



Cuajilote, (*Pamentiera acuelata*)

A tree throughout Maya Areas that produces lots of fruits every year

**Parque Nacional Tikal
Reserva de la Biósfera Maya (RBM)
Petén, Guatemala**

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FLAAR Reports Series: Edible Fruits, Trees Native to Guatemala and surrounding Mesoamérica

Part I: Trees that Fruit "all year long" every year

As part of our long-term research and field work project to find, photograph, document, and publish the edible wild plants of the Mayan areas of Mesoamérica, we are now putting the publications into series. A major series is "Edible Wild Plants of Wetlands of the Maya Lowlands: Food from Swamps, Marshes, and shores of rivers, lakes, lagoons, and aguadas". For the eastern part of Izabal, Guatemala we have over 20 reports on edible wild plants of those wetlands. Now we are preparing a similar series for edible plants of the wetlands of the Reserva de la Biosfera Maya (RBM), Petén, Guatemala. Two of the initial reports of this series will be one on Tasiste palm (has edible seeds and edible inside of the stem). Second will be on calabash tree, *Crescentia cujete*, since both these plants grow in seasonally inundated savanna areas or near the edges of rivers that flood adjacent areas during the rainy season.

A second series, that we initiate now is "Edible Fruits that Fruit all year long every year for decades." This series will include lots of trees; we start our list with the obvious ones, and initiate this series with *Parmentiera aculeata*, Cuajilote, since this tree has fruited ALL YEAR LONG and the fruit is edible and nutritious.

Theobroma cacao fruits much of the year. Based on the variety and local climate there may be a few months it does not fruit but usually there are fruits up and down the trunk and limbs most of the year.

Mamey Zapote, *Pouteria sapota*, fruits much of the year. This tree can grow to impressive size and thus produce LOTS of tasty edible healthy fruits most months of the year.

Zapote bobo, Zapoton, *Pachira aquatica* fruits much of the year. These fruits are GIGANTIC (the largest wild native fruits of all Mesoamérica). You can make a cacao-like drink from the seeds.

Lots more to come, but let's start with *Parmentiera aculeata*, Cuajilote, since we see this tree on almost every field trip as we drive to Petén.

FRONT COVER PHOTOGRAPH

Photo by: Roxana Leal, FLAAR Mesoamerica,
Paxcaman, Guatemala. Oct. 10, 2021.
Camera: iPhone 13 Pro Max.



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Introduction to *Parmentiera aculeata* of Guatemala

Studies of underutilized edible food plants can help provide healthy options for local people in rural areas.

We (FLAAR, USA and FLAAR Mesoamérica, Guatemala) are preparing a project proposal to suggest that if every rural house in Guatemala were to plant between 10 and 20 species of local native fruit trees around their home, they could have fresh fruit for a healthy diet every month for half a century. For example, a single Zapote tree can have over 342 fruits per season. That's enough fruit to feed a family for weeks. Imagine if you had 10 other species of fruit or nuts around your house (and of course also super foods such as Amaranth and Bledo).

Cuajilote, *Parmentiera aculeata*, is not a fruit tree you normally have in your list. In fact, I bet over

50% of the monographs on Mayan agriculture and food resources are not aware of this native tree. Yet one solitary *Parmentiera aculeata* tree can produce over 600 fruits in a single year. that's about 2 fruits per day all year "for the rest of your life" and it starts fruiting about three years after planting. So, we suggest you plant about 10 different fruit trees around your home such as: Cuajilote, Ramon, Avocado, Zapote, Cacao.

Plus, *Parmentiera aculeata* grows in most areas of Guatemala: both seasonally wet and other areas seasonally dry. Let's learn more about this remarkably adaptable tree and its literally abundant fruit, since in some eco-systems the tree produces fruit all year long.

My Personal Experience with *Parmentiera aculeata*, Cuajilote

I had never seen or heard of this plant ever before 2009. In 2009 botanist Mirtha Cano mentioned it occurring in a hotel near Remate, El Petén (there are several hotels in the Remate area with nice gardens of local Mayan plants).

Then in 2011 I found and photographed this tree in several more locations and included *Parmentiera edulis* in several lectures on Maya iconography (Tulane University and a conference in San Salvador).

I got deeper into Cuajilote after 2011 with the first

web page on the www.Maya-ethnobotany.org website of the FLAAR network in August of 2011 and was updated in April of 2012. Since the fruits of Cuajilote hang en masse from the main trunk and limbs and are slightly like size and (thin) shape of a cacao, I discussed the faux-cacao aspect in our related web site, www.maya-archaeology.org.

I noticed even more that there were flowers and fruits on the tree trunk when we had dinner in the restaurant Café Maya in Sayaxché year after year. So, in April of 2018, we returned with cameras and lighting.



This same tree has been full of mature as well as young fruits 100% of the times we have had meals in this restaurant over the last decade, when we are in this area (Sayaxché, Rio la Pasión). I estimate 600 fruits per year, yet an article says a single tree can produce between 1000 and 2000 fruits a year.

The people in the restaurant recognize the FLAAR team since we have been taking photos of the tree, flowers, and fruit over many years. They said the tree was a sapling when they bought the house (that was later turned into their restaurant). They estimate the tree was then 2 years old. They have owned the restaurant for 17 years. So today the tree is over 25 years old.

Parmentiera aculeata is one of the edible indigenous fruit trees that had been overlooked by Mayanists such as me. We were all touting Ramon nuts, thanks first the tip by Cyrus Lundell then the excellent follow-up field work by Dennis

Puleston. But the colonial chronicles mention the fruit of the *Parmentiera aculeata* tree as one of the foods grown in the yards or fence rows of houses and were part of the staple diet of some villages where the tree flourished. Like cacao, the fruit can be eaten raw or cooked in different ways.

Cyrus Lundell, Botanist and ethnobotanist, also mentions *Parmentiera edulis* as being edible (1938), but he does not feature it the way he does for Ramon. So, I would like to rescue Cuajilote, especially under its preferred scientific name of *Parmentiera aculeata*.

Once I became familiar with the tree and its fruits in Sayaxché, I noticed a tree in a village a few kilometers north of Chisec, Alta Verapaz. We also found this tree around Lake Atitlan (Maya Highlands of Guatemala), Monterrico (Pacific coastal area), and El Chal (Petén).

Cuajilote, *Parmentiera aculeata*, flowering and fruiting from the trunk, July 7, 2016. One flower is not yet open (middle, right). Photo by Nicholas Hellmuth with flash. In open patio of Restaurant Café Maya, Sayaxché, Petén. Camera: Nikon D810. Settings: 1/200; sec; f/10; ISO 500.



Parmentiera aculeata, Cuajilote tree, aldea of Canaan, alongside Highway AV9, circa km297. Curiously there are several kilometer marker sequences in this area of the highway: one lists km from Guatemala City being zero; the other lists from somewhere way north. So best to realize this tree is about 6 km north of Chisec, along the west side of the highway, in front of a Mayan home.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. Jul. 11, 2019.
Camera: Nikon D5. Settings: 1/160; sec; f/13; ISO 8,000



Most of the fruits are visible on the trunk; but the limbs also have fruits directly from the limb. *Parmentiera aculeata*, Cuajilote tree, aldea of Canaan, alongside Highway AV9. July 11, 2019.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica.
Camera: Nikon D810. Settings: 1/250; sec; f/g; ISO 640

Full Botanical Name

Parmentiera aculeata (Kunth) Seem. is the accepted name. But... *Parmentiera edulis* D.C. is the scientific name used most often up to recently. The name also frequently used in more recent years is *Parmentiera aculeata* (Kunth) Seem. This is the designation given by Ana Lucrecia de MacVean (2003:34). But about half the web sites and monographs call it *Parmentiera edulis*. Technically one is the “accepted name” and the other is the “synonym.” But no two botanists seem to agree since if you look at ten monographs some use one name the others use the other. That said, [ThePlantList.org](https://www.theplantlist.org) web site very clearly lists *Parmentiera aculeata* (Kunth) Seem. To make it easier we consider it one tree with two competing botanical names. Let’s move on to learn more about other aspects.

Family name is Bignoniaceae. This plant family has 85 plant genera and 841 accepted species names

[Click here to read more](#)

Our present FLAAR Report is focused on *Parmentiera aculeata* but other relatives are also present throughout Mesoamérica and are also edible: two species of *Crescentia*, Calabash tree, Jícara, Morro, of Guatemala are good examples since their flowers are similar size and bizarre shape.



Here are synonyms for *Parmentiera aculeata*

Cuajilote is correctly named *Parmentiera aculeata*. Here are the synonyms for *Parmentiera aculeata*.

- *Crescentia aculeata* Kunth
- *Crescentia edulis* Desv.
- *Crescentia edulis* Sessé & Moc. [Illegitimate]
- *Crescentia edulis* Moc. ex A. DC. C.Heller [Invalid]
- *Crescentia musicarpa* Zaldivar ex C.Heller [Invalid]
- *Parmentiera aculeata* (Kunth) L.O. Williams
- *Parmentiera edulis* DC.
- *Parmentiera edulis* Raf.
- *Parmentiera foliolosa* Miers
- *Parmentiera lanceolata* Miers [Illegitimate]

[Click here to read more.](#)

The reason this tree used to be called *Crescentia edulis* is because the flower of Cuajilote is clearly similar in size and shape as flowers of both species of Jícaro and Morro (*Crescentia alata* and *Crescentia kujete*). Although the flowers are same, the fruit is totally different: Cuajilote is ridged and the size of a cacao pod (but soft). Morro and Jícaro are usually completely smooth and with a solid husk. The hollow pods of Jícaro and Morro are used for musical instruments (small pods) or drinking cups (large pods). When we visit Mayan villages in remote areas of Alta Verapaz the local Q'eqchi' Mayan people offer us cacao and maize atol and other local Mayan drinks always in a Morrobowl.

The fruit of Cuajilote is edible. What's amazing is that one botanist says he estimates a single tree can produce between 1000 and 2000 fruits a year. I can state that every single time I have seen this tree in Sayaxché, Petén, over the last six years, no matter what time of month, there is ripe fruit waiting to be picked and eaten.

This year I estimated the tree was 40+ years old (considering its height and thickness of the trunk). But the owner of the restaurant said that the tree is only 19 years old. So if you plant this tree around your house, you and your family will have fresh fruit every week of the year for decades. It starts to fruit after only a few years from being planted.

J. Eric S. Thompson and Sylvanus Morley were good at working in Mayan sites and doing basic hieroglyphic recording, but they did not realize that the Maya had much more than maize, beans, and squash available.

Dennis Puleston is a respected archaeologist, and I knew him since I worked as a student intern at Tikal in 1965 and 1966. He championed Ramon nut as a probable staple of the ancient Maya (though today other botanists have proposed aspects not aware to Puleston). Bennett Bronson was very helpful by proposing that the ancient Mayan people had lots of root crops available (I have found many more edible roots and rhizomes than he lists). But still, I have also found over 40 edible leaves and more than 162 native edible fruits (for Guatemala alone).

A single Zapote tree can have between 300 and 400 or more fruits on it at a single time; and this tree will bear fruit for decade after decade after decade (and these fruits are larger than Ramon).

So yes, the Classic Maya ate maize, beans and squash (I have been to milpas in the Highlands where these staples literally grow all together in the same area). Yes, the Maya had root crops, Ramon, and any other plant you wish to popularize but they had 162 DIFFERENT fruits (and this does not count vegetables, nuts, and berries, plus edible plant stalks: I eat Bayalpalm vine for example. I eat Junco (kala) stalks (a tree very similar in size and shape to guano palm but is a *Carludovica palmate* not related even remotely to any palm tree, despite the species name palmate).

The team at FLAAR has dedicated over 10 years to making complete lists of all edible food plants. Plus, all other utilitarian plants: for soap, basketry, roof thatch: everything. And we do high resolution photography of these plants, especially the flowers (though with over a thousand plants we still need funding to finish the photography, especially for a 4WD double-cabin pickup truck that will survive bringing our team and camera equipment to the mountain trails that we must hike up to reach the plants).

We hope you have enjoyed the introduction to Cuajilote: edible, medicinal, and the fruit is ridged (as cacao), similar size to cacao, and grows directly from the trunk (as cacao).

Common local names in different parts of Mesoamérica

Cuajilote is the most common local name, both in Mexico and Guatemala and evidently also in Costa Rica. Like most local plants it has a different name in each local cultural area; so, I prefer to stick with the most common international name, Cuajilote. The name is listed as being spelled Guajilote, but I see it most often as Cuajilote. Caiba is another popular local name for this tree.

Also realize that most Spanish common names for plants are imprecise: most words are used for many diverse species that have no relationship to each other. I avoid using the word caiba, and I prefer to stay with Cuajilote.

Be careful with common names, as the UNAM web site (Atlas de las Plantas de la Medicina Tradicional Mexicana) lists *Pseudosmodium perniciosum* (Kunth) Engelm, Anacardiaceae under the local name Cuajilote. The Cuajilote we study in Guatemala is generally named *Parmentiera edulis* or *Parmentiera aculeata* and is of the Bignoniaceae family.

Called "Cow Okra" in Belize; "Pepino de Árbol" (Yucatán); "Cat"; "Caat" (Yucatán, Maya). Kaat, Kat Ku'uk, Xkat Xnuuk (Mariaca 2012: 503). Notice that Standley and Williams spell the word with "C"; Mexican scholars with "K".

The common name in Guatemala, "Cuajilote," is of Nahuatl origin, and signifies maize-ear tree. Cuajilote is the name of a village in Jalapa. (Standley and Williams 1974: 211).

I am estimating that all the Cuajilote that we are studying is all the same species (irrespective of what local botanists call it, *edulis* or *aculeata*). But Standley and Williams say "One other species, *Parmentiera millspaughiana* L. Wms. occurs in the Yucatán Peninsula and may eventually be found in Petén." (1974: 209). We have not yet noticed this other species.

