



FLAAR
MESOAMÉRICA

WETLANDS #2

SINTULE

CARIBBEAN SPIKE-RUSH

Eleocharis geniculata

Swamp Edges and Marshes,
Municipio de Livingston,
Izabal, Guatemala

NICHOLAS **HELLMUTH** AND SERGIO **D' ANGELO**

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Izabal, Guatemala

DECEMBER 2022



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FRONT COVER PHOTOGRAPH

Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 157 p.m. Aldea Buena Vista, Tapón Creek, Livingston. Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1800 sec; f/8; ISO 3,200.

TITLE PAGE PHOTOGRAPH

Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 1:57 p.m. Reserva Natural Tapón Creek, Livingston. Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1800 sec; f/8; ISO 3,200.



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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





Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 157 p.m. Aldea Buena Vista, Tapón Creek, Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1800 sec; f/8; ISO 3,200.

MY PERSONAL EXPERIENCE WITH ***ELEOCHARIS GENICULATA***

The *Eleocharis* genus is one of the most diverse in the Cyperaceae family and I've seen several of the species throughout different ecosystems in Guatemala. I've found them growing in full shade and the total opposite full sun. I've also found them on rocky places and humid montane forests. During this year's August 2021 expedition, I was also able to find one of the *Eleocharis* species growing on what we call the Spider Lily Savanna (a never before explored location in Paso Caballos that stands out in the region for its ecological characteristics - the savanna appears as a grassland island in the middle of the lush tropical forest and spider lilies abound). *Eleocharis* species are always associated with saturated soils and water bodies, and this has been true for the specimens I've found so far.

A notable characteristic of this genus is how similar most of the species look. Even when I've found several of these plants growing in different localities, only on rare occasions have I been able to recognize a plant as a different species from the other plants I've seen. In general, most of the species appear as clumps of slender leafless stems and share the same dimensions. In this regard, I've only known that I've come across with a different species because a notorious height divergence.

Apart from what I've found in nature, I also know that some *Eleocharis* species are very popular among aquarists and aquarium enthusiasts, so there are some species (mostly exotic) that you'll find in pet shops and aquariums in Guatemala City. In that sense, I regret that the same cannot be said for local plant markets and garden centers since these plants are very popular features on water gardens and ponds in other countries.

At this point, it is evident noticing that it is not difficult to come across with these plants, yet, I had never heard about other of their uses or that the *Eleocharis geniculata* species was edible. That's why I found very intriguing that Standley and Steyemark include the following description for *E. geniculata* on the *Flora de Guatemala*:

A decoction of the thick roots is used in Huehuetenango as a beverage, with the addition of atol or other substances

(Standley and Steyemark 1958: 146).

Standley also describes how the plant was used in Costa Rica to weave mats that were destined to serve as mattresses:

In Costa Rica, where it is called “junco”, this plant is used extensively for making thick mats that are used as mattresses on beds. In the mountains of that country there are often large meadows overgrown almost exclusively with the plant

(Standley, 1931: 262).

Some *Eleocharis* species have also been used and incorporated in wastewater treatment systems because of their remarkable phytoremediative abilities (Vymazal 2013). Therefore, and considering all that has been mentioned at this point, *Eleocharis geniculata* constitutes an interesting plant for further research projects, which could be very advantageous if focused on this plant’s potential uses.

