CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Sixteenth meeting of the Conference of the Parties
Bangkok (Thailand), 3-14 March 2013

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of *Yucca queretaroensis* in Appendix II in compliance with Article II, paragraph 2(a) of the Convention and in compliance with Resolution Conf. 9.24 (Rev. CoP15), Annex 2 a, criterion B.

B. Proponent

Mexico*.

C. Supporting statement

1. Taxonomy

1.1	Class:	Liliopsida	
1.2	Order:	Asparagales	
1.3	Family:	Agavaceae	
1.4	Genus and species:	*Yucca queretaroensis* Piña (1989).	
1.5	Scientific synonyms:	None	
1.6	Common names:	English:	Queretaro Yucca, perennial Queretaro swaport and biconvex denticulate leaf yuca
		French:	None
		Spanish:	Estoquillo, lonjas, palma, toquillo, yuca biconvexa, yuca denticulada and yuca biconvexa denticulada
1.7	Code numbers:	Not applicable	

2. Overview

Yucca queretaroensis is a plant endemic to central Mexico, specifically portions of the Sierra Madre Oriental in the states of Guanajuato, Querétaro and Hidalgo. Its wild populations are small (aproximately 60,300 individuals) and fragmented (607.64 km^2). In addition, the species has a high habitat specificity (Magallán-Hernández *et al.*, 2011, 2012a, y 2012b); it is therefore considered biologically rare.

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* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat or the United Nations Environment Programme concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

Currently, national legislation (Official Mexican Standard NOM-059-SEMARNAT-2010) listed the species as 'Pr' (subject to special protection). However, the most recent assessment of its state of conservation indicated that it could be listed as "endangered".

Its wild populations have a high vulnerability to intrinsic and extrinsic factors. Notable intrinsic factors include a low sexual reproductive rate, low growth rate, long generation period, specialized habitat and specialized pollination. Extrinsic factors include the harvesting of adult individuals for international trade ends; which diminishes sexual recruitment of wild populations.

During the 18th meeting of the Plants Committee (PC18; Buenos Aires, 2009), the Management Authority of Switzerland submitted the document PC18 Doc. 21.1, on *Trade in Agavaceae*, drawing attention to the growing international demand (mainly in Europe) and trade possibly unsustainable of xerophytes of North America, including wild specimens of *Yucca queretaroensis* since 2006.

In 2011, the CITES Scientific Authority of Mexico (CONABIO) coordinated—together with the Regional Botanical Garden of Cadereyta—a project to assess the conservation status, use and threats of the *Yucca queretaroensis* Piña (Agavaceae) and the pertinence of including it in CITES Appendices, concluding that the species should be included in CITES Appendix II.

The proposal is based on the following points: 1) *Yucca queretaroensis* is an endemic, rare, endangered species, and therefore meets the biological criteria for inclusion in Appendix I [A and B, of Annex 1 of Resolution Conf. 9.24 (Rev. CoP15)]; 2) Evidence exists of international trade in adult wild specimens of unknown origin, confirmed through an official consultation of Mexico with CITES Authorities of the Regions of North America and Europe; 3) Its international trade needs to be regulated so that this is not the reason it becomes extinct.

3. Species characteristics

3.1 Distribution

Yucca queretaroensis, is a species endemic to central Mexico that is distributed in portions of Sierra Madre Oriental in the states of Guanajuato, Querétaro and Hidalgo (20°46´41.8" and 21°20´14.4" N; 99°26´02.3" and 100°01´41.2 W), specifically in the natural region known as Querétaro and Hidalgo's semi-desert; in an estimated area of 607.64 km^2. Its distribution is fragmented, as can be seen in the map of potential distribution drawn up using the MaxEnt algorithm (Ocaña *et al* 2012); due to geographic barriers such as ravines and steep hillsides (Fig. 1).

Below is an aggregated distribution pattern in different scales: small local populations are formed made up of colonies of up to 30 individuals that are separated from each other in different habitat areas (Magallán-Hernández *et al*., 2011). There are two main populations: one in the municipality of Xichú (Guanajuato); and one with the largest number of sub-populations in the municipalities of Pinal de Amoles, San Joaquín and Cadereyta de Montes (Querétaro), and Pacula and Zimapán (Hidalgo).

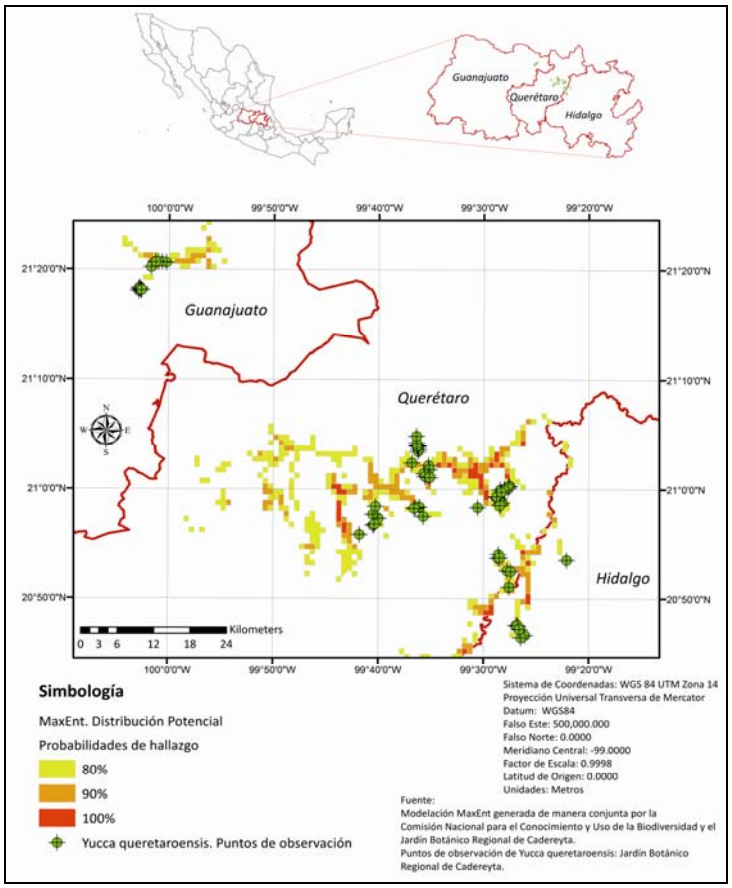

Figure 1. Potential distribution of *Y. queretaroensis* according to the Maximum Entropy algorithm (Ocaña *et al.,* 2012).

