FLAAR
MESOAMÉRICA

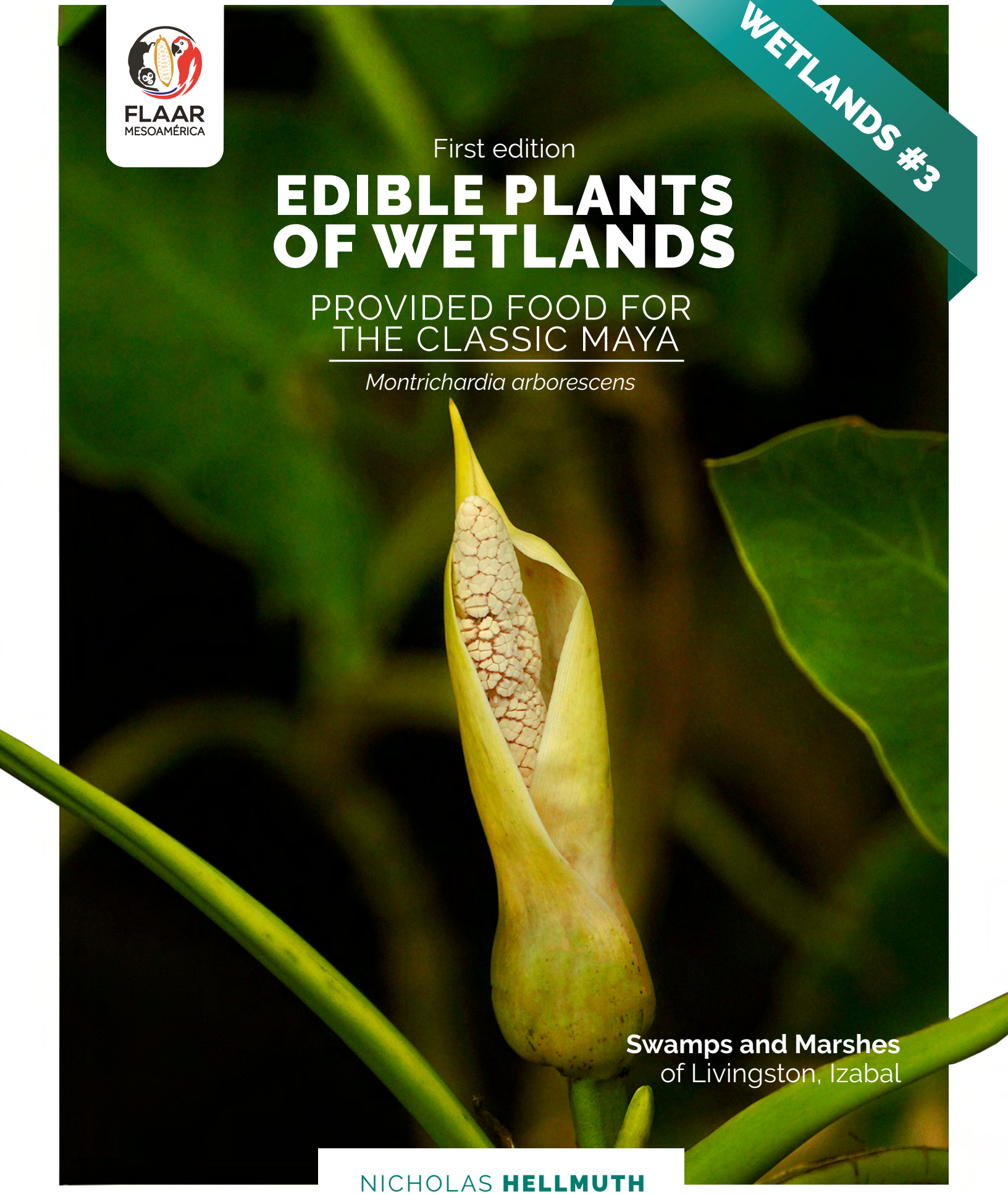
WETLANDS #3

First edition

EDIBLE PLANTS OF WETLANDS

PROVIDED FOOD FOR THE CLASSIC MAYA

Montrichardia arborescens



Swamps and Marshes
of Livingston, Izabal

NICHOLAS **HELLMUTH**

WETLANDS #3

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FEBRUARY **2021**

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Montrichardia arborescens inflorescence.
Photo by: Victor Castillo, FLAAR Mesoamerica, Dec. 17, 2020. Quehueche beach, Izabal.
Camera: Sony Alpha A7R IV. Lens: Sony FE Macro. Settings: 1/320 sec; f/7,1; ISO 2,500.

PHOTO FROM TITLE PAGE
Montrichardia arborescens inflorescence.
Photo by: Victor Castillo. FLAAR Mesoamerica, Dec. 17, 2020. Finca Gangadiwali, Livingston.
Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/125 sec; f/7,1; ISO 640.

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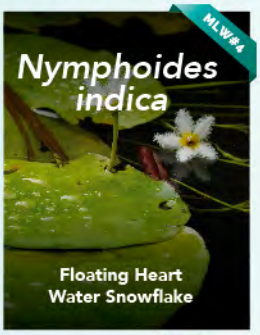
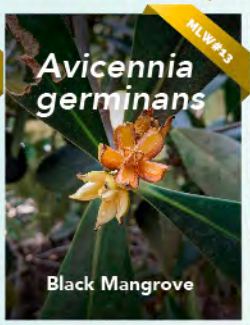
Edible Wetlands Plants of Municipio de Livingston, Izabal

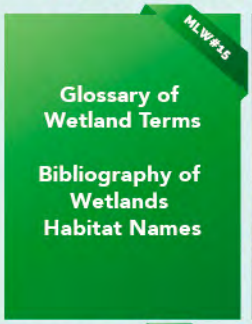
Wetland Series 1: from Swamps, Marshes and Seasonally Inundated Flatlands of Izabal

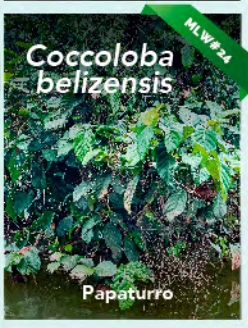


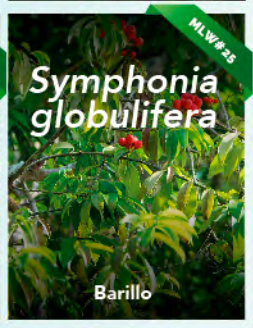
Wetland Series 2: plants that grow along the beach shore of Amatique Bay



Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean







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GLOSSARY

Bog: I thought these were primarily in Ireland, but I hiked through a bog within the Savanna "of 3 Fern Species" in Parque Nacional Yaxha, Nakum y Naranjo (PNYNN), Petén. I estimate there were areas of bog within the Savanna East of Nakum as well. We (Teco, Lorena, and I) even found "bog moss" all over the ground in one area of the Savanna of 3 Fern Species, a savanna I discovered from aerial photographs of IGN.

Marsh: usually has water all year but has no total tree cover. Grasses, reeds and low plants are more common; plus, underwater plants and floating plants.

Riparian: the bank of a river or stream. In a location such as the Municipio de Livingston, it would help to have a single word for the bank of a river, stream, and lagoon. I will use shoreline or comparable.