The following common names are for *Parmentiera aculeata*:

- Cacao de Mono
- Caiba
- Coxluto
- Cuajilote (is the common name that I use)
- Pepino de Árbol

chichup (ch'ol), chachip (tseltal) and kat (lacandón). (Román et al. n.d.: 42).

Every author lists additional names. The most complete list that I have found so far is here:

Common names list by CONABIO, Mexico:

- Chic'b (Ch'ol)
- Auue-quec, Cal-o-ue-quec, Auve-quec (Chontal)
- Pepín, Pepino, Estropajo, Crucetillo, Chote, Cuajilote, Pepino de Árbol, Pepino de Ardilla (Español)
- Pepino Kat (Español-Maya)
- Tzoté (Huasteco)
- Kat, Amché, Kaat, Shat-kuuk, Skat-kuuk, X-kat-kuuk, Kat kut, At ku'ut, Chocol, Kat ku'uk (Maya)
- Tyacua-najnu, Tyacuanajun (Mixteco)
- Turi, Cactuuc, Cat, Catcuuc, Cuachilote, Cuajilotillo, Guachilote, Guajilote, Kat-kuuk, Pepino silvestre, Kat néctar, Cuahxilotl, Cuaxiloc, Tzote, Cuajxilult, Paka'ak, Huajilote, Pepino criollo, Turí, Pepino cat (ND)
- Chotecuáhuítl, Cuajxilutl, Cuaxílotl, Cuaxílot (Náhuatl)
- Gueto-xiga, Guetoxiga (Zapoteco)
- Tzutzu (Zoque) / Ain che' (maya)

(CONABIO 2016)

There's a tabulated the list to make it easier to see which words come from which language.

A student lists Chuté as the name for this plant in Nahuatl (Reyes 2020: 37), keeping in mind he is a biology student, not a linguist. His biological research area was Santa Catarina y El Chote localidades de Huejutla Hidalgo (Reyes 2020). I would expect Té to be like a Maya word for tree, so I prefer for Nahuatl to stick to Chotecuáhuítl, Cuajxilutl, Cuaxílotl, Cuaxílot.

Tucker and Janick list:

- Cuachilote
- Cuauhayohtli
- Quauhxilotl
- Quauxitol

(2019: 261, 277, 279 citing Díaz 1976)

Each generation of scholars uses the spelling that is chic for their generation.



The common local names for Belize are:
cat, cow okra, kat, k'at, wild okra (Balick, Nee and Atha 2000: 140)

CUAJILOTE Cua-jilote: cuahuitl, árbol; xi; oll, chilote «Árbol que produce chilotes». Propio de montaña. Produce frutos comestibles. (Inga sp. Parmentera sp.)

[Click here to read more.](#)

Cuahuitl": árbol y. "Xilotl": mazorca tierna

[Click here to read more.](#)

The pod at the right looks like a maize pod (opened, with the kernels visible). So no wonder that this was called "Maize Tree" by the Aztecs.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Jul. 7, 2016.
Camera: Nikon D810. Settings: 1/200; sec; f/10; ISO 500.



Cuahuitl-xilot

Tree with Fresh Young Corn-shaped Fruit. Maize-shaped fruit of Cuajilote, *Parmentiera Aculeata*, Restaurant Café Maya, Sayaxché, Petén.

This tree was growing inside the open area of this restaurant and now 20 years later continues to fruit ALL YEAR LONG.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. July. 7, 2016.

Camera: Nikon D810. Settings: 1/200; sec; f/10; ISO 500

Habit for *Parmentiera aculeata*

The *Parmentiera aculeata* tree can grow large (though not super tall). Lots of limbs and branches at all heights (depends on which branches are cut off; the tree inside the Café Maya in Sayaxché has thick limbs from the lower trunk). This tree has “more branches per cubic meter” than most other trees.

Lots of other genera of plant family Bignoniaceae are lianas (woody vines). But the two common species of *Crescentia* are mid-sized trees (*Crescentia alata* in dry areas; *Crescentia cujete* in seasonally inundated areas, especially grassland savannas and Tasiste palm savannas of Petén). In Rabinal area of Guatemala, both species are planted near homes of the Achi Mayan people who make musical instruments and decorated drinking cups from the dried pods of both species.

In what Ecosystem(s) can you find native *Parmentiera aculeata*?

Parmentiera aculeata grows at many elevations; we have *Crescentia* in our ethnobotanical research garden around the FLAAR office at 1500 meters above sea level (Zona 15, Vistahermosa II, Guatemala City). *Parmentiera aculeata* can grow in seasonally very wet areas or seasonally very dry areas (if its really wet part of the year). You can take the seeds and plant them in diverse areas (which means this is a helpful tree for local people throughout most of rural Mesoamérica).

This tree is found “all over Mexico” in many diverse habitats:

Crece en huertos y está asociado con la selva tropical caducifolia y perennifolia; matorral xerófilo, bosques mesófilos de montaña, de encino y pino, Figura 1. Se encuentra en climas cálidos, semicálidos y templados desde los 2 m hasta los 2,240 m de altura sobre el nivel del mar (Pérez et al., 1998).

(Angon 2006: 2).

What other Trees or Plants are often found in the same Habitat?

What Eco-Systems support presence of *Parmentiera aculeata*?

The map of Pennington and Sarukhan (1968: 377) shows the tree present in two eco-systems of Chiapas which abut Guatemala; The part of Tabasco that borders the northern part of Chiapas also touches Guatemala; In addition, the entire area of Campeche is parallel to the north of Petén. In other words, this tree, if really present in all these parts of Southern Mexico, then it should be in ALL adjacent parts of Guatemala, for example, at El Mirador (when in a helicopter over El Mirador you can see the ruins of Calakmul, Campeche across the border).

Parker (2008: 92) (copy and pasting from all past botanical authors) lists:

- Alta Verapaz
- Baja Verapaz (which abuts Alta Verapaz)
- Chiquimula
- El Progreso
- Guatemala
- Petén (adjacent to far western Tabasco plus all of Campeche, plus a bit of Quintana Roo)
- Quiche (adjacent to Chiapas, Mexico)
- Retalhuleu
- Santa Rosa

If the Pennington and Sarukhan map is correct, you should look for *Parmentiera* also in Huehuetenango and San Marcos (both of which face the western border of Chiapas). Ironically San Marcos is listed by Standley and Williams (1974: 209) but seems to have escaped the copy-and-paste of Parker. Suchitepéquez (Costa Sur area) also eluded Parker's copy-and-paste system.

The tree seems very adoptable to different eco-systems, since the owners of the restaurant in Sayaxché said the tree there grew so thick due to lots of water being available under the building. Yet "The tree is found in abundance in the dry hills between El Rancho and Salama..." (Parker 2008: 92 but taken from Standley and Williams). This area is so dry it supports *Ceiba aesculifolia* and *Plumeria* species (we know since we drive from El Rancho north to Coban about every two months). We will need to ask local people if they know of the actual Cuajilote tree. The *Ceiba aesculifolia* trees are easy to spot even driving full speed because of all the cotton-like kapok when the seed pods split. And the frangipani is easy to see out of the corner of your eye while driving since the flowers are white in an otherwise very dry eco-system (filled with cacti).

Yet Alta Verapaz is rather rainy: parts more so than seasonally dry Petén. So clearly a botanical student could accomplish a helpful thesis or dissertation to physically find where actual *Parmentiera aculeata* trees grow today (so more than just copy-and-paste from Standley and Williams which is already copied-and-pasted by Parker (2008).

The trees we have photographed are in Monterrico, along the street; So, they could be kitchen garden plants (in other words, not out in a wild forest). Same with the tree inside the restaurant in Sayaxché. We are writing about this tree because its fruit is potentially one of the most under-utilized large productive fruits in Guatemala.

Botanists say: "Moist or dry thickets or lowland forest, often along rocky watercourses, chiefly at 1,200 m. or less; planted commonly about dwellings in the drier regions; ..."

Zapotal'-The Zapote, *Achras zapota*, thrives on the shallow soils of the uplands. Either through an advantage accruing to it from protection by the Maya, or through its tolerance, aggressiveness, and longevity the species has become dominant, forming a great forest (see p. 10). The species has considerable adaptability; it is present in exposed habitats (hill caps and sequelar), rain-forest, and in the better-drained sections of the wooded swamps. At least 75 per cent of the upland forest of Northern Petén may be classed as a zapotal. As many as twenty large sapodillas per acre may be found in some areas; the general average is not less than six large trees per acre. In the uppermost tier of the zapotal appear the Santa Maria, *Calophyllum brasiliense* var. *rekoii*, the caoba, *Swietenia macrophylla*, *Rheedia edulis*, *Lucuma campechiana* (Lundell 3948), *Sideroxylon amygdalinum*, and species of *Ficus*. The list of species of the upper tier will be extended considerably as exploration progresses. It is extremely difficult to obtain herbarium material, as most of these trees are too large to climb.

To the middle tier of trees belong the dominant Zapote, *Achras zapota*, the yaxnic, *Vitex gaumeri* (Lundell 1509), *Ficus radula* (3181), *Ficus aerstediana* (2200), *Cecropia mexicana*, *Bursera simaruba*, *Spondias mombin*, *Aspidosperma megalocarpon*, the Ramon, *Brosimum alicastrum*, the manax, *Pseudolmedia spuria*, and species of the Lauraceae and Leguminosae. The lower tree tier is outstanding in the areas of somewhat open forest. Many of the species of low trees average about 10 meters in height. In one locality the tier may not exceed 8 meters in height, while in another it may reach 20 meters.

The trees include *Trichilia minutiflora* (Lundell 3949, 3951), *T. havanensis* (3950), *Sideroxylum meyeri* (3947), *Sapium jamaicense* (2192), *Sebastiania longicuspis* (4304), *Misanteca* sp. (2216), *Parmentiera edulis* (2079), *Myriocarpa obovata* (2194), *Lucuma durlandii* (2154), *Louteridium donnell-smithii* (2081), *Laetia thamnia* (3952), *Deherainia smaragdina* (2199), *Annona* sp., *Sabal* sp., *Pimenta officinalis*, *Protium copal*, *Ocotea lundellii*, and species of *Zanthoxylum*, *Pithecolobium*, *Talisia*, *Cordia*, and *Croton*.

(...)

The floristic composition of the middle and lowest tree tiers is most varied. It is much easier to obtain specimens from the smaller trees, and for that reason the lower tier is more amply represented by collections. It is to be understood that younger trees of the upper tier species are prominent throughout. Often there are more representatives of such trees as *Lucuma campechiana*, *Bursera simaruba*, and *Spondias mombin* in the lower than in the upper reaches. Lianas with their foliage in the tree tops abound, but the difficulty in making collections has delayed their identification. The Bignoniaceae appear to be widely represented. I collected only one species, *Clytostoma mayanum* (Lundell 4008). The underwood varies considerably in height. As in the Ramonal the species

(Lundell 1937: 37-38).



Photo by: Edwin Solares, FLAAR Mesoamerica, Aldea Paxcaman, Petén. Oct. 15, 2022.
Camera: Sony A1. Settings: 1/125; sec; f/g; ISO 1,000

Where has *Parmentiera aculeata* been found in Yaxha Nakum and Naranjo National Park

Not a single species of plant family Bignoniaceae is listed in "Anexo I. Listado de especies arbóreas para el Parque Nacional Yaxha-Nakum-Naranjo (CONAP 2004: 147)".

We have found one tree at the end of the dirt road that goes through the site of Naranjo towards the northeast end of the Jimbal-Cibal-savanna area. This tree may have been planted by the chicleros, xateros, or huecheros who had camps at Naranjo in the 1960's-1990's.

Are *Parmentiera aculeata* trees registered for Tikal National Park?

In Schulze and Whitacre's helpful 1999 "A Classification and Ordination of the Tree Community of Tikal National Park, Petén, Guatemala" there is no listing under *Parmentiera*.

What species of *Parmentiera* trees did Cyrus Lundell find in Petén?

Parmentiera edulis is listed for his pages 38, 39, and 77.

Parmentiera edulis DC. Aguada Tigre, on Yaxha-Remate road, Lundell 2079. A small tree about 8 meters high; occasional in climax forest.

(Lundell 1937: 77)

Where has *Parmentiera aculeata* been found elsewhere in the Petén?

Neotropical Flora is a great place to search for where trees have been found. Then visit the herbaria of the universities of Guatemala, especially herbaria of USAC and of UVG.

[Click here to read more](#)

Besides Petén, *Parmentiera aculeata* is found in other parts of Guatemala

- Chinautla
- Alta Verapaz
- Petén
- Retalhuleu
- Santa Rosa

[Click here to read more](#)

If you go in-person to herbaria at universities in Guatemala you will find additional locations, such as:

- Guatemala, Izabal, near Cuenca Las Cañas and Juan de Paz, Sierra de las Minas (UVG)
- Guatemala, Baja Verapaz, Salamá, Aldea Cachil (UVG)
- Universidad del Valle de Guatemala - Herbario UVAL

[Click here to read more](#)

CONAP lists three species for Parque Nacional Sierra del Lacandón, a national park of western Petén that borders on the Rio Usumacinta (which is the Petén-Chiapas border):

- 25 *Bignoniaceae* *Amphitecna donnell-smithii* (Sprague) L. Morro
- 26 *Bignoniaceae* *Parmentiera aculeata* (HBK) L. Cuajilote
- 27 *Bignoniaceae* *Tabebuia rosea* (Bertol.) D.C. maqueliz, maculiz, matilisguate



Is *Parmentiera aculeata* from the Maya Highlands or from the Maya Lowlands (or both)?

Grows next to homes in both Alta Verapaz (6 km north of Chisec) and in the Maya Lowlands. There are plenty of botanical databases to show more. In Mexico grows at many different elevations and locations.

I could not find Cuajilote mentioned in *Plantas Útiles de Solola*, by Ana Lucrecia de MacVean, suggesting that Lake Atitlan area is not an area for this tree. But we found *Parmentiera aculeata* with

healthy fruits in the San Juan La Laguna area. FLAAR did field trips to every area of Guatemala from year 2000 onward (in previous decades primarily to Petén plus more in Mexico, Belize, and Honduras, and more focused on photographing with high resolution cameras the monumental architecture of pyramids, temples, palaces, acropolises and ballcourts).