3.2 Habitat

Yucca queretaroensis is found in folded chains and with faults, mountainous hillsides with reclined limestone folds, mountainside valleys and intermountain valleys (GEQ, 2009), associated with temporary and permanent water runoffs, preferably in terrains facing NW and sloped 40-70° that are terraced and with a uniform slope. It altitude interval is 986-1800 metres above sea level, but is concentrated between 1,000 and 1,340 metres above sea level. It grows in shallow sandy lithosols and regosols, on medium-sized rocks such as Mesozoic limestone and shale. It occurs in "warm sub-humid climates with summer rains" and "semi-dry warm climates with summer rains" (according to the Köppen climate classification system, modified by Enriqueta García; in GEQ, 2002), with an annual average temperature of 16-17° C and precipitation of 600-1,050 mm, concentrated at 950-1,000 mm. It is associated exclusively with sub-mountain thicket (Zamudio *et al*., 1992), with open canopy and low density, with 30-40 % cover. No need for a nurse has been observed for its development; but rather, the species acts as a nurse for other species (Magallán-Hernández *et al*., 2012a).

3.3 Biological characteristics

Yucca queretaroensis is a species with a low growth rate and long generation period. It is hermaphrodite and reproduces mostly asexually, via the production of ramets (rosettes) at the base of mother plants (Magallán-Hernández *et al.,* 2011 and 2012a), which makes the species a clonal organism (Golubov *et al.*, 2007; Mandujano, 2007).

After two years of monitoring, it was observed that sexual reproduction, unlike other *Yucca* species, is not annual, only five individuals bearing fruit were observed in years and populations that were different, which suggests that the species behaves sporadically in its sexual reproduction. Mature fruit was observed between June and July, however few plants bearing fruit in the wild were observed. The fruit production in the wild is low compared to flower production. The fertility rate is lower than 10 % of potential reproductive capacity per individual (Magallán-Hernández *et al*., 2012a); which

could be due to the specificity of the pollinator and a high reproductive cost of the species, whose low fruit production is probably a factor in adjusting to its environment (Calvo y Horvitz, 1999).

Although the pollinator is not known, the co-evolutionary relationship of the *Yucca* species with *Tegeticula* or *Parategeticula* moths has been documented (Pellmyr, 2003) and larvae have been observed inside the fruit of the *Yucca queretaroensis*.

Owing to the characteristics of the fruit and seeds, it is likely that they are spread by mammals and/or birds, however there is no specific information on its dispersal and germination. In greenhouse conditions, germination of over 80 % has been observed.

3.4 Morphological characteristics

It is an arborescent species that reaches a maximum height of 6 m (**Annex 1**, Fig. 1). Its stem is generally found covered in dry straight leaves, light grey, arranged in levels (**Annex 1**, Fig. 2). Very dense rosettes grow in an almost spherical shape, each one with up to 1,300 leaves (**Annex 1**, Fig. 3).

Fresh leaves have a linear shape and are 45-74 cm long and 2-5 mm wide, light green and smooth, with a serrate hyaline margin (**Annex 1**, Fig. 4). The terminal spine of the leaf is very small (3-8 mm), conical and reddish coffee coloured (**Annex 1**, Fig. 5). The leaves are flexible, which can be demonstrated with a knot test, in which a simple knot is made with the leaf, as if it were a rope, and it does not break (**Annex 1**, Fig. 6). Also, in a cross-section of the leaf, it is bio-convex along its length, both surfaces with central papillae keels that run lengthwise along the leaf converging around the terminal spine. Picked leaves, upon loosing their turgidity, have a rhomboid cross-section (**Annex 1**, Fig. 7) (Magallán-Hernández *et al*., 2012).

The inflorescence is a panicle of approximately 1,000 creamy-white flowers (**Annex 1**, Fig. 8). The panicle is 60 to 100 cm wide, oval and elliptical, upright, projecting from the rosette; the flowering part covers 90 % of the inflorescence, with 120-140 branches; each branch has 4-10 flowers. The flowers are 2.2-3.6 cm long, campanulate, round and pendulous.

Fruit is fleshy and indehiscent (they do not open spontaneously when ripe) (**Annex 1**, Fig. 9), it is 7.5-11.5 cm long and 3-4.5 cm wide, cylindrical, pendulous, green coloured. The seeds have different shapes depending on the location in the fruit and are flat, oval, spherical or lacriform (**Annex 1**, Fig. 10) 6.3-9.1 mm long, and 2-3(-6) mm thick, black and with a ruminate head (**Annex 1**, Fig. 11).

3.5 Role of the species in its ecosystem

Yucca queretaroensis contributes to soil formation and retention, thanks to its shallow and fibrous root system (Magallán-Hernández *et al*., 2012a). It is a nurse species and occurs in a habitat with birds and insects in different stages of their life cycles. Like other species in the Agavaceae family, the rosette of this species is an efficient structure for the maintenance of relative humidity via water harvesting (Hernández, unpublished data). Therefore, it can be considered that *Yucca queretaroensis* is a key species in its ecosystem.

4. Status and trends

4.1 Habitat trends

The habitat of *Yucca queretaroensis* is in a good state of conservation. In its area of distribution there is not a high density of human population or a trend towards urban development or drastic transformation of the environment. There are also steep slopes limiting the development of deep soils (Bayona, 2011) and where there exists potential erosion values from high (50 to 200 ton/ha/year) to severe (200 to 500 ton/ha/year) (GEQ, 2009).

4.2 Population size

Based on real and potential distribution models of the species and the density of individuals in the sample plots, there is an estimated wild population of 60,300 individuals (Magallán-Hernández *et al.*, 2012a).

4.3 Population structure

Magallán-Hernández *et al.* (2011) notes that using the parameter of the total height of individuals, the two *Yucca queretaroensis* populations can be divided into three major groups: small, medium and tall (Figure 2). Also, using the parameter of the number of leaves of the rosette, the size structure is similar in the locations: the group with a medium number is the biggest, followed by the group with the fewest number and last, the group with the largest number of leaves (Figure 3). The individuals that are tallest and with the largest number of leaves are located in Xichú (Guanajuato) (**Annex 1**, Figs. 12 to 15) (Magallán-Hernández *et al.,* 2011).

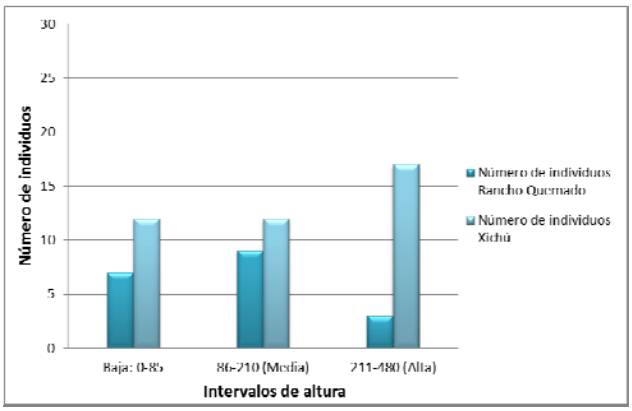

Figure 2. Size structure in two populations of *Y. queretaroensis*, based on the height of individuals.