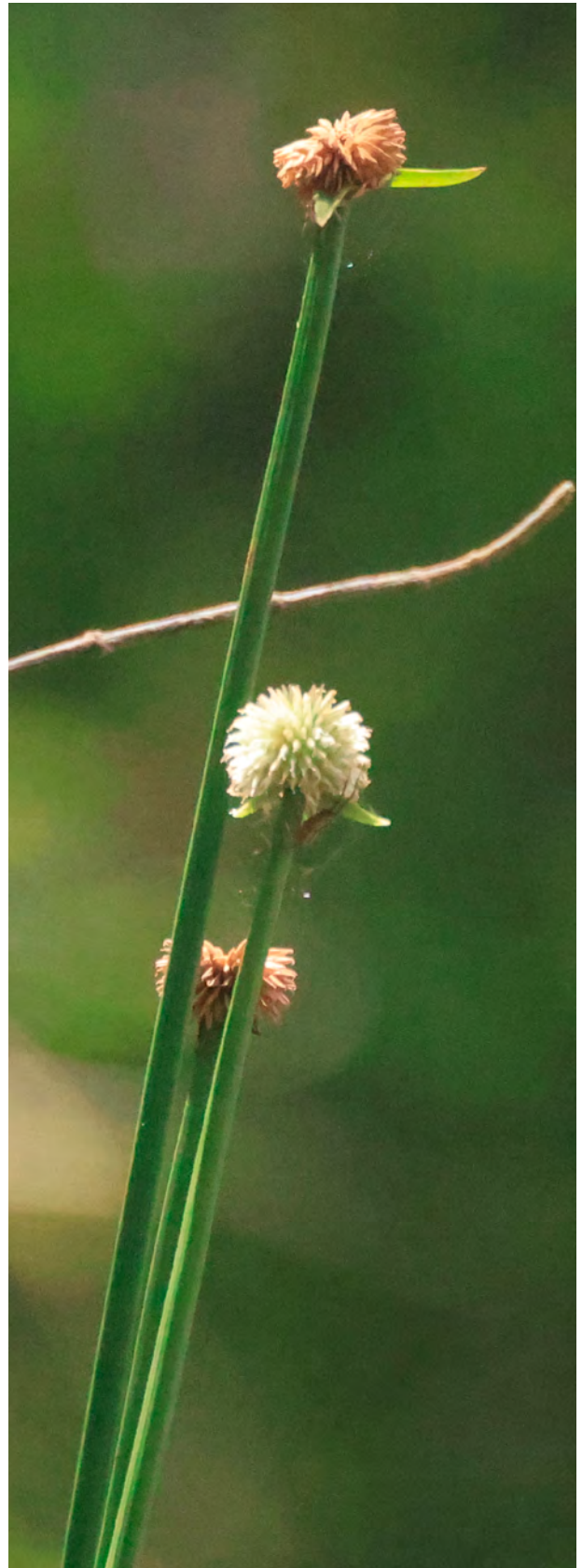
FULL BOTANICAL NAME

- *Eleocharis geniculata* (L.) Roem. & Schult.

<http://legacy.tropicos.org/Name/9900349?projectid=3>

Eleocharis geniculata.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Dec. 14, 2021, 2:19 p.m. Reserva Natural Tapón Creek, Livingston.
Camera: Canon EOS REBEL T3i. Lens: Canon EF 300mm IS II
USM. Settings: 1/2000 sec; f/11; ISO 12,800.



SYNONYMS FOR *ELEOCHARIS GENICULATA*

- *Bulbostylis capitata* (L.) Steven
- *Bulbostylis geniculatus* (L.) Steven
- *Chlorocharis capitata* (L.) Rikli
- *Chlorocharis geniculata* (L.) Rikli
- *Cyperus capitatus* (L.) Burm.f.
ex B.D.Jacks. [Invalid]
- *Eleocharis brizantha* Steud.
- *Eleocharis capitata* (L.) R.Br.
- *Eleocharis capitata* Miq.
- *Eleocharis capitata* var. *dispar*
(E.J.Hill) Fernald
- *Eleocharis caribaea* (Rottb.) S.F.Blake
- *Eleocharis caribaea* var. *achlamydea*
Zavaro & Pabón
- *Eleocharis caribaea* var. *dispar*
(E.J.Hill) S.F.Blake
- *Eleocharis densisquamata* Steud.
- *Eleocharis dispar* E.J.Hill
- *Eleocharis geniculata* f.
brunnea S.González & Reznicek
- *Eleocharis geniculata* f. *geniculata*
- *Eleocharis geniculata* var. *minor* (Vahl)
Roem. & Schult.
- *Eleocharis melanosperma* Steud.
- *Eleocharis mexicana* Peyr.
- *Eleocharis microformis* Buckley
- *Eleocharis riparia* Nees ex Spreng.
- *Eleocharis setacea* R.Br.
- *Eleocharis singularis* Steud.
- *Eleocharis sintenisii* Boeckeler
- *Eleocharis valida* Boeckeler
- *Eleogenus capitatus* (L.) Nees
- *Eleogenus capitatus* (L.) Nees ex Mart.
- *Eleogenus capitatus* var. *intermedius* Nees
- *Eleogenus capitatus* var. *major* Nees
- *Eleogenus capitatus* var. *minor* Nees
- *Eleogenus capitatus* var. *recurvus* Nees
- *Limnochloa constricta*
(Schrad. ex Kunth) Nees
- *Limnochloa densa* Liebm.
- *Limnochloa geniculata* (L.) Nees
- *Megadenus capitatus* (L.) Raf.
- *Scirpus atrofactus* Steud.
- *Scirpus brownii* Spreng.
- *Scirpus capitatus* L.
- *Scirpus caribaeus* Rottb.
- *Scirpus constrictus* (Nees) Griseb.
- *Scirpus constrictus* Schrad. ex Kunth
- *Scirpus depressus* Vell.
- *Scirpus geniculatus* L.
- *Scirpus geniculatus* var. *minor* Vahl
- *Scirpus interstinctus* Poepp. ex C.Presl
- *Scirpus repens* Willd. ex Schult.
- *Scirpus validus* (Boeckeler)
Kuntze [Illegitimate]
- *Trichophyllum capitatum* (L.) House

<http://www.theplantlist.org/tpl1.1/record/kew-242508>

As of early 2021, this website has not been updated to https:// and no longer is easy to access. But in previous years this website was super-helpful.

LOCAL NAMES FOR *ELEOCHARIS GENICULATA*

Standley (1931: 262) mentions that this species is called “junco” in Costa Rica, while it is also called as “tul”, “tule”, “sintule” and “zuntule” at El Salvador.