To find edible plants of the Mayan world, whether out in the wild or in a kitchen garden surrounding a thatched-roofed Maya house, it helps to have been doing field trips for several decades.

You can notice that this tree is up in the moist Maya Highlands by the many tiny epiphytic bromeliads on the same branches of this *Parmentiera aculeata*. San Juan La Laguna, Lake Atitlan area, Maya Highlands, Guatemala. Photo by FLAAR team, December 25, 2012.

Camera: Canon 1D X Mark II. Settings: 1/50; sec; f/13; ISO 500.

Botanical Description of *Parmentiera aculeata* in Guatemala by Standley and Williams (1974)

PARMENTIERA DC.

Reference: Louis O. Williams, *Parmentiera*, Fieldiana, Bot. 36 (4): 27-29. 1973.

Small or medium-sized trees, the branches subterete, usually armed with a short spine at each node, the nodes amplified to form the spines; leaves opposite or subopposite, often alternate on young branchlets, often fasciculate in the axils of the spines, trifoliolate or simple on young shoots, the petioles usually narrowly winged; at least near the apex; flowers large or small, greenish, solitary or fasciculate from nodes on old wood, or terminating the branchlets; calyx spathaceous, closed in bud, cleft on one side in anthesis and soon deciduous, glandular-lepidote; corolla campanulate and somewhat curved, the limb somewhat bilabiate;

stamens slightly exerted, the anthers glabrous; disc large, pulvinate; ovary oblong, glandular-lepidote, 2-celled; fruit elongate, subcylindric, indehiscent, with fleshy pericarp, smooth or costate; seeds small, numerous, not winged, imbedded in pulp. There are seven species of the genus, all in tropical North America; one of these is the "candle tree" of Panama, *P. cerifera* Seeman, which bears many showy smooth yellowish fruits 30-120 cm. long, strongly suggestive of wax candles. One other species, *Parmentiera millspaughiana* L. Wms. occurs in the Yucatán Peninsula and may eventually be found in Petén.

Parmentiera aculeata (HBK.) L. Wms., Fieldiana, Bot. 36: 27. 1973. *Crescentia aculeata* HBK. Nov. Gen. & Sp. Pl. 3: 158. 1819. *Parmentiera edulis* DC. Prodr. 9: 244. 1845. *Crescentia edulis* Moc. ex DC. l.e., nomen nudum. *Parmentiera aculeata* Seeman, Bot. Voy. Herald 183. 1854, nomen nudum, non *Crescentia aculeatum* of HBK. Cuajilote; caiba; coxluto (Chimaltenango, fide Tejada); ixlut (Huehuetenango, fide Tejada). Moist or dry thickets or lowland forest, often along rocky watercourses, chiefly at 1,200 m. or less; planted commonly about dwellings in the drier regions; Petén; Alta Verapaz; Baja Verapaz; El Progreso; Chiquimula; Santa Rosa; Guatemala; Suchitepéquez; Retalhuleu; San Marcos; El Quiché. Southern Mexico; British Honduras; El Salvador; Honduras.

(...)

Small or sometimes rather large trees with usually broad, dense crowns, the trunk short and thick, the bark pale, the branches with short, stout, somewhat incurved spines at the nodes; leaves minutely lepidote, the petioles long, winged. leaflets 3, entire, elliptic to obovate, acute or obtuse, cuneate at the base, 4-8 cm. long, the nerve axils barbate beneath; flowers fasciculate on old wood or axillary at or near the ends of the branches; calyx 2.5-3.5 cm. long, green; corolla green with brown-purple lines, 5-6.5 cm. long; fruit pale yellow, 11-17 cm. long, 2-3 cm. or more in diameter, often curved, conspicuously costate, acute or acuminate. Called "Cow Okra" in British Honduras; "Pepino De Árbol" (Yucatán); "Cat"; "Caat" (Yucatán, Maya). The usual name in Guatemala, "Cuajilote," is of Nahuatl origin, and signifies maize-ear tree. Cuajilote is the name of a village in Jalapa. The tree is abundant on the dry hills between El Rancho and Salama, and less frequent in other dry regions. It is widely spread in cultivation in Guatemala, but the trees are not very numerous, since the fruit is not highly esteemed except in the very dry regions where there is often a shortage of fruits and other food. The fruit is fried or otherwise cooked before being eaten, and it is often stuffed with meat or other articles. It is said to be eaten greedily by pigs where available. At Aguacatán it was stated that the Indians employ the ripe fruit for making sweets.

(Standley and Williams 1974: 209 and 211; illustration is on their page 210)

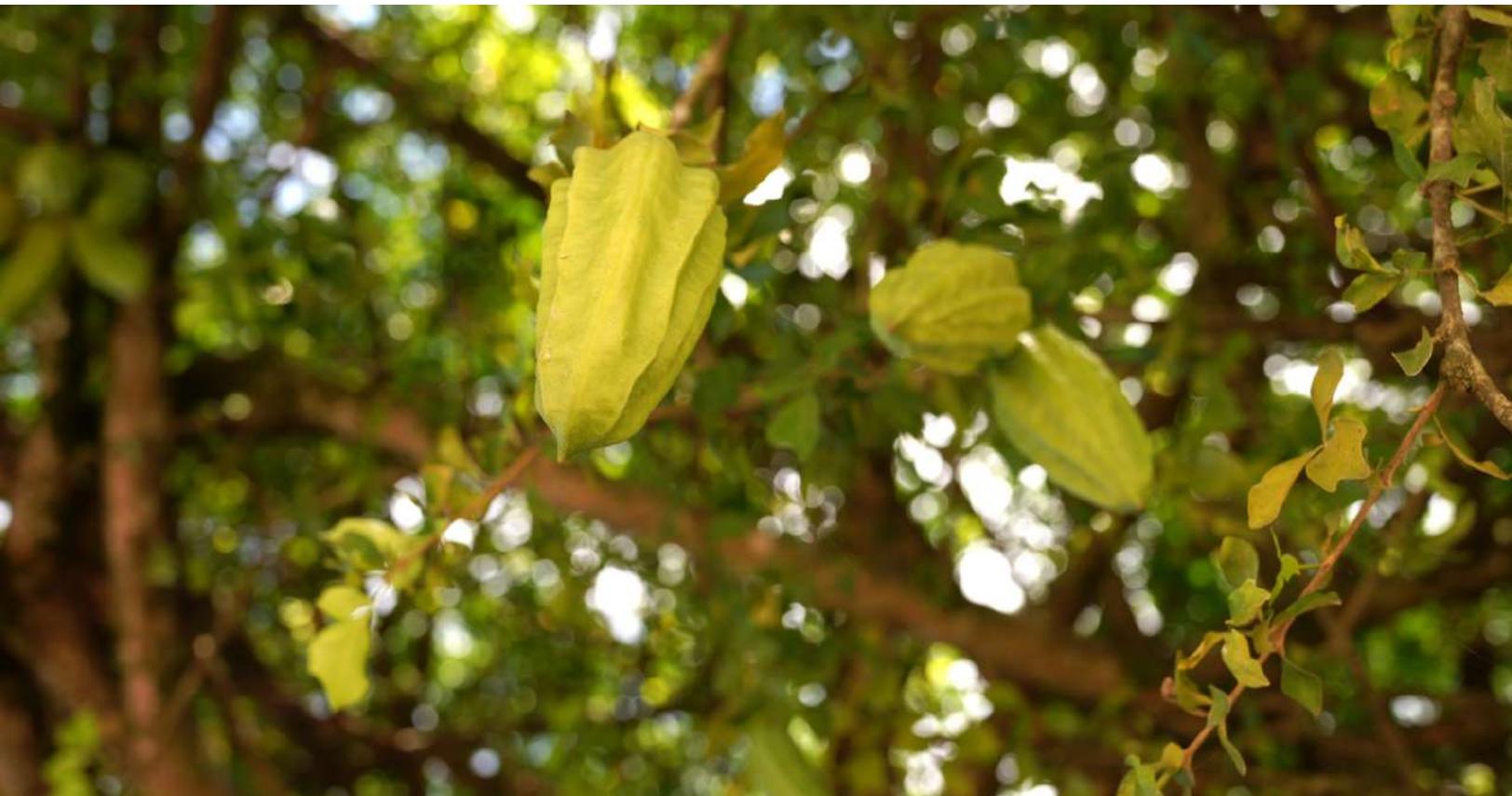


Photo by: Edwin Solares, FLAAR Mesoamerica, Oct. 15, 2022.

Camera: Sony A1. Settings: 1/160; sec; f/8; ISO 640.

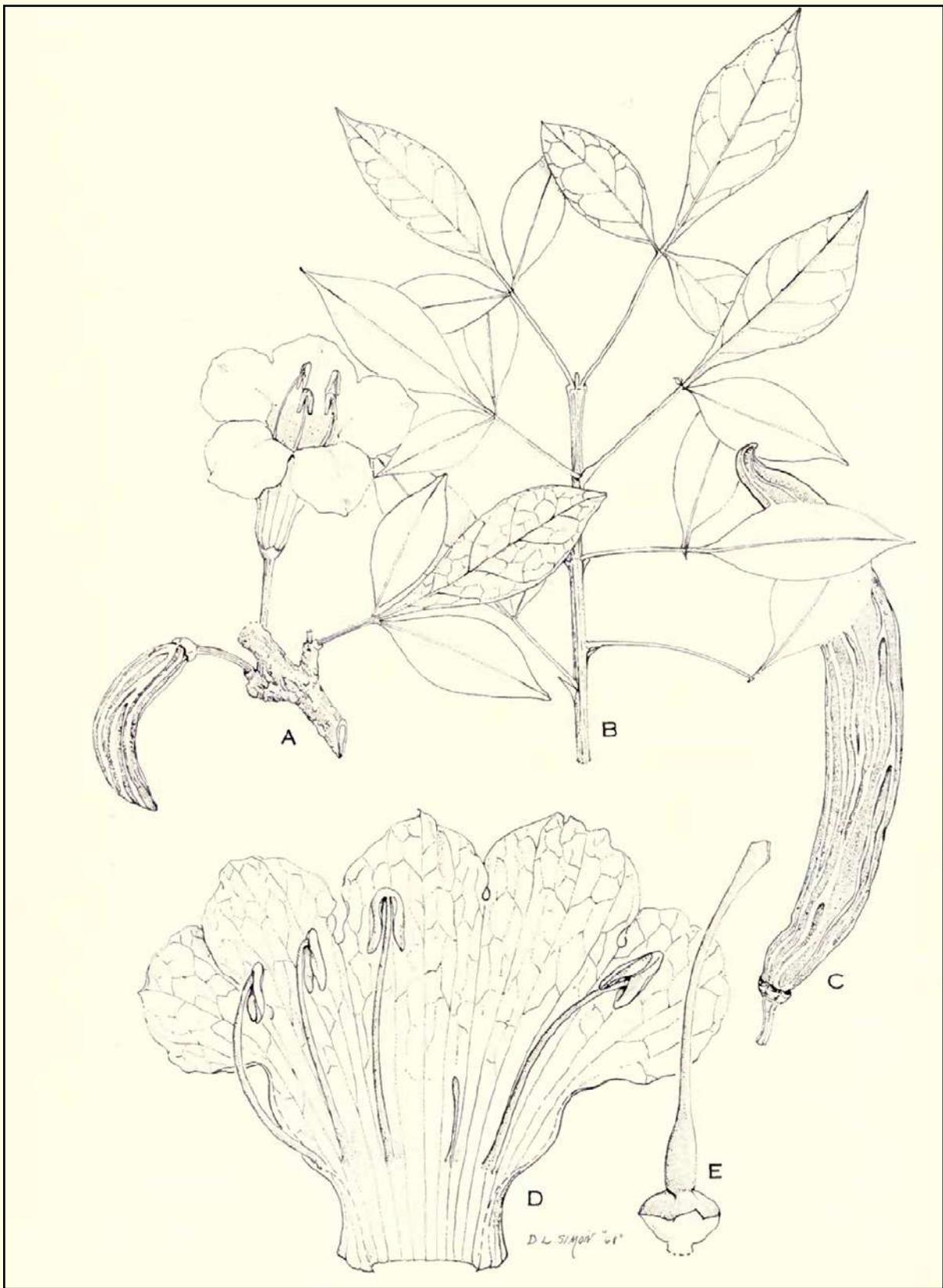


FIG. 36. *Parmentiera aculeata*. A habit with flower and immature fruit, X $\frac{1}{2}$; B, terminal growth, X $\frac{1}{2}$; C, fruit, X $\frac{1}{2}$; D, corolla dissected to show stamens and staminode, X 1; E, calyx, disk, and pistil, X 1. (Standley and Williams 1974: Fig. 36).

Our comments 2023: the fruit can be many different sizes and different features on the sides. The fruit shown by Standley and Williams is too thin and probably a dried specimen? The flower has an angle from the tree that is a tad different than shown here but the leaves are correct. In other words, best to find an actual tree out in the wild and study the flowers and fruits out in the real world. Then you notice that their caption admits this is an "immature fruit" (so this is why it is thin).



Here is a Cuajilote fruit the same size and shape as that of Standley and Steyermark. But this fruit is young; not mature whatsoever.

A flower is alongside. Note that both are sticking out of the end of a twig (so not on a trunk or limb). You can see the outline much more precisely with a Phase One medium format digital back on a Hasselblad camera with a Zeiss lens Made in Germany.

Flash helps bring out the details in the ridges (Metz flash, Made in Germany). This is the equipment we used two decades ago, along with the sturdiest model of Gitzo tripod and heavy-duty tripod heads.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica. Sep. 4, 2011.
Camera: Canon 1D X Mark II. Settings: 1/10; sec; f/18; ISO 250.