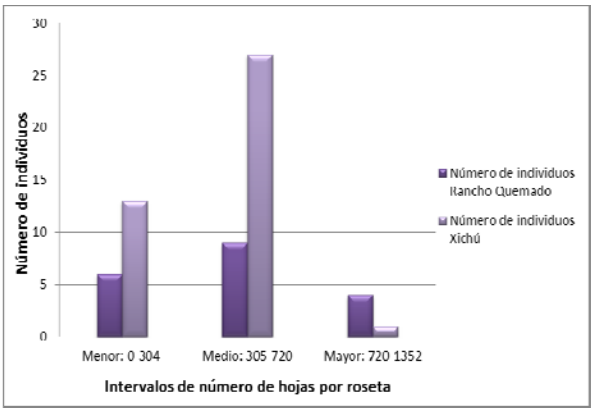

Figure 3. Size structure in two populations of *Y. queretaroensis*, based on the number of leavers per rosette.

Although the 2011 sample (Magallán-Hernández *et al*. 2011) determined that the largest percentage (60 %) is made up of individuals that are growing on their own, they are nearby individuals that grow in groups. No seedlings from seeds were observed during rounds and samples in the distribution area, and the small individuals (0-85 cm tall) make up close to a third of the sampled populations (36.85 % in Rancho Quemado and 29.26 % in Xichú), in many cases growing next to a large individual.

Apparently, *Yucca queretaroensis* individuals are tall in places where a less abrupt topography provides stability and resources for their growth, in deeper soil, like that of Xichú, Guanajuato, where tall individuals make up 41.46 % of the population, which is higher than the percentage of individuals of medium height (29.26 %). However, most distribution areas have steep slopes with shallow soil, which represents a major risk for individuals of sliding and falling down the hillside, which could be associated with the vegetative dispersal of the species. This has occurred in Rancho Quemado, Cadereyta, where the biggest percentage of individuals are of medium height (47 %), and the smallest percentage of individuals are tall (15.78 %). Considering that events of sexual reproduction are rare and that the fertility rate of the species is low, it is likely that flowering is limited to tall individuals.

4.4 Population trends

No estimates of the *Yucca queretaroensis p*opulation trend are available.

4.5 Geographic trends

No information is available on *Yucca queretaroensis* geographic trends.

5. Threats

The main threats to this species are illegal harvesting of wild specimens, and the loss of habitat from erosion and grazing.

6. Utilization and trade

6.1 National utilization

The plant is mainly used for ornamental purposes, and flowers have a traditional use in festive events. Previously, it was used locally in the making of watertight roofs for rural housing (Magallán-Hernández *et al*., 2011 and 2012[a].)

6.2 Legal trade

Included in NOM-059-SEMARNAT-2010, its use and exportation must be regulated by the *Secretaría de Medio Ambiente y Recursos Naturales* (SEMARNAT); however, there are export records managed by the *Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación* (SAGARPA). Therefore, the inclusion of the species in the CITES Appendices will help improve its monitoring and regulation.

In order to characterize international trade in *Yucca queretaroensis*, and to learn its extent, on 17 August 2012, the Scientific Authority of Mexico (CONABIO) conducted an official consultation (OF. DEAI-239/2012) with the CITES Scientific and Management Authorities of North America and Europe, requesting the following:

1. If it is aware that *Yucca queretaroensis* is being traded in their country;

2. If so, to specify the type of specimens being traded: a) seeds; b) small plants (stemless rosettes); c) medium-sized plants (up to 70 cm tall, with a stem); d) adult plants (70 cm tall and over, with a stem); e) unknown specimens; or f) others.

3. To specify the origin of specimens being traded (artificial propagation, wild, both or unknown).

4. For networking purposes, to provide contact (and other) information on the nurseries that trade *Yucca queretaroensis* in their country. And finally,

5. To provide any other relevant information on the trade in *Yucca queretaroensis*.

Of the 47 countries in the CITES Region of Europe, 12 replied to the consultation: eight (Bulgaria, Croatia, Czech Republic, Denmark, Georgia, Greek, Poland and Slovakia) replied that they had no known trade in the species in their country; and four (Germany, Italy, the Netherlands and the United Kingdom) replied that yes, the species was being traded in their country, and some even affirmed that it is traded throughout the European Union.

With respect to the CITES Region of North America, the Scientific Authority of Canada replied that it was not aware that the species was being traded in its country. The Scientific Authority of the United States replied that yes, the species was being traded.

Based on the replies of Authorities that affirmed that *Yucca queretaroensis* is being traded in their country, it is possible to conclude the following:

a. The main specimens being traded are: seeds, medium-sized plants (up to 70 cm tall, with a stem), and large plants (70 cm tall and over, with a stem)

b. The specimens being traded internationally are mainly wild and unknown.

6.3 Parts and derivatives in trade

Yucca queretaroensis is mainly traded as an entire plant, although seeds are also traded.

6.4 Illegal trade

Although it has not been established if existing trade in the species is illegal, searches on the Internet have affirmed that there is international trade in this species that cannot be clearly quantified; in addition to the fact there is no access to adequate documentation that supports such trade. Nineteen

companies were identified that trade the species. They can be divided into two types of trade (**Annex 2**):

a. The first group announce seeds and very small seedlings with stemless rosettes with few leaves that seem to be germinated from seeds (**Annex 2**, Box 1). This group includes companies in Germany, the United States, Japan, the Netherlands and the United Kingdom.

b. The second group offers, distributes and auctions large specimens, with developed trunks (80-160 cm tall), priced at hundreds and thousands of dollars. Due to the slow growth of the species, the size of the plants offered could suggest that they are from the wild. This group includes companies in Belgium, France, Germany, the Netherlands and Portugal (**Annex 2**, Box 2).

6.5 Actual or potential trade impacts

Unregulated and illegal harvesting of large plants may decrease the reproductive contingent of the species and it is considered biologically rare.

7. Legal instruments

7.1 National

Yucca queretaroensis is listed in the Official Mexican Standard NOM-059-SEMARNAT-2010 on "Environmental protection-Native species of wild fauna and flora of Mexico-Categories of risk and specifications for inclusion, exclusion and change-List of endangered species", under the category 'Pr' (subject to special protection). Being listed in the said Standard, its use is regulated by General Wildlife Law (LGVS, 2000; Art. 1).

7.2 International

None.

8. Species management

8.1 Management measures

To date, under the System of Management Units for the Conservation and Sustainable Use of Wildlife (SUMA) of the Ministry of Environment and Natural Resources (SEMARNAT), only the Regional Botanical Garden of Cadereyta (Querétaro, code 'UMA DGCERN-JB-019-QRO') includes the species in its management plan.

8.2 Population monitoring

There is no programme that monitors the situation of wild populations of *Yucca queretaroensis* or viability and consequences of harvesting of wild specimens.

8.3 Control measures

8.3.1 International

Unknown.

8.3.2 Domestic

The species is listed in the Official Mexican Standard NOM-059-SEMARNAT-2010, under the category 'Pr' (subject to special protection); and its use is regulated by the General Wildlife Law (LGVS, 2000).

8.4 Captive breeding and artificial propagation

Controlled artificial reproduction for this species does not exist in Mexico. However three Mexican Botanical Gardens belonging to the Mexican Association of Botanical Gardens, have *Yucca*

queretaroensis specimens in their live collections. They include: “El Charco del Ingenio” Botanical Garden (San Miguel de Allende, Guanajuato), “Ing. Manuel González de Cosío” Regional Botanical Garden of Caderyta (Cadereyta de Montes, Querétaro) and the Botanical Garden of the National Autonomous University of Mexico (Mexico, D. F.). These institutions have three, nine and three adult *Yucca queretaroensis* specimens respectively.