Swamp: usually has water all year but has lots of trees. During the rainy season the water simply gets deeper. Petén has more marshes than swamps; Izabal has both. You get mangrove swamps all around the Caribbean coast and parallel to the Pacific Ocean coast (several impressive mangrove swamp areas inland from the Pacific coast of Guatemala).

Wetland: to me is a generic word to cover swamps, marshes, and seasonally inundated areas. Each ecologist and geographer and botanist use their own academic terms. But, Holdridge (life zone systems) never hiked through the Savanna of 3 Fern Species nor the Savanna East of Nakum nor took a boat up all the rivers entering into El Golfete. And if he cruised up Arroyo Petexbatún, he (and Lundell and all other capable scholars who accomplished fieldwork in Petén) did not get out of their seats on the lancha to hike through the swamps to see what was 100 to 200 meters inland.

Life of Land: is the Sustainable Development Goal (number 15) wich is focused on the conservation of terrestrial and fresh water ecosystems. Municipio de Livingston has multiple natural areas associated to rivers, lagoons and wetlands for example.

Mortrichardia arborescens

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Livingston, Izabal.
Camera: Sony Alpha A7R IV. Lens: Sony FE Macro. Settings: 1/250 sec; f/7,1; ISO 2,500.

INTRODUCTION TO A PHILODENDRON-LIKE VINE **THAT IS A "TREE" *MONTRICHARDIA ARBORESCENS***

Montrichardia arborescens is a plant native to the swamps and marshes of Mesoamérica and South America. The fruits are huge and potentially edible. What if the Classic Maya were aware of the edible nature of the seeds and noticed how many already grew in swamps and marshes?

Yet this plant is not mentioned, discussed, or introduced in 99% of books and articles on foods of the Maya. In over 50 years of interest in plants of the Maya, I have never seen this plant in the wild not read about it in any book. But in November 2020 we found thousands of this plant along the edges of swamps and marshes while entering these areas via rivers and creeks from El Golfete, Municipio de Livingston, Izabal, Guatemala.

Let's also introduce the unexpected botanical aspects of this plant: a "*Philodendron*" that is a "tree" but acts like a vine on steroids. This plant is not a vine and does not climb up trees: it is a tall energetic "sapling". But every part of the plant has DNA from Araceae vines and the *Montrichardia arborescens* version still grows in some aspects as if it were a *Philodendron*. We need to get our plant illustrators in front of this plant and do a series of illustrations to make a glossary of each part because everything about this plant conflicts with what I know about Araceae.

Since I am not an expert in Aroids, I am relieved to notice that botanist Kunth also seemed to estimate that this plant was a *Philodendron*

(www.theplantlist.org/tpl1.1/record/kew-129694).

What made me notice it here in Izabal was that clearly it is an Aroid. I am not a botanist but I can tell from the leaf that it is of the Family Araceae. But what confused me was that although the leaves and other parts looked like dozens of different Aroid vines, this plant was nowhere trying to entwine with vines nor climb up any tree trunk.

It was pure luck that about 1% of the plants were either flowering or fruiting. So, we had the unexpected opportunity to photograph the spadix and the fruit.

I was really pleasantly surprised to find (on Wikipedia) that parts are edible. But I will have to accomplish lots more research for this plant in Guatemala. I will check the publications of Croat to learn more. Standley and Steyermark make no mention of any part being edible (1958). They do not list the plant for Mexico (but Croat does, 2005). So, I estimate that no publication on plants of the Maya yet lists this as a potentially edible plant.

We have a 15-month contract with the Alcalde of the Municipio de Livingston, Daniel Pinto and his team, for us to explore and photograph remote areas of the Municipio de Livingston and list all flora and fauna of interest that we find. We will then share our finds with CONAP and with the Municipio and make our findings available to botanists in Guatemala, Mesoamérica, and the rest of the world.

***Montrichardia arborescens* (L.) Schott.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Dec. 18, 2020. Río Chocón Machacas, Livingston, Guatemala. Camera: Nikon D810. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Settings: 1/500 sec; f/7,1; ISO 3,200.

MY PERSONAL EXPERIENCE WITH *MONTRICHARDIA ARBORESCENS:* **AN AROID THAT IS ACTUALLY A TREE**

I first noticed this plant in November 2020 when the lancha slowed down to enter between large trees so we could have lunch. There is nowhere you can walk when you enter a swamp via a river; so almuerzo is in the boat (we bring lunch every day). After I had finished eating, I began to look around to see what plants I could study. Most of the trees of these swamps are so high that you can't see their leaves about the crown.

I noticed a vine-like plant rising about a meter out of the water. It looked like an obvious relative of a *Philodendron*. The leaves and the stem and the "branches" looked like a vine but overall, the plant rose up like a sapling: however not one of these plants was attempting to find a tree to climb up.

Once I had noticed the leaf size and shape, I began to see more of these plants on both sides of the river, day after day, as we entered wetlands inland from El Golfete. Each day we went up and down a different river or creek. There are so many *Montrichardia arborescens* that we photographed only samples.

When I got back to my library and learned that the giant fruits are edible, I about fell off my chair with surprise. Why is such a giant edible seed mass not featured in reports on edible plants of the Maya? So, I decided to prepare this photo essay report to draw attention and to find in how many additional riversides of Guatemala (and Mexico) you should be able to find more *Montrichardia arborescens* "trees."

We found this plant along the shore of rivers that enter swamps on the north side of the El Golfete area. We found lots of these plants along the Creeke Negro (may be spelled Creek Negro but it is pronounced Creeke). And lots along Rio Chocon Machacas. These two rivers flow into the El Golfete area of Rio Dulce, Municipio de Livingston, Izabal, Guatemala.

I had never seen this plant in Peten or Alta Verapaz. Does that mean it likes brackish water? But it grows far upstream from El Golfete. Yet during a hurricane even upstream got about an extra meter of water depth (but I doubt it was tide going upstream; I bet it was water coming down from the hills further north). It would be helpful for an ecologist to answer the question of why it is so common here in Izabal. Or maybe I simply never noticed it before in Petén or Alta Verapaz.

Montrichardia arborescens. Family: Araceae.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Nov. 04, 2020.
Río Chocón Machacas, Livingston.
Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS. Settings: 1/8000 sec; f/7.1; ISO 6,400.

FULL BOTANICAL **NAME**

Montrichardia arborescens (L.) Schott
Family: Araceae

HERE ARE SYNONYMS FOR ***MONTRICHARDIA ARBORESCENS***

Arum aculeatum (G.Mey.) Steud.
Arum arborescens L.
Caladium aculeatum G.Mey.
Caladium arborescens (L.) Vent.
Caladium arboreum Kunth
Montrichardia aculeatum (G.Mey.) Crueg.
Montrichardia arborea (Kunth) Schott
Montrichardia fendleri Schott
Montrichardia splitgerberi Schott
Philodendron arborescens (L.) Kunth
Philodendron arboreum (Kunth) Kunth
Pleurospa reticulata Raf. [Illegitimate]

(www.theplantlist.org/tpl1.1/record/kew-129694)

Montrichardia arborescens.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Dec. 18, 2020. Río Chocón Machacas, Livingston, Guatemala. Camera: Nikon D810. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro.
Settings: 1/500 sec; f/7,1; ISO 3,200.