Standley and Steyemark (1958: 146) also include the common names “tule” and “sintule” in the Flora of Guatemala.

Véliz et al. (2003: 16) mention the name “junquillo” for the arid zones of Guatemala.

Since it might be confused by other species in the genus then it might be called by the same names that these other species. Some common names for *Eleocharis elegans*, a species that is reported to be easily mistaken for *E. geniculata*, are “camalote”, in Cobán, “guirnalda”, in Cobán as well, and “cebolla de agua”, in Quetzaltenago (Standley and Steyemark 1958; 147).

The names “cebollín” and “monte de suampo” do not appear in any document that is available online, but they are used locally at Livingston, Izabal, to name this species.

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

There might be several species in the same genus or even in the Cyperaceae family that could be called the same. As mentioned before, many species on the *Eleocharis* genus look the same, so they might be called by the same local names.

By the other hand, the names “tule” and “tul” are used more often in Guatemala for the two *Thyphus+* species that are native to the country.



Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 1:48 p.m. Rio Bonito, Lago el Golfete Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1600 sec; f/8; ISO 1,000.



Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 1:48 p.m. Rio Bonito, Lago el Golfete Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1600 sec; f/8; ISO 5,000.

MAYAN NAMES FOR *ELEOCHARIS GENICULATA*

The only mayan name that is included by Standley and Steyermark (1958: 149) for any *Eleocharis* species is "cham" (used in Huehuetenango) and corresponds to the species *E. fistulosa* Schult. (wich is a synonym for *E. acutangula* subsp. *acutangula*). Both species look alike and the same mayan name might be used for both. Nevertheless, *E. geniculata* is reported by Standley and Steyermark to be consumed in Huehuetenango, so even when both species look the same and have been documented in some of the same departments, perhaps people call them differentiating that at least one of them is edible.

HABIT FOR *ELEOCHARIS GENICULATA*

Species in the *Eleocharis* genus can be considered as herbs (M. Thulin et al. 2008, as cited in Royal Botanical Gardens Kew 2017) and more specifically, as emergent aquatic plants (Lot et al. 2015: 74). This means that, among other habits that aquatic plants have, they root themselves into a substrate and develop their leaves above the water (although they might survive being completely submerged through intervals).

HABITAT FOR *ELEOCHARIS GENICULATA*

E. geniculata grows on wet, preferably sandy soil, both on fresh water and brackish water puddles; on marshes, irrigation canals (Lot et al 2015: 75), stream banks (Standley 1931: 262), mangrove thickets, wet fields, and wet thickets (Standley and Steyermark 1958: 146). It can be found on regions with tropical and semiarid climates that go from sea level up to 2000 meters above (Lot et al. 2015: 74).

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

There is a particular variety of plants related with *E. geniculata*'s habitat. For instance, some of the species we have documented in the same locations belong to the following genera: *Acoelorrhaphis*, *Cladium*, *Cuscuta*, *Hydrocotyle*, *Hymenocallis*, *Landoltia*, *Lemna*, *Rynchospora*, *Sagittaria*, *Salvinia*, along with various sedges, grasses, and rushes species.

Dix and Fernández (eds. 2001) mention *E. geniculata* among a list of other species that might be commonly found on riparian forests from the municipality of La Libertad, in Petén:

Aphelandra scabra; *Sagittaria lancifolia*, *Altheranthera obovata*, *Annona glabra*, *Bactris major*, *Desmoncus orthacanthos*, *Sabal* spp., *Crescentia cujete*, *Pachira aquatica*, *Quararibea funebris*, *Cabombapalaeformis*, *Chrysobalanus icaco*, *Ipomoea indica*, *Cladium jamaicense*, *Eleocharis geniculata*, *Haematoxylum campechianum*, *Lysiloma bahamensis*, *Lonchocarpus hondurensis*, *Piscidia piscipula*, *Nectandra membranacea*, *varias especies de Utricularia*, *Najas wrightiana*, *Nymphaea ampla*, *Ludwigia* spp., *Habenaria* spp.

(Dix and Fernández eds. 2001).

Lot et al. (2015) include *E. geniculata* in their field guide on Mexican wetlands indicator species, among the following species that might be found on Guatemala and which might share the same habitat: *Aeschynomene scabra*, *Ammannia coccinea*, *Arundo donax* (exotic), *Aquarius subulatus*, *Arenaria paludicola*, *Bacopa monnieri*, *Brasenia schreberi*, *Cabomba palaeformis*, *Callisia purpurascens*, *Calopogonium caeruleum*, *Canna glauca*, *Carex longii*, *Cephalanthus occidentalis*, *Cerastium glomeratum*, *Ceratophyllum demersum*, *Cladium jamaicense*, *Crinum Americanum*, *Cyperus articulatus*, *Cyperus canus*, *Cyperus giganteus*, *Echinochloa colona*, *Echinochloa pyramidalis*, *Eleocharis cellulosa*, *Eleocharis elegans*, *Fimbristylis spadicea*, *Gymnocoronis latifolia*, *Gynerium sagittatum*, *Heteranthera limosa*, *Hydrocotyle verticillata*, *Hydrolea spinosa*, *Hymenachne amplexicaulis*, *Ludwigia palustris*, *Ludwigia peploides*, *Marathrum schiedeanum*, *Mimosa pigra*, *Phragmites australis*, *Pistia stratiotes*, *Pontederia sagittata*, *Ranunculus hydrocharoides*, *Rotala ramosior*, *Ruppia maritima*, *Sagittaria demersal*, *Sagittaria latifolia*, *Schoenoplectus californicus*, *Sisyrinchium convolutum*, *Sphenoclea zeylanica*, *Stuckenia pectinate*, *Thalia geniculata*, *Typha domingensis*, *Utricularia subulata*, and *Vallisneria americana*.