Internationally there are some nurseries in the United States and the Netherlands that in recent years reproduce *Yucca queretaroensis* from seeds and micro-propagation (Magallán-Hernández *et al*., 2012a).

8.5 Habitat conservation

Yucca queretaroensis is distributed in the municipalities of Xichú (Guanajuato), Zimapán (Hidalgo) and Cadereyta de Montes, Pinal de Amoles and San Joaquín (Querétaro). The municipality of Xichú belongs to the Sierra Gorda Biosphere Reserve of Guanajuato, decreed on 19 May 1997, with a protected area of 383,567.44 ha.

8.6 Safeguards

The distribution area of the species coincides with two Biosphere Reserves decreed by the Natural Commission of Natural Protected Areas (CONANP): one in Guanajuato, and another in Querétaro (see Section 8.5). Also, in Mexico, three botanical gardens have the species in *ex situ* collection mode (see Section 8.4). Lastly, and as mentioned previously (Sections 7.1 and 8.3.2), being listed in NOM-059-SEMARNAT-2010, the species is provided for under the General Wildlife Law (LGVS, 2000).

9. Information on similar species

Yucca queretaroensis can be confused with other species of the same genus, and with morphologically similar ones of different genera. It is considered that the most similar species in Mexican territory are: *Yucca linearifolia, Yucca rostrata, Yucca thompsoniana, Dasylirion quadrangulatum, Agave striata* and *Agave aff. striata.* To make it easier to tell them apart, a visual guide for the identification of Yucca *queretaroensis* and related species is included in **Annex 3**.

10. Consultations

The species is endemic to Mexico, and therefore consultations do not need to be held with other countries.

11. Additional remarks

None

12. References

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Illustrations on *Yucca queretaroensis* for the proposal for inclusion in Appendix II

Figura 1. Forma de vida de *Yucca queretaroensis*

Figura 2. Apariencia del tallo de *Yucca queretaroensis*

Figure 1. Typical *Yucca queretaroensis* in its natural environment

Figure 2. *Yucca queretaroensis* stems

Figure 3. *Yucca queretaroensis* rosette

Figura 3. Roseta de *Yucca queretaroensis*.

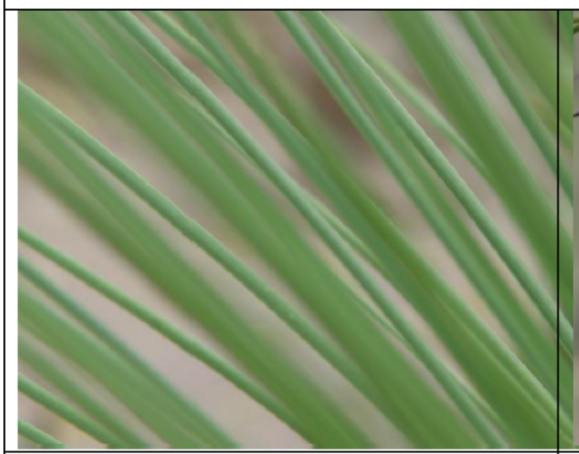


Figura 4. Detalle de las hojas frescas de *Yucca queretaroensis*.

Figura 5. Detalle de la espina terminal de *Yucca queretaroensis*.

Figure 4. Close-up of fresh *Yucca queretaroensis* leaves

Figure 5. Close-up of a *Yucca queretaroensis* terminal spine

Figure 6. "Knot" test to demonstrate the flexibility of a *Yucca queretaroensis* leaf

Figura 6. La prueba del "nudo" para demostrar la flexibilidad de la hoja de *Yucca queretaroensis*.

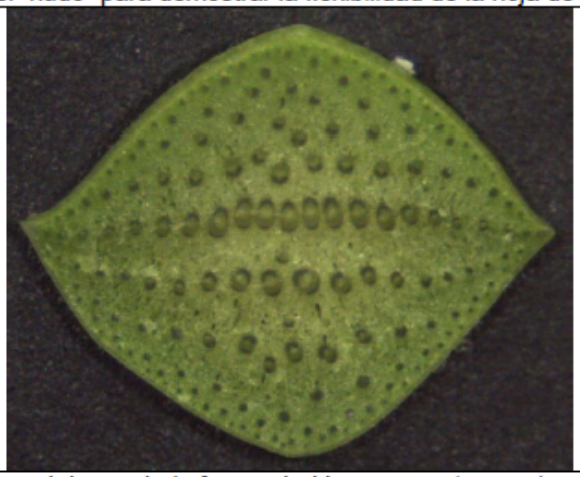


Figura 7. Sección transversal de una hoja fresca de *Yucca queretaroensis*.

Figura 8. Inflorescencia de *Yucca queretaroensis*.

Figure 7. Cross-section of a fresh *Yucca queretaroensis* leaf

Figure 8. *Yucca queretaroensis* inflorescence

Figure 9. *Yucca queretaroensis* fruit

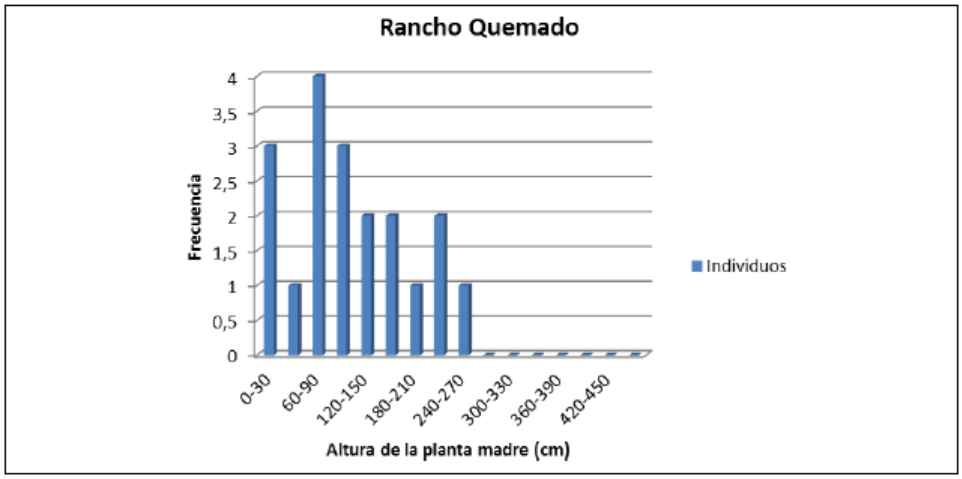
Figure 10. Shape of a *Yucca queretaroensis* seed

Figure 11. *Yucca queretaroensis* seed head

Figura 9. Frutos de *Yucca queretaroensis*.

Figura 10. Forma de la semilla de *Yucca queretaroensis*.

Figura 11. Testa de la semillas de *Yucca queretaroensis*.



