of course I like epiphytic bromeliads, I experienced a lot of terrestrial bromeliads as well: park ranger "Teco" (Moises Daniel Pérez Díaz) took us to special ecosystems where we photographed *Aechmea magdalenae* often in masses of several hundred surrounding a seasonal "aguada" (aguada means an area which often inundates on the rainy season).

The biodiversity of Municipio de Livingston is another paradise of bromeliads. Since you can take boat trips along the shores of Rio Dulce, El Golfete, and Canyon Rio Dulce, you can see the bromeliads flowering up in the trees. And when you hike the trails of the several nature reserves in this Caribbean area, you see even more bromeliads. We recently went up every single river on the north side of El Golfete: several had awesome paradise of bromeliads, many in flower (November 2020).

With the present FLAAR report, I would like to introduce one of the bromeliads we saw most often during mid-March 2020: *Aechmea tillandsioides.*

Exploring Livingston.

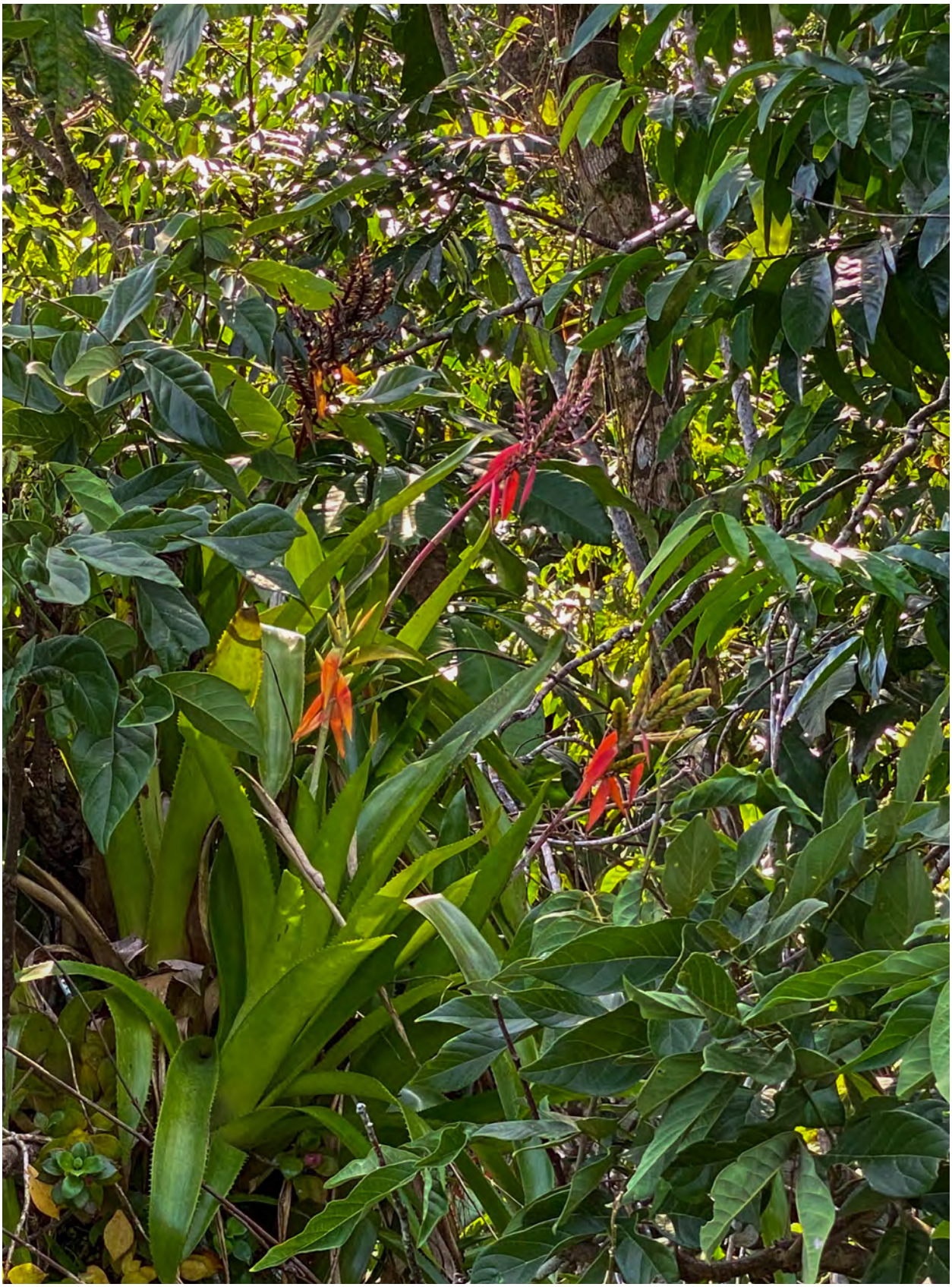
Photo by: Juan Pablo Fumagalli, FLAAR Mesoamerica, Mar. 9, 2020. Livingston, Izabal.

Camera: Google Pixel 3 XL.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala. Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Mar. 11, 2020. Chocón Machacas, Livingston, Izabal. Camera: Google Pixel 3 XL.

¡!

If you want to discover more from Parque Nacional Yaxha, Nakum and Naranjo visit our site: https://flaar-mesoamerica.org/projects-national-park-yaxha-nakum-naranjo/



***Aechmea tillandsioides* Baker.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Livingston.
Camera: iPhone 11 Pro Max.

FULL BOTANICAL **NAME AND HABIT**

Aechmea tillandsioides (Mart. ex Schult. & Schult.f.) Baker

Habit: herb, epiphytic. This bromeliad species survives happily "on the ground" if the branch holding it also falls down. However, it occasionally survives by itself on the ground even without the branch. Nonetheless, it is definitely an arboreal plant.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 11, 2020. Municipio de Livingston, Izabal.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/250 sec; f/14; ISO 3,200.

We found it in full bloom in February and still in March in Biotope Chocón Machacas, El Golfete, Municipio de Livingston.

> Experienced botanist of MOBOT, Dr Thomas Croat, found it at Yaxha (ironically near the FLAAR camp in 1973; FLAAR was founded in 1969 to map Yaxha and we worked there from 1970 through 1974).

Only two specimens are in herbaria on-line for all of Izabal: so in two short field trips the team of FLAAR Mesoamerica found as many individual plants as botanists from USA have collected in the past half century.

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Jul. 9, 2019. Naranjo, Yaxha, Petén, Guatemala. Camera: iPhone XS.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: Vivian Díaz, FLAAR Mesoamerica, Feb. 14, 2020. Livingston, Izabal.
Camera: Google Pixel 3 XL.

LOCAL NAMES FOR *AECHMEA TILLANDSIOIDES*

Surely this plant has local names but most publications do not provide any list. We will ask when we return to Livingston Municipality in a future field trip. In the meantime, two local names are provided by Standley and Steyermark: Pie de gallo (Petén); eck (Alta Verapaz) (1958: 386).

Aechmea tillandsioides, a bromeliad flower coming out of the treetop.

Photo by: Victor Mendoza, FLAAR Mesoamerica, Nov. 8, 2020. Río Tatín, Río Dulce, Municipio de Livingston.
Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS.
Settings: 1/250 sec; f/4; ISO 200.

SYNONYMS FOR *AECHMEA TILLANDSIOIDES*

- *Aechmea chiriquensis* Baker
- *Aechmea kienastii* E.Morren ex Mez
- *Aechmea tillandsioides* var. *kienastii* (E. Morren ex Mez) L.B.Sm.
- *Aechmea tillandsioides* var. *tillandsioides*
- *Aechmea vrieseoides* Baker
- *Aechmea xiphophylla* Baker
- *Billbergia gracilis* Poepp. ex Beer
- *Billbergia tillandsioides* Mart. ex Schult. & Schult.f.
- *Ortgiesia tillandsioides* (Mart. ex Schult. & Schult.f.) Regel
- *Ortgiesia tillandsioides* var. *nidulans* Regel
- *Platyaechmea tillandsioides* (Mart. ex Schult. & Schult.f.) L.B.Sm. & W.J.Kress
- *Platyaechmea tillandsioides* var. *kienastii* (E. Morren ex Mez) L.B.Sm. & W.J.Kress
- *Platystachys gracilis* Beer [Invalid] Synonym
- *Portea tillandsioides* (Mart. ex Schult. & Schult.f.) G.Nicholson

www.theplantlist.org/tpl1.1/record/kew-218283

***Aechmea tillandsioides* Baker.**

Photo by: Senaida Ba, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Río Dulce, Livingston.

Camera: Nikon D5. Lens: Nikon AF-S NIKKOR 400mm FL ED VR.
Settings: 1/160 sec; f/8; ISO 800.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.
Photo by: Victor Castillo, FLAAR Mesoamerica, Nov. 7, 2020. Chocón Machacas, Livingston, Izabal.
Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS. Settings: 1/640 sec; f/6.3; ISO 2,000.

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.
Photo by: María Alejandra Gutierrez, FLAAR Mesoamerica, Nov. 7, 2020. Chocón Machacas, Livingston, Izabal.
Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS. Settings: 1/1,000 sec; f/10; ISO 6,400.

CLOSE RELATIVES OF *AECHMEA TILLANDSIOIDES* **PRESENT IN GUATEMALA**

Aechmea bracteata
Aechmea bromeliifolia
Aechmea lueddemanniana
Aechmea magdalenae
Aechmea mexicana
Aechmea tessmannii (if you are not a botanist with a magnifying glass), looks a bit similar to *Aechmea tillandsioides.*

But *Aechmea tessmanii* is from South America, not Central America, and is a different species. *Aechmea tessmanii* is in fact an accepted name for this different species; so, it may not be considered a synonym of *Aechmea tillandsioides*.