BOTANICAL DESCRIPTION OF *ELEOCHARIS GENICULATA* IN STANDLEY AND CO-AUTHORS CHICAGO BOTANICAL MONOGRAPHS

E. geniculata appears as *E. caribaea* (a synonym) in Standley and Steyermark's *Flora of Guatemala* and is described as follows:

Plants densely cespitose, usually perennial, the slender culms firm, mostly 15-40 cm. tall, striate and sulcate; sheaths stramineous or brown, the apex firm, oblique, often attenuate; spikelets subglobose or ovoid, obtuse, many-flowered; scales ovate-orbicular, almost cartilaginous to membranous, yellow to pale brown; style 2-fid; stamens 2-3 achene 1 mm. long, obovoid, lustrous black, the style base spongy, whitened, variable in shape but usually much depressed; bristles 6 or 8, coarse, brown, exceeding the achene, rarely absent

(Standley and Steyermark 1958: 146).

It also appears in Standley's *The Cyperaceae* of Central America, where *E. caribaea* and *E. geniculata* are described as different species.

E. caribaea is described as:

Culms slender, 5-30 cm. high, tufted, stiff; spikelet ovoid, obtuse, 3-5 mm. long, the scales obtuse, pale or dark brown, scarious-margined; bristles equaling the achene, the latter obovate, black, smooth and shining, the tubercle minute, depressed

(Standley 1931: 262).

By the other hand, *E. geniculata* is followed by the next description:

Plants with rhizomes, the culms 30-100 cm. high, transversely septate, terete; spikelet 1-3 cm. long, 5-9 mm. thick, brown, the scales acutish; bristles equaling or longer than the achene, this ellipsoid, trigonous, smooth or granular, yellow-brown, the tubercle conic

(Standley 1931: 262).



Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 1:48 p.m. Río Bonito, Lago el Golfete Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1600 sec; f/8; ISO 1,000.

BOTANICAL DESCRIPTION OF *ELEOCHARIS GENICULATA* BY STANDLEY FOR YUCATÁN

By the other hand, *E. geniculata* is followed by the next description:

Stems terete, the single spike light brown, ovoid, obtuse, 3.5 mm. long; achene 1 mm. long, black, shining, the tubercle white.

(Standley 1931: 262).

It is important to note that the tubercle described beforehand is referring to an expanded part of the achenes.

CLOSE RELATIVE(S) OF *ELEOCHARIS GENICULATA*

The *Eleocharis* genus, as mentioned before, belongs to the Cyperaceae family, where other genera, such as *Bulbostylis*, *Fimbristylis*, and *Schoenoplectus*, might resemble the same look with slender and round stems or leaves. In this regard, all these genera are related. It is worth mentioning that generally the species in these genera are called as different types of rushes; in fact the *Eleocharis* species are commonly called as spike-rushes.

Even when the morphology looks very similar to that of the genus *Eleocharis*, the *Equisetum* genus (conformed by the species called as horse tails) is not a close relative.

ELEOCHARIS GENICULATA IN BELIZE

Goodwin et al. (2013: 42) include *E. geniculata* in their checklist of vascular plants from the lowland savannas of Belize. Moreover, the species might be distributed in other areas from Belize as well.

WHERE HAVE *ELEOCHARIS GENICULATA* BEEN FOUND IN THE MUNICIPIO OF LIVINGSTON?

> **Is *Eleocharis geniculata* listed for Biotopo Protegido Chocón Machacas, CECON/USAC?**

According to Perez et al. (2001) none of the *Eleocharis* species had been documented in the biotope until 2001, but there are herbarium samples of *Eleocharis* species from 1993 that were collected there (Herbario UVAL retrieved on Dec. 31st, 2021).

> **Is *Eleocharis geniculata* listed for Tapón Creek Nature Reserve (including Taponcito Creek), FUNDAECO?**

Not mentioned, no data found.

> **Is *Eleocharis geniculata* listed for Buena Vista Tapón Creek Nature Reserve?**

Not mentioned, no data found.

> **Is *Eleocharis geniculata* listed for Cerro San Gil (south side of Río Dulce)?**

No *Eleocharis*, nor species in the family *Cyperaceae*, is mentioned in the master plan of this reserve.