Rancho Quemado site: y axis = frequency; x axis = height of the mother plant (cm); blue columns: individuals

Figure 12. Frequency of *Yucca queretaroensis* sizes
(Total height in cm of the mother plant of each individual) in Rancho Quemado

Figura 12. Frecuencia de tamaños de *Y. queretaroensis* (Altura total en cm de la planta madre de cada individuo) en la localidad de Rancho Quemado.

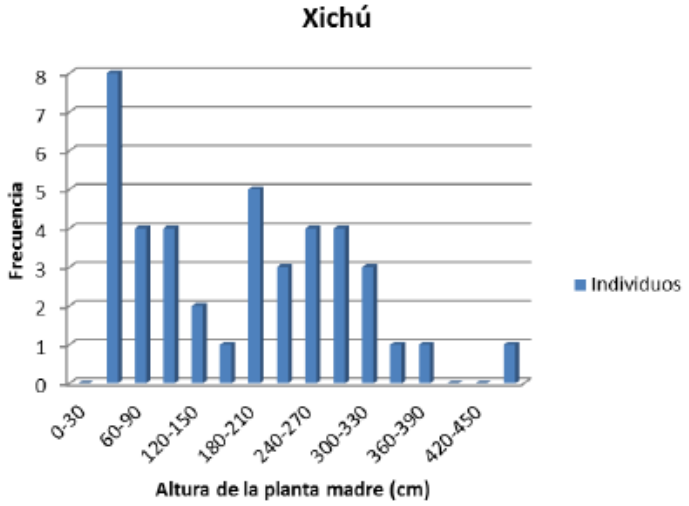


Figura 13. Frecuencia de tamaños de *Y. queretaroensis* (Altura total en cm de la planta madre de cada individuo) en las localidad de Xichú.

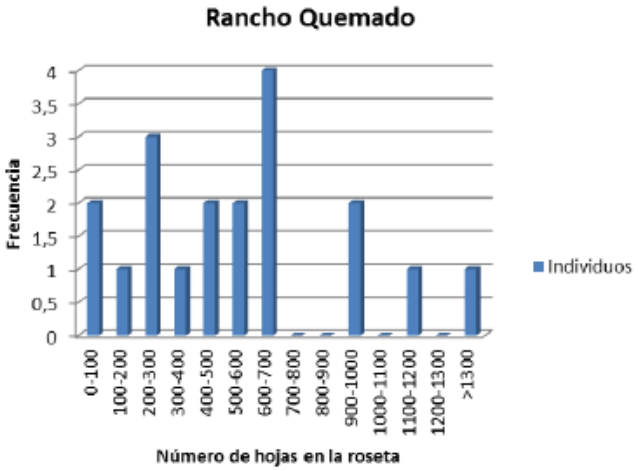


Figura 14. Frecuencia de tamaños de *Y. queretaroensis* (Número de hojas de la roseta de la planta madre) en la localidad de Rancho Quemado

Figure 13. Frequency of *Yucca queretaroensis* sizes
(Total height in cm of the mother plant of each individual) in Xichú

Figure 14. Frequency of *Yucca queretaroensis sizes*
(Number of leaves on the rosette of the mother plant) in Rancho Quemado

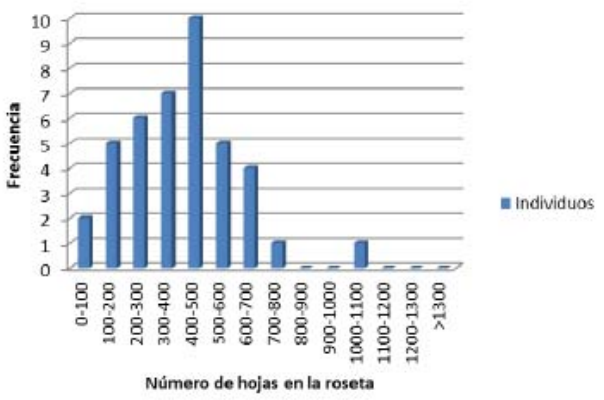


Figura 15. Frecuencia de tamaños de *Y. queretaroensis* (Número de hojas de la roseta de la planta madre) en la localidad de Xichú.

Figure 15. Frequency of *Yucca queretaroensis* sizes (Number of leaves on the rosette of the adult plant) in Xichú

Empresas internacionales que comercializan *Yucca queretaroensis/International companies that trade* Y. queretaroensis

Por medio de búsquedas y consultas por internet, así como con base en los insumos proporcionados por las Autoridades CITES de las Regiones Norteamérica y Europa en respuesta a la consulta oficial de la Autoridad Científica CITES de México (CONABIO), se han identificado un total de 19 empresas que comercializan *Yucca queretaroensis* a nivel internacional. Con base en la información obtenida, fue posible identificar dos modalidades de comercio internacional de *Yucca queretaroensis*, como sigue:

By means of online surveys and consultations, as well as based on the inputs provided by the CITES Authorities of the North American and European Regions in response to the formal consultation by the Mexican CITES Scientific Authority (CONABIO), a total of 19 companies that internationally trade Yucca queretaroensis *have been identified. Based on the information obtained, it was possible to identify two types of international trade of* Y. queretaroensis*, as follows:*

a) El primer tipo de comercio (Cuadro 1) consta de 13 empresas que anuncian semillas y plántulas de tamaño muy pequeño (rosetas de pocas hojas), sin tallos desarrollados y que parecen haber germinado de semillas.
/
The first type of trade (Table 1) comprises 13 companies that announce seeds and small seedlings (rosettes of few leaves) without stems that seem to be germinated from seeds.

Cuadro 1 / *Table 1.* Empresas que ofrecen semillas y plántulas (rosetas sin tallo) de *Y. queretaroensis* / *Companies that offer seeds and seedlings (stemless rosettes) of* Y. queretaroensis.

Nombre/Name	País/ Country	Sitio web u ofertas en línea/ Web site and online offers	Especímenes en comercio/ Specimens in trade	Precio (USD)/ Price (USD)	Observaciones/ Observations
1. *Amulree Exotics*	Reino Unido/ United Kingdom	http://www.turn-it-tropical.co.uk/scripts/	Plántulas/ Seedlings	$59	De acuerdo con la oferta en internet, las plántulas se obtuvieron por propagación artificial. / *According to the online offer, the seedlings were obtained through artificial propagation.*
2. *J T Mayo Farms*	Estados Unidos de América/ USA	www.mayofarmsnursery.com	Plántulas/ Seedlings	No disponible/ Not available	Se desconoce el origen de las plántulas ofrecidas. / *The origin of the seedlings offered is unknown.*
3. *Köhres Kakteen*	Alemania/ Germany	http://www.koehres-kaktus.de/shop/index.php	Semillas/ Seeds	No disponible/ Not available	Principales distribuidoras de semilla de *Y. queretaroensis* en Europa y Estados Unidos; sin embargo, se desconoce el origen de las semillas ofrecidas. / *Main distributor of* Y. queretaroensis' *seeds in Europe and USA; however, the origin of the seeds offered is unknown.*
4. *Kraut & Ruam*	Alemania/ Germany	www.krautstecher-ruam.de	Plántulas/ Seedlings	$19.60	Las plántulas son de 11 hojas, y se anuncian como 'recientemente germinadas'. Sin embargo, se desconoce el origen del material parental. / *The seedlings have11 leafs, and are announced as "recently germinated". However, the origin of the parental material is unknown.*
5. *Peckerwood Garden Conservation Foundation*	Estados Unidos de América/ USA	www.peckerwoodgarden.org	Plántulas/ Seedlings	$15.00	Las semillas a partir de las que se propagaron las plántulas fueron adquiridas a través de una empresa alemana no especificada. / *The seeds from which the seedlings were obtained were acquired through an unspecified German company.*
6. *Plant Delights Nursey Inc.*	Estados Unidos de América/ USA	- www.plantdelights.com - http://www.plantdelights.com/Yucca-queretaroensis-	Plántulas/ Seedlings	$14.00	De acuerdo con el propietario de la empresa, las plántulas que ofrece provienen de reproducción artificial. / *According to the company's owner, the seedlings were obtained through artificial propagation.*