***Aechmea bracteata* Griseb.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Jun. 3, 2019. Yaxha, Petén, Guatemala.
Camera: iPhone XS.

Aechmea bracteata. This bromeliad is known as "gallito" in some Spanish speaking countries.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Yaxha, Petén.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/200 sec; f/10; ISO 3,200.

AECHMEA TILLANDSIOIDES HAS BEEN **COLLECTED AT PARQUE NACIONAL TIKAL**

- **Missouri Botanical Garden**
- **Catalog #:** 1793184
- **Taxon:** *Aechmea tillandsioides* var. *kienastii* (E. Morren ex Mez) L.B. Sm.
- **Family:** Bromeliaceae
- **Determiner:** L.B. Smith,
- **Collector:** C.L. Lundell 15498
- **Date:** 1959-01-29
- **Locality:** Guatemala, Petén, Tikal National Park, Tikal. In ramonal covering the ruins 17.23 -89.61

(https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=941103&clid=0)

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Livingston, Izabal.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/320 sec; f/10; ISO 800.

SAME FOR YAXHA, NAKUM AND NARANJO, ***AECHMEA TILLANDSIOIDES*** **HAS BEEN COLLECTED AT YAXHA?**

- **Missouri Botanical Garden**
- **Catalog #:** 1976048
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Utley
- **Collector:** Thomas B. Croat 24678
- **Date:** 1973-06-18
- **Locality:** Guatemala, Petén, Vicinity of Archeological camp on north shore of Lake Yaxha. Disturbed forest 17.06 -89.39
- **Elevation:** 152 meters (499ft)

(https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=942939&clid=0)

- **Missouri Botanical Garden**
- **Catalog #:** 100276492
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** M. Véliz
- **Collector:** 1265
- **Date:** 1989-03-10
- **Locality:** Guatemala, Petén, Yaxha, El Petén.

(https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=930607&clid=0)

Guzmania scherzeriana, "Gallinzaco" is the common name given on Livingston for this Bromeliad.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Mirador El Cañón, El Golfete, Río Negro, Livingston.

Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/250 sec; f/11; ISO 2,560.

***Aechmea tillandsioides* Baker.**
Photo by: Victor Mendoza, FLAAR Mesoamerica, Nov. 8, 2020. Río Tatin, Río Dulce, Izabal.
Camera: Sony RX10 IV. Lens: Sony FE 90mm Macro G OSS. Settings: 1/80 sec; f/4; ISO 800.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.
Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Oct. 28, 2018. Yaxha, Petén.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/250 sec; f/13; ISO 640.

¡!

Vilma Fialko has found *Aechmea tillandsioides* at Naranjo area of the park. The team of FLAAR Mesoamérica has noticed *Aechmea tillandsioides* at the Yaxha and Nakum areas of this extensive park.

***Aechmea tillandsioides* Baker.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 20, 2020. Mirador El Cañón, El Golfete, Río Negro, Livingston. Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/250 sec; f/9; ISO 4,000.

BRIEF MENTION OF *AECHMEA TILLANDSIOIDES* BY **STANDLEY AND RECORD (1936)**

Only one single solitary line on this gorgeous plant. No botanical description; only a mention in passing.

> *Aechmea tillandsioides* Baker. Big Creek, Schipp 98.

(Standley and Record 1936: 90).

Biotopo Chocón Machacas

Photo by: Victor Mendoza, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Livingston, Izabal. Camera: Google Pixel 3 XL.

BOTANICAL DESCRIPTION OF *AECHMEA TILLANDSIOIDES* BY **STANDLEY AND STEYERMARK (1958)**

> ***Aechmea tillandsioides*** (Mart.) Baker var. *Kienastii* (E. Morr. ex Mez) L. B. Smith, Caldasia 5: 5. 1942. Ae. *Kienastii* E. Morr. ex Mez in DC. Monog. Phan. 9: 243. 1896. Ae. squarrosa Baker, Jour. Bot. 28: 305. 1890 (type from Boca de Polochic, Dept. Izabal, J. D. Smith 1823), not Baker, 1889. Pie de gallo (Petén); eck (Alta Verapaz). Figure 66. Epiphytic in forests, up to 300 meters; Petén; Alta Verapaz; Izabal. Southern México; Central America; Colombia; Amazon Basin. The typical variety is in Colombia, the Amazon Basin and Guiana. Leaves 5-9 dm. long with serrate blades 10-65 mm. wide; scape short, its bracts remote, lanceolate, red, serrate; inflorescence simple or digitate (pinnate in the typical variety), white-floccose at first; spikes oblong, 4-11 cm. long; rhachis excavated; floral bracts distichous, imbricate, 10-17 mm. long, convex, nerved; sepals asymmetric, 7-10 mm. long; petals dark purple.

(Standley and Steyermark 1958: 386-387)

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston. Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/9; ISO 640.

Aechmea tillandsioides. Family Bromeliaceae.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston. Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/9; ISO 640.

COVERAGE OF *AECHMEA TILLANDSIOIDES* IN OTHER **PERTINENT BOOKS**

Harvard University Herbaria

Aechmea tillandsioides (Mart. & Schult, f.)

Baker var. *tillandsioides* , J. Bot. 17: 134. 1879.

Basionym: *Billbergia tillandsioides* Mart. & Schult, f., Syst. Veg. 7, 2: 1269. 1830.

Synonym: *Platyaechmea tillandsioides* (Mart. & Schult, f.) L. B. Sm. & Kress var *tillandsioides*, Phytologia 69(4): 274. 1990. MEXICO.

Campeche: Calakmul, E. Martinez et al. 27 828- A (MEXU); Quintana Roo: Selva Mediana, 1 km E of Chanká Veracruz, selva mediana con Brosimum , *Pithecellobium* y *Vitex*, epifita acaulescente con inflorescencias rojas, 7 Mayo 1983, E . Cabrera and R. Durán 4668 (CIQRO, MEXU).

Previous records of this species for the peninsula area are here referred to *Aechmea tillandsioides* (Mart. & Schult, f.) Baker var *kienastii* (E. Morr.) L. B. S.

(Ramírez, I. M. & Carnevali, G. 1999: 185-194)

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.

Photo by: María Alejandra Gutierrez, FLAAR Mesoamerica, Mar. 10, 2020. Livingston, Izabal.
Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/500 sec; f/8; ISO 8,000.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 25, 2018. Plaza G, Yaxha, Petén, Guatemala.

Camera: Nikon D5. Lens: Nikon AF-S Micro NIKKOR 60mm G ED. Settings: 1/60 sec; f/14; ISO 6,400.

It is interesting to note that the only species known to live at the very top of the canopy in full sunlight is *Aechmea tillandsioides* (Bromeliaceae), which is a tank epiphyte with a built-in water reservoir, and is usually found growing on ant nests. The nutrients derived from the microfauna in the tank reservoir and from the ant nest apparently compensate for its otherwise nutrient-poor position.

(Croat 1978: 23)

Diaspore strategy has diverged in two directions in the family, those with superior ovaries having capsular fruits with plumose, wind-dispersed seeds, and those with inferior ovaries having fleshy fruits dispersed by animals, chiefly birds. Among the latter, *Aechmea magdalenae* is eaten by coatis (Kaufmann, 1962), and *A. tillandsioides*, often associated with ant nests, is partly dispersed by ants, I believe.

(Croat 1978: 227)

Common in the tops of trees in the full sunlight; less common on exposed branches over the edge of the lake. Inflorescences usually begin to open in the early dry season, but individual plants may flower over a long period, perhaps for the full flowering season. Flowering from at least January to August. Mature fruits have been seen from May to December.

(Croat 1978: 231)

Río Dulce, Chocón Machacas.

Photo by: Vivian Díaz, FLAAR Mesoamerica, Feb. 14, 2020. Canyon Rio Dulce, a kilometer east of Chocon Machacas, Livingston. Camera: Google Pixel 3 XL.

***Aechmea tillandsioides* Baker.**

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston. Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/9; ISO 640.

WHERE DID FLAAR MESOAMERICA TEAM FIND ***AECHMEA TILLANDSIOIDES*** **IN IZABAL?**

At Biotope Chocón Machacas I found *Aechmea tillandsioides* a few meters from the open area after you get up the hill to the level where the original housing area was. A branch had fallen down and the bromeliad was in full bloom on our first visit in February. So, in March I returned to see whether it was still flowering, and yes, it was still flowering!

We also found this species at least once a day, high in trees, almost every area we visited: Lagunita Creek, Canyon Río Dulce, and along the shore of the inlets on both sides of El Golfete. There are so many ecosystems to study in these areas that we have not yet doing fieldwork and photography in the west half of El Golfete nor the western end of the Municipio (west of the highway bridge over Río Dulce).

Landscape of Municipio de Livingston.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Feb. 14, 2020. Canyon Rio Dulce, a kilometer east of Chocon Machacas, Livingston, Izabal.
Camera: Sony RX10 IV. Lens: Sony FE Macro. Settings: 1/4,000 sec; f/2.8; ISO 500.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston. Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/9; ISO 640.