Often the unripe young fruits get knocked off by a rainstorm and you find them on the ground under a *Parmentiera aculeata* tree. These fruits are not yet their full diameter.

Photo by: David Arrivillaga, Biotopo Cerro Cahui, Reserva de la Biosfera Maya (RBM), Petén, June 25, 2021.
Camera: Sony A1. Settings: 1/320; sec; f/5,6; ISO 2,500.

Botanical Description of *Parmentiera aculeata* in Flora of Yucatán

Parmentiera aculeata (HBK.) *Parmentiera aculeata* (HBK.) Seem. Bot. Voy. Herald 183. 1854. *Crescentia aculeata* HBK. Nov. Gen. & Sp. 3: 158. 1818. *P. baculis* Donde", Emulation 3: Apend. 13. 1878. *P. cereifera* Millsp. FMB. 1: 390. 1898, not Seem. Cacuuc (Gaumer); listed also as "Catcuuc," "Katzuz," "Katcuuc," "catcuuk" (Donde"). Sp. Pepino de ardilla. Cultivated and wild. type from Campeche. A shrub or small tree, armed with short. stout spines: leaves 3-foliolate, the leaflets rounded to obovate, 1-3 cm. long, rounded at the apex, often toothed, glabrous or puberulent. flowers large, greenish, borne on young branches; fruit terete, fleshy, 15-25 cm. long, 1 cm. thick, yellow, ripening in October. The fruit is edible when cooked.

(Standley: 419)

Parmentiera edulis DC. Cat (Gaumer); reported also as "kaat." Sp. Pepino de arbol, Cuajilote (Camp.; of Nahuatl derivation). Cow okra (B. H.). Cultivated and perhaps native, at least in the southern part of the Peninsula. A small tree, armed with short spines; leaflets elliptic or obovate, 3-8.5 cm. long, usually acute, entire; flowers greenish white, 7 cm. long; fruit fleshy, 10-16 cm. long, 2 cm. thick or more. The fruit is eaten raw or cooked, and is sometimes pickled or preserved. It is also reputed to have diuretic properties, and is eaten to relieve pain in the kidneys. An infusion of the root is administered as a remedy for diabetes.

(Standley: 420)

Botanical Description of

Parmentiera aculeata in Trees and Shrubs of Mexico

16. PARMENTIERA DC. Prodr. 9: 244. 1845.

Trees, usually armed with spines; leaves alternate or subopposite, mostly trifoliolate; flowers large, greenish, pedicellate, solitary or fasciculate on old wood; calyx closed in bud, in anthesis cleft along one side and spathe-like; corolla tube dilated and campanulate, curved, the limb somewhat bilabiate, 5-lobate; stamens 4; ovary 2-celled; fruit elongate, terete, indehiscent, with fleshy pericarp, smooth or costate; seeds small, numerous, not winged. One other species is known, *P. cereifera* Seem., the candle-tree of Panama. Fruit short and thick, costate; leaflets mostly acute and entire 1. *P. edulis*. Fruit long and slender, smooth or nearly so; leaflets usually very obtuse and often toothed 2. *P. aculeata*.

1. *Parmentiera edulis* DC. Prodr. 9: 244. 1845.

- *Crescentia edulis* Desv. Journ. de Bot. Desv. 4: 113. 1814.
- *Parmentiera foliolosa* Miers, Trans. Linn. Soc. Bot. 26: 166. 1870.
- *Parmentiera lanceolata* Miers, Trans. Linn. Soc. Bot. 26: 167. 1870.

Tree, 4.5 to 9 meters high, the branches armed with short stout incurved spines; leaves glabrous, long-petiolate, the petiole naked or narrowly winged, the leaflets elliptic, ovate, or obovate, 3 to 8.5 cm. long, acute or abruptly attenuate at base; corolla about 7 cm. long; fruit 10 to 16 cm. long and 2 cm. thick or larger. "Chote" (Tamaulipas, San Luis Potosí); "Cuajilote," "huajilote," "cuachilote," "guajilote" (Oaxaca, Tamaulipas, Veracruz, Jalisco, Morelos, Campeche, Sinaloa, Costa Rica, El Salvador, Guatemala; from the Nahuatl cuau-xilotl); "gueto-xiga" (Oaxaca, Zapotec, Reko). The tree is often cultivated for its shade and fruit. The fruit is sweet and edible, and is eaten either raw or cooked. It is sometimes made into pickles or preserves and also roasted in ashes. Stock of all kinds are fond of it. It is considered a good remedy for colds; the roots are used as a diuretic, especially in the treatment of dropsy, and the juice of the leaves was formerly, at least, dropped into the ears as a cure for deafness. The flowers are greenish white or greenish yellow, and the fruit green tinged with yellow. The name *Crescentia edulis* Desv. has no connection with *Parmentiera edulis* DC, and it is not certain that Desvaux's name relates to the present plant. He describes the leaves as simple, but his description of the fruit points to *Parmentiera edulis*.

2. ***Parmentiera aculeata*** (H. B. K.) Seem. Bot. Voy. Herald 183. 1854. *Crescentia aculeata* H. B. K. Nov. Gen. & Sp. 3: 158. 1818. Colima, Campeche, and Yucatán; type from Campeche. Shrub or tree, 3.5 to 7.5 meters high, the branches armed with stout spines; leaves long-petiolate, the petioles not winged, the leaflets suborbicular to obovate, 1 to 3 cm. long, abruptly decurrent at base, puberulent or glabrous; calyx 2 cm. long; fruit 18 to 25 cm. long, about 1 cm. thick. "Xkat-cunc," "kaat," "pepina" (Yucatán). The flowers are said to be green. This species has been reported from Yucatán as *P. cereifera* Seem.

(Standley 1926: 1323).

In which States of Mexico is *Parmentiera aculeata* listed by Villaseñor

Those that are in bold font are the Mexican states that are adjacent to or near Petén, Guatemala.

Parmentiera aculeata (Kunth) Seem. BCS, **CAM**, **CHIS**, COL, GRO, HGO, JAL, MEX, MICH, MOR, NAY, OAX, PUE, **QRO**, QROO, SLP, SIN, **TAB**, TAMS, VER, **YUC**

(Villaseñor 2016: 669)

The list by Villaseñor documents my concluding remarks that this tree can be planted “almost anywhere and everywhere in Guatemala and surrounding Mesoamérica” to provide edible and medicinal benefits to local rural people.



This map shows where the trees are planted for production: CHIS, COL, GRO, JAL, MICH, NAY, OAX, SLP, SIN, TAMS, YUC. Villaseñor shows where the trees can be found (in the wild or in fields, so he lists many more area).

Brief description of *Parmentiera aculeata* trees for Belize by Standley and Record (1936)

Parmentiera edulis DC. Cow Okra. Cuajilote (Campeche). Kat (Yucatán, Maya). Occasional; Mexico and northern Central America. A shrub or small tree, often armed with short spines; leaves long-stalked, the 3 leaflets elliptic to obovate, small or large, acute or obtuse, entire or toothed; flowers greenish white, on old wood, 7 cm. long; fruit fleshy, 10-15 cm. long, 2 cm. thick or more. The fruit is eaten either raw or cooked. It may be that the closely related *P. aculeata* (HBK.) Seem., with slender fruit 15-25 cm. long, also occurs in British Honduras.

(Standley and Record 1936: 362-363)

Parmentiera aculeata in Belize

Balick, Nee and Atha (2000) list

Parmentiera aculeata (H.B.K.) Seem. — **Syn:** *Parmentiera edulis* DC. — **Loc Use:** FOOD, FORG. — **Reg Use:** FOOD, ORN, SPC, FORG, MED. — **Nv:** cat, cow okra, kat, k'at, wild okra. — **Habit:** Tree.

(Balick, Nee and Atha 2000: 140)

World Range for *Parmentiera aculeata*

Clearly *Parmentiera aculeata* is common in Mexico, Guatemala, Belize. Its presence in Costa Rica, Colombia and Ecuador needs to have local botanists there decide whether native or introduced. I vote for introduced as a cultivar or garden plant and escaped to nearby forests. But best for a specialist in those three countries to comment.

Close relative(s) of *Parmentiera aculeata*; how many other species of *Parmentiera* are in Petén?

No other species of *Parmentiera* are listed for Belize; but several are listed for Guatemala. *P. aculeata* is the most widespread. For the Mayan areas there are three species:

- *Parmentiera aculeata*
- *Parmentiera millspaughiana*
- *Parmentiera parviflora*

Altogether (for all of the Americas), the other accepted species names of genus *Parmentiera* are:

- *Parmentiera aculeata* (Kunth) Seem.
- *Parmentiera cereifera* Seem.
- *Parmentiera dressleri* A.H.Gentry
- *Parmentiera macrophylla* Standl.
- *Parmentiera millspaughiana* L.O.Williams
- *Parmentiera morii* A.H.Gentry
- *Parmentiera parviflora* Lundell
- *Parmentiera stenocarpa* Dugand & L.B.Sm.
- *Parmentiera trunciflora* Standl. & L.O.Williams
- *Parmentiera valerii* Standl.

[Click here to read more.](#)

The website [ThePlantList.org](#) has been replaced by a newer database; but I am so accustomed to using ThePlantList.org that I prefer to continue with that.

Parmentiera parviflora

Of the species listed for the Mayan areas, here is a second one included by Standley and Williams.

Parmentiera parviflora Lundell, Lloydia 3: 211. 1940. Wet forest and on-stream banks to 300 m.; Petén (Tun 835). Mexico (type from Chiapas, Matuda 3210).

Shrubs or small trees, a meter or taller, the branches slender, terete, obscurely puberulent at first, with 1 or 2 short porrect spines at the nodes, these sometimes bearing small leaflets; leaves 1 or more from the nodes, opposite or alternate, trifoliolate or simple, with sparse peltate scales, especially below, leaves when simple 2-4 at a node, oval, about 1 cm. long, when trifoliolate the mid-leaflet lanceolate or ovate-lanceolate, acuminate, (2-)3-7 cm. long, the lateral leaflets smaller, suborbicular to ovate, apex rounded or acute, 1-2 cm. long or even less; petioles slender, canaliculate, 1-3 cm. long (or even less); inflorescence terminal, a single short pedicellate flower; calyx spathaceous, about 1-1.5 cm. long; corolla narrowly campanulate-tubular, about 1.5 cm. long, obscurely bilabiate; anthers reaching the throat; fruits terete, smooth or obscurely costate, somewhat arcuate, fusiform, up to 6 cm. long and 1.5 cm. in diameter; seeds bilobate, about 8 mm. long and 9 mm. broad.

This is the species with the smallest flowers and fruits of the tree species known in the Guatemalan-Yucatecan area and is closely related to *P. millspaughiana* L. Wms.

Parmentiera parviflora Lundell has no synonyms. There are records of this plant in:

- Guatemala, Petén, Along Río Cancuen, between El Cambio and Río Machaquila, 16.02 -90.01
- Guatemala, Petén, Sayaxché, En orillando de camino para Sayaxché, 70 km de Santa Elena. En foresta alta, 16.53 -90.19
- Guatemala, Petén, Río Pasión, above Altar de Sacrificios, 16.48 -90.53
- Guatemala, Izabal, Livingston, Los Zapatillos, 15.85626 -89.33244

Parmentiera parviflora is listed for Mexico only in Chiapas and Tabasco (Villaseñor 2016: 670) Tabasco and Chiapas are both in the Mayan-speaking area of Mexico).

Parmentiera millspaughiana

Parmentiera millspaughiana L.O.Williams has no synonyms.

Parmentiera millspaughiana is listed for Mexico for CAM, COL, QROO, YUC. (Villaseñor 2016: 669-670). Campeche, Quintana Roo and Yucatán are the Yucatec-Maya speaking parts of Mexico. But *Parmentiera millspaughiana* is not listed for Guatemala whatsoever

[Click here to read more](#)

These fruits are literally the length and diameter of a candle. *Parmentiera millspaughiana* fruit is edible (Anderson et al. 2003).

Flowers of Parmentiera aculeata

The flower of Cuajilote is similar in size and shape as flowers of both species of Jícara and Morro (*Crescentia alata* and *Crescentia cujete*). Although I see fruits on most trees more than 10 months out of every year, I very rarely see any flowers. That said, the fruits that I see each month vary from young to mature. Because it flowers at night, you may not notice the flowers easily during a hot day.



Flowers of *Parmentiera aculeata* in Restaurant Café Maya, Sayaxché, Petén, April 20, 2018.

Top: Erick Flores and Nicholas Hellmuth. Bottom: Melanny Celeste Quiñonez Izquierdo and Senaida Ba Mucu.



Flower of *Parmentiera aculeata*, Cuajilote, Restaurant Café Maya, Sayaxché, April 20, 2018, photo by. Erick Flores or Nicholas Hellmuth.

Camera: Nikon D5. Settings: 1/5; sec; f/9; ISO 200.



Neotropical flowers of *Parmentiera aculeata* in various stages of bud to start of the fruit.

Photograph by Nicholas Hellmuth, September 2011, Monterrico, Hasselblad, Zeiss lens, Phase One medium format digital back.

Camera: Canon 1D X Mark II. Settings: 1/30; sec; f/18; ISO 250.



In the previous photo one flower as similar to the one here; but in the present photo the outside of the bud has wilted away, and you can see the fruit emerging. A cacao pod looks very similar in size and shape when it begins to grow up and out.

Photograph by Nicholas Hellmuth, September 2011, Monterrico, Hasselblad, Zeiss lens, Phase One medium format digital back.

Camera: Canon 1D X Mark II. Settings: 1/4; sec; f/18; ISO 250.

Immature fruits and fresh flowers of *Parmentiera aculeata* photographed by FLAAR team with portable studio (photo stand, tripod, tripod head, lighting, etc.), April 20, 2015, El Chal, Petén. We take Petate or woven "plates" along on field trip so we can have the native flowers and fruits on a Maya handwoven background (so not plastic).



Here are several dozen flowers of *Parmentiera aculeata* from El Chal, Petén (south of Lake Petén Itza, along the highway heading to far away Rio Dulce, Izabal).