Nombre/Name	País/ Country	Sitio web u ofertas en línea/ Web site and online offers	Especímenes en comercio/ Specimens in trade	Precio (USD)/ Price (USD)	Observaciones/ Observations
		Perennial-Queretaro-Soapwort/productinfo/8987/			
7. *Rare Palm Seeds*	Alemania/ Germany	http://www.rarepalmseeds.com/es/index.shtml	Semillas/ Seeds	No disponible/ Not available	Parece ser uno de los principales distribuidores de semilla de *Y. queretaroensis* en Europa; sin embargo, se desconoce el origen de las mismas. / *Apparently, this company is one of the main distributors of* Y. queretaroensis' *seeds in Europe; however, the origin of the seeds is unknown.*
8. *San Marcos Growers*	Estados Unidos de América/ USA	www.smgrowers.com	Plántulas/ Seedlings	No disponible/ Not available	Se desconoce el origen de las plántulas. / *The origin of the seedlings is unknown.*
9. *Succulent Tissue Culture*	Países Bajos/ Netherlands	www.succulent-tissue-culture.com	Plántulas/ Seedlings	$9.86	Las plántulas se propagaron artificialmente a partir de semillas obtenidas de la empresa *Köhres Kakteen*. / *The seedlings were artificially propagated from seeds obtained from the company* Köhres Kakteen.
10. *T & J's Palms and Yucca's*	Países Bajos/ Netherlands	- www.tenjpalmsenyuccas.nl - http://www.tenjpalmsenyuccas.nl/Yucca%20assortiment/yucca%20queretaroensis.htm	Plántulas/ Seedlings	$46.00	De acuerdo con el propietario, las plántulas se obtuvieron a partir de semillas, que a su vez fueron compradas a la empresa Alemana *Rare Palm Seeds*. / *According to the owner, the seedlings were obtained from seeds, which in turn were bought from the German company* Rare Palm Seeds.
11. *Tejas Tropicals*	Estados Unidos/ USA	- http://www.tejastropicals.com/ - http://www.ebay.com/itm/Yucca-queretaroensis-SPECTACULAR-HARD-FIND-COLD-HARDY-LIVE-DESERT-PLANT-/110935002966	Plántulas/ Seedlings	$12.95	De acuerdo con los insumos de la Autoridad Científica de Estados Unidos (USFWS), los ejemplares se obtuvieron por propagación artificial. También se promocionan en *Ebay*. / *According to the inputs provided by the USA Scientific Authority (USFWS), the specimens were obtained through artificial propagation. They are also offered on* Ebay.
12. *World Plants Market*	Japón/ Japan	http://www.worldplantsmarket.com/shopdetail/005003000001/order/	Plántulas/ Seedlings	$18	Se desconoce el origen de las plántulas. / *The origin of the seedlings is unknown.*
13. *Yucca Do Nursery Inc.*	Estados Unidos de América/ USA	www.yuccado.com	Plántulas/ Seedlings	No disponible/ Not available	Se desconoce el origen de las plántulas. / *The origin of the seedlings is unknown.*

b) El segundo tipo de comercio (Cuadro 2) consta de 6 empresas que anuncian plantas adultas de gran tamaño (80-160 cm de altura) con troncos desarrollados.
/
The second type of trade (Table 2) comprises 6 companies that offer large-size adult plants (80-160 cm in height) with developed stems.

Cuadro 2/*Table 2*. Empresas que ofrecen plantas adultas de *Y. queretaroensis* de gran tamaño / *Companies that offer large-size adult plants of* Y. queretaroensis.

Nombre/Name	País/Country	Sitios web u ofertas en línea/ Web site and online offers	Especímenes en comercio/ Specimens in trade	Precio (USD)/ Price (USD)	Observaciones/ Observations
1. *A l'ombre des figuiers*	Francia/ France	- www.alombredesfiguiers.com - http://www.alombredesfiguiers.com/succulentes/yucca_queretaroensis.htm	Plantas adultas/ Adult plants	$638.00	Las plantas ofrecidas son de 80 cm; se desconoce su origen. / *The plants in trade are 80 cm in height; their origin is unknown.*
2. *Bonjo Versand*	Alemania/ Germany	- www.bonjoversand.de - http://www.ebay.at/itm/Yucca-queretaroensis-Echte-70-80-Stamm-/370345419360	Plantas adultas/ Adult plants	$662.00-1,157.00	Las plantas ofrecidas alcanzan hasta 100 cm de altura. / *The plants in trade measure up to 100 cm in height.*
3. *Crazy Palm Garden*	Francia/ France	www.crazypalmgarden.fr	Plantas adultas/ Adult plants	$551.00	Las plantas ofrecidas alcanzan hasta 120 cm de altura; se desconoce el origen de los ejemplares. / *The plants in trade measure up to 120 cm in height; the origin of the specimens is unknown.*
4. *Musa Palm*	Bélgica/ Belgium	www.musapalm.be	Plantas adultas/ Adult plants	$519.00-2,185.00	Las plantas ofrecidas alcanzan hasta 140 cm de altura; se desconoce el origen de los ejemplares. / *The plants in trade measure up to 140 cm in height; the origin of the specimens is unknown.*
5. *Tropical Centre*	Países Bajos/ Netherlands	www.tropicalcentre.com	Plantas adultas/ Adult plants	$578.00-1,577.00	Las plantas ofrecidas alcanzan una altura de hasta 250 cm; se desconoce el origen de los ejemplares. / *The plants in trade measure up to 250 cm in height; the origin of the specimens is unknown.*
6. *Yucca Ranch*	Portugal/ Portugal	http://myworld.ebay.com/yuccSa-ranch/	Plantas adultas/ Adult plants	$620	Las plantas son de 175 cm de altura, con tronco desarrollado; se ofrecen en *Ebay* como plantas provenientes de México. / *The plants measure 175 cm in height, with developed stem; they are offered on* Ebay *as plants from Mexico.*

Guía visual para la identificación de *Yucca queretaroensis* y especies afines

Este documento forma parte integrante del primer informe de resultados del Proyecto JE005 "Evaluación del estado de conservación, uso y amenazas de *Yucca queretaroensis* Piña (Agavaceae) y la pertinencia de incluirla en los Apéndices de la CITES".