WHERE ELSE HAS *AECHMEA TILLANDSIOIDES* **BEEN FOUND IN IZABAL?**

- **Missouri Botanical Garden** (MO:MO)
- **Catalog #:** 3459083
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Bitther,
- **Collector:** Rafael Molina 4856
- **Date:** 1976-10-10
- **Locality:** Guatemala, Izabal, El Estor, Canaboncito

(https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=963642&clid=0)

- **Missouri Botanical Garden**
- **Catalog #:** 3594981
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Utley (NOLS),
- **Collector:** W.E. Harmon & J.A.
- Fuentes 2117
- **Date:** 1970-03-14
- **Locality:** Guatemala, Izabal, 15.8 km S of Modesto Méndez. Collection from along newly constructed road in mixed tropical rainforest. Epiphytes from an oak tree felled by road construction 15.76 -89.1
- **Elevation:** 70 meters (230ft)

(https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=964708&clid=0)

Nicholas preparing his photography equipment.

Photo by: Victor Mendoza, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Livingston, Izabal.

Camera: Google Pixel 3 XL.

WHERE ELSE HAS *A. TILLANDSIOIDES* BEEN FOUND IN **PETÉN, NOT FAR FROM IZABAL?**

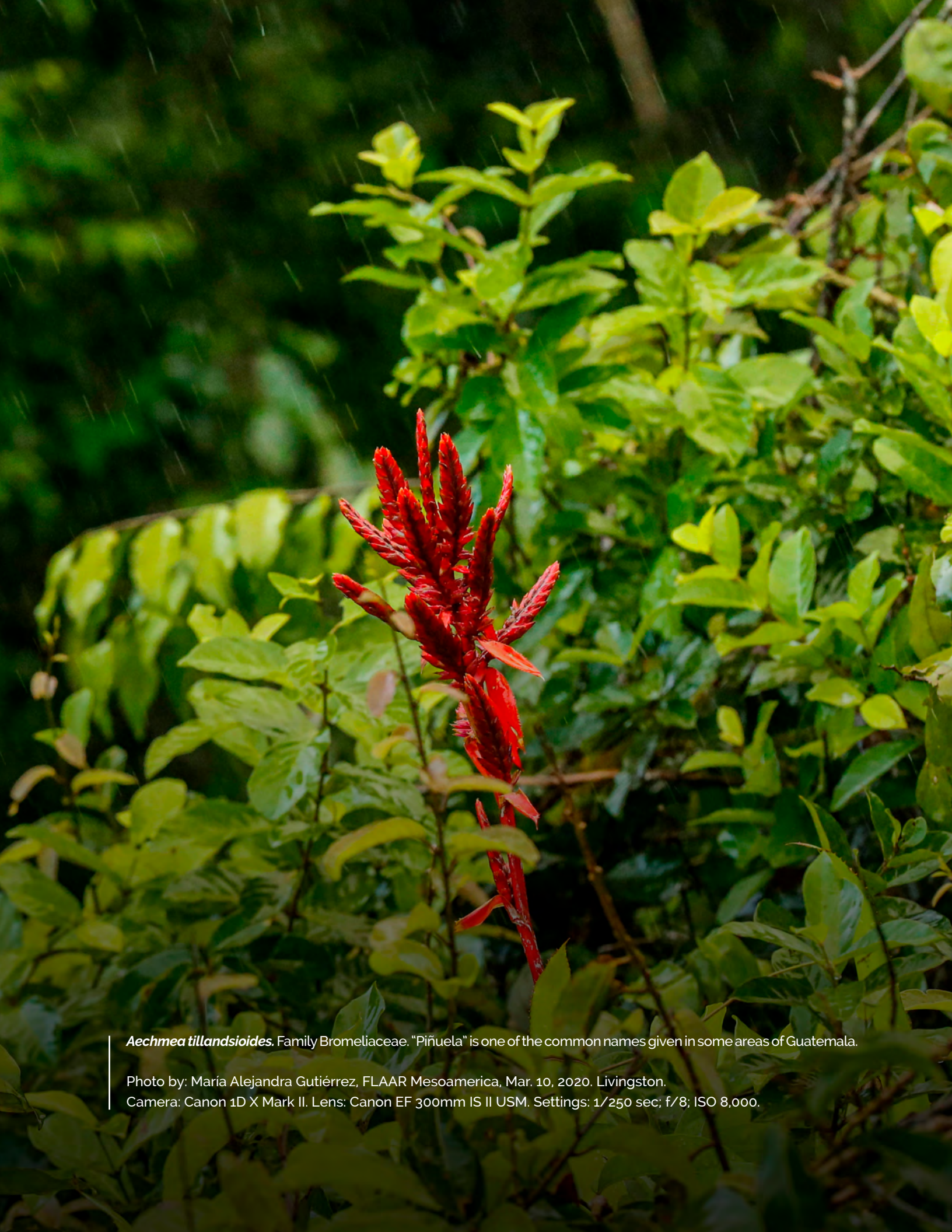
All universities are closed during the unfortunate Coronavirus pandemic, so we have not yet been able to have our team of botany students visit the helpful herbaria at the universities in Guatemala City.

WHERE ELSE HAS *A. TILLANDSIOIDES* BEEN FOUND IN **ALTA VERAPAZ, NEAR IZABAL?**

So far neither MOBOT herbarium records nor www.naturalista.mx/taxa/283296-Aechmea-tillandsioides has any list of *Aechmea tillandsioides* for Alta Verapaz.

***Aechmea tillandsioides* Baker.** This is the curious fruit of *A. tillandsioides.* On this stage, the new fruits have this blue-violet color.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Jul. 9, 2019. Yaxha, Nakum and Naranjo Park, Petén. Camera: Nikon D5. Lens: Nikon AF-S Micro NIKKOR 60mm G ED. Settings: 1/200 sec; f/4.5; ISO 2,000.



Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Mar. 10, 2020. Livingston.
Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/250 sec; f/8; ISO 8,000.

WHERE ELSE HAS *AECHMEA TILLANDSIOIDES* **BEEN FOUND IN GUATEMALA?**

So far we have not yet found the records for collections throughout the rest of Petén. But surely, since this bromeliad is found in Chiapas, Tabasco, southern Campeche, and Southern Quintana Roo, it will be findable in more areas of Petén besides just Tikal, Yaxha, and Izabal. We need to hike to the multiple herbaria at universities in Guatemala and check where their botanists have collected *Aechmea tillandsioides*.

Androlepsis skinneri and *Aechmea tillandsioides.*

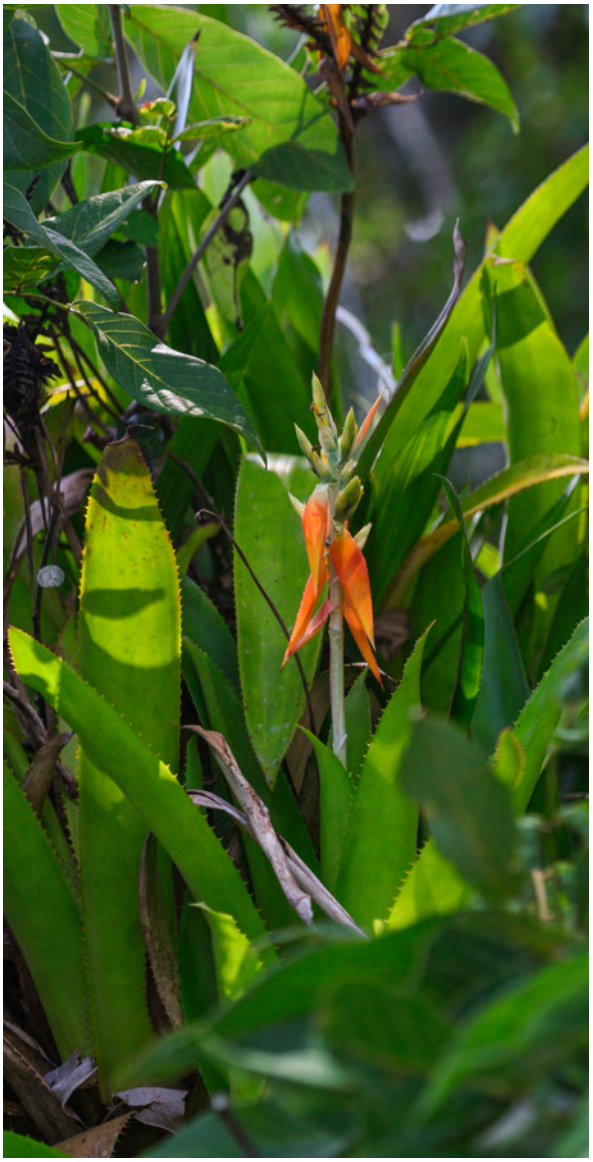
Photo by: Senaida Ba, FLAAR Mesoamerica, Nov. 10, 2020. El Golfete, Livingston.
Camera: Nikon D5. Lens: Nikon AF-S VR Micro-NIKKOR 105mm IF-ED. Settings: 1/320 sec; f/8; ISO 640.

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Livingston.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/320 sec; f/8; ISO 1,600.

AECHMEA TILLANDSIOIDES IN CHIAPAS

Since there are not many local uses of *Aechmea tillandsioides*, I can understand that Cook does not include *Aechmea tillandsioides* in her index. However, in Belize, the roots of a mature *Aechmea tillandsioides*, can be made into a brush to utilize for household chores (Balick and Arvigo 2015: 135). It would help if ethnographers can recheck in their areas of field work.



Aechmea tillandsioides.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Livingston.

Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/320 sec; f/8; ISO 1,600.