Photographed April 20, 2015 by the FLAAR team.



Neotropical flowers of *Parmentiera aculeata*, San Juan La Laguna, Atitlan area, by FLAAR photography team in past decade. This flower is seen from the front and has greener (possibly because it is aging?).

Camera: Canon 1D X Mark II. Settings: 1/100; sec; f/13; ISO 250.

What are the primary pollinators of *Parmentiera aculeata* flowers?

Bats are listed as the primary pollinators of the two species of *Crescentia* (*C. alata* and *C. cujete*). But even when the flowers open in the early evening, there's no record of the bats coming closer, maybe because the bats saw us near the tree. We will need to ask local people what pollinators they notice for flowers of *Parmentiera aculeata*.

Fruits of *Parmentiera aculeata*

Although the flowers are similar as those of *Crescentia* species, the fruit is totally different: Cuajilote is ridged and the size of a cacao pod (but soft). Morro and Jícaro are completely smooth and with a solid husk. The hollow pods of Jícaro and Morro are used for musical instruments (small pods) or drinking cups (large pods). When we visit Mayan villages in remote areas of Alta Verapaz the local Q'eqchi' Mayan people offer us cacao and maize atol and other local Mayan drinks always in a Morro bowl.



Another view of an immature but almost ripe Cuajilote fruit cut in half.



Cuajilote fruit cut in half. This fruit is immature.



I deliberately left the fingers so you could estimate the size of this Cuajilote fruit. I show two views of the same fruit so you can see how the outer surface varies considerably. If you look at a hundred pods you will see lots of different sizes and shapes of furrows and undulations.

Photo over a decade ago by FLAAR Mesoamérica portable photo studio.
Camera: Canon 1D X Mark II. Settings: 1/10; sec; f/7,1; ISO 320.



Each *Parmentiera aculeata* tree has so many upright limbs they look like multiple trunks, and constantly branching out.

Photo by Nicholas Hellmuth, Oct. 10, 2021, with iPhone 12 Pro, Paxcamán, Petén, along the edge of the highway going east from Flores/Santa Elena (towards Melchor de Mencos).



Fruits directly from the trunk. Sometimes two fruits from same location; but also, can have single fruits (since often the others have ripened earlier and already fallen off).

Notice the thin bump-extension at the end of the fruit (present in many but not all fruits).

Photo by Nicholas Hellmuth, Oct. 10, 2021, with iPhone 12 Pro, Paxcamán, Petén, along the edge of the highway going east from Flores/Santa Elena (towards Melchor de Mencos).

***Parmentiera aculeata* flowers are cauliflorous however, also bloom and fruit from end of the branches**

Inside the restaurant Café Maya in Sayaxché, most of the fruits you see are directly from the main trunk or main limbs. *Parmentiera aculeata* is obviously cauliflorous (as are *Crescentia* and *Theobroma cacao* and lots of other trees such as several species of genus *Zygia*).

But if you see a complete tree out along a road, you notice that all the fruits that you see are at the tip of the branches. This is often because the tree produces so much shade you can't see the upper part of the trunk unless you are standing next to the tree.



Parmentiera aculeata flowering from the end of many twigs. Paxcamán, Petén, Oct. 10, 2021, photo by Nicholas Hellmuth with iPhone 12 Pro. The iPhone X was better than others; Model 11 was even better. The subsequent models were a tad better; today in 2023 we use the better iPhone 14 Pro Max.



Parmentiera aculeata, Cuajilote fruits from the end of dozens of twigs. Paxcamán.

Photo by Nicholas Hellmuth with iPhone 12 Pro, Oct. 10, 2021.



The trunks and limbs of this same tree have cauliflorous fruits. But there are HUNDREDS of fruits at the end of twigs all up and down the crown.

Paxcamán, east of Flores/Santa Elena, Petén. The several trees are on the north side of the main highway that heads east towards the Petén-Belize border of Melchor de Mencos. Photo by Nicholas Hellmuth, Oct. 10, 2021, iPhone 12 Pro.



Literally the END of the TWIG is where this fruit has grown from the earlier flower. Monterrico, Guatemala, over a decade ago by FLAAR photography team.

Camera: Canon 1D X Mark II. Settings: 1/20; sec; f/10; ISO 125.

In addition to Flowering/Fruiting from Trunk and large Limbs, and Flowering/Fruiting from Ends of the Twigs, *Parmentiera aculeata* also Flowers and Fruits from its Branches

This tree has branches everywhere. When you are standing next to the trunk, looking up, you see what you don't experience in a botanical monograph or drawer in a herbaria: you see entangled branches and limbs of every size and shape. The tree is a veritable spaghetti of branches and twigs growing all over the place from the trunk and limbs.



Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 20, 2015.
Camera: Nikon D810. Settings: 1/40; sec; f/13; ISO 640.



Not surprisingly, it's estimated that there may be over 600 fruits per year and other botanists suggest over a thousand, potentially up to 2,000 fruits per year from a single tree. I would suggest a maximum of 50-100 per month. Here's a good segment for a master's or master's thesis and for sure this tree deserves a Ph.D. dissertation, our current FLAAR Report will save you lots of time, but more fieldwork is needed. Also, it would help to have a 3D image of several real trees and show all the positions of the fruits, however, it would help a student to physically count the number of fruits on a tree at any given time. We have already done this for Mamey Zapote because these trees are tall with plenty of space between branches and branches that you can more easily see and count all the fruits.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica, Apr. 20, 2015.

Camera: Nikon D810. Settings: 1/40; sec; f/13; ISO 640.

Usually, multiple fruits from same area



Note that you can more easily see and count all the fruits.

Photo by: Camila Morales, FLAAR Mesoamerica. Jardín Botánico, Guatemala. 2011.

Camera: Nikon D810. Settings: 1/40; sec; f/13; ISO 640.



Four fruits from same location, *Parmentiera aculeata*, patio of Restaurant Café Maya, Sayaxché, July 30, 2011, FLAAR photo team.

Camera: Canon 1D X Mark II. Settings: 1/20; sec; f/10; ISO 125.



SEVEN fruits from same position, *Parmentiera aculeata*, Paxcamán, Petén. Photo by Nicholas Hellmuth, Oct. 10, 2021, iPhone 12 Pro.

Size and Shape of the Fruits



Long and thin, still has a long way to grow (and change to light green). *Parmentiera aculeata*, Monterrico.

Photo by Nicholas Hellmuth with Hasselblad, Zeiss lens, Phase One medium format digital back, September 2011.
Camera: Canon 1D X Mark II. Settings: 1/20; sec; f/18; ISO 250.



If you have access to a thousand different Cuajilote fruits, you will find them in many different sizes and shapes, such as this unexpected, curved example here, Paxcamán, Petén.

Photo by Nicholas Hellmuth, Oct. 10, 2021, with iPhone 12 Pro.



This fruit has wide open areas and deep ridges. There are dozens of profiles (shapes) of these Cuajilote fruits. Many are like size and shape of cacao (but cacao fruits are rarely curved).

Photo by Nicholas Hellmuth with Hasselblad and Phase One medium format digital back, Monterrico, September 2011.

Camera: Canon 1D X Mark II. Settings: 1/4; sec; f/18; ISO 250.



These photos are to assist iconographers in case someday this fruit is found pictured on a Maya vase and/or carried in the hand of a monkey on a Late Classic Maya scene.

Photo by Nicholas Hellmuth with Hasselblad and Phase One medium format digital back, Monterrico, September 2011.

Camera: Canon 1D X Mark II. Settings: 1/13; sec; f/18; ISO 250.

Cuajilote, cacao de mono, as faux cacao

When we presume that every monkey running or dancing on a Late Classic Mayan vase or bowl is carrying a *Theobroma cacao* pod, I can show you several other plants whose fruits are the same size and ridged shape (more kinds of fruit than just Cuajilote). Monkeys eat different tree and vine fruits that are close to IDENTICAL in size and ridged shape as a cacao pod. We raise cacao and many of the other faux-cacao fruit plants in the FLAAR Mayan Ethnobotanical Research Garden that surrounds our offices. Many botanists and students visit our office and garden; you are always welcome. Our plant research is shown on www.maya-ethnobotany.org. I discuss the faux-cacao aspect in our related web site, www.maya-archaeology.org. I have an entire PowerPoint lecture to show all the wild native plants of Guatemala whose fruits are, literally, the same size and shape as a cacao pods and most of these are eaten by monkeys!



You can find regional varieties of *Theobroma cacao* throughout Guatemala that is roughly the same size and shape. You can tell this is up in the moist Maya Highlands by the tiny epiphytic bromeliads on the same branches of this *Parmentiera aculeata*. San Juan La Laguna, Lake Atitlan area, Maya Highlands, Guatemala. Photo by FLAAR team, December 25, 2012.

Do *Parmentiera aculeata* trees also grow in home gardens?

I would estimate that yes, this tree grows in kitchen gardens in some parts of Mesoamérica. Our goal is to encourage more people to plant and protect *Parmentiera aculeata* trees around their homes. In the ethnobotanical research garden surrounding the FLAAR office in Guatemala City, we have Avocado, Nance, and *Theobroma cacao* trees. But the local squirrels harvest most before we do. And since we like to help the squirrels, we let them eat what they want.



Tree growing in the back corner of kitchen garden in rural area a few kilometers from Panajachel, Maya Highlands of Guatemala.

Photo by FLAAR team with Canon flash combined with Metz flash, July 5, 2012.

Camera: Canon 1D X Mark II. Settings: 1/500; sec; f/11; ISO 500.



Closer view of the same *Parmentiera aculeata* tree. This tree has had most of its branches sawn off (as I see in other photos not shown here). July 5, 2012, FLAAR Photo Archive.

Photo by: Nicholas Hellmuth, FLAAR Mesoamerica.

Camera: Canon 1D X Mark II. Settings: 1/50; sec; f/11; ISO 500.

Are any parts of *Parmentiera aculeata* edible?

It is widely spread in cultivation in Guatemala, but the trees are not very numerous, since the fruit is not highly esteemed except in the very dry regions where there is often a shortage of fruits and other food. The fruit is fried or otherwise cooked before being eaten, and it is often stuffed with meat or other articles. It is said to be eaten greedily by pigs where available. At Aguacatán it was stated that the Indians employ the ripe fruit for making sweets.

(Standley and Williams 1974: 211).

But in theory you can also eat the fruit raw, as is, with no preparation or seasoning, as shown on this video:

[Click here](#)

Her helpful book on utilitarian plants of the Petén has been out of print and we can't even find a copy used in Guatemala. But from the scanned copy as a PDF I could see that it was included primarily as a medicinal plant: not much about it being used as regular food other than four words, "Los frutos son comestibles" (2003:34). Frankly I find Cuajilote a fascinating species and well worth further study.

The fruit may not entice us the way a banana, apple or orange would, but the fruit can grow alongside houses of the Mayan people and provide the following nutrients:

For micronutrients, depending on the area and season, these are the average amounts of vitamins present

- C from 23.7 to 29.8 mg/100 g
- Fe 0.39 to 0.68 mg/100 g
- Zn 2.38-6.21 mg/100 g
- Cu from 0.96 to 2.55 mg/100 g.

(Angon 2006: i).

An additional consideration is the quantification of vitamin A, in the fruit of *P. edulis*, for presenting a yellow coloration, which suggests the presence of this vitamin. Also carry out the quantification of dietary fiber in the fruit of *P. edulis*, because the percentage of crude fiber was relatively high, and with this determine the quality of the fiber.

(Angon 2006:36-37)

Cuajilote, *Parmentiera aculeata* is listed as comestible by Mariaca (2012: 474). However, most articles give any more significant information about the edibility of this fruit other than the single word, comestible. Only Angon specifically says "it is eaten" (by people) and has Vitamin C and several minerals (2006). Villar (2011) also discusses its vitamins and minerals.

Suzanne Cook's comprehensive ethnobotanical study of the Lacandón calls the tree *Parmentiera edulis* DC. (2016: 107 and again 169). Says it is indeed edible and eaten raw. Cook cites Atran et al 2004, Nations and Nigh 1980 and others.

I have never previously noticed this plant in many lists by archaeologists of Maya fruit plants (though I am sure it is present, since the tree is not that scarce). So I spent time in my library and was pleasantly surprised to find two references:

Other plants in the region having edible inflorescences, leaves, or fruits are *Chamaedorea* spp. (roil, chiat), *Crotalaria maypurensis* HBK., *Ceiba aesculifolia* (HBK.) Britt. & Baker (piim, pochote), *Parmentiera edulis* DC. (cot), and *Physalis philadelphica* L. (paknul, tomatillo).

(Lundell 1938).

Parmentiera aculeata (Kunth) Seem. The fruit is eaten as a good when very green or mature. It is eaten raw or, but if very hard or over-ripe, boiled first.

Balick and Arvigo 2015: 229).

Surely more would be available on the edible nature of Cuajilote if you did a thesis or dissertation on *Parmentiera aculeata*. For example, Standley and Williams have helpful tips:

The fruit is fried or otherwise cooked before being eaten, and it is often stuffed with meat or other articles... At Aguacatán it was stated that the Indians employ the ripe fruit for making sweets. (Standley and Williams 1974: 211).

Yet almost all other authors say that usually the fruit is eaten raw. This is why a thesis or dissertation is best: and to visit each Mayan cultural area and ask the grandmothers and grandfathers how their grandparents ate Cuajilote.

The two botanical plant names are the same tree: some botanists consider *aculeata* as correct; others, still today, use *edulis*. It is confusing, which is a synonym, since even botanical professors do not all use just one name.

Is there potential medicinal usage of *Parmentiera aculeata* by local people?

Cuajilote, *Parmentiera aculeata* is used in the treatment of diabetes mellitus and hypertension (Esquivel et al. 2012).

The plant is used to treat tos, diabetes y dolor de oído (Maldonado 2005). Dozens of articles cite its medicinal properties.