Mortrichardia arborescens

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020.El Golfete, Livingston.
Camera: iPhone 12.

LOCAL NAMES FOR ***MONTRICHARDIA ARBORESCENS***

Camotillo, mosaico (misspelled músico), water chestnut. However, I have not yet noticed reports that suggest the root is edible. What is edible are the nuts in the giant fruit.

Malanga acuática; masico (Corona 2013: 55).

HOW MANY OTHER PLANTS OF GUATEMALA **HAVE THE SAME SPANISH NAME?**

Camotillo is a recipe for camote (sweet potato). Camotillo is also the name of a fish. So, you get a lot of Google returns.

Montrichardia arborescens. The spike inflorescence, when it matures, will leave an edible fruit.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: Nikon D810. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Settings: 1/250 sec; f/10; ISO 1,600.

Landscape of a swamp, distinctive of the wetlands ecosystems in the Caribbean side of the country.
Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: iPhone 11 Pro Max.

HABIT FOR ***MONTRICHARDIA ARBORESCENS***

Three experienced botanists list this plant as an herb (Balick, Nee and Atha 2000). Yet it regularly grows over 3 meters high and can reach 5 meters in height (Croat, Fernández and González 2005). The fruit pod (seed pod) itself is larger than most normal fruits (only zapoton is larger "*Pachira aquatica*"). Yet the stem is only a few centimeters in diameter (as you would expect of a plant whose relatives are mostly vines).

HABITAT FOR ***MONTRICHARDIA ARBORESCENS***

You easily see lots of these plants on the edge of rivers flowing through tree-filled swamps directly on the edge, with their roots in water. But they can also grow up on the riversides; in Municipio de Livingston these river edges can be muddy or can be karstic beneath the trees. Since many lagoons and rivers and creeks flood most years in the rainy season, *Montrichardia arborescens* can survive this aspect.

We need to learn whether *Montrichardia arborescens* can grow in an actual year-long swamp. I estimate yes. And can it grow only with its roots covered by water?

Although we found this plant under lots of tall trees, I also estimate that *Montrichardia arborescens* prefers lots of sun and thus I wish to learn whether in the tree-covered swamps it grows primarily on the edges. But this needs to be checked. Since we are passing through these swamps in a boat, and since the water is very deep, we have no way to "enter" the swamp since the three roots are too entangled.

Montrichardia arborescens is listed for species collected "en los rios Carrizal, Samaria y zonas acuaticas circundantes"

(Bueno et al: 2006: 120, Tabla 2)

***Montrichardia arborescens* (L.) Schott.**

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: Google Pixel 3 XL.

WHY DOES ONLY ONE BOTANIST SUGGEST IS FROM **SOUTH AMERICA AND NOT NATIVE TO MESOAMERICA?**

> **Montrichardia arborescens** (L.) Schott
> Hábitat. Cuerpos de agua, como lagunas. Del nivel del mar hasta 100 m de altitud. Distribución. De origen sudamericano, introducida en México. Otras observaciones. Esta especie se ha citado en la literatura como Montrichardia aculeatum (G. Mey) Crueg. y Montrichardia arborea (Kunth) Schott. Parece ser una especie escasa o recientemente introducida a México ya que sólo existe una colecta del estado de Tabasco. Aunque es posible que también se encuentre en otros estados del sureste mexicano colindantes con Centroamérica donde se ha reportado la presencia del género. Novelo y Ramos 1510 (MEXU).
>
> (Lot et al. 2013: 62)

WHAT OTHER TREES OR PLANTS ARE OFTEN **FOUND IN THE SAME HABITAT?**

> Bueno et al. list over 100 different plants in the wetlands of even just one area of Tabasco
>
> (2006: Tabla 2, pp. 120-121).

Would help for a student to undertake a thesis on *Montrichardia arborescens* in Izabal and to make lists of every plant which is growing in the same habitats.

Montrichardia arborescens.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Río Chocón Machacas, Livingston. Camera: Nikon D5. Lens: AF-S VR Micro-Nikkor 105mm IF-ED. Settings: 1/320 sec; f/7,1; ISO 2,500.

BOTANICAL DESCRIPTION OF *MONTRICHARDIA ARBORESCENS* IN STANDLEY AND CO-AUTHORS **CHICAGO BOTANICAL MONOGRAPHS**

> **Montrichardia arborescens** (L.) Schott, Arac. Betreff. 1: 4. 1854. Arum arborescens L. Sp. Pl. ed. 2. 371. 1763. Masica.
>
> Occasional in tidal swamps of the North Coast, usually growing in shallow water; Izabal. British Honduras to Panama, Lesser An- tilles, Venezuela, and the Guianas. Figure 57.
>
> Caudex as much as 3 meters high but usually lower, 1.5-2 cm. thick or toward the base much thicker, the internodes about 1 cm. long, smooth or slightly aculeo- late; petioles 20-30 cm. long, the sheath extending above the middle; blades 20-30 cm. long or often much larger, deeply sagittate, the basal lobes retrorse, triangular-lanceolate, acuminate, the anterior lobe triangular or ovate-triangular, short-cuspidate or obtuse, the primary costal nerves 3-4 on each side, united to form an obscure collective nerve close to the margin; peduncles half as long as the spathe; spathe oblong-ovate, cuspidate, 10-13 cm. long, 6-7 cm. wide, white; spadix very thick and stout, the staminate portion 7 cm. long, the pistillate part one-third as long; berries 1-1.5 cm. in diameter.
>
> The plant is a characteristic one on muddy banks of the coastal swamps. The massive stems often are supported by prop roots.
>
> The large white spathes are conspicuous and handsome, suggesting those of the cultivated calla (Zantedeschia).

(Standley and Steyermark 1958: 335-336)

So far, we have found it only "in shallow water" and "on muddy banks of the coastal swamps." We have not yet noticed it in tidal swamps. Tidal swamps near Amatique Bay in the Municipio de Livingston are primarily mangrove.

Mortrichardia arborescens

Photo by: Victor Castillo, FLAAR Mesoamerica, Dec. 17, 2020. Quehueche beach, Livingston. Camera: iPhone 11 Pro Max.

MONTRICHARDIA ARBORESCENS **TREES IN PETÉN**

Neither accepted name nor synonyms of this plant are in Lundell's *The Vegetation of Peten* (1937). We have scanned the entire book so we can search for any and every plant name easily (took several months to scan and correct the endless spelling errors that are typical of the scanning resulted).

This raises the question of whether *Montrichardia arborescens* requires or at least prefers brackish water (which is plentiful in Izabal but not present in Petén). But if *Montrichardia arborescens* is found in Bocas de Polochic, then I doubt it really needs brackish water. So, let's look for *Montrichardia arborescens* upstream along the edges of swamps facing Rio Polochic. Then, let's look in streams flowing through swamps and marshes in Petén such as along Rio San Pedro (western Petén).