Aechmea tillandsioides.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar, 11. 2020. Livingston.

Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/250 sec; f/10; ISO 3,200.

Most plants that are found in Chiapas, Tabasco or Campeche are also in adjacent Petén. *Aechmea tillandsioides* is present in Chiapas:

www.naturalista.mx/taxa/283296-Aechmea-tillandsioides shows in three places in Chiapas (all three near the border of Guatemala). So, it should be possible to find in northern or northwestern Huehuetenango (which borders on Chiapas) and western Petén (which borders on Chiapas) and north (western) Petén which is just a few miles from where has been found in Campeche.

(www.naturalista.mx/taxa/283296-Aechmea-tillandsioides).

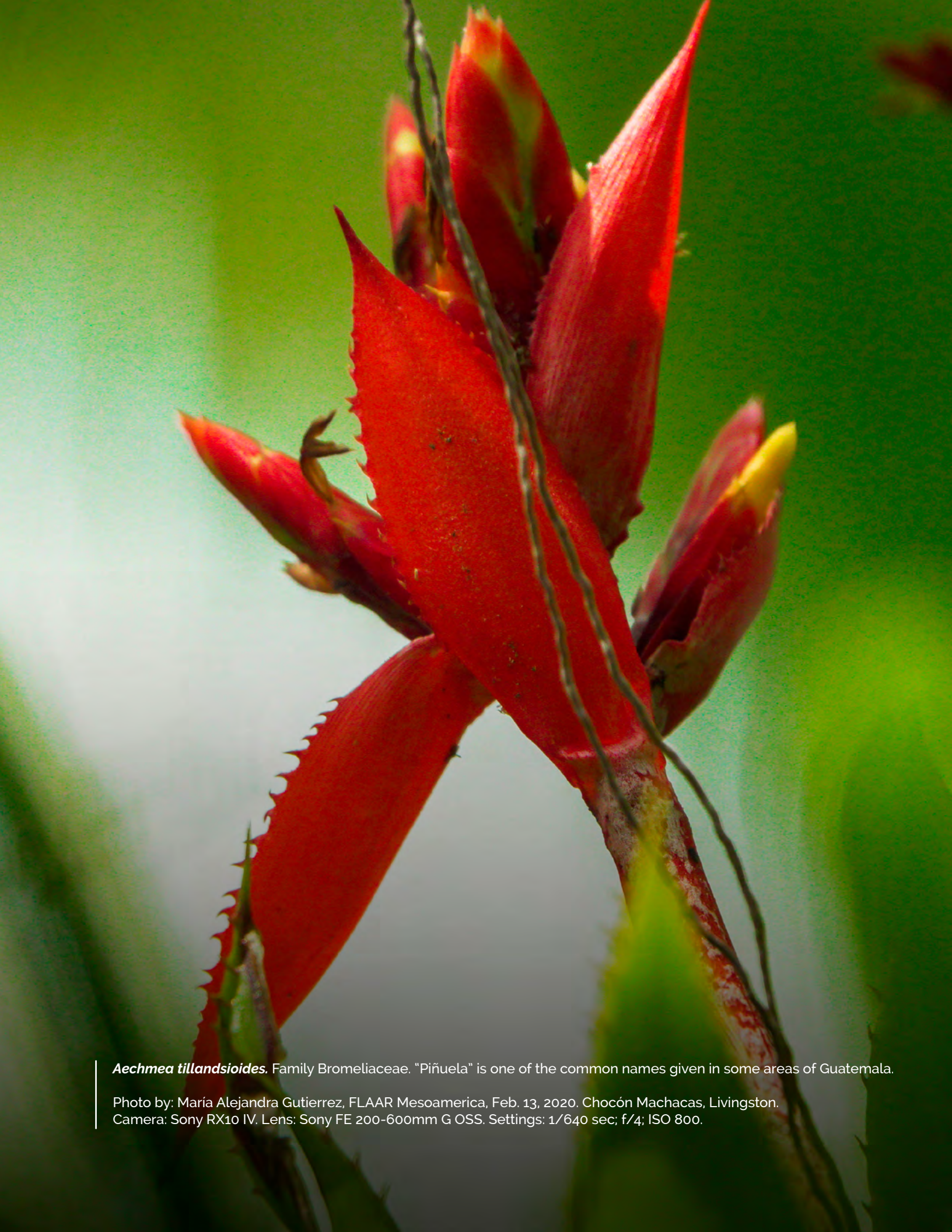
Aechmea tillandsioides is in the plant list for Yaxchilan Natural Monument (Meave et al. 2008: 66). Since Yaxchilan is on one side of the Río Usumacinta, surely *Aechmea tillandsioides* can be found on the Petén side.

If found at Yaxchilan, no surprise that *Aechmea tillandsioides* is also documented for Bonampak (SEMARNAT n.d.: 22). And if found in both these areas, nice that it has also been documented for Palenque area (Gomez et al. 2015: 576).

Dr Hellmuth always recommend different equipment to take the best photos on a field trip.

Photo by: Vivian Díaz, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Livingston, Izabal.

Camera: Google Pixel 3 XL.



Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: María Alejandra Gutierrez, FLAAR Mesoamerica, Feb. 13, 2020. Chocón Machacas, Livingston.
Camera: Sony RX10 IV. Lens: Sony FE 200-600mm G OSS. Settings: 1/640 sec; f/4; ISO 800.

AECHMEA TILLANDSIOIDES IN TABASCO

So far nothing on the map of www.naturalista.mx. But, another web site does list for Tabasco: Campeche, Quintana Roo, Tabasco, Chiapas (so all areas of Mexico that border on Peten, Guatemala).

(www.cicy.mx/sitios/flora%20digital/ficha_virtual.php?especie=173)

> The same web site also lists *Aechmea tillandsioides* for Oaxaca and Veracruz.

Platyaechmea tillandsioides is listed for Tabasco (Bueno et al. 2005: 104, without saying where). *Platyaechmea tillandsioides* is one old name for *Aechmea tillandsioides*. When you really want to find where *Aechmea tillandsioides* can be found, it helps to also search for the synonyms.

***Aechmea tillandsioides* Baker.** This is the curious fruit of *A. tillandsioides*. On this stage, the new fruits have this blue-violet color.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Jul. 9, 2019. Yaxha, Nakum and Naranjo Park, Petén. Camera: Nikon D5. Lens: Nikon AF-S Micro NIKKOR 60mm G ED. Settings: 1/800 sec; f/5.6; ISO 2,000.

AECHMEA TILLANDSIOIDES IN CAMPECHE

Mentioned for Campeche in several publications including by Ramírez (2010).

One location in Campeche on the map of www.naturalista.mx.

Aechmea tillandsioides. Family Bromeliaceae. This is the curious fruit of *A. tillandsioides.* On this stage, the new fruits have this blue-violet color.
Photo by: David Arrivillaga, FLAAR Mesoamerica, Jul. 9, 2019. Yaxha, Nakum and Naranjo Park, Petén.
Camera: Nikon D810. Lens: Nikon AF-S Micro NIKKOR 60mm G ED. Settings: 1/20 sec; f/11; ISO 2,000.

AECHMEA TILLANDSIOIDES IN QUINTANA ROO

One location on the map of www.naturalista.mx. Also:

Nombre científico
Aechmea tillandsioides var. *tillandsioides*

Determinador (es)
Ivón Ramírez

País
México (MX)

Estado
Quintana Roo

Municipio
Felipe Carrillo Puerto

Localidad
A 1 km al este de Chanca Veracruz

Colector (es)
E. Cabrera y R. Durán

Número de colecta
4668

Fecha de colecta
1983-05-07

Forma de vida o estadio
Epífita

Dependencia
Departamento de Botánica, Instituto de Biología (IBUNAM)

Institución
Universidad Nacional Autónoma de México (UNAM)

Recuperado de: http://datosabiertos.unam.mx/IBUNAM:MEXU:701067

***Aechmea bracteata* Griseb.**

Photo by: Erick Flores, FLAAR Mesoamerica, Sep. 5, 2018. Yaxha, Petén.
Camera: Canon 1D X Mark II. Lens: Canon EF 300mm IS II USM. Settings: 1/1,100 sec; f/3.2; ISO 1,000.

AECHMEA TILLANDSIOIDES IN BELIZE

Three locations for Belize are on the map of www.naturalista.mx.

> Plus mention by:
> (Balick, Nee and Atha 2000: 174).
> (Balick and Arvigo 2015: 135).

Surely more locations can be found for Belize. Any energetic student could find mention of *Aechmea tillandsioides* in REA assessments of nature preserves throughout Belize. For example, REA on Flora of the Sarstoon Temash National Park and Surroundings lists *Aechmea tillandsioides* (Meerman, Herrera, and Howe 2003: Sheet 3 and Sheet 4).

Aechmea tillandsioides.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston.
Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/9; ISO 640.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Municipio de Livingston. Camera: Sony Alpha A9 II. Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/10; ISO 1,250.

IN WHAT ECOSYSTEMS CAN YOU FIND **NATIVE *AECHMEA TILLANDSIOIDES?***

We found *Aechmea tillandsioides* on trees branches in very humid areas (Biotopo Chocón Machacas). Also, in dry-seasonally moist areas (Parque Nacional Yaxhá, Nakum and Naranjo, Petén).

We are curious why no examples are yet documented for adjacent Alta Verapaz, though surely when we ask our plant scouts there and we are allowed to check herbaria lists in Guatemala universities, we will find *Aechmea tillandsioides* in Alta Verapaz.