> **Is *Eleocharis geniculata* listed for El Refugio de Vida Silvestre Punta de Manabique?**

It is included as *Eleocharis caribaea* in the 2002-2006 master plan of this protected area (CONAP and Fundación Mario Dary Rivera 2001; appendix 4).

> **Is *Eleocharis geniculata* listed for Ecoalbergue Lagunita Creek (Área de Usos Múltiples Río Sarstún)?**

Not mentioned.

> **Is *Eleocharis geniculata* listed for Sarstoon-Temash National Park (northern side of Río Sarstún)?**

Not mentioned

> **Is *Eleocharis geniculata* listed for Bocas de Polochic?**

Not mentioned.

ARE *ELEOCHARIS GENICULATA* PLANT REGISTERED FOR PARQUE NACIONAL TIKAL?

There is an herbarium sample from the Missouri Botanical Garden that was collected in the park (Missouri Botanical Garden, retrieved online on Dec. 31st, 2021). Reyes et al. (2009: 71) didn't document this species for Tikal, but did reported it on Lake Petén Itzá and Salpetén Lagoon; they also reported other species from the genus on different water bodies from Petén.

ARE *ELEOCHARIS GENICULATA* PLANTS REGISTERED FOR PARQUE NACIONAL YAXHA, NAKUM AND NARANJO, IS *ELEOCHARIS GENICULATA* PRESENT OR MISSING FROM EARLIER LISTS?

An herbarium sample is present in the Missouri Botanica Garden which was collected in the Sacnab Lagoon (inside of the park) (Missouri Botanical Garden retrieved online on Dec. 31st, 2021).

WORLD RANGE FOR *ELEOCHARIS GENICULATA*

Standley and Steyermark (1958: 146) indicate that *E. geniculata* can be found from the United States to Mexico, as well as in Guatemala, Belize and Panama; it is also distributed on the West Indies, South America and the tropics of the Old World. In Canada, conservation efforts are being made to protect this species (Environment Canada 2015) which imply that it is also present in that country. It is also present in Australia and other countries in Oceania (Royal Botanical Gardens Kew 2017).

DOES *ELEOCHARIS GENICULATA* ALSO **GROW IN HOME GARDENS?**

This species is used in Australia as an ornamental plant in ponds and water gardens. Yet, it is not used with the same frequency in the United States or México. Moreover, it might not be used in Guatemala or other country in Central America, but this has more to do with the fact that ponds and water gardens are not as popular locally as they are in other regions of the world.



Eleocharis geniculata.

Photo by: María Alejandra Gutiérrez, FLAAR Mesoamerica, Dec. 14, 2021, 2:19 p.m.

Reserva Natural Tapón Creek, Livingston.

Camera: Canon EOS REBEL T3i. Lens: Canon EF 300mm IS II USM. Settings: 1/2000 sec; f/11; ISO 12,800.



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Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100MM Macro USM. Settings: 1/1600 sec; f/8; ISO 5,000.

USES OF **ELEOCHARIS GENICULATA**

The most popular use of *E. geniculata* might be as a weaving material. As mentioned in the first section of this work, this plant had been used to weave mattresses, and it might had been used for other handworks, knowing that many other rushes and species in the Cyperaceae family are used with that purpose (Ludlow-Wiechers and Diego-Pérez 2002: 90).

Apart from the description (also cited in the first section of this work) given by Standley and Steyermark (1958: 146) it looks like there are not other authors that describe this species as a food; in fact, many publications that mention the species only cite the same use description from Standley and Steyermark. Therefore, it will be interesting to conduct further research on how this plant could be consumed.

Lastly, it is worth mentioning once again that many *Eleocharis* species have been incorporated in constructed wetlands for wastewater treatment (Vymazal 2013). Since *E. geniculata* has not been mentioned to be used in such systems, more research on this species will show if it is useful or not in this context.

IS THERE POTENTIAL MEDICINAL USAGE OF **ELEOCHARIS GENICULATA BY LOCAL PEOPLE?**

Quattrocchi (2012: 1536) mentions that this species has stomachic, febrifuge, analgesic, antirheumatic, emetic, astringent, and antidiarrheal properties.

WHAT ARE THE PRIMARY POLLINATORS OF **ELEOCHARIS GENICULATA FLOWERS?**

It is most probable that *E. geniculata* is more often wind pollinated (Chimera, 2019).

ARE ANY PARTS OF *ELEOCHARIS GENICULATA* **EATEN BY MAMMALS?**

It has been suggested that *E. geniculata* is part of manatees' diet (Taylor and Powell eds. 2016). Nevertheless, the information proceeds from research conducted in Brazil and local research still needs to be done on this topic (or perhaps it has already been done but isn't available online). The Texas A&M AgriLife Extension (2018) mentions that ducks, geese, muskrats, and nutrias eat spike rushes.