MONTRICHARDIA ARBORESCENS TREES IN BELIZE: **STANDLEY AND RECORD**

> **Montrichardia arborescens** (L.) Schott. A tall, erect, aquatic plant, growing in shallow water. It is common in much of tropical America, but is unknown north of British Honduras.
>
> (Standley and Record 1936: 88)

MONTRICHARDIA ARBORESCENS IN BELIZE **(BALICK, NEE AND ATHA 2000)**

Montrichardia arborescens is present but not listed as edible or medicinal or usable at all by Balick, Nee, and Atha (2000). They list it as an herb.

Mortrichardia arborescens

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Nov. 07, 2020. Livingston, Izabal. Camera: Sony Alpha A9 II. Lens: Sony FE 200-600mm G OSS. Settings: 1/8000 sec; f/7,1; ISO 6,400.

MONTRICHARDIA ARBORESCENS TREES **IN MEXICO**

Montrichardia arborescens is totally missing from Villaseñor 2016. Yet Leon Ibarra González found this plant in the State of Quintana Roo along the edge of a river and published it in 2005 (Croat, Fernandez-Concha and González). But since a century ago Standley never mentions *Montrichardia arborescens* for Mexico, no surprise that other authors do not include it.

We hope to better document this plant on the map for Izabal, Guatemala and then find it on other river and swamp edges elsewhere in Guatemala in the future, when funding is available.

It is possible that *Montrichardia arborescens* prefers brackish water and thus is common in Izabal and any other areas not far from the Caribbean coast. If this is true, we would not expect *Montrichardia arborescens* in Petén.

Montrichardia arborescens.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.

Camera: Nikon D810.
Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Settings: 1/250 sec; f/10; ISO 1,600.

CLOSE RELATIVE(S) OF ***MONTRICHARDIA ARBORESCENS***

Pistia stratiotes grows in stagnant marshes; we found lots in Aguada Maya, 3 to 4 kilometers north of Yaxha (PNYNN, Petén). As is *Montrichardia arborescens, Pistia stratiotes* is also an Araceae (but sure does not look like any *Philodendron* or *Monstera* vine)

Montrichardia arborescens looks like a *Philodendron* vine that is trying to pretend to be a tree. But its "trunk" looks more the size and shape of a vine stem; and its limbs also look more like what you would expect of an Araceae vine.

Montrichardia arborescens. Family: Araceae.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: iPhone 11 Pro Max.

WHERE HAS *MONTRICHARDIA ARBORESCENS* BEEN FOUND IN THE **MUNICIPIO OF LIVINGSTON BY OTHER BOTANISTS?**

Is *Montrichardia arborescens* listed for Biotopo Protegido Chocón Machacas, CECON/USAC?

Not mentioned, no data found.

Is *Montrichardia arborescens* listed for Tapón Creek Nature Reserve (including Taponcito Creek), FUNDAECO?

Not mentioned, no data found.

Is *Montrichardia arborescens* listed for Buena Vista Tapón Creek Nature Reserve?

The Buena Vista area of Tapón Creek is new; Buena Vista is a community that is not even shown on Google maps nor can you find it in Google unless perhaps by Googling Buena Vista Tapón Creek. Since this nature reserve is new, they do not yet have a list of plants available. We would like to cooperate with them and provide the plant names that we have found. But in our visit, there we did not yet know as much about *Montrichardia arborescens* as we know now.

Is *Montrichardia arborescens* listed for Cerro San Gil (south side of Río Dulce)?

3320, but no mention of habitat whatsoever (Barrios et al. 2003: Anexo 7). But since this same report covers Chocón Machacas in addition to Cerro San Gil, I estimate that the sample is from the swamps or riversides of Chocón Machacas and not the hills of Cerro San Gil.

Is *Montrichardia arborescens* listed for El Refugio de Vida Silvestre Punta de Manabique?

Not mentioned.

Is *Montrichardia arborescens* listed for Sarstoon-Temash National Park (northern side of Río Sarstún)?

Not mentioned, but surely the plant must be here since it is on the northern side of Rio Sarstún (the Belize side of Rio Sarstoon).

Mortrichardia arborescens

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: iPhone 11 Pro Max.

Montrichardia arborescens. This plant grows happily next to the fresh water river sides on Municipio de Livingston.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. Livingston, Izabal.
Camera: iPhone 11 Pro Max.

Mortrichardia arborescens

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Quehueche beach, Livingston. Camera: Sony Alpha A7R IV. Lens: Sony FE Macro. Settings: 1/320 sec; f/7.1; ISO 2,500.

IS *MONTRICHARDIA ARBORESCENS* LISTED **FOR BOCAS DE POLOCHIC?**

Yes, Aquatic vegetation that grows in stagnant shallow water. The predominant species are:

> *Hymenocallis litoralis, Montrichardia arborescens, Nymphaea ampla* and *Pontederia* sp. (Fundación Defensores de la Naturaleza 1996).

We have found *Montrichardia arborescens, Nymphaea ampla* and *Pontederia* sp. In many of the creeks and rivers that flow into El Golfete. We have found and photographed *Hymenocallis litoralis*, beach spider lily, along the shores of lagoons near El Golfete and sometimes on river banks. *Hymenocallis litoralis* has potential medicinal properties but is not used as food. *Nymphaea ampla* was used thousands of years ago as a narcotic or comparable, but is not edible. *Montrichardia arborescens* and *Pontederia* sp. are among the more important edible plants of swamps and marshes.

If *Montrichardia arborescens* is common in Bocas de Polochic, this suggests it does not absolutely require tidal water or even brackish water to survive. But I would estimate that it does prefer brackish water because the bull shark is known to enter the other end of Lake Izabal, so it would help if a specialist could test the water in each part of Bocas de Polochic to see whether it is brackish in the area supporting *Montrichardia arborescens.*

Pontederia species is also edible. We have a separate report on this edible wetlands plant.

IS *MONTRICHARDIA ARBORESCENS* FROM THE **HIGHLANDS OR FROM THE LOWLANDS (OR BOTH)?**

In Guatemala and in Mexico only found in the Lowlands. I estimate the same for the rest of Mesoamérica, Central America, and northern South America.

WORLD RANGE FOR ***MONTRICHARDIA ARBORESCENS***

"Central America, the Lesser Antilles, and northern South America" (Croat, Fernandez-Concha and Gonzalez 2005).

Montrichardia arborescens.

Photo by: Victor Castillo, FLAAR Mesoamerica, Dec. 17, 2020. Finca Gangadiwali, Livingston.
Camera: Canon 1D X Mark II. Lens: Canon 50mm Macro. Settings: 1/125 sec; f/7,1; ISO 640.

DOES *MONTRICHARDIA ARBORESCENS* **ALSO GROW IN HOME GARDENS?**

Kitchen gardens in Guatemala do not have this plant, but if you like unusual plants to amaze visitors, I highly recommend this "alien" plant. It looks, literally, like a vine attempting to become a sapling, but stuck with all its *Philodendron* DNA so it flails around with vine-like stem and "branches."

Montrichardia arborescens.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Nov. 10, 2020. El Golfete, Livingston.
Camera: Nikon D810. Lens: Nikon AF-Micro-NIKKOR 200mm IF-ED Macro. Settings: 1/320 sec; f/11; ISO 5,000.

USES OF ***MONTRICHARDIA ARBORESCENS***

No usage of *Montrichardia arborescens* by the Chicago botanists (Standley, Steyermark, Williams, over decades). No usage of *Montrichardia arborescens* by Balick, Nee and Atha (2000). No usage of *Montrichardia arborescens* by Hellmuth (in the first 13 editions).