DOES *AECHMEA TILLANDSIOIDES* **ALSO GROW IN HOME GARDENS?**

This is a popular garden plant sold around the world. So it is found in gardens. But so far we have not noticed this bromeliad in Mayan home gardens.

Nicholas taking photos at Biotopo Chocón Machacas.

Photo by: Juan Pablo Fumagalli, FLAAR Mesoamerica, Mar. 11, 2020. Biotopo Chocón Machacas, Livingston, Izabal.

Camera: Google Pixel 3 XL.

***Aechmea tillandsioides* Baker.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Livingston.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/320 sec; f/8; ISO 1,600.

USES OF ***AECHMEA TILLANDSIOIDES***

The roots of a mature *Aechmea tillandsioides* can be made into a brush to utilize for household chores (Balick and Arvigo 2015: 135). This is helpful information especially to avoid using plastic. But a brush is best made from leaves of palm trees because if you tear up the roots then you exterminate this plant.

POTENTIAL MEDICINAL USAGE BY LOCAL PEOPLE

We have not yet found peer-reviewed journal articles on medicinal usage of *Aechmea tillandsioides* by local people.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala.

Photo by: Victor Castillo, FLAAR Mesoamerica, Nov. 7, 2020. Río Chocón Machacas, Livingston, Izabal. Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS. Settings: 1/640 sec; f/6.3; ISO 2,000.

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.

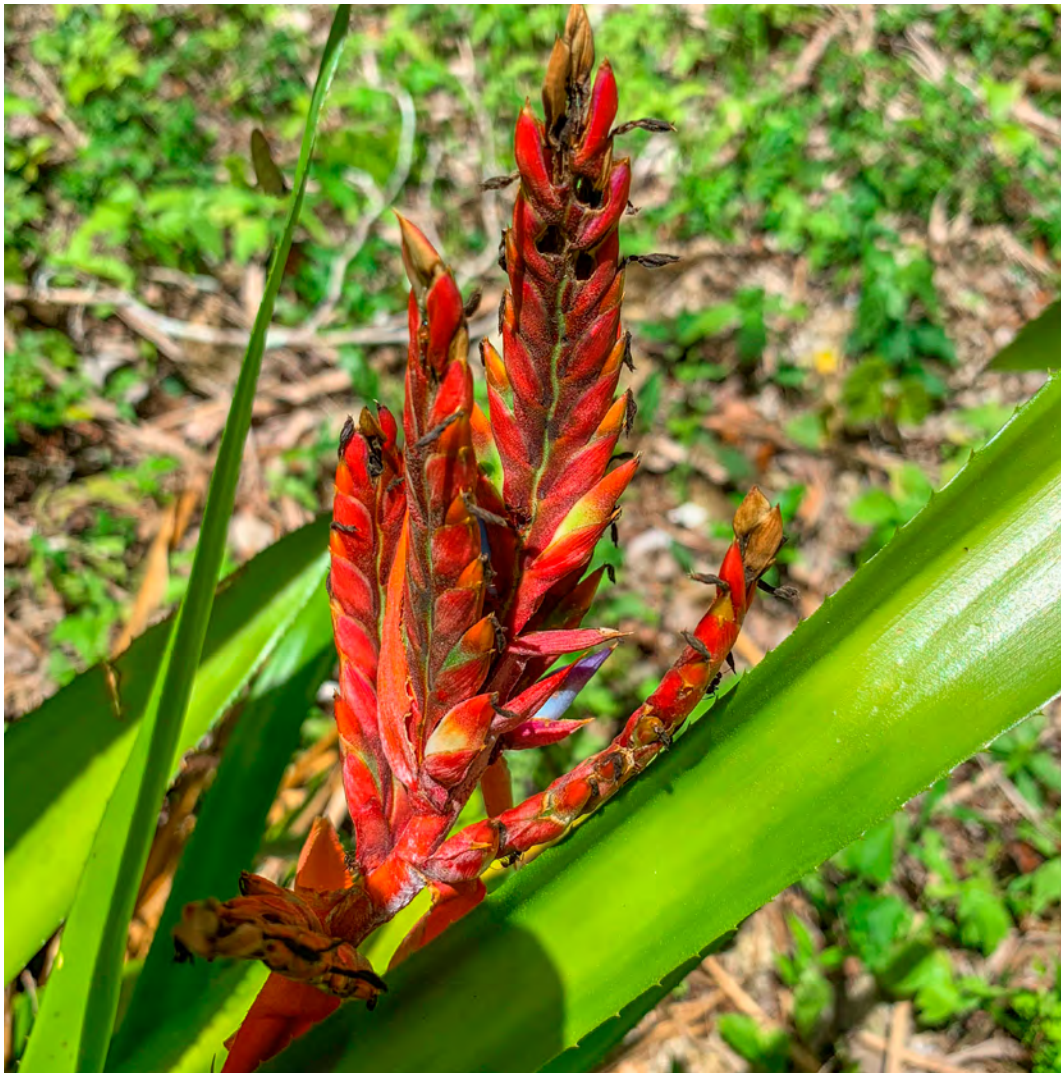
Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 25, 2018. Plaza G, Yaxha, Petén.
Camera: Nikon D5. Lens: Nikon AF-S Micro NIKKOR 60mm G ED. Settings: 1/60 sec; f/14; ISO 2,560.

WHEN DOES ***AECHMEA TILLANDSIOIDES*** **FLOWER*?***

In México is listed as flowering in April and May.

(www.cicy.mx/sitios/flora%20digital/ficha_virtual.php?especie=173)

In Izabal it was flowering in February and March (and surely the flowering will continue into April). I bet it began to flower in January.



Aechmea tillandsioides

Photo by: Nicholas Hellmuth, FLAAR Mesoamérica, Jul. 9, 2019. Naranjo, Yaxha, Nakúm y Naranjo. Camera: iPhone XS.

WHAT ARE THE PRIMARY POLLINATORS OF *AECHMEA TILLANDSIOIDES* FLOWERS?

Bimodal pollinator by birds and insects, commonly bees.

(Aguilar-Rodríguez, Kromer, Tschapka, García-Franco, Escobedo-Sarti, MacSwiney G 2019: 4)

"Standley considered *Codonanthe calcarata* Hanst. a synonym of this species, but the name was misapplied according to Leeuwenberg (1958). Like most other members of the genus, C. *crassifolia* is usually associated with ant nests, though many seedlings are found in cracks in tree bark and are not attended by ants. The ant nests frequently also contain *Aechmea tillandsioides* (22. Bromeliaceae)."

(Croat 1978: 641)

Fruits are no doubt chiefly dispersed by birds. The seeds ooze from the base when the fruit is pressed in the midsection, in the manner of Anthurium (21. Araceae). Part of the seeds may stick to the bird's beak, owing to the slender mucilaginous funicles.

(Croat 1978: 232)

Aechmea tillandsioides

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar, 11. 2020. Livingston, Izabal.

Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/250 sec; f/14; ISO 3,200.

***Aechmea tillandsioides* Baker.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Jul. 9, 2019. Naranjo, Yaxha, Petén.
Camera: iPhone XS.

Aechmea tillandsioides. Family Bromeliaceae. "Piñuela" is one of the common names given in some areas of Guatemala

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 8, 2020. Río Lámpara, Livingston.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro.
Settings: 1/320 sec; f/8; ISO 1,600.

CONCLUDING DISCUSSION AND SUMMARY ON *AECHMEA TILLANDSIOIDES*

I did not learn about the relationship of ants with the roots of until I was back in my office, 300 kilometers away from these bromeliads in Izabal areas. So definitely will inspect the roots the next time we are hiking through the nature reserves of Municipio de Livingston and boating through the Río Dulce Canyon.

It will also help on a future field trip to see whether *Aechmea tillandsioides* bromeliads are still flowering in months other than February and March.

Our long-range goal is to make a map of Municipio de Livingston, and have one map for orchids, one map for bromeliads, etc. to show where you can see and photograph these plants when you arrive here yourself.

***Aechmea tillandsioides* Baker.** Family Bromeliaceae.

Photo by: Senaida Ba, FLAAR Mesoamerica, Nov. 5, 2020. Mirador del Cañón, Río Dulce, Livingston.
Camera: Nikon D5. Lens: Nikon AF-S VR Micro-NIKKOR 105mm IF-ED. Settings: 1/125 sec; f/6.3; ISO 2,560.

Aechmea tillandsioides.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. El Golfete, Río Negro, Livingston.
Camera: Nikon D810. Lens: Nikon 200mm AF-D Tele-Macro. Settings: 1/250 sec; f/9; ISO 4,000.

BIBLIOGRAPHY, REFERENCES CITED AND SUGGESTED **READING ON *AECHMEA TILLANDSIOIDES***

Most helpful monographs on this plant

Croat of MOBOT has published helpful information (1978). It is especially helpful that this report is available on-line as an easy download.

SMITH, Lyman B. and **Robert Jack DOWNS**
1974 Pitcairnioideae (Bromeliaceae). Flora Neotropica. Vol. 14, No. 1, (Oct. 14, 1974), pp. 1-609+611-641+643-658. New York Botanical Garden Press on behalf of Organization for Flora Neotropica

If this is available as a digital edition, open (so you can search and so you can copy-and-paste to cite) we will use it. Otherwise Standley and Steyermark and Standley and Williams are the best sources, especially since Standley and also Williams were interested in ethno-botanical information; after they passed away the subsequent botanical monographs did not include information on how local Maya and other local people used the plants.