Responsable Técnico: Dra. Fabiola Magallán Hernández
Jardín Botánico Regional de Cadereyta (CONCYTEQ).

Claves para la identificación de especies

Paso 1: Cortar una hoja de la roseta desde la base (Fig. 1), revisar la punta (Fig. 2).

1. No tiene espina terminal (la punta de la hoja no es punzante, no causa dolor si se le toca).
……*Dasylirion quadrangulatum* (Pag. 17)

1. Presenta espina terminal (la punta de la hoja es punzante, duele si se le toca con la punta del dedo)
…… Paso 2

Paso 2: Observar la superficie de la hoja (Fig. 3).

2. Se ve lisa (sin rayas)……..Paso 3

2. Se ve con rayas, estrías o líneas acanaladas……..Paso 4

Paso 3: Localizar punto medio de la hoja y medir el ancho (Fig. 4).

3. Mide de 6-12 mm de ancho……*Yucca thompsoniana* (Pag. 12)

3. Mide de 2-5 mm de ancho……Paso 5

Figura 1

Figura 2

Figura 3

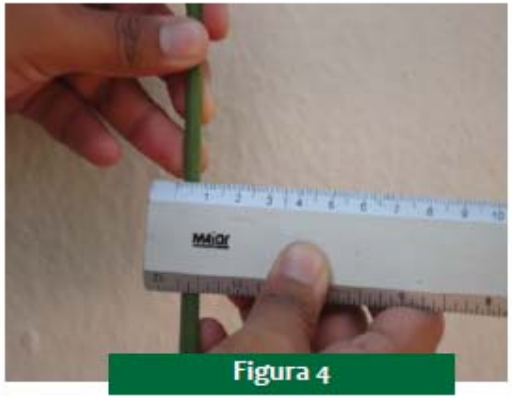


Figura 4

Claves para la identificación de especies

Paso 4: Cortar transversalmente la hoja con un cutter, cuidar que el corte sea a la mitad de la hoja (Fig. 5). Observar la hoja de frente (Fig. 6).

4. La hoja se ve plana……*Yucca rostrata* (Pag. 14).

4. La hoja se ve con forma de rombo……Paso 6

Paso 5: A. Observar el grosor de la hoja a todo lo largo (Fig. 7). B. Cortar transversalmente la hoja con un cutter, cuidar que el corte sea arriba de la mitad (Fig. 8) y observar la hoja de frente (Fig. 6). C. Observar el color de la hoja.

5. La hoja se ve redondo-angulosa de la mitad hacia abajo y plana de la mitad hacia arriba. La hoja cortada y vista de frente es plana. La superficie tiene color verde grisáceo o glauco……*Yucca linearifolia* (Pags. 12 y 14).

5. La hoja se ve redondo-angulosa a todo su largo. La hoja cortada y vista de frente tiene forma de rombo. La superficie tiene color verde claro brillante……*Yucca queretaroensis* (Pags. 12 y 14).

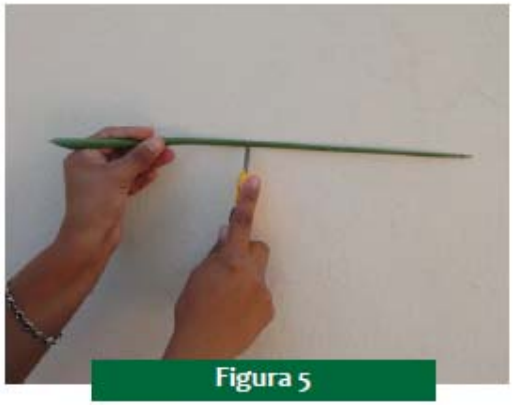


Figura 5

Figura 6

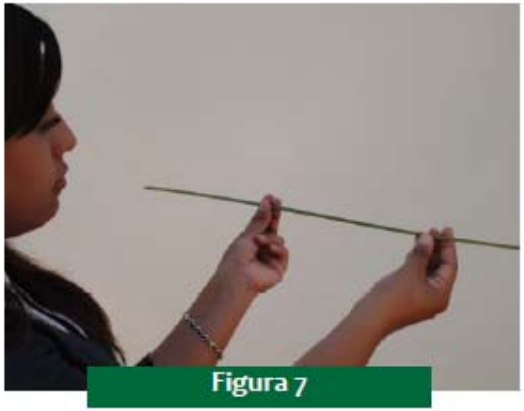


Figura 7

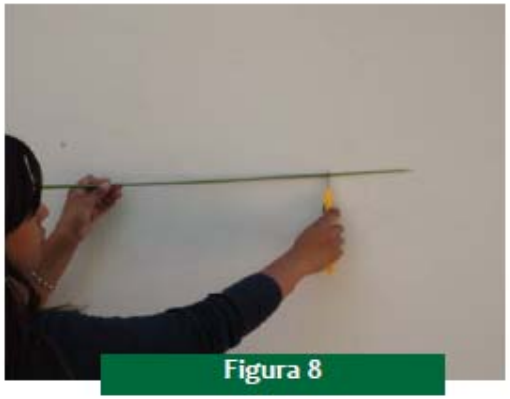


Figura 8

Claves para la identificación de especies

Paso 6: A. Intentar hacer un círculo con la hoja (Fig. 9) y tratar de hacer un nudo para cerrarlo (Fig. 10).

B. Medir el largo de la espina terminal (Fig. 11).

6. La hoja se rompe o secciona al intentar hacer el círculo y no se puede hacer el nudo. La espina terminal mide de 12-19 mm……*Agave striata* ssp. *striata* (Pags. 17 y 19).

6. Es posible hacer el círculo y el nudo sin que la hoja se rompa o seccione. La espina terminal mide de 8-10 mm……..*Agave* aff. *striata* (Pags. 17 y 19).

Figura 9

Figura 10

Figura 11

FORMA DE VIDA

Yucca queretaroensis
Árbol.
Altura máxima: 5 m.

Yucca linearifolia
Árbol.
Altura máxima: 3.5 m.

Yucca rostrata
Árbol.
Altura máxima: 4.5 m.

Yucca thompsoniana
Árbol.
Altura máxima: 2.5 m.

Dasylirion quadrangulatum
Árbol.
Altura máxima: 5 m.

Agave striata* ssp. *striata
Arbusto.
Altura máxima: 80 cm.

Agave* aff. *striata
Arbusto.
Altura màxima: 1 m.

Yucca queretaroensis
(HIJUELO.)
Altura máxima: 30 cm.

Yucca queretaroensis
(HIJUELO.)
Altura máxima: 50 cm.

CARACTERÍSTICAS DE LA ROSETA

Yucca queretaroensis

Esférica, muy densa.

500-700 hojas rígidas.