All mention of medicinal and edible aspects are from South America. One example is Roa and Boado (2018: 24).

But if your library has several thousand books (in searchable PDF format), then you can search hundreds of volumes and peer-reviewed journal articles in a single day:

> The fruiting spadix is eaten in many areas (25, 94, 104, 123, 135). The seeds are eaten cooked or toasted. They have a very agreeable flavor resembling that of the breadfruit. Each inflorescence contains some 80 seeds (104). The starchy roots are utilized by the natives in Paraguay (94) and Argentina (126) for food.
>
> The sap is acrid and caustic and is applied to ulcers in a poultice (66). The crushed leaves are mixed with manioc meal as a poultice for torpid abscesses, and a decoetion of the plant is used in compresses for gout. The powdered root is diuretic and drastic (66, 78, 95). Hegnauer (49) reports that the dried leaves and stem contain 0.69% steroid-sapogenine.
>
> The fibers in the stem, which extend into the root, are employed for cordage (23). The berries and fruiting spike are widely used for fishing bait (22, 23, 66). The tissues of the stem are the source of an excellent paper pulp (23, 99, 104). Considering the huge stands which this species occupies, it is a potentially important raw material, especially since the plants regenerate in about three months after cutting (104).

(Plowman 1969: 109).

I am not surprised that this plant is not eaten or used in Belize: there are hundreds of other wild edible plants and even more useful plants. What counts is that a human being can and does eat the fruit elsewhere in the Americas. Surely, 2000 years ago, the Classic Maya did also.

IS THERE POTENTIAL MEDICINAL USAGE OF ***MONTRICHARDIA ARBORESCENS*** BY LOCAL PEOPLE?

No mention of medicinal usage for Guatemala or Belize, but if you Google *Montrichardia arborescens*, medicinal you get lots of results for South America.

ARE ANY PARTS OF ***MONTRICHARDIA ARBORESCENS*** EATEN BY MAMMALS?

Manatee in South America may eat the leaves of *Montrichardia arborescens.* (Spiegelberger 2002). If you Google *Montrichardia arborescens* manatee you will find even more mention of *Montrichardia arborescens* being in areas favored by manatee. However so far all are for nowhere near Guatemala. But surely the local manatee in Izabal also appreciates the *Montrichardia arborescens* leaves and fruits.

WHAT ARE THE PRIMARY POLLINATORS OF ***MONTRICHARDIA ARBORESCENS*** FLOWERS?

The most frequent visitor, *Cyclocephala colasi*, is known to be the pollinator of *Philodendron solimoesense* and *P. melinonii* which flower at the same time in the adjacent forests surrounding the populations of *Montrichardia* (Gibernau 2013).

Montrichardia arborescens.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Livingston, Izabal.
Camera: Sony Alpha A7R IV. Lens: Sony FE Macro. Settings: 1/200 sec; f/7,1; ISO 2,500.

CONCLUDING DISCUSSION AND SUMMARY ON ***MONTRICHARDIA ARBORESCENS* TREES**

Montrichardia arborescens.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Río Quehueche.
Camera: iPhone 12 Pro Max.

There are a lot more of these plants in Izabal than any of us would have calculated. Very easy: spend a week doing library research. Then spend a week exploring deep into swamps and marshes, every day of the week going up a different river or creek. You will very quickly see that on riversides *Montrichardia arborescens* trees can be considered to be quite common.

When I saw the photograph listed below, it was like seeing precisely what I was proposing: the possibility that some marshes had amazing production of edible aquatic plants.

www.naturepl.com/stock-photo-moucou-moucou-moko-moko-montrichardia-arborescens-growing-rampant-in-image01312710.html

This is from South America, but imagine lowland marshes throughout the Maya Lowlands with this many "millions of fruit producing" fast growing miniature trees like this. Is this not a bread-basket of unexpected magnitude?

So there are a lot more rivers and swamps to search: Tabasco, Campeche, Quintana Roo, Rio San Pedro area of Peten; Rio Ixtinto area of Peten (we have not yet found any in either of those two river locations but we were not searching for *Montrichardia arborescens* in past years). Plus there are still lots more rivers, creeks, and lagoons of Municipio de Livingston, Izabal, Guatemala to search for.

Just look at the size of the *Montrichardia arborescens* seed pod. Just notice at how easily these *Montrichardia arborescens* grow in swamps. Looks like a native, natural, innovative food source available to the Maya for thousands of years.

Let's add this plant to more research projects. Even if the Maya today do not either eat it or even know that its edible, even if not in lists, we need to look in every dictionary and vocabulary for Mayan languages in areas where this plant is native (a challenge since it is known primarily in coastal areas).

> The fruiting spadix is eaten in many areas (25, 94, 104, 123, 135). The seeds are eaten cooked or toasted. They have a very agreeable flavor resembling that of the bread-fruit. Each inflorescence contains some 80 seeds (104). The starchy roots are utilized by the natives in Paraguay (94) and Argentina (126) for food.
>
> (Plowman 1969: 109)

Martin et al. list the seeds of *Montrichardia arborescens* as edible, in Colombia. (1987: 82).

What is important is learning that in fact the plant is edible and is native to the Maya Lowlands. I predict that *Montrichardia arborescens* will also be findable in the endless swamps along Rio San Pedro in western Petén.

I finish this first edition with the photograph I mention next: this is how I envision the swamps and marshes of the Maya Lowlands (before agricultural engineering was developed; and after the collapse): solid *Montrichardia arborescens,* and also in the more open swamps lots of other edible native wild wetland's plants.

This single photograph of endless mass of *Montrichardia arborescens* may change our understanding of what early inhabitants of Mesoamerica had available to eat without needing milpa slash and burn agriculture. Photo from webpage that discusses Moco Moco – A Healing Plant of the Guianas – Things Guyana (www.thingsguyana.com/moco-moco-healing-plant-of-the-guianas/).
Photo By: Tarciso Leão (https://www.flickr.com/photos/tarcisoleao/18478957961).

¡! WHAT IF?

What if all the swamps and Caribbean area river edges and lagoon edges and wetlands were this thick of this same plant in Izabal, Belize, and Quintana Roo (and potentially coasts of Honduras to the south and Yucatan, Campeche, and Tabasco to the northeast)?

What if this plant is missing from 90% of the lists of usable and edible plants of the Maya (including missing from our over a dozen years of research on underutilized and forgotten edible plants of the Maya?).

What if MILLIONS of this plant could easily grow in the wetlands and swamps of the Maya Lowlands that are near the Caribbean or Amatique Bay?

And… what if we have discovered other plants that grow in the same swamps and wetlands that are also edible?

What if we have discovered the breadbasket of the Lowland Maya (and the ingredients of Classic Maya diet)?

What if none of these plants are common on hillside forests or hilltop forests? What if this is not a "managed forest" but a "managed swamp and wetlands"?

Mortrichardia arborescens Growing along “suampos” the local Spanish name for “swamp”.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2020. Río Chocón Machacas, Livingston. Camera: Nikon D5. Lens: AF-S VR Micro-Nikkor 105mm IF-ED. Settings: 1/320 sec; f/7.1; ISO 2,500.