Most helpful articles on this plant

Need to keep looking to find an article on *Aechmea tillandsioides* of Mesoamérica.

Most helpful web sites on this plant

Need to accomplish lots more research to find a website with helpful info on a single species. Most websites on bromeliads are for garden varieties; we are studying wild native bromeliads.

AGUILAR-Rodríguez, Pedro, KRÖMER, Thorsten, TSCHAPKA, Marco, GARCÍA-Franco, José, ESCOBEDO-Sarti, Jeanett and **McSWINEY G., Cristina**
2019 Bat pollination in Bromeliaceae. Plant Ecology & Diversity Journal. Taylor & Francis Group. Volume 12. Pages 1-19

ATRAN, Scott, LOIS, Mimena and **Edilberto UCAN Ek'**
2004 Plants of the Petén Itza' Maya. Museum of Anthropology, Memoirs, Number 38, University of Michigan. 248 pages.
Very helpful and nice collaboration with local Itza' Maya people. But would help in the future to have a single index that has all Latin, Spanish, and English plant names so that you can find plants more easily.

Not available as a download.

BALICK, Michael J., NEE, Michael H. and **Daniel E. ATHA**
2000 Checklist of the Vascular Plants of Belize: With Common Names and Uses. Memoirs of the New York Botanical Garden Vol. 85. 246 pages.

BALICK, Michael J. and **Rosita ARVIGO**
2015 Messages from the Gods: A Guide to the Useful Plants of Belize. The New York Botanical Garden, Oxford University Press.

BUENO, Joaquín, ALVAREZ, Fernando and **Silvia SANTIAGO (Editors)**
2005 Biodiversidad del Estado de Tabasco. CONABIO, Instituto de Biologia, UNAM, Mexico. 370 pages

COOK, Suzanne
2016 The forest of the Lacandon Maya: an ethnobotanical guide. Springer. 334 pages.

One of the most helpful and informative monographs on ethnobotanical aspects of plants of this part of the Lacandon area of Chiapas.

Probably since *Aechmea tillandsioides* is nowadays not often used by local people, this colorful bromeliad is not in her botanical index. However it would be worth checking all Lacandon and Q'eqchi' Mayan areas of Chiapas and Guatemala to see if the roots are used, since for Belize this is a use listed by Balick and Arvigo.

Sold online: www.springer.com/la/book/9781461491101

CROAT, Thomas B.
1978 Flora of Barro Colorado Island. Stanford University Press. 943 pages.

https://books.google.com.gt/books?id=Whc_ahfhFFoC&pg=PA231&lpg=PA231&dq=thomas+b.+croat+aechmea+tillandsioides&source=bl&ots=VqnSB1TtWt&sig=ACfU3U13QTQZnzzBqTI1e4SgbYytSEj_qw&hl=en&sa=X&ved=2ahUKEwjOv4ikrffsAhUDqlkKHQPGD2MQ6AEwDnoECAgQAg#v=onepage&q=thomas%20b.%20croat%20aechmea%20tillandsioides&f=false

ESPEJO-Serna, Adolfo and **Ana Rosa LÓPEZ-Ferrari**
2010 La familia Bromeliaceae en México. Botanical Sciences 96 (3): 533-554, 2018.

Downloadable: www.scielo.org.mx/pdf/bs/v96n3/2007-4476-bs-96-03-533.pdf

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LAUBE, Stefan and **Ferhard ZOTZ**
2006 Neither Host-specific nor Random: Vascular Epiphytes on Three Tree Species in a Panamanian Lowland Forest. Annals of Botany 97: 1103–1114, 2006.

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1937 The Vegetation of Peten. Carnegie Institution of Washington, Publ. 478. Washington. 244 pages.

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1938 Plants Probably Utilized by the Old Empire Maya of Peten and Adjacent Lowlands. Papers of the Michigan Academy of Sciences, Arts and Letters 24, Part I:37-59.

MARTÍNEZ, J. N
2011 Estado actual y valor de uso etnobotánico de las especies vegetales utilizadas en la industria artesanal alfarera del municipio de Guatajiagua, Morazán El Salvador. Universidad de El Salvador. 54 pages.

MEAVE, Jorge A., ROMERO-Romero, Marco A.,VALLE-DOMÉNECH, ANDRÉS;RINCÓN-GUTIÉRREZ, ARMANDO;MARTÍNEZ, ESTEBAN and **Clara H. RAMOS**
2008 Plant diversity assessment in the Yaxchilán Natural Monument, Chiapas, México Boletín de la Sociedad Botánica de México, Núm. 83, sin mes, 2008, pp. 53-76. Sociedad Botánica de México, A.C. México.

Downloadable from Redalyc.

MEERMAN, J. C., HERRERA, P. and **A. HOWE**
2003 Rapid Ecological Assessment Sarstoon Temash National Park, Toledo District, Belize Volume II: Appendices (Species lists and raw data). Sarstoon Temash Institute for Indigenous Management (SATIIM).

Downloadable on the Internet.

MONDRAGÓN-Chaparro, Demetria Martha, RAMÍREZ-Morillo, Ivón Mercedes, FLORES Cruz, María and **José Guadalupe GARCÍA-Franco**
2011 La familia Bromeliaceae en México. Universidad Autónoma Chapingo. Grupo Publicitario Imagen Digital, Texcoco, Edo. de México

MORALES-Linares, Jonas
Spatial structure of ant-gardens: Vertical distribution on host trees and succession/ segregation of associated vascular epiphytes.

www.researchgate.net/publication/318201906_Spatial_structure_of_ant-gardens_Vertical_distribution_on_host_trees_and_successionsegregation_of_associated_vascular_epiphytes/link/59b06c42458515a5b484e061/download

RAMÍREZ Morillo, Ivón M. and **F. C. GERMÁN Carnevali**
1999 A new species of Tillandsia, some new records and a checklist of the Bromelliaceae from the Yucatán Peninsula. Harvard Papers in Botany Vol. 4, No. 1 (September 1999), pp. 185-194.

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2010 Bromelias. pp 228-233 In; La Biodiversidad en Campeche: Estudio de Estado. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (conabio), Gobierno del Estado de Campeche, Universidad Autónoma de Campeche, El Colegio de la Frontera Sur. México. 730 pages. Volume coordinators: Villalobos-Zapata, G. J., and J. Mendoza Vega (Coord.)

Download: http://bioteca.biodiversidad.gob.mx/janium/Documentos/7371.pdf

SELVEN Pérez, Edgar and **Miriam Lorena CASTILLO Villeda**
2000 A rapid assessment of avifaunal diversity in aquatic habitats of Laguna del Tigre National Park, Petén, Guatemala. Pages 56-60 in: A Biological Assessment of Laguna del Tigre National Park, Petén, Guatemala, Bestelmeyer, B.T. and Alonso, L.E. (editors). Conservation International.

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STANDLEY, Paul C. and **Samuel J. RECORD**
1936 The Forests and Flora of British Honduras. Field Museum of Natural History. Publication 350, Botanical Series Volume XII. 432 pages plus photographs.

STANDLEY, Paul C. and **Julian A. STEYERMARK**
1958 Flora of Guatemala. Fieldiana: Botany, Vol. 24, Part I. Chicago Natural History Museum.

Downloadable from several web sites. Here is one:

https://libsysdigi.library.illinois.edu/oca/Books2009-04/floraofguatemala1fistan/floraofguatemala1fistan.pdf

VÉLIZ Mario, MIJANGOS, Ismael and **Vilma FIALKO**
2010 Guía florística del sitio arqueológico Naranjo-Saal, Petén, Guatemala. IDAEH-WMF-PIAREN-FCG, 31 pages.

Nicely designed, helpful, list of orchids and bromeliads of the Naranjo site area of Parque Nacional Yaxha Nakum Naranjo. Archaeologist Vilma Fialko also saves all orchids and bromeliads which are found blown over in heavy rain storms.

VOGL, C. R., VOGL-Lukasser, B. and **J. CABALLERO**
2002 Homegardens of Maya Migrants in the District of Palenque (Chiapas/México): Implications for Sustainable Rural Development. In: Stepp, J.R., Wyndham, F.S., and R.K. Zarger (eds.). Ethnobiology and Biocultural Diversity. Pp: 631 – 647. University of Georgia Press; Athens, Georgia

LEE, Jones

1972 A Highland Maya People and their Habitat: The Natural History, Demography and Economy K´ekchí´ PhD dissertation. 475 pages.

His field work was near San Pedro Carcha, which is now a suburb of Cobán, Alta Verapaz. The climate is moist due to moist clouds during many times of the year.

Downloadable on the Internet.

WOLF, J. H. D. and **A. FLAENCO S.**

2003 Patterns in species richness and distribution of vascular epiphytes in Chiapas, México. J. Biogeogr. 30(11): 1689-1707.

HELPFUL WEB SITES FOR ANY AND **ALL PLANTS**

There are several web sites that are helpful even though not of a university or botanical garden or government institute.