CONCLUDING DISCUSSION AND SUMMARY **ON *ELEOCHARIS GENICULATA***

Eleocharis geniculata is definitely a plant which could be better studied. Moreover, there is enough information regarding its ecological importance (as it is, for example, a food source for the endangered manatees), and the various potential uses which were mentioned on this report that could encourage further research. It would be particularly interesting to find more knowledge on how this plant has been consumed, since this is something which seems to have been rarely mentioned. Doing further explorations on this topic could confirm if people in Mayan areas even consider this plant edible or if by the other hand, such use of the plant has been forgotten nowadays.

It is also worth considering doing more documentation of the species' distribution. Since the species in the genus share morphological features and each species can have significant variations, it is still worth doing the proper efforts to find where else is the species distributed regionally. Perhaps, ongoing research projects focused on ecological assessments, or any other topic related whit this plant's ecosystem, could tackle the task by including this species in their observation activities.

[Continued on the next page]

By the other hand, anybody who is interested in where the species can be located counts with several herbarium samples that have been collected and which can be reviewed online. The most helpful book on plants that we use every day for studying every plant is by Balick, Nee and Atha. They list 17 species of *Eleocharis* for Belize (2000: 181-182). Since none are eaten in Belize today no species is listed as food. Today, two decades later, being able to search online, you quickly find that *Eleocharis geniculata* leaves and also roots are used as food. Facciola is often cited (by date (1998), no page number, but the page number is 90). However *Eleocharis geniculata* is nowhere mentioned so I don't see why Cornucopia II is cited for this plant. He mentions only a species eaten in China.

Williams 1981 is a good summary of all the Flora of Guatemala monographs but in the recent four decades more information is available from other ethnobotanists.

Eleocharis geniculata is found in about 29 states of Mexico (Villasenor 2016: 717) (mas o menos the entire country). Lots of this same plant grows wild in wetlands of Guatemala, both coastal and also inland. So if this plant is edible in Huehuetenango (Standley and Steyemark 1958: 146) it's a great plant to focus on for the edible wetland plants of the Municipio de Livingston, Izabal, Guatemala.

The biodiverse wetlands ecosystems should be protected and would be great if the edible wild plants can help local health to reduce Diabetes 2.



Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 1:46 p.m. Río Bonito, Lago el Golfete Livingston.
Camera: Sony A7R (ILCE-7RM4). Lens: Sony FE 90mm Macro G OSS. Settings: 1/250 sec; f/6.3; ISO 320.



Eleocharis geniculata.

Photo by: David Arrivillaga, FLAAR Mesoamerica, Mar. 25, 2021, 157 p.m. Aldea Buena Vista, Tapón Creek, Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF 100mm Macro USM. Settings: 1/1800 sec; f/8; ISO 3,200.

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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). Therefore, 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 the collection of the Field Museum herbarium of 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, 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 PAGES SPECIFICALLY ON ***ELEOCHARIS GENICULATA***

<http://www.conabio.gob.mx/malezasdemexico/cyperaceae/eleocharis-elegans/fichas/ficha.htm>

Eleocharis geniculata morphological characteristic that differs from *E. elegans*, another species that could be easily mistaken.

<https://florida.plantatlas.usf.edu/plant.aspx?id=916>
Information and photos.

<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:1029981-2>
Distribution range and photos

<https://www.gbif.org/es/species/2716850>
Registry, information and photos.

<http://www.theplantlist.org/tpl1.1/record/kew-242508>
Synonyms.

<https://masgc.org/jcho/frames/home.html>
Photos.



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 and fauna projects (which includes field work and the resulting reports that can be helpful for botanists, zoologists and ecologists, and for university students). She also coordinates activities at MayanToons, a FLAAR 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).

Sergio Jerez prepares the bibliography of each topic and download the pertinent research material for our electronic library on flora and fauna. We all use these two downloads plus our internal library on Mesoamerican flora and fauna (México through Guatemala to Costa Rica). He also does plant identification and works on the processing of GPS coordinates to create maps of the routes traveled during our expeditions.

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

Norma Estefany Cho Cu helps with preparing the camera equipment for each field trip and helps in the office (and on field trips) as a cook.

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

Roxana Leal is the Social Media Manager for flora and fauna research and publications, as well as for the 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 which are useful to photographing tiny insects, tiny flowers, and tiny mushrooms. She is also involved in work during and after a field trip, which includes photo sorting, naming and processing, as well as the consequent report preparation.

David Arrivillaga is an experienced photographer able to handle both Nikon and the newest Sony digital cameras. His 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 Áviles is an illustrator for MayanToons, the division in charge of educational materials for schools, especially the Q'eqchi' Maya schools in Alta Verapaz, Q'eqchi' and Petén Itzá Maya in Petén, and the Q'eqchi' Maya and Garifuna schools in the municipality of Livingston, Izabal.

Josefina Sequén an illustrator for MayanToons and also helps prepare illustrations for Social Media posts and for animated videos.

Rosa Sequén 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 understand 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 design team, which does the editing of every photographic report and educational material of Flora and Fauna. She works together with the other members of the design team to prepare the finished PDF editions of the material of the Yaxha, Nakum and Naranjo Project.