APPENDIX A

A few Herbaria examples of where samples have been noted for Guatemala

Most are from Colombia; endless examples from Panama. Finally a few from Guatemala:

Catalog #: 100276308
Taxon: *Montrichardia arborescens* (L.) Schott
Family: Araceae
Determiner: J. Morales
Date: 2001-07-31
Locality: Guatemala, Izabal, Livingston, Río Cálix, Biotopo Chocón Machacas. 15.79 -88.88

Rio Cálix is a great river to explore. We also saw a lot of *Montrichardia arborescens* along this river.

We recommend field trips during the height of the rainy season. This way the rivers are deep enough that your motorboat can traverse the streams that wander into the hills and swamps that line the edge of El Golfete

Catalog #: 1679773
Taxon: *Montrichardia arborescens* (L.) Schott
Family: Araceae
Collector: W.E. Harmon 2476
Date: 1970-06-08
Locality: Guatemala, Izabal, 1 km east of San Felipe. From partially cleared swampy forest along Río Dulce.15.63 -88.99
Elevation: 30 meters (98ft)

Catalog #: 01158856
Occurrence ID (GUID): 3376a4ba-ff5b-4609-b092-cb49e8d96fb4
Taxon: *Montrichardia arborescens* (L.) Schott
Family: Araceae
Determiner: M. H. Nee; D. E. Atha (1996)
Collector: D. E. Atha 1364
Date: 1996-06-08
Verbatim Date: 08 Jun 1996
Locality: Belize, Toledo District, Temash River, ca 11 km W of Caribbean Sea and ca 3.5 km N of Belize/Guatemala border, 15.9495361 -89.0334081
Elevation: 1-1 meters Verbatim
Elevation: ca 3 ft
Habitat: Riparian and floodplain forest; associated with Orbigyna, Pachira, Ceiba, Desmoncus, Cecropia, Cedrela, Bursera simarouba, tall Calophyllum, Calathea, Heliconia with upright orange bracts, Bactris mexicana?

Out of 224 samples in Herbaria, only two are from Guatemala and two are from identical location in Belize (so we cite only one). This means that in one single week (November 2020), the team of FLAAR (USA) and FLAAR Mesoamerica found and photographed more *Montrichardia arborescens* of Guatemala than all herbaria of the world (since we found this plant in multiple locations along several creeks and rivers feeding into El Golfete, and we have only barely begun to explore all the other areas of this bio-diverse area of Guatemala).

To find any and every plant, simply go to

https://serv.biokic.asu.edu/neotrop/plantae/collections/harvestparams.php

And put in the scientific name, click, and you get all the results. We don't waste time filling in any of the other things such as Locality Criteria (since we wish to see Mexico, Belize, Guatemala and nearby countries all at once).

We highly recommend botanists and botanical herbaria and university biology departments come to the Municipio de Livingston. We have over 50 years experience in Guatemala and will be glad to share our contacts and share locations where we have found plants that interest you.

REFERENCES CITED AND SUGGESTED READING ON *MONTRICHARDIA ARBORESCENS*

Helpful article on this plant: first documention of *Montrichardia arborescens* for Mexico plus mentions the potential height of 5 meters: Croat, Fernandez-Concha and Gonzalez 2005.

Helpful report on this plant: CROAT, Thomas, B., n.d., Araceae of Central America. Missouri Botanical Garden. This is helpful because of all the full-color photographs.

Essential article for uses of this plant: PLOWMAN, Timothy
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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.

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2001 The developmental floral morphology of *Montrichardia arborescens* (Araceae) revisited. *Botanical Journal of the Linnean Society* (200l), 135: 413-420. With 17 figures.

Available as a download via: https://europepmc.org/article/agr/ind23213285

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Downloadable online: www.aroid.org/gallery/gibernau/aroideana/0280011.pdf

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www.missouribotanicalgarden.org/Portals/0/staff/PDFs/croat/AraceaeOfCentralAmericaV5.pd

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

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

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DUKE, James A. and **Rodolfo VASQUEZ**
1994 Phytochemical Database. USDA - ARS - NGRL, Beltsville Agricultural Research Center, Beltsville, Maryland.

ESTRADA Loreto, Feliciana
2010 Indicadores ecológicos de la zona riparia del río San Pedro, Tabasco, México. MS Thesis, El Colegio de la Frontera Sur. 131 pages.

Download:https://ecosur.repositorioinstitucional.mx/jspui bitstream/1017/1656/1/100000050585_documento.pdf

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FUNDACION DEFENSORES DE LA NATURALEZA

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En los cuerpos de agua se encuentra una vegetación particular, la presencia de *Chara vulgaris, Ceratopteris pteridoides, Acrostichum daneaefolium, Azolla caroliniana, Salvinia auriculata, Nymphaea ampla, Utricularia foliosa, Jussiaea natans, Hymenocalis littoralis, Pistia stratiotes, Vallisneria americana, Pontederia sagittata y Typha dominguensis*, señalado por Scott y Carbonell 1,986. Además se determinó como más abundantes y representativas a la "ninfa de agua" (*N. Ampla*), "músico" (*Montrichardia arborescens*), "lechuga de agua" (*Pontederia* sp.) y "lechuguilla" (*P. stratiotes.*) (Villar, 1992) (page 16).

FUNDACIÓN PARA EL FORTALECIMIENTO DE LA FRUTICULTURA Y PLANTAS ALIMENTICIAS NO CONVENCIONALES EN COLOMBIA

2018 Frutos Comestibles Silvestres y Cultivados de Colombia. Inventario total de frutas, nueces y semillas silvestres cultivadas en Colombia.

Montrichardia arborescens apprears on page 26. The seeds are edible.

Available online, not available for download: https://issuu.com/fffpancc/docs/los_frutos_comestibles_silvestres_y_cultivados_de_

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2005 Elsevier's Dictionary of Trees: Volume 1: North America. ELSEVIER. 1493 pages.

HALL, Louisa
2016 *Monstrous deliciousness* and devilish fruit - Kew's edible aroids. 1 web page.

and the 'fruit of the devil'? This is *Montrichardia arborescens*, cultivated in South America for its starchy tubers, and acquired its nickname due to its irresistible fruiting spadices which produce large infructescences, each containing about 80 edible yellow fruits. (Hall 2016).

Downloadable: https://www.kew.org/read-and-watch/edible-aroids

HARRIS, Roger and **Peter HUTCHISON**
2011 Amazonas. Guias Bradt. Alhena Media. 432 pages.

(*Montrichardia arborescens*) es común a lo largo de los ríos lentos de igapó. Crece sobre un tallo alto y corpulento y tiene un enorme espádice comestible parecido a la piña. (page 111).

HELLMUTH, Nicholas M.
2013 Maya Ethnobotany, Complete Inventory, Fruits, nuts, root crops, grains, construction materials, utilitarian uses, sacred plants, sacred flowers 12th edition. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala). 106 pages.

The 13th edition that followed is an update but the 12th edition has tons of material to get you started.

HELLMUTH, Nicholas M.
2014 Maya Ethnobotany, Complete Inventory, Fruits, nuts, root crops, grains, construction materials, utilitarian uses, sacred plants, sacred flowers 13th edition. FLAAR Reports, FLAAR (USA) and FLAAR Mesoamerica (Guatemala). 111 pages.