The Cuajilote is often discussed on web pages about fruits of Veracruz, Morelos, and Oaxaca Mexico, including the Jardín Botánico de Cuernavaca, Morelos, México and program of Medicina Tradicional. Escuela de Enfermería Universidad Autónoma del Estado de Morelos. Plus there is a short thesis by Pedro Angon Galvan (Oaxaca). The comments on the medicinal usage are from various sources including the above.

The applications are clearly listed: used as a laxative and diuretic in various parts of central and southern regions. It is also recommended to treat

kidney ailments and their treatment includes fruit, bark, flowers and roots, which are being boiled and eaten as a tea. In other cases, such as kidney and urinary tract infections, is effective grinding and eating fruit extract or roast and eat it. Besides cooking the flower, root or fruit, is a good diuretic. It is also used for other diseases such as asthma, flu and cough, the flowers are boiled with and sweeten to drink warm for two weeks. (Hipernatural.com).

If you made a list of all books on medicinal plants of Mayan areas of all four countries, you would find Cuajilote in most of them. However, I did not find it in the bibliography of one book on local medicinal plants of Belize. Yet Cuajilote is listed in plenty of other books on plants of Belize.

So yes, local people in rural areas use the fruit for medicine. There are many references; I show here one example for Mexico:

It is considered a good remedy for colds; the roots are used as a diuretic, especially in the treatment of dropsy, and the juice of the leaves was formerly, at least, dropped into the ears as a cure for deafness.

(Standley 1926: 1323).

Even the flower is used for medicine:

Parmentiera aculeata, Chuté, El tallo y las raíces son buenos para tratamiento de riñones, su fruto es para infección en las vías urinarias, la flor es bueno para el asma, tos y gripa.

(Reyes 2020: 37).

Aromatic?

Listed as aromatico by (Mariaca 2012: 81). But no other article lists it for aromatherapy. Thus, needs more research before we cite it as a possible source for a perfume.

Cerco Vivo of Cuajilote trees would be great to see

Several publications list this tree used as a cerco vivo, but I have not yet found a part of Mesoamérica where this is noticeable. Nonetheless it is listed for Petén as a living fence (Leon 2006: 39-40). A living fence of this tree would produce “tons” of fruits each year

Firewood

Unfortunately, it is also used as firewood (which means it is chopped down) (Leon 2006: 41). Better is to use the branches when old and they fall off; this wood is still viable for your kitchen stove. As a child in the Ozark Mountains of southern Missouri, the job of my brother and I was to cut the firewood for the kitchen stove (no electricity in rural Missouri in those years and still today not much Internet signal). But that’s why we liked to live there, to be out in the karst hills.

Are any parts of *Parmentiera aculeata* trees eaten by mammals?

I would assume that many animals eat the fruits, but I have not yet found a mention other than that pigs love the fruits. So surely peccary and other wild animals do also.

Concluding Discussion and Summary on *Parmentiera aculeata*

Although there are scores of helpful articles on medicinal plants, edible plants, and other useful plants, in 90% of these *Parmentiera* species is only listed in tabulations with a single word (comestible) or just has a very simple page that again, only has one single word to indicate that the plant has an edible part. There is no meaty discussion of the plant's edible aspects other than Angon (2006) and Villar (2011). So clearly it would be helpful to have additional MA, MS theses and PhD dissertations on the edible aspects of this plant, especially recipes. An additional question is whether the Cuajilote was eaten by grandparents but has been dropped by today's generation in favor of oranges, apples, and other non-native fruits. Plus, is there evidence of *Parmentiera* species in middens or pollen samples from pre-Columbian Mayan sites?

There are many capable scholars who write about plants and forests, but also, I too am unlikely to include every single solitary edible plant in my eight years of research, for the simple reason that every time I visit an archaeological site, the really good local guides mention edible aspects of vines, roots, or leaves that I was previously not familiar with. Also, my lists are focused on Guatemala; in El Salvador, Tabasco, Quintana Roo, surely there are plants that I still need to learn about.

This is why I work, plant by plant, to rescue edible and utilitarian plants from obscurity, to assist the Mayan, Xinca, and Garifuna people to improve their health.

J. Eric S. Thompson and Sylvanus Morley were good at working in Mayan sites and doing basic hieroglyphic

recording, but they did not realize that the Maya had much more than maize, beans, and squash available. Dennis Puleston is a respected archaeologist, and I knew him since I worked as a student intern at Tikal in 1965 and 1966. He noted Lundell's mention of Ramon and so he (Puleston) championed Ramon nut as a probable staple of the ancient Maya (though today other botanists have proposed aspects not aware to Puleston). Bennett Bronson was very helpful by proposing that the ancient Mayan people had lots of root crops available (I have found many more edible roots and rhizomes than he lists). But still, I have also found over 40 edible leaves and more than 162 native edible fruits (for Guatemala alone).

A single Zapote tree can have between 300 and 400 or more fruits on it at a single time; and this tree will bear fruit for decade after decade after decade (and these fruits are larger than Ramon).

So yes, the Classic Maya ate maize, beans and squash (I have been to milpas in the Highlands where these staples literally grow all together in the same area). Yes, the Maya had root crops, Ramon, and any other plant you wish to popularize but they had 162 DIFFERENT fruits (and this does not count vegetables, nuts, and berries, plus edible plant stalks: I eat Bayal palm vine for example. I eat junco (kala) stalks (a tree very very similar in size and shape to guano palm but is a *Carludovica palmate* not related even remotely to any palm tree, despite the species name palmate).

The team at FLAAR has dedicated over 10 years to making complete lists of all edible food plants. Plus, all other utilitarian plants: for soap, basketry, roof thatch: everything. And we do high resolution photography of these plants, especially the flowers (though with over a thousand plants we still need funding to finish the photography, especially for a 4WD double-cabin pickup truck that will survive bringing our team and camera equipment to the mountain trails that we must hike up to reach the plants).

We hope you have enjoyed the introduction to Cuajilote: edible, medicinal, and the fruit is ridged (as cacao), similar size to cacao, and grows directly from the trunk (as cacao). When we presume that every monkey running or dancing on a Late Classic Mayan vase or bowl is carrying a *Theobroma cacao*

pod, I can show you several other plants whose fruits are the same size and ridged shape (more kinds of fruit than just Cuajilote). We raise cacao and many of the other faux-cacao fruit plants in the FLAAR Mayan Ethnobotanical Research Garden that surrounds our offices. Many botanists and students visit us; you are always welcome, including any group from IMS. Our plant research is shown on www.maya-ethnobotany.org.

Even if only 600 fruits a year that's about 2 fruits per day all year "for the rest of your life" and it starts fruiting about three years after planting. So, plant 10 different fruit trees around your home: Cuajilote, Ramón, avocado, Zapote, cacao and others, and you are pretty well taken care of.



Photo by: Nicholas Hellmuth. FLAAR Mesoamerica. March 30, 2012.

According to Standley and Williams (1974: 211): “Cuajilote,” is of Nahuatl origin, and signifies maize-ear tree. In other words, is this a “maize tree” that all of us, me included (up to 2011), have neglected to study in depth? This tree produces food all year long for potentially half a century.

Photo by FLAAR team, of “young corn on the cob” growing from main upward limbs of a *Parmentiera aculeata* tree in the Restaurant Café Maya, Sayaxché, Petén, March 2012. It helps to have portable lighting equipment so you can see the details better.

More corn on the cob.

There are no leaves around these maize cobs (this is their outside).

But you can tell why the Aztec called these young cobs of corn.

Photograph by the FLAAR team in a past decade with background removed by Norma Chu Cu so you can focus on the individual gains of corn.



To remind ourselves how “forgotten” and overlooked Cuajilote really is, if you look at the 505-page monograph, *Fruits of Warm Climates*, by Julia F. Morton (2013), I was not able to find any Cuajilote, caiba or *Parmentiera* species in her index. So here is a literal bible of tropical fruits and Cuajilote is totally missing.

One of the long-range goals of FLAAR is to suggest that underutilized indigenous plants can resolve many of the health and food shortages of the countries of Mesoamérica. The problem of course is that there are multi-national food companies making profit from introduced fruits (oranges, apples) yet not yet companies making more Mayan fruits available, other than Papaya and a few others. It would sure help to have grants to help the local people know of all the nutritious foods which they can grow literally in their backyards.

Very simple: here is a tree which one scholar says produces 1000 to 2000 fruits a year (Villar 2011). It fruits ALMOST ALL YEAR LONG. So even if only 1000+ fruits, that is three fruits a day, every day, for 365 days of the year. Now you can see why we seek funding to help people learn about these underutilized edible plants.

Millions of dollars are going into funding the helpful LIDAR project, which is finding that millions of Mayan people lived 2000 years ago in Petén... How did these multi-million people survive? No highways? No supermarket chains with delivery trucks? Yes, they had salt to preserve some foods and could smoke meat, etc., but no refrigerators.

The point is, sure would be helpful if funding were available to document that these multi-millions of Mayan people could indeed feed themselves in

Petén and adjacent lands (and that it is not only milpa agriculture that allowed them to live for thousands of years).

Plus, Cuajilote has potential for improving healthy food access in dry rural areas. These are precisely areas with lack of jobs and thus difficulty with survival. Why is there so much child malnutrition if we now know there are trees which will grow for decades in these areas and provide “thousands” of fruits a year. Here is what the world’s reading botanist mentioned already in 1974: “The tree is abundant on the dry hills between El Rancho and Salama, and less frequent in other dry regions.” (Standley and Williams).

BUT, even if “less frequent” what counts is that it is growable in “other dry regions.”

It is widely spread in cultivation in Guatemala, but the trees are not very numerous, since the fruit is not highly esteemed except in the very dry regions where there is often a shortage of fruits and other food... (Standley and Williams 1974: 211).

One good way to raise the esteem is to help local families know the vitamin(s) and minerals and have books to explain this in a family-friendly manner (which FLAAR Mesoamérica and MayanToons can produce when funding is available).

Still Needed to Accomplish

Have an ethnobotanist, ethnohistorian and Náhuatl linguist work out the meaning of the words Chotecuáhuítl, Cuajxilutl, Cuaxílotl, Cuaxílot.

And if Cuajilote really means “Tree with Maize Cob” next step would be to see whether any of the dozens of Mayan languages, or Zapotec, Mixtec, etc. also associates the fruits of *Parmentiera* with maize pods.

The fact that Cuajilote fruits are color of a banana and often similar shape, does not mean doing research on banana relationship (because bananas are not native). Palo De Jilote means tree of “baby maize” since a jilote is a fresh corn cob still growing. “Green ear of Maize” is understandable since most of the time the *Parmentiera* fruits are green.

I myself was not aware that *Parmentiera aculeata* was potentially considered a “tree of young maize cobs” to the Nahuatl-speaking Aztecs. Need to find this tree in Sahagun’s *Florentine Codex*, or in Hernandez’s --- or included in the murals of Malinalco.



Photo by: David ArrivillaGa, FLAAR Mesoamerica, Jun. 25, 2021.
Camera: Sony A1. Settings: 1/320; sec; f/5,6; ISO 2,500.

APPENDIX A

You can see a Cuajilote Tree with Fruit inside a Restaurant in Sayaxché

This year I estimated the tree was 40+ years old (considering its height and thickness of the trunk). But the owner of the restaurant said that the tree was then only 19 years old. Today (2023) is a quarter of a century producing edible fruit. This tree fruits every week every month all year for decades. It starts to fruit after only a few years from being planted.

APPENDIX B

Cuajilote Tree along the Highway from Sayaxché to Alta Verapaz

If you are driving north from Coban towards Petén, there is a single Cuajilote tree on the left side of the highway about 6 km north from Chisec.

If you are driving south from Sayaxché towards Coban, this same tree is about 3 km south of the main highway turnoff to the right towards Playa Grande (don't take that turnoff, take the older and thus slightly narrower, more work out highway south towards Chisec.



Photo by: David Arrivillaga, FLAAR Mesoamerica, Dec. 17, 2021.
Camera: Sony A1. Settings: 1/160; sec; f/4; ISO 2,500.