Alejandra Valenzuela biology student who is now part of our Flora and Fauna photographic report and educational material editing team

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

Cristina Ríos a graphic designer student who joined the editorial design team on December 2020. She will combine the text, pictures and maps into the PDF according to FLAAR Mesoamerica editorial criteria.

Byron Pacay handles GPS mapping of where we hike or go in the lancha (boat) on each field trip day. He also lists where we stop to take photos and what each one of us is photographing to then prepare tabulations with this information.

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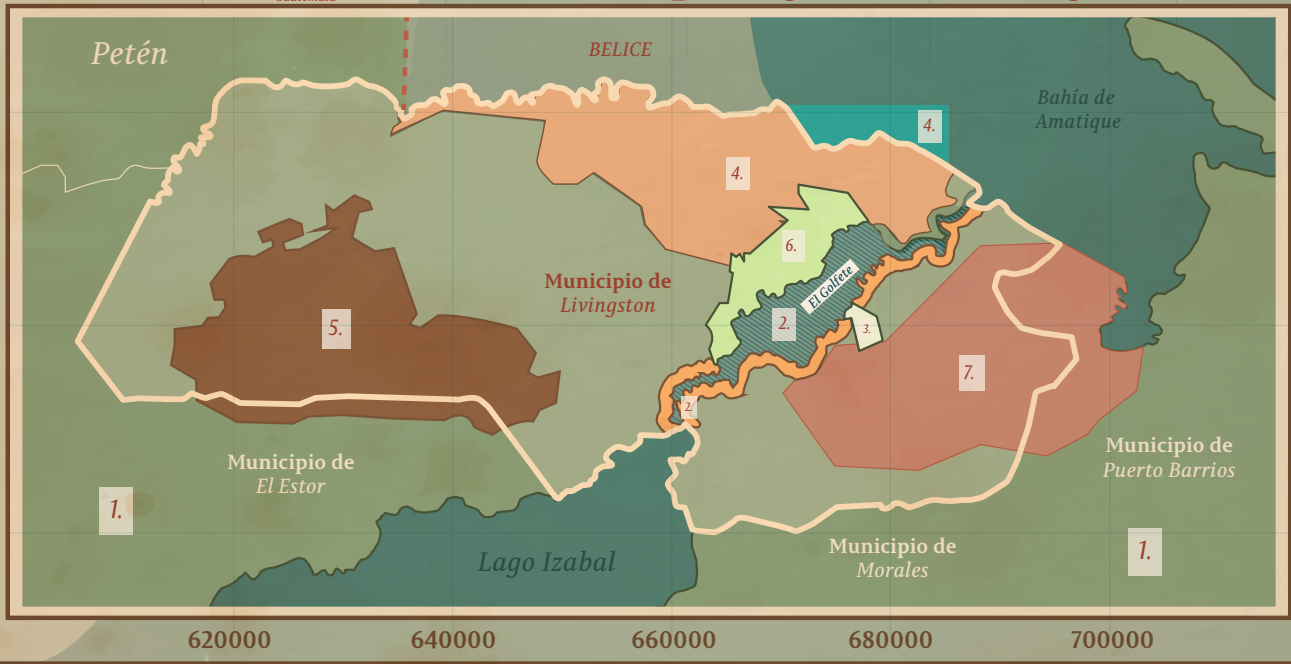
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Áreas naturales protegidas de Livingston



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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



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Reserva Natural Tapón Creek, Livingston

Bahía de Amatique

Área de Usos Múltiples
Río Sarstún

Punta
Cocolí

Aldea Buena
Vista Tapon Creek

San Juan

Reserva Natural Tapón Creek
Municipio de Livingston

Siete
Altares

Finca
Gangadiwali

Sarstún Creek

Taponcito
Creek

El Rosario

San
Martin

La Desmembración

Plan Grande
Tatín

Área de Usos Múltiples
Río Sarstún

Biotopo
Chocón Machacas

El Golfete

Parque Nacional
Río Dulce



Izabal



Información de referencia:

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

Edible Wetlands Plants of Municipio de Livingston, Izabal

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

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

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

<p>Amphitecna latifolia</p> <p>Black calabash</p> <p>MLW#9</p>	<p>Coccoloba uvifera</p> <p>Uva del mar</p> <p>MLW#10</p>	<p>Manicaria saccifera</p> <p>Confra, Manaca</p> <p>MLW#11</p>	<p>Chrysobalanus icaco</p> <p>Coco Plum</p> <p>MLW#12</p>	<p>Avicennia germinans</p> <p>Black Mangrove</p> <p>MLW#13</p>	<p>Rhizophora mangle</p> <p>Red Mangrove</p> <p>MLW#14</p>
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Wetland Series 3: plants that grow alongside water: rivers, lagoons, swamps, or ocean