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www.botanicalsciences.com.mx/index.php/botanicalSciences/article/download/1660/1309/

MARTIN, Franklin W., CAMPBELL, Carl W. and **Ruth M. RUBERTE**
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http://naldc.nal.usda.gov/download/CAT87886130/PDF

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). Temash Institute for Indigenous Management (SATIIM). 92 pages.

PARKER, Tracey
2008 Trees of Guatemala. The Tree Press. 1033 pages.
This plant was named arborescens, but is missing from Parker's book.

PEÑA-Chocarro, María and **Sandra KNAPP**
2011 Árboles del mundo maya. Natural History Museum Publications. 263 pages.

Helpful book; contributing authors are experienced botanists. They cover 220 species of trees, more than virtually all other "Books on Trees of the Maya." Even include tasiste (which is missing from all other books on "Trees of the Maya" except for the recent book on Árboles de Calakmul.

But if all this effort is going into a book, would help if there were more photos, larger photos, and not so much blank space at the bottom of each page. Plus would help if the text could include personal first hand experience with these trees out in the Mundo Maya. But even as is, it is a helpful book.

If you are doing field work you need this, plus Árboles de Calakmul, plus Árboles tropicales de México. Parker's book you need back in your office, since out in the field it's not much help due to lack of photographs. Back in your office the books by Regina Aguirre de Riojas are also helpful.

PLOWMAN, Timothy
1969 Folk Uses of New World Aroids. *Economic Botany* 23(2):97-122.

ROA, Johanna Andrea G. and **Danna Sofia G. BOADO**
2018 Frutos comestibles silvestres y cultivados de Colombia. Inventario total de frutas, nueces y semillas silvestres y cultivados, en Columbia. Fundacion para el Fortalecimiento de la Fruticultura y Plantas Alimenticias no Convencionales en Colombia. 46 pages.

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SPIEGELBERGER, Thomas
2018 Frutos comestibles silvestres y cultivados de Colombia. Inventario total de frutas, nueces y semillas silvestres y cultivados, en Columbia. Fundacion para el Fortalecimiento de la Fruticultura y Plantas Alimenticias no Convencionales en Colombia. 46 pages.

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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.
1923 Trees and Shrubs of Mexico. Contributions from the United States National Herbarium, Volume 23, Part 3. Smithsonian Institution.

In this one monograph the species are not listed in alphabetical order, so it's a mental adventure finding the species you are looking for.

All monographs by Standley and co-authors can be easily found and downloaded. I would recommend finding the .pdf versions as they are easier to store, easier to copy, and easier to share with students and colleagues.

STANDLEY, Paul C. and **Julian A. STEYERMARK**
1958 Flora of Guatemala. Fieldiana: Botany, Volume 24, Part I Chicago Natural History Museum. 478 pages

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2000 Endemismo florístico en la reserva de la biosfera Sierra de las Minas. USAC

Unfortunately the PDF is locked, so no way to show the information without having to hand type each letter, each word, each list.

Download here:
http://glifos.concyt.gob.gt/digital/fodecyt/fodecyt%201999.69.pdf

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2016 Checklist of the native vascular plants of Mexico. Catálogo de las plantas vasculares nativas de México. Revista Mexicana de Biodiversidad 87 (2016) 559–902.

http://revista.ib.unam.mx/index.php/bio/article/view/1638/1296

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. So 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://legacy.tropicos.org/NameSearch.aspx?projectid=3
This is the main SEARCH page.

https://plantidtools.fieldmuseum.org/pt/rrc/5582
SEARCH page, but only for collection of the Field Museum herbarium, Chicago.

https://fieldguides.fieldmuseum.org/guides?category=37
These field guides are very helpful. Put in the Country (Guatemala) and you get eight photo albums.

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.

USEFUL WEBSITES ON ***MONTRICHARDIA ARBORESCENS***

https://b-and-t-world-seeds.com/Aroideth.htm
Montrichardia arborescens is eaten in many areas of Tropical America, the seeds are 'cooked or toasted' each inflorescence containing about 80 seeds.

www.invasive.org/browse/subthumb.cfm?sub=55417&fam=37
Useful photos

www.jungledragon.com/image/87913/montrichardia_arborescens.html
Amazing photo and information about the edible uses.

www.naturalista.mx/taxa/362191-Montrichardia-arborescens
Photos and map distribution

www.natureloveyou.sg/Montrichardia%20arborescens/Main.html
Very useful photos.

www.naturepl.com/stock-photo-moucou-moucou-moko-moko-montrichardia-arborescens-growing-rampant-in-image01312710.html
This is from South America, but imagine lowland marshes throughout the Maya Lowlands with this many "millions of fruit producing" fast growing miniature tree like this. Is this not a bread-basket of unexpected magnitude.

http://plantillustrations.org/species.php?id_species=680084&mobile=0
Helpful illustrations, including in color. However the one that shows the plant as a "tree" is totally incorrect. Almost none are straight up like this and almost none have leaves only at the top.

www.thingsguyana.com/moco-moco-healing-plant-of-the-guianas/
Information and uses

www.tramil.net/es/plant/montrichardia-arborescens
Nice photos

http://www.theplantlist.org/tpl1.1/record/kew-129694
Synonyms

www.worldfloraonline.org/taxon/wfo-0000245847;jsessionid=A1139D5591F7442B9E8A1A025A52BE69
General Information

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 is part of our bibliography team. In addition, she also prepares blogs and articles for our websites with helpful information about the flora and fauna we document in our field trips and other topics we interested in.

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 new Canon mirorless R5 and our four 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

Maria 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.

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 she is 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 join the editorial design team on December 2020. He will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

Cristina Ríos designer student who join the editorial design team on December 2020. She will combine the text, pictures and maps into the FLAAR Mesoamerica editorial criteria.

Carlos Marroquín is a USAC graphic design student who volunteered to do his professional practice with the Editorial Design Team. We are very grateful with people like him who join our team and bring his knowledge and work.

Sergio Jerez 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).

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


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Tatín, Livingston
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Río Cocolí
Siete Altares
Playa Quehueche
Reserva Natural
Tapón Creek
Taponcito
Creek
Río Tapon Creek
Gangadiwali
Río Quehueche
Vuelve Mujer
Finca Paradise
Pirate Hidden
Casco
Urbano
Livingston
Plan Grande
Quehueche
Plan Grande Tatín
Tampico
Río Creek Salvador
2.
Cueva del
Tigre
4.
Piscina natural
Cayo Grande
Isla de Pájaros
Río Tatín
Canón Río Dulce
3.
El
Golfete
Quebrada
La Pintada
Río Lámpara
Cayo Quemado
Río Tamejá
1.
Izabal
1. Reserva Protectora de
Manantiales Cerro San Gil
2. Biotopo Protegido
Chocón Machacas
3. Área sin protección
4. Parque Nacional
Río Dulce
5. Área de Usos Múltiples
Río Sarstún
Acceso terrestre
Acceso de tierra
FLAAR
MESOAMÉRICA
Información de referencia:
· Limites departamentales de Guatemala. (IGN)
· Instituto Geográfico Nacional (IGN)
(Hojas 2463 IV y 2463 III)
· Google Map data 2020. Shapes:
Sistema Guatemalteco de Áreas Protegidas 2017.
· Cuerpos de agua. Ministerio de Agricultura Ganadería y
Alimentación (MAGA)
· Dirección de Análisis Geoespacial del (CONAP), Marzo/2017.
Elaborado por: Andrea de la Paz; Amanda Estrada Rodas. FLAAR Mesoamerica 2020