However most popular web sites are copy-and-paste (a polite way of saying that their authors do not work out in the field, or even in a botanical garden). Many of these web sites are click bait (they make money when you buy stuff in the advertisements that are all along the sides and in wide banners also. We prefer to focus on web sites that have reliable information.

https://serv.biokic.asu.edu/neotrop/plantae/
Neotropical Flora data base. To start your search click on this page:
https://serv.biokic.asu.edu/neotrop/plantae/collections/harvestparams.php

http://enciclovida.mx
CONABIO. The video they show on their home page shows a wide range of flowers pollinators, a snake and animals. The videos of the insects are great.

www.kew.org/science/tropamerica/imagedatabase/index.html
Kew gardens in the UK is one of several botanical gardens that I have visited (also New York Botanical Gardens and Missouri Botanical Gardens (MOBOT), in St Louis. Also the botanical garden in Singapore and El Jardín Botánico, the open forest botanical garden in Guatemala City).

www.ThePlantList.org
This is the most reliable botanical web site to find synonyms. In the recent year, only one plant had more synonyms on another botanical web site.

WEB SITES SPECIFICALLY ON *AECHMEA* GENUS OR ***AECHMEA TILLANDSIOIDES*** SPECIES

www.cicy.mx/sitios/flora%20digital/ficha_virtual.php?especie=173
Often a helpful web site but very little information on *Aechmea tillandsioides*. But does at least mention that it is found in Tabasco, Campeche and Quintana Roo. However it is only rarely mentioned for Tabasco, but considered common in habitats that are appropriate (southern Campeche and southern Quintana Roo).

http://www.fcbs.org/pictures/Aechmea.htm
Lists all species of *Aechmea* (but does not indicate where they are found).

www.maya-ethnobotany.org
This web site of FLAAR (USA) and FLAAR Mesoamerica (Guatemala) has two pages on this plant: one where found in Parque Nacional Yaxha, Nakum and Naranjo by our team last year. And one page where found in Biotopo Chocon Machacas, Municipio de Livingston, Izabal, Guatemala. We estimate this species is very common on trees throughout the Municipio de Livingston.

www.naturalista.mx/taxa/283296-Aechmea-tillandsioides
Gorgeous photos (though the color balance may be a tad off; the red is a bit too red).

APPENDIX A

Where has *Aechmea tillandsioides* been stored in Botanical Herbaria that are listed on the Neotropical Flora data base

- **Missouri Botanical Garden**
- **Catalog #:** 3459083
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Bitther,
- **Collector:** Rafael Molina 4856
- **Date:** 1976-10-10
- **Locality:** Guatemala, Izabal, El Estor, Canaboncito

https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=963642&clid=0

- **Missouri Botanical Garden**
- **Catalog #:** 3594981
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Utley (NOLS),
- **Collector:** W.E. Harmon & J.A. Fuentes 2117
- **Date:** 1970-03-14
- **Locality:** Guatemala, Izabal, 15.8 km S of Modesto Méndez. Collection from along newly constructed road in mixed tropical rainforest. Epiphytes from an oak tree feld by road construction 15.76 -89.1
- **Elevation:** 70 meters (230ft)

https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=964708&clid=0

- **Missouri Botanical Garden**
- **Catalog #:** 1976048
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** J. Utley
- **Collector:** Thomas B. Croat 24678
- **Date:** 1973-06-18
- **Locality:** Guatemala, Petén, Vicinity of Archeological camp on north shore of Lake Yaxha. Disturbed forest 17.06 -89.39
- **Elevation:** 152 meters (499ft)

https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=942939&clid=0

- **Missouri Botanical Garden**
- **Catalog #:** 100276492
- **Taxon:** *Aechmea tillandsioides* (Mart. ex Schult. & Schult. f.) Baker
- **Family:** Bromeliaceae
- **Determiner:** M. Véliz
- **Collector:** 1265
- **Date:** 1989-03-10
- **Locality:** Guatemala, Petén, Yaxhaw, El Petén.

https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=930607&clid=0

- **Missouri Botanical Garden**
- **Catalog #:** 1793184
- **Taxon:** *Aechmea tillandsioides* var. *kienastii* (E. Morren ex Mez) L.B. Sm.
- **Family:** Bromeliaceae
- **Determiner:** L.B. Smith,
- **Collector:** C.L. Lundell 15498
- **Date:** 1959-01-29
- **Locality:** Guatemala, Petén, Tikal National Park, Tikal. In ramonal covering the ruins 17.23 -89.61

https://serv.biokic.asu.edu/neotrop/plantae/collections/individual/index.php?occid=941103&clid=0

APPENDIX B

Where has *Aechmea tillandsioides* been located in Guatemala Based on herbaria of Guatemala (which are not yet digitized)

We will include this information in a second edition (when the herbaria are open).

APPENDIX C

Ant Relationships with *Aechmea tillandsioides*

While doing research on *Aechmea tillandsioides* I found several articles and reports which mentioned a relationship of ants and *Aechmea tillandsioides*. Since these ants are evidently focused on the roots, I have not yet noticed them because the flowers are so photogenic, I must admit I focused totally on the flowers. We do not yet have our own documentation nor photos of ants associated with the roots of *Aechmea tillandsioides* in Municipio Livingston. Nonetheless, we show here an introductory bibliography on this ant relationship.

We are long ago familiar with the well-known ant symbiosis with bull-horn acacia ("subin" is the local name for these kinds of plants). And of course we are equally familiar with the ant symbiosis of the hollow trunks of *Cecropia* trees ("guarumo" is the local name for these trees).

Plus about two years ago, while hiking along trails looking for wild vanilla orchid vines in really remote areas south of Laguna Lachua (Alta Verapaz), we noticed that most of the *Costus* flowers had ants on them. Same in the Biotopo Chocón Machacas: at least 40% of the *Costus* flowers had ants on them. In other words, we enjoy studying, learning about, photographing, and then publishing about ant relationships with plants in Guatemala.

MORALES-Linares, Jonas

Spatial structure of ant-gardens: Vertical distribution on host trees and succession/ segregation of associated vascular epiphytes.

www.researchgate.net/publication/318201906_Spatial_structure_of_ant-gardens_Vertical_distribution_on_host_trees_andsuccessionsegregation_of_associated_vascular_epiphytes/link/59b06c42458515a5b484e061/download

Izabal

- 1. Área sin protección
- 2. Parque Nacional Río Dulce
- 3. El Higuerito
- 4. Área de Usos Múltiples Río Sarstún
- 5. Sierra de Santa Cruz
- 6. Biotopo Protegido Chocón Machacas
- 7. Reserva Protectora de Manantiales Cerro San Gil

Elaborado por: Andrea de la Paz; Amanda Estrada Rodas. FLAAR Mesoamerica 2020

FLAAR MESOAMÉRICA

ACKNOWLEDGEMENTS TO FLAAR MESOAMÉRICA

The reports are a joint production between the field trip team and the in-house office team. So here we wish to cite the full team:

Flor de María Setina is the office manager, overseeing all the diverse projects around the world (including FLAAR-REPORTS research on advanced wide-format digital inkjet printers, a worldwide project for over 20 years). We also utilize the inkjet prints to produce educational banners to donate to schools.

Vivian Díaz environmental engineer, is project manager for flora, fauna projects (field work and resulting reports at a level helpful for botanists, zoologists and ecologists, and for university students). Also coordinates activities at MayanToons, division where educational material for kids is prepared.

Victor Mendoza identifies plants, mushrooms, lichen, insects, and arachnids. When his university schedule allows, he also likes to participate in field trips on flora and fauna research.

Vivian Hurtado prepares the bibliography for each subject and downloads pertinent research material for our e-library on flora and fauna. All of us use both these downloads plus our in-house library on flora and fauna of Mesoamerica (Mexico through Guatemala into Costa Rica).

Andrea de la Paz is a designer who helps prepare the master-plan for aspects of our publications. She is our editorial art director

Senaida Ba is photography assistant for many years. She knows the Canon, Nikon and is learning the two new Sony mirrorless cameras. She prepares, packs, sets-up, and helps the photographers before, during, and after each day's field trip.

Jaqueline González is a designer who puts together the text and photographs to create the actual report (we have several designers at work since we have multiple reports to produce).

Roxana Leal is Social Media Manager for flora and fauna research and publications, and MayanToons educational book projects

María Alejandra Gutiérrez is an experienced photographer, especially with the Canon EOS 1D X Mark II camera and 5x macro lens for photographing tiny insects, tiny flowers, and tiny mushrooms. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

David Arrivillaga is an experienced photographer and is able to handle both Nikon and the newest Sony digital cameras. Work during and after a field trip also includes sorting, naming, and processing. And then preparing reports in PDF format.

Juan Carlos Hernández takes the material that we write and places it into the pertinent modern Internet software to produce our web pages (total network is read by over half a million people around the world).

Paulo Núñez is a webmaster, overlooking the multitude of web sites. Internet SEO changes every year, so we work together to evolve the format of our web sites.

Valeria Avilés is an illustrator for MayanToons, the division in charge of educational materials for schools, especially the Q'eqchi' Mayan schools in Alta Verapaz, Q'eqchi' and Petén Itzá Maya in Petén, and the Q'eqchi' Mayan and Garifuna schools in the municipality of Livingston, Izabal.

Josefina Sequen is illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequen is also an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

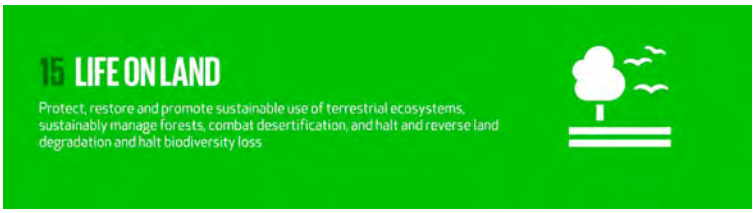
Laura Morales is preparing animated videos in MayanToons style since animated videos are the best way to help school children how to protect the fragile ecosystems and endangered species

Heidy Alejandra Galindo Setina joined our design team in August 2020. She likes photography, drawing, painting, and design.