<p>Guadua longifolia</p> <p>Jimba</p> <p>MLW#15</p>	<p>Acoelorrhaphe wrightii</p> <p>Pimientillo, Tasiste, Palmetto Palm</p> <p>MLW#16</p>	<p>Acrostichum aureum</p> <p>Mangrove Fern</p> <p>MLW#17</p>	<p>Annona glabra</p> <p>Alligator Apple</p> <p>MLW#18</p>	<p>Bactris major</p> <p>Huiscoyol Palm</p> <p>MLW#19</p>	<p>Diospyros nigra</p> <p>Zapote negro</p> <p>MLW#20</p>
<p>Grias cauliflora</p> <p>Palo de Jawuilla</p> <p>MLW#21</p>	<p>Inga vera Inga multijuga Inga thibaudiana</p> <p>River Koko</p> <p>MLW#22</p>	<p>Pithecellobium lanceolatum</p> <p>Bastard Bully Tree Chucum Red Fowl</p> <p>MLW#23</p>	<p>Coccoloba belizensis</p> <p>Papaturro</p> <p>MLW#24</p>	<p>Symphonia globulifera</p> <p>Barillo</p> <p>MLW#25</p>	<p>Lacmellea standleyi</p> <p>Lechemiel</p> <p>MLW#26</p>

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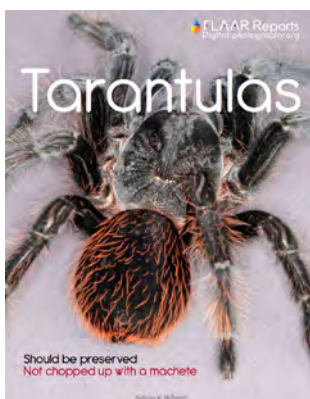
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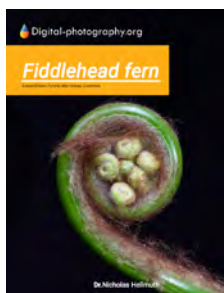
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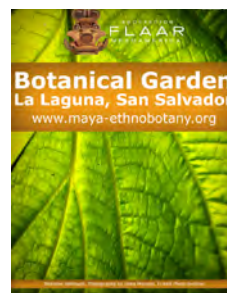
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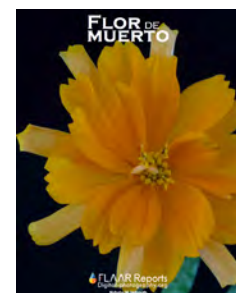
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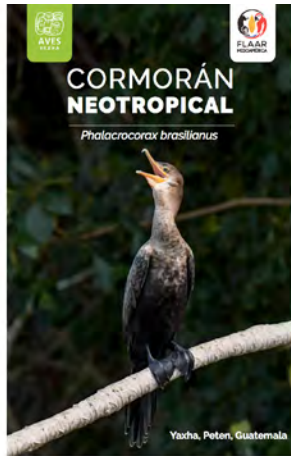
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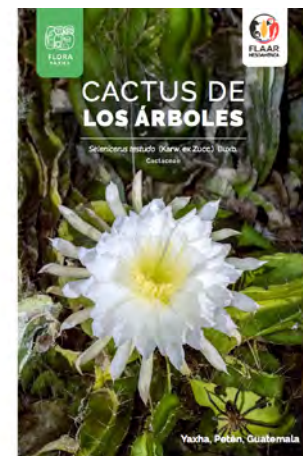
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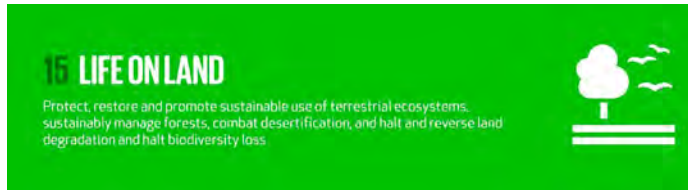


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The current Alcalde of Livingston, Mr. Daniel Pinto, together with his team on the Division of International Cooperation, has set the goal of achieving the municipality development in the years 2020-2024 based on the goals and indicators proposed by the 2030 Agenda for Sustainable Development. In this regard, bot FLAAR (USA) and FLAAR Mesoamerica (Guatemala) will collaborate whit this Municipality achieve the Sustainable Development Goal (SDG), number 15 "Life on Land".

Throughout this cooperation project, different materials will be and publishes prepared, as this Photo Essay. These will help to collect information on species, different ecosystems (terrestrial, wetlands and fresh water asociated) and biodiversity. This information will also be useful as it is considered in various conservation estrategias to protect threatened species and prevent their extinction. Moreover, the municipality goals also look forward to promote the sustainable use, conservation and research of the flora and animal species of all terrestrial, wetlands, aquatic shore and coastal associated ecosystems of the Guatemalan Caribbean region. You can learn more about this project and the SDG indicators wich are being pursued at:

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BACK COVER PHOTO
***Eleocharis geniculata*.**

Photo by: David Arrivillaga, FLAAR Mesoamerica,
Mar. 25, 2021, 157 p.m.
Aldea Buena Vista, Tapón Creek, Livingston.
Camera: Canon EOS-1D X Mark II. Lens: Canon EF
100mmMacro USM. Settings: 1/1800 sec; f/8; ISO 3,200.

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