FLAAR MESOAMÉRICA

WETLANDS

Edible Wetlands Plants of Municipio de Livingston, Izabal

Wetland Series 1: from Swamps, Marshes and Seasonally Inundated Flatlands of Izabal

Cyperus esculentus Chufa, Yellow Nutsedge, Earth Almond MLW#1	***Eleocharis geniculata*** ***Eleocharis caribaea*** Caribbean Spike-Rush MLW#2	***Montrichardia arborescens*** Camotillo Water Chestnut MLW#3	***Nymphoides indica*** Floating Heart Water Snowflake MLW#4
Pachira aquatica Zapoton MLW#5	***Pontederia cordata*** Pickerel Weed MLW#6	***Sagittaria latifolia*** Water Potatoes MLW#7	***Typha dominguensis*** Cattail MLW#8

Wetland Series 2: plants that grow along the beach shore of Amatique Bay

Amphitecna latifolia Black calabash MLW#9	***Coccoloba uvifera*** Uva del mar MLW#10	***Manicaria saccifera*** Confra, Manaca MLW#11	***Chrysobalanus icaco*** Coco Plum MLW#12	***Avicennia germinans*** Black Mangrove MLW#13	***Rhizophora mangle*** Red Mangrove MLW#14

Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean

Glossary of Wetland Terms Bibliography of Wetlands Habitat Names MLW#15	***Acoelorrhaphe wrightii*** Pimientillo, Tasiste, Palmetto Palm MLW#16	***Acrostichum aureum*** Mangrove Fern MLW#17	***Annona glabra*** Alligator Apple MLW#18	***Bactris major*** Huiscoyol Palm MLW#19	***Diospyros nigra*** Zapote negro MLW#20
Grias cauliflora Palo de Jawuilla MLW#21	***Inga vera*** ***Inga multijuga*** ***Inga thibaudiana*** River Koko MLW#22	***Pithecellobium lanceolatum*** Bastard Bully Tree Chucum Red Fowl MLW#23	***Coccoloba belizensis*** Papaturro MLW#24	***Symphonia globulifera*** Barillo MLW#25	***Crataeva tapia*** Matasanillo, Granadillo, Tortugo MLW#26

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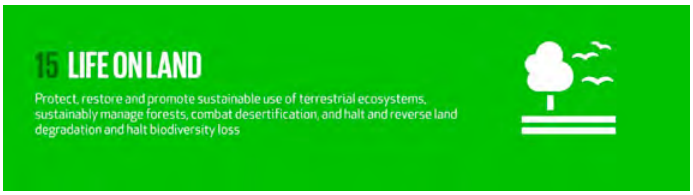

The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team of International Cooperation division, have set the goal of achieving the municipality development in the years 2020-2024 based on the goals and indicators proposed by the 2030 Agenda for Sustainable Development. From this agenda, FLAAR (USA) and FLAAR Mesoamerica (Guatemala) 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/

SERIES OF MUNICIPIO OF LIVINGSTON

Any school, college, university, botanical garden, zoological garden, botanical or zoological association (or club) may post this report on their web sites, (at no cost) as long as they link back to one of our web sites:

www.maya-ethnobotany.org
www.maya-ethnozoology.org
www.maya-archaeology.org
www.digital-photography.org
www.FLAAR-Mesoamerica.org

This report may be cited with this information:

Hellmuth, N. (2021)
Wetland Series MLW1: Edible Plants of Municipio de Livingston from Swamps, Marshes and Seasonally Inundated Flatlands of Izabal. Plants that Provided Food for the Classic Maya, *Montrichardia arborescens*. Wetlands report. Wetlands Report #4, MLW1 Number 3. FLAAR (USA), FLAAR Mesoamerica (Guatemala).

BACK COVER PHOTO

Montrichardia arborescens.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 18, 2020. Road to Río Quehueche, Izabal.
Camera: Sony Alpha A7C. Lens: Sony FE 90mm Macro G OSS. Settings: 1/160 sec; f/4; ISO 1,250.

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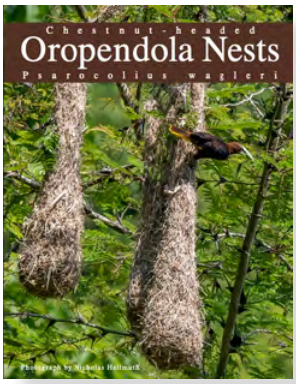

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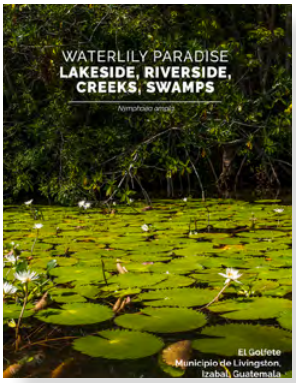

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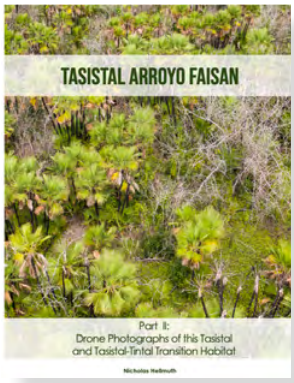

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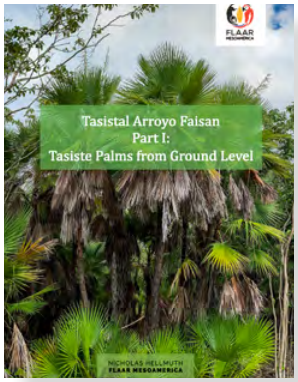

Tasistal Arroyo Faisan (part 1)
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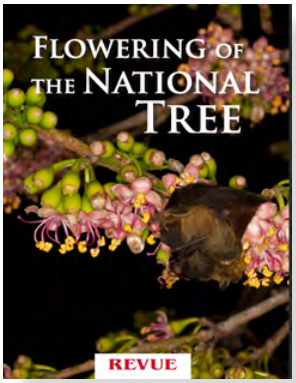

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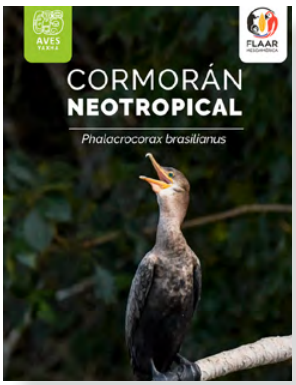

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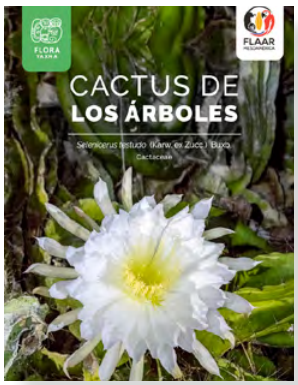

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