Maria José Rabanales sheis part of the team for editing photographic reports and educational material of Flora and Fauna since September 2020. She works together with others of the team to prepare the finished pdf editions of the material of the Yaxha, Nakum and Naranjo Project.

Alejandra Valenzuela, biology student is now part of Flora y Fauna's photographic report and educational material editing team since September 2020.

Alexander Gudiel: designer who joined the editorial design team on December 2020. He will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.



The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team of International Cooperation division, Mr. Edwin Mármol, have set the goal of achieving the municipality development in the years 2020-2024 based on the goals and indicators proposed by the 2030 Agenda for Sustainable Development. From this agenda, FLAAR Mesoamerica will collaborate to achieve Sustainable Development Goal (SDG) number 15 "Life on Land".

Throughout this cooperation project, different materials have been prepared, like this Photo Essay, that helps to collect information on species, different ecosystems: terrestrial, wetlands and fresh water biodiversity. This information would also be useful as part of a strategy to protect threatened species and prevent their extinction. The municipality's goals include to promote the sustainable use, conservation and research of the species of flora and fauna of the terrestrial, wetlands and aquatic shore and coastal ecosystems of the Guatemalan Caribbean. Learn more about this project and the SDG indicators at: **https://flaar-mesoamerica.org/rain-forests-rivers-lakes-bays-ocean-caves-canyons-livingston-the-caribbean-biodiversity-wonderland-of-guatemala/**

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Hellmuth, N. (2020) Bright Red and Yellow, *Aechmea tillandsioides*. Biotopo Chocón Machacas Livingston, Izabal, Guatemala: FLAAR Mesoamerica.

BACK COVER PHOTO
Aechmea tillandsioides.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Feb. 14, 2020. Biotopo Chocón Machacas, Livingston, Izabal.

Camera: Sony a9 II. Lens: Sony FE 90mm OSS.
Settings: 1/250 sec; f/10; ISO 640.

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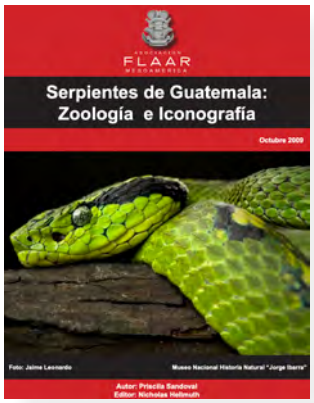

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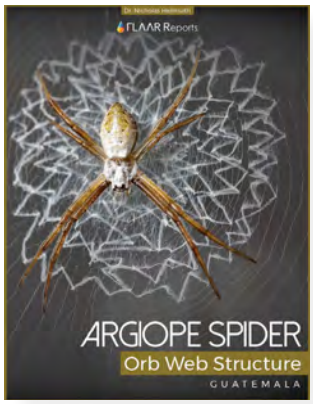

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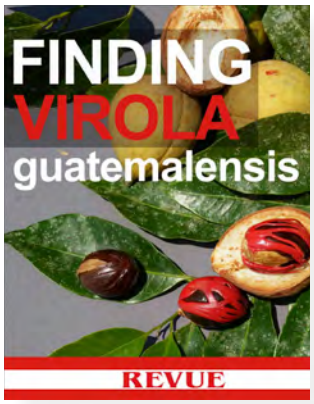

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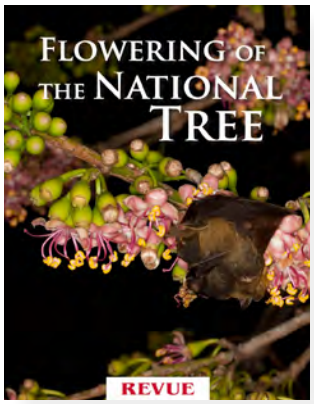

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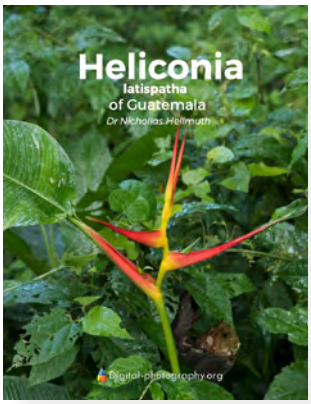

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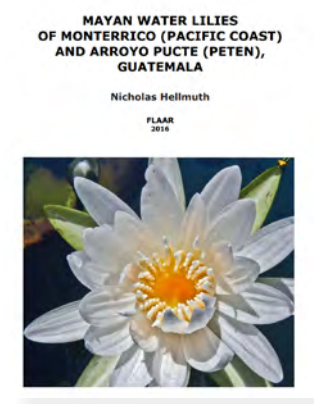

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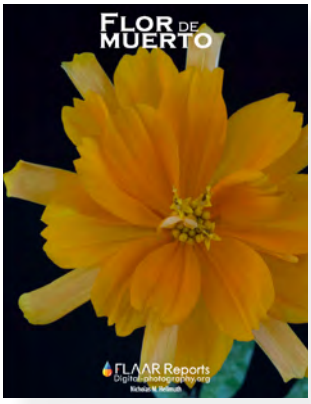

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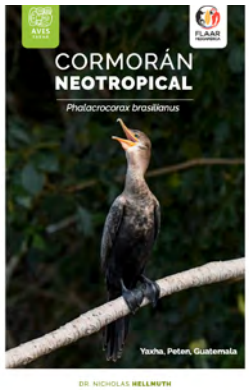

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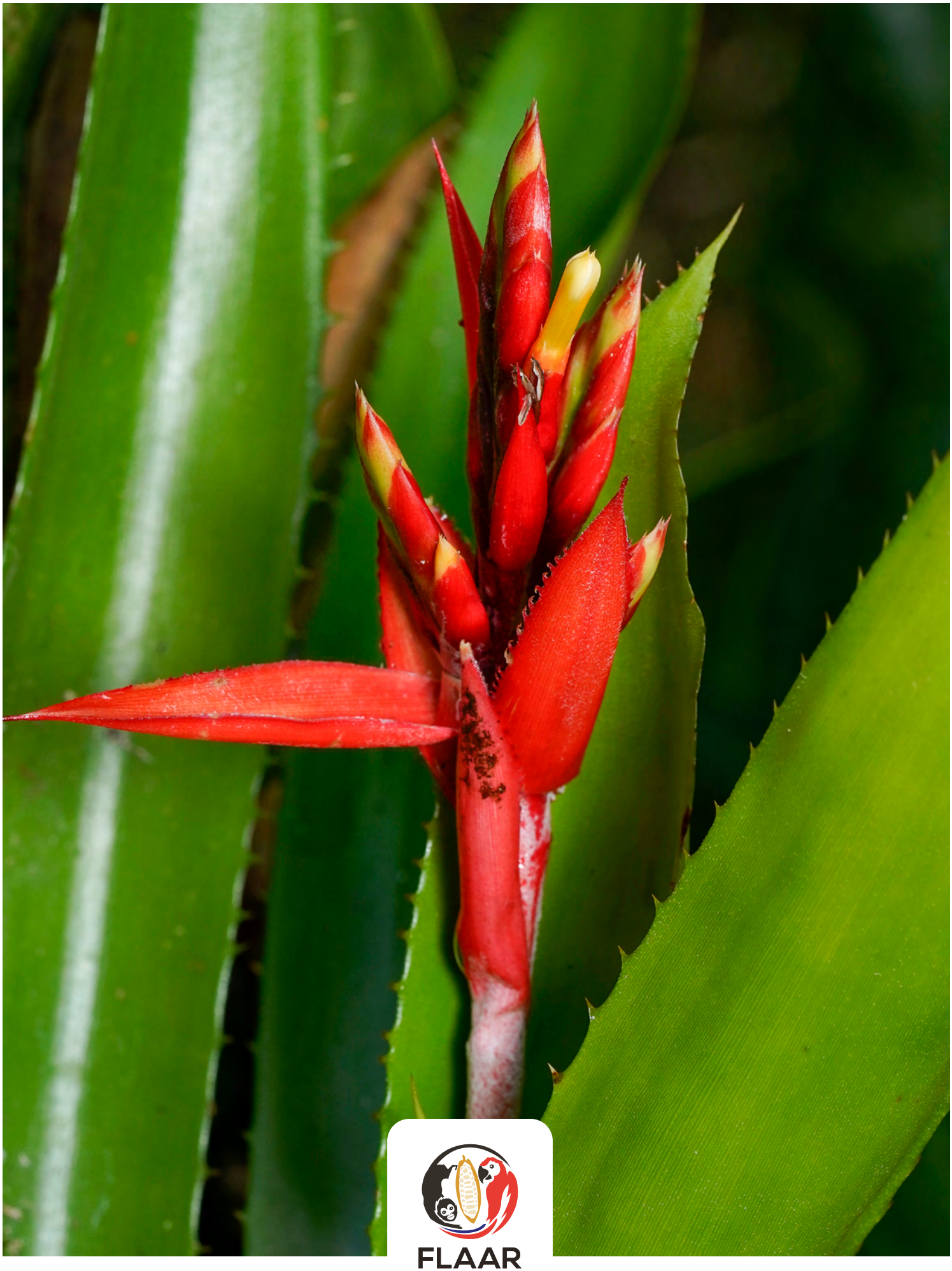

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