APPENDIX C

Photo Folder Names for *Parmentiera aculeata* in FLAAR Photo Archive of Flora and Fauna

Hard Drive: 8TB-M-EB

Master Folder: ETHNOBOTANY

Cuajilote_parmentiera_aculeata_fruit_botanical_garden_Jul_28_2011_CamiM
 Parmentiera_aculeata_caiba_Cuajilote_Jardin_Botanico_Jul_29_2011_NH
 Parmentiera_aculeata_Cuajilote_cacao_demono_andrea_3d
 Parmentiera_aculeata_Cuajilote_Maya_restaurant_Sayaxché_flash_Jul_7_2016_NH
 Parmentiera_aculeata_Cuajilote_Maya_restaurant_Sayaxché_Westcott_Jul_8_2016_NH
 Parmentiera_aculeata_Cuajilote-Restaurante_Cafe-Maya_Sayaxché_Petén_Apr_20_2018_NH-and-EF
 Parmentiera_aculeata-caiba-Cuajilote-fruits-Westcott-Fam-Bignoniaceae-Jul_28_2011
 Parmentiera-aculeata-Cuajilote_Restaurant_Maya_Sayaxché-with-Shaila_Jul_8_2016_Alejandra
 Parmentiera-aculeata-Cuajilote-Cafe-Maya-Sayaxché-Apr-20-2018-NH

Hard Drive: NMH-backup

Parmentiera-aculeata-Cuajilote-Aldea-Canaan-Chisec-west-side-of-HW-AV-9-km-448-442and6-Feb-26-2023-
 iPhone-14ProMax-NH

Hard Drive: RBM+LIB-1

Paxcamán-Petén-Parmentiera-aculeata-Cuajilote-iPhone-12Pro-4pm-Oct-10-2021-NH

Elsewhere:

Caiba Parmentiera aculeata Fam Bignoniaceae

Caiba_Parmentiera_aculeata-Jul-28-2011

Parmentiera-aculeata-Cuajilote-tree-fruit-kanahan-alongside-highway-hwy-AV9-km297-Jul-11-2019-NH

Hard Drive: Samuel

Cuajilote_Caiba_Monterrico_Sept_2011

Cuajilote_Caiba_Parmentiera_aculeata_Monterrico_2011

Cuajilote_fruit_El_Chal_studio_April_2015_SM

Cuajilote_Parmentiera edulis_late_March_2012_Sayaxché

Cuajilote_Parmentiera_aculeata_El_Chal_Apr_20_2015_NH

Cuajilote_Parmentiera_aculeata_El_Chal-in-woven-basket-background-Nikon_macro_flash_Apr-20_2015_NH

Cuajilote_parmentiera_aculeata_fruit_botanical_garden_Jul_28_2011_CamiM

Cuajilote_Parmentiera_aculeata_San_Juan_la_Laguna_Dec25_2012

Cuajilote_Parmentiera_edulis_Monterrico

Cuajilote_Parmentiera_edulis_Monterrico_July_Sayaxché_Aug_FTP-both

Cuajilote_Parmentiera_edulis_Monterrico_July_Sayaxché_Aug_FTPGuate

Cuajilote_Restaurant-Cafe=Maya_Sayaxché-Nicholas-with-Shaila-perhaps-3-to-4-years-old-_Jul_8_2016

Cuajilote-fruit-on-trunk-Aug-10-2011-probably-Cafe-Maya-Sayaxché

Cuajilote-fruit-on-trunk-Parmentiera edulis_Panajachel_Jul-5-2012

Bibliography Cuajilote, Pepino de árbol, *Parmentiera aculeata*

Although there are scores of helpful articles on medicinal plants, edible plants, and other useful plants, in 90% of these *Parmentiera* species is only listed in tabulations with a single word (comestible) or just has a very simple page that again, only has one single word to indicate that the plant has an edible part. There is no meaty discussion of the plant's edible aspects other than Angon (2006) and a few others. So clearly it would be helpful to have additional MA, MS theses and PhD dissertations on the edible aspects of this plant, especially recipes. An additional question is whether the Cuajilote was eaten by grandparents but has been dropped by today's generation in favor of oranges, apples, and other non-native fruits. Plus, is there evidence of *Parmentiera* species in middens or pollen samples from pre-Columbian Mayan sites?

In this bibliography we will not focus on the books on forests which omit *Parmentiera* species in their coverage. There are several books on Belize which sadly omit *Parmentiera* species in their plant lists and/or index. Plus, on forest trees of the Maya there is a book, in Spanish, with nice color photos of the trunk of most trees of the Maya area, and photos of fruit and/or flowers: but has ZERO mention of usage of *Parmentiera*. We do not include in our

bibliography this otherwise nice compilation of trees of the Maya.

There are many capable scholars who write about plants and forests, but also, I too am unlikely to include every single solitary edible plant in my multiple decades years of research, There are over 600 edible plants. Every time I visit an archaeological site, the great local guides mention edible aspects of vines, roots, or leaves that I was previously not familiar with. My lists are focused on Guatemala; in El Salvador, Tabasco, Quintana Roo, surely there are plants that I still need to learn about.

This is why I work, plant by plant, to rescue edible and utilitarian plants from obscurity, to assist the Mayan, Xinca, and Garifuna people to improve their health.

The first edition of this bibliography was by Marcella Sarti in 2018 (FLAAR Mesoamérica). We update all bibliographies for the year in which we publish a FLAAR Report on the plant of interest. So this bibliography for 2023 has been updated by Roberto Enrique Aguiar Siguil (FLAAR Mesoamérica). The introductory text and comments on each book or article or thesis are all by Nicholas Hellmuth.

Most helpful monographs on this plant:

There is no monograph on *Parmentiera aculeata* that we have yet found. These trees certainly deserve more attention in Guatemala and adjacent countries. In the meantime, the thesis by Pedro Angon Galvan is a good start.

Most helpful web page on this plant:

<http://www.Yucatánadventure.com.mx/Yucatán-flora.htm>

Only one photo and only one paragraph but shows the real size and shape of the fruit (thicker than that of Standley and Williams 1974).

Most helpful photo (album) on this plant:

https://www.naturalista.mx/taxa/209957-Parmentiera-aculeata/browse_photos

Has HUNDREDS and HUNDREDS of photos (close to a THOUSAND of photos), of the flowers, of the fruits hanging from the trunk and limbs. Also shows the quantity of fruits (lots hanging off same position).

PDF, Articles, Books on *Parmentiera aculeata* (and the earlier name, *Parmentiera edulis*)

ÁLVAREZ-Olivera, P. A., CALZADA-Almas, E. and Clara BATISTA-Cruz

2010 Etnobotánica y propagación de *Parmentiera edulis* D.C., árbol de uso múltiple en Cuba. Revista Forestal Baracoa. Vol. 29, No. 1. Pages 77-86.

Available online: www.actaf.co.cu/revistas/rev_forestal/Baracoa-2010-1/FAO1%202010/ET

ANDERSON, E. N., CAUICH Canul, José, DZIB, Aurora, FLORES Guido, Salvador, ISLEBE, Gerald, MEDINA Tzuc, Feliz, SÁNCHEZ Sánchez, Odilón and Pastor VALDEZ Chale.

2003 Those Who Bring the Flowers: Maya Ethnobotany in Quintana Roo, Mexico. El Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, Mexico.

ANGÓN-Galván, Pedro

2006 Caracterización parcial del fruto de *Parmentiera edulis*. Thesis, Universidad Tecnológica de la Mixteca. 58 pages.

Available online: http://jupiter.utm.mx/~tesis_dig/9947.pdf

This thesis, and Balick and Arvigo's guide to the useful plants of Belize, are, so far, the only books I have yet found which give more than a single cell in a tabulation, or a single word "comestible" for this plant.

ATRAN, Scott., LOIS, Ximena and Edilberto UCAN

2004 Plants of the Petén Itza' Maya: Plantas de los maya itza' del Petén. *Memoirs of the Museum of Anthropology*, University of Michigan, Memoir 38. 248 pages.

Sold online: www.amazon.com/Plants-Petén-Itza-Maya-Anthropology/dp/0915703556

Cuajilote is mentioned in the Spanish list of plants (p. 214) but since this book on many capable years of research has zero index, it is a challenge to find where this plant is actually discussed. With over 14,000 books in my research library, even with many helpful student research assistants, it is not realistic to search every page of a multi-hundred page book to find a single plant. The CD is searchable but there is not much chance that with so many people in the office that a single CD disk can be found after having the book for over a decade.

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. 539 pages.

Sold online: www.amazon.com/Messages-Gods-Useful-Plants-Belize/dp/0199965765

Fortunately this has a complete A to Z index of plant names, so you can quickly jump to page 229 with more on the top half of page 230. Here you find literally the first actual discussion, even if only 2 sentences, that Cuajilote really is eaten by Mayan people.

CONABIO

2016 Chachi (*Parmentiera aculeata*). EOL.

I downloaded this in past years; am no longer able to find it on EOL website (in March 2023).

CONAP

2004 Plan Maestro del Parque Nacional Sierra del Lacandón 2005-2009. CONAP. 189 pages.

Page 134 lists trees of Bignoniaceae family.

CONAP

2006 Plan Maestro del Parque Nacional Yaxha – Nakum – Naranjo 2006-2010. CONAP, Consejo Nacional de Areas Protegidas.

COOK, Suzanne

2016 The Forest of the Lacandón Maya, An Ethnobotanical Guide. Springer. 379 pages.

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

This is the most complete book on the plants of the Lacandón area of Chiapas. We are proud to have provided photographs for this book to the author from the FLAAR Photo Archive of Flora & Fauna.

DÍAZ, J. L.

1976 Índice y sinonimia de las plantas medicinales de México. Instituto Mexicano para el Estudio de las Plantas.

DIX, Margaret A. and M. W. DIX

1992 Recursos biológicos de Yaxhá-Nakúm-Yaloch. 54pp.

This is one of the sources for the tree list portion of CONAP Plan Maestro reports on Yaxha in the past decade. Unfortunately the Dix and Dix list is rather limited. The 1999 Schulze and Whitacre list for Tikal is more complete (but all these lists need more field work to improve).

A "short list is better than no list" and our FLAAR list is not all estimated 180 to 220 tree species but at least we have lots more than Dix and Dix.

We have asked the authors for a copy but received no reply. But the basic list is in all the Plan Maestro reports for PNYNN.

EMMART, E. W.

1940 The Badianus Manuscript (Codex Barberini, Latin 241). Johns Hopkins Press.

ESCAMILLA-Pérez, Blanca and Patricia MORENO-Casasola

2015 Plantas medicinales de La Matamba y El Piñonal, municipio de Jamapa, Veracruz. INECOL. 108 pages.

Available online: www.itto.int/files/itto_project_db_input/3000/Technical/Manual%20plan

FORD, Anabel and Ronald NIGH

2015 The Maya Forest Garden: Eight Millennia of Sustainable Cultivation of the Tropical Woodlands. Left Coast Press.

GONZÁLEZ-Basulto, Roldan and Silvia RODRÍGUEZ-Hernán

2012 Frutos Mesoamericanos: breve historia de sabores y sin sabores. CONABIO. Biodiversitas. No. 103. Pages 6-11.

Available online: www.biodiversidad.gob.mx/Biodiversitas/Articulos/biodiv103art2.pdf

HELLMUTH, Nicholas M.

2011 Re-Identifying Flora and Fauna in Maya Art & the Popol Vuh. Prepared for Tulane University, October 2011.

This was a lecture prepared at the request of a student organization at Tulane University. 65 full color slides with text.

This PPT presentation shows several of the most noticeable errors of archaeologists and iconographers misidentifying plants and animals in Mayan art. This lecture also addresses whether the Popol Vuh discussion of plants and animals is entirely mythological rhetoric, or whether what is described exists out in the fields, forests, rivers, and oceans of the Mayan lands.

I show several fruits that if pictured on a Mayan vase would instinctively and instantly be labeled as cacao (but are not even related to cacao, though their pods are identical to fruits pictured in Mesoamerican paintings, figurines, and incensarios).

INCAP

1988 Plantas alimenticias y medicinales de las zonas semiáridas de Guatemala. Pages 61-63.

Available online: <http://bvssan.incap.int/local/M/M-017.pdf>

LUNDELL, Cyrus L.

1937 The Vegetation of Petén. Carnegie Institution of Washington. 244 pages.

Available online: <https://babel.hathitrust.org/cgi/pt?id=mdp.39015012268689;view=1up;s>

Parmentiera edulis is listed in the index for pages 38, 39, and 77.

LUNDELL, Cyrus L.

1938 Plants probably utilized by the Old Empire Maya of Petén and Adjacent Lowlands. *Papers of the Michigan Academy of Sciences, Arts, and Letters*; vol. 24, pp: 37-56. University of Michigan, Ann Arbor.

Other plants in the region having edible inflorescences, leaves, or fruits are *Chamaedorea* spp. (roil, chiat), *Crotalaria maypurensis* HBK., *Ceiba aesculifolia* (HBK.) Britt. & Baker (piim, pochote), *Parmentiera edulis* DC. (cot), and *Physalis philadelphica* L. (paknul, tomatillo).

MacVEAN, Ana Lucrecia de

2003 Plantas Útiles de Petén. Herbario, Instituto de Investigaciones, Universidad del Valle de Guatemala. 155 pages.

MacVEAN, Ana Lucrecia de

2006 Plantas Útiles de Solola. Herbario, Instituto de Investigaciones, Universidad del Valle de Guatemala. 222 pages.

We highly recommend all the books by botanist/ethnobotanist Ana Lucrecia de MacVean.

MORALES-Sánchez, Viridiana., OSUNA-Fernández, Helia., BRECHÚ, Alicia., LAGUNA-Hernández, Guillermo and Rosario VARGAS-Solís

2015 Evaluación del efecto antirolítico del fruto de *Parmentiera aculeata* en rata wistar. *Botanical Sciences*. Vol. 93, No.2. Pages 293-298.

Available online: www.scielo.org.mx/pdf/bs/v93n2/v93n2a11.pdf

MORTON, Julia F.

2013 *Fruits of Warm Climates*. Echo Point Books & Media. 550 pages.

NATIONS, James D. and Ronald B. NIGH

1980 The evolutionary potential of Lacandón Maya sustained-yield tropical forest agriculture. *Journal of Anthropological Research*. Vol. 36, No. 1. Pages 1-30.

Sold online: www.jstor.org/stable/3629550?seq=1#page_scan_tab_contents

PAREDES-García, Irma., VALENCIA-Gutiérrez, Marvel and Nidelvia BOLÍVAR-Fernández

n.d. Estudios de caracterización poscosecha del pepino kat (*Parmentiera aculeata*). Universidad Autónoma de Campeche.

Available online:

https://smbb.mx/congresos%20smbb/veracruz01/TRABAJOS/AREA_XIII/CXIII-57.pdf

PARKER, Tracey

2008 Trees of Guatemala. The Tree Press.

Sold online: www.amazon.es/Trees-Guatemala-Tracey-Parker/dp/0971873909

p. 92 copies-and-pastes material from other books. Sadly there is no citation anywhere in the book for specific material: there is only a bibliography at the end of every family. So you have to estimate that 80% of what is in her book is from Standley and his team.

PENNINGTON, T. D. and Jose SARUKHAN

1958 Arboles Tropicales de Mexico. FAO, United Nations. 413 pages.

El fruto es comido frecuentemente por el Ganado y en algunas zonas las personas los comen hervidos. (page 376).

Helpful book; but not much on uses. Now exists in new edition which I will need to track down in my seven metric tons of books.

PÉREZ-Morales, S., CROSBY-Galván, M. M., RAMÍREZ-Mella, M., BÁRCENA-Gama, J. R., HERNÁNDEZ-Mendo, O. and E. M. CROSBY-Galván

2021 Cuajilote (*Parmentiera aculeata* (Kunth) Seem.): A Potential Fruit for Ruminant Feed. *Agro Productividad*.

REYES Ramos, Nicolás

2020 Ritual de consagración en Santa Catarina y El Chote localidades de Huejutla Hidalgo. Licenciatura thesis, Biology. 87 pages.

ROBLES-Fonseca, Lucia

2017 Identificación de árboles y arbustos con potencial forrajero en el municipio de Teopisca, Chiapas, México. El Colegio de la Frontera Sur. 115 pages.

Available online: <https://ecosur.repositorioinstitucional.mx/jspui/bitstream/1017/259/1>

ROMÁN, Francisco., LEVY, Sanuel., AGUIRRE, Rogelio and Antonio SÁNCHEZ

n.d. Árboles de la Selva Lacandón a útiles para la restauración ecológica. SEMARNAT, CONAFOR. 94 pages.

RZEDOWSKI, Jerzy and Graciela CALDERÓN-De Rzedowski

1993 Bignoniaceae. Flora del bajío y de regiones adyacentes. Fascículo 22. 44 pages.

Available online: <http://www1.inecol.edu.mx/publicaciones/resumeness/FLOBA/Flora%2022>

SAHAGUN, Bernardo de

1963 Florentine Codex. General History of the Things of New Spain, Book 11, Earthly Things. Translated by C. E. Dibble and A. J. O. Anderson. University of Utah.

SCHULZE, Mark D. and David F. WHITACRE

1999 A Classification and Ordination of the Tree Community of Tikal National Park, Petén, Guatemala. *Bulletin of the Florida Museum of Natural History*. Vol. 41, No. 3, pp. 169-297.

Even though almost a quarter of a century ago, it's the best list of trees of Tikal that I have found. There is a web site with plants of Tikal but they are not separated into trees, vines, shrubs, etc., so harder to use. The new monograph on *Arboles de Calakmul* is better than anything available so far on Tikal (and the nice albeit short book by Felipe Lanza of decades back on trees of Tikal is neither available as a scanned PDF nor as a book on Amazon or ebay).

STANDLEY, Paul C.

1926 Trees and Shrubs of Mexico. *Contributions from the United States National Herbarium*, Volume 23, Part 5. 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. Fortunately you can search digitally when you have an open PDF edition.

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.

1930 Flora of Yucatán. Botanical Series Volume III, No. 3. Publication 279. Field Museum of Natural History.

STANDLEY, Paul and Louis O. WILLIAMS

1974 Flora of Guatemala. *Fieldiana, Botany*, Vol. 24, Part X, No. 3, Chicago Natural History Museum.

Available online: www.biodiversitylibrary.org/item/19972#page/11/mode/1up

TUCKER, Arthur O. and Jules JANICK

2019 Flora of the Voynich Codex, An Exploration of Aztec Plants. Springer. 353 pages.

VILLAR-Herrera, Saira Lisbeth

2011 Evaluación nutrimental del fruto Parmentiera edulis para su posible utilización en la industria alimentaria. Thesis, Universidad Autónoma Agraria Antonio Narro. 67 pages.

Available online: <http://repositorio.uaaan.mx:8080/xmlui/bitstream/handle/12345678>

VILLARREAL-Ibarra, Edelia., GARCÍA-López, Eustolia., LÓPEZ, Pedro., PALMA-López, David., LAGUNES-Esponza, Luz., ORTIZ-García, Carlos and Azucena ORANDAY-Cárdenas

2014 Plantas útiles en la medicina tradicional de Malpasito-Huimanguillo, Tabasco, México. *Polibotánica*. No. 37. Pages 109-134.

Available online: www.redalyc.org/pdf/621/62129967007.pdf

VILLASEÑOR, José Luis

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>

WILLIAMS, Louis O.

1973 *Parmentiera*, *Fieldiana*, Bot. 36 (4) :27-29.

Cited by Standley and Williams 1974:209 as the reference for their page on *Parmentiera* DC.

Suggested web pages with photos and information on *Parmentiera aculeata*

<http://ecoforestal.org/viveros/Fototeca/Arboles/>
Information.

<http://www.medicinatradicionalmexicana.unam.>
A professional medicinal plant web site of the Atlas de las Plantas de la Medicina Tradicional Mexicana.

www.naturalista.mx/taxa/209957-Parmentiera-aculeata
https://www.naturalista.mx/taxa/209957-Parmentiera-aculeata/browse_photos

This webpage has more photos than every other web page on the Internet put together. Shows flowers and shots fruits, in situ, on the tree trunk, limb, and twigs.

www.pronaturaveracruz.org/ecoforestal/catalogo/
Information.

www.theplantlist.org/tpl/record/kew-318041
Synonyms.

<http://www.Yucatanadventure.com.mx/Yucatan-flo>
Wild Cucumber Trees (English) also know as Candle Tree. Pepino de Arbol Silvestre (Spanish), Kat or Cat (Maya), Parmentiera edulis, Bignoniáceas

family. Native to Mesoamérica (South Mexico and Guatemala). Evergreen fruit tree, grows with full sun, trifoliate leafs drop in clusters together; large cream color flowers bloom in April at the tip of Candle tree branches, the fruits are know as pepino kat in Yucatán always eaten cooked. The fruit is used in Mayan remedies to cure urinary track ailments. Bats propagates the fruits' seeds.

Uses the synonym and not the accepted name but nonetheless has a great photo of fruit size and shape. The photo links itself to Pinterest, so not sure whether an image from the author of www.YucatanAdventure.com.mx, or simply borrowed from Pinterest. Either way, the photo is EXCELLENT in showing size, shape (ridges and pointed end) and that three fruits are issuing from common stem area (as I have also seen).

Videos

The first two of these videos do not show fruits or flowers from the trunk.

<https://www.youtube.com/watch?v=XsX277lpFj0>
Guajilote Review (Parmentiera edulis)- Weird Fruit Explorer Ep. 297. 6:02

<https://www.youtube.com/watch?v=Dfl-XcugLKg>
2:08

Obviously you can find a dozen more on Google, in Video section. Then you find photos of the fruits on the trunks: *Cuajilote*, *guajilote*, *turi*, *cacao de mono*, *jilote de árbol* ...

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/>

<http://legacy.tropicos.org/NameSearch.aspx>
This is the main SEARCH page.

<https://plantidtools.fieldmuseum.org/pt/rrc/5>
SEARCH page, but only for collection of the Field Museum herbarium, Chicago.

<https://fieldguides.fieldmuseum.org/guides?>

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/imagedatab

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

www.ThePlantList.org

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

Web sites with helpful photographs and information on Merremia species

Global Biodiversity Information Facility
<https://www.gbif.org/>

Tropicos
<https://tropicos.org>

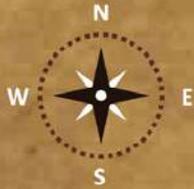
Biodiversidad de Guatemala
(This is specifically for Guatemala)
<https://biodiversidad.gt/portal/>

RESERVA DE LA BIÓSFERA MAYA - RBM - DEPARTAMENTO DE PETÉN, GUATEMALA



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- CONCESIÓN INDUSTRIAL
- CONCESIÓN COMUNITARIA
- RESERVA MUNICIPAL
- MONUMENTO CULTURAL
- ÁREAS PROTEGIDAS DEL SUR DE PETÉN



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Flor de María Setina is in charge of the financial administration of the institution and supports the supervision of daily activities.

Vivian Hurtado is the current project manager of the FLAAR divisions: Flora & Fauna and MayanToons. She is also an environmental engineer and a passionate researcher.

Victor Mendoza environmental engineer in charge of the photographic database and its taxonomic identification. He also helps with the coordination of research activities.

Sergio Jerez agronomy engineering student involved in the identification of plants and support in research topics.

Belén Chacón biology student who organizes, tabulates and updates our ethnobotanical list.

Diana Sandoval agricultural engineer who compiles scientific information that is added to our flora and fauna reports.

Roberto Aguiar history student collects information and bibliographic references to feed our electronic library of flora and fauna and support research for reports and websites.

Samuel Herrera is in charge of processing maps of our field trips and helping with the identification and investigation of species.

Pedro Pablo Marroquín is part of the editing team, review and add information to our photographic reports

Alejandra Valenzuela is a biology student and part of the photographic reports editing team. She also supports the realization and analysis of web statistics.

Byron Pacay is our assistant during field trips to handle GPS data. He also assists in the main office with different tasks.

Norma Cho is a helpful photography assistant during field trips. She also assists in the main office with different tasks.

Hanny López is a communication student. She manages all our social networks and digital community.

Isabel Rodriguez Paiz is in charge of fundraising and partnership development.

Edwin Solares is a photographer and videographer during our expeditions. Later, he edits this content to be used in our different materials.

Haniel López is a drone pilot and photographer during our expeditions.

Pedro Pablo Ranero with a degree in communication is responsible for editing videos of flora and fauna to create content on our sites.

Andrea Sánchez graphic designer who helps prepare the graphic line of our publications. She is our editorial art director.

Jaqueline González graphic designer who combines text layout and photo editing to create our reports.

Heidy Galindo graphic designer who combines text layout and photo editing to create our reports.

Cristina Ríos graphic designer who combines text layout and photo editing to create our reports.

David Arrivillaga is an experienced photographer and graphic designer. Sometimes he is a photographer during our expeditions, but he also designs our flora and fauna reports.

María Alejandra Gutiérrez is an experienced photographer who is now in charge of the preparation of photographic catalogs. She was also coordinator of the field trips for the research project in Livingston, Izabal.

Paulo Núñez is an engineer and our webmaster. He is the person in charge of the maintenance and programming of the entire network of FLAAR websites.

Juan Carlos Hernández is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

María José García is a graphic designer and part of the web team. Receive the material we produce to place on our sites.

Andrés Fernández is a graphic designer and in charge of keeping our websites updated and more efficient for the user.

Karla Cho helps with general research and design assistant in the office.

Luis Molina is a professional illustrator specialized in line drawings of Maya vases, bowls, and plates.

Valeria Áviles is a graphic designer and illustrator. She is in charge of coordinating the activities of MayanToons, as well as making illustrations for the different materials that we prepare.

Laura Morales is a digital content engineer, She is in charge of directing the animation area of our MayanToons project.

Paula García is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

Niza Franco is part of our MayanToons animation team. Her job is to bring our favorite characters to life.

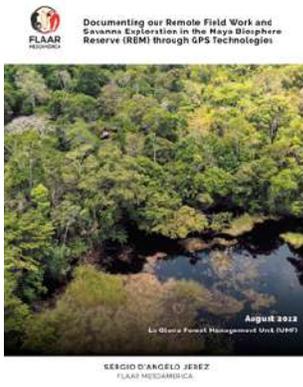
Isabel Trejo is a graphic designer and illustrator for MayanToons and for social media posts.

Andrea Bracamonte is a graphic designer and illustrator for MayanToons and for social media posts.

Josefina Sequén is an illustrator for MayanToons.

Rosa Sequén is an illustrator for MayanToons.

Other publications on RBM Project



Documenting our remote field work
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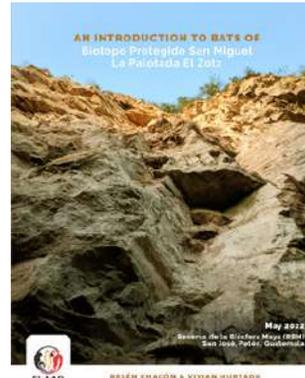
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Island of *Thalia geniculata*
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Fruits of *Gaussia maya* palms
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Bats from El Zotz
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Tasistal Ecosystem, Savanna #24
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Corozera, Palm Area South of Nakum
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Nasua narica-Coatimundi
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Wild Vanilla Orchid, *Vanilla insignis*
Download now

If you wish more FLAAR reports on RBM Project of Guatemala, visit our website:
<https://flaar-mesoamerica.org/reserva-biosfera-maya-project/>

Other publications of the fauna of Guatemala



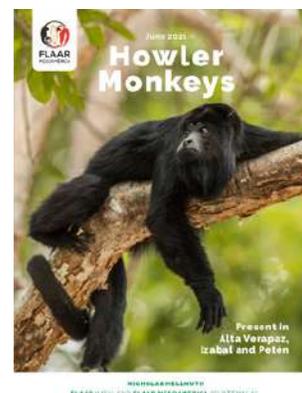
Protect Howler Monkeys

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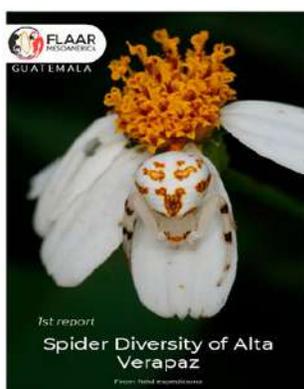
Mantled, Howler Monkeys

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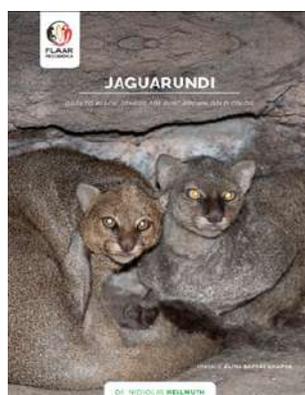
Howler Monkeys

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Spider Diversity of Alta Verapaz

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Jaguarundi

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Wild animals of the Mayan World

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Honey Bees

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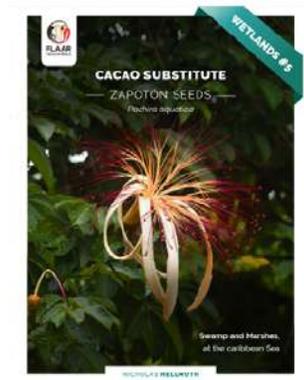
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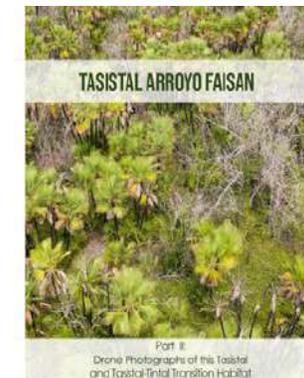
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