Yucca linearifolia

Casi esférica, con la parte superior ligeramente aplanada, muy densa.

400-500 hojas flexibles.

Yucca rostrata

Elíptica, a veces en forma de abanico. Densa.

400 hojas rígidas.

Yucca thompsoniana

Elíptica, densa.

250-300 hojas rígidas.

Dasylirion quadrangulatum

En forma de abanico densa.

500-600 hojas rígidas de apariencia arqueada.

Agave striata* ssp. *striata

Semiesférica, abierta, densa.

100-200 hojas rígidas.

Agave* aff. *striata

Semiesférica, abierta, densa.

200 hojas flexibles en la base, rígidas hacia la punta.

Yucca queretaroensis

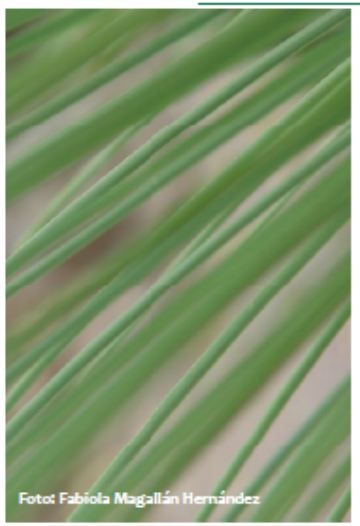
(HIJUELO) Semiesférica, menos densa que la planta madura.

Yucca queretaroensis

(HIJUELO) Esférica, densa.

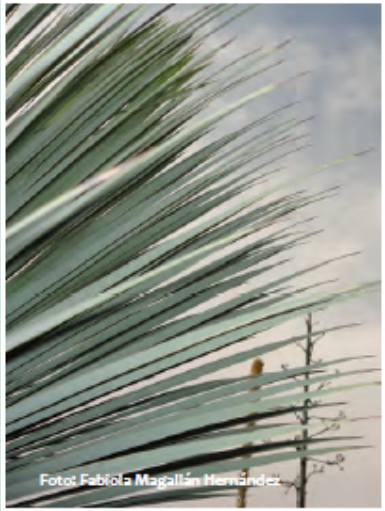
200-300 hojas rígidas.

CARACTERÍSTICAS DE LA HOJA FRESCA



Yucca queretaroensis

Forma: Linear.
Largo: 45-74 cm.
Ancho: 2-5 mm.
Color: Verde claro.
Textura: Lisa.
Margen: serrulado, transparente.

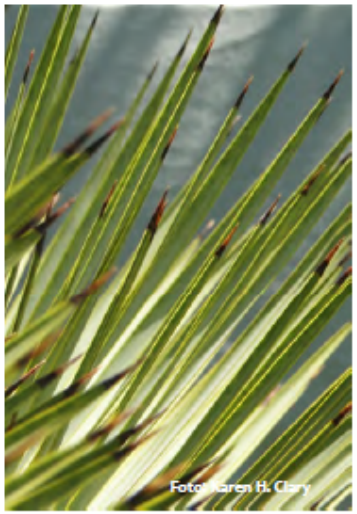


Yucca linearifolia

Forma: Linear.
Largo: 30-40 cm.
Ancho: 4-5 mm.
Color: Verde grisáceo, o glauco.
Textura: Lisa.
Margen: serrulado[1], color amarillo pálido.

Yucca rostrata

Forma: Linear lanceolada.
Largo: 35-65 cm.
Ancho: 8-15 mm.
Color: Verde glauco.
Textura: Estriada.
Margen: serrulado, color amarillo.



Yucca thompsoniana

Forma: Linear lanceolada.
Largo: 30-50 cm.
Ancho: 6-12 mm.
Color: Verde azulado.
Textura: Lisa.
Margen: serrulado, color amarillo brillante.

Dasylirion quadrangulatum

Forma: Linear, de apariencia arqueada.
Largo: 80-100 cm.
Ancho: 4-6 mm., hasta 8 en la base.
Color: Verde obscuro
Textura: Lisa.
Margen: Sin espinas.

Agave* aff. *striata

Forma: Linear/Linear falcada (en forma de hoz).
Largo: 35-45 cm.
Ancho: 4-6 mm.
Color: Verde claro.
Textura: Estriada
Margen: Serrulado, color amarillo pálido.

Agave striata* ssp *striata

Forma: Linear.
Largo: 45-70 cm.
Ancho: 4-6 mm.
Color: Verde claro o glauco.
Textura: Estriada
Margen: serrulado, color amarillo pálido.

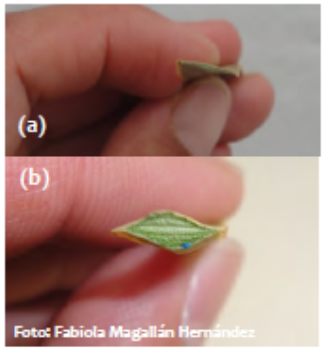
CARACTERÍSTICAS DE LA SECCIÓN TRANSVERSAL[14]

Yucca queretaroensis

Sección transversal biconvexa a todo lo largo.

Yucca linearifolia

Sección transversal plana de la mitad hacia la punta de la hoja, y biconvexa de la mitad hacia la base.



Yucca rostrata

Sección transversal plana a todo lo largo (a), a excepción de la base (biconvexa) (b).

Yucca thompsoniana

Sección transversal plana a todo lo largo de la hoja.

Dasylirion quadrangulatum

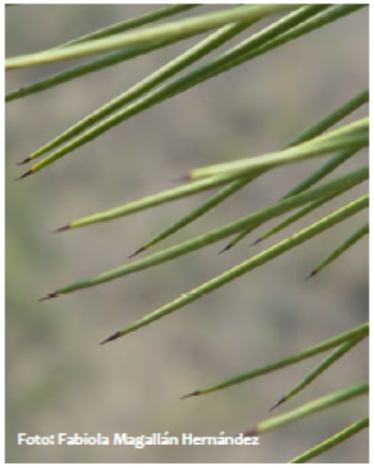
Sección transversal biconvexa a todo lo largo de la hoja.

Agave aff. *striata*

Agave striata ssp. *striata*

Sección transversal biconvexa a todo lo largo de la hoja.

CARACTERÍSTICAS DE LA ESPINA TERMINAL



Yucca queretaroensis

Forma: Cónica, angulosa.

Largo: 3-8 mm.

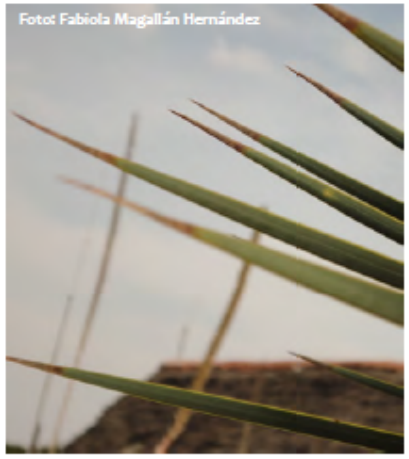
Color: Café rojizo.

Yucca linearifolia

Forma: Cónica.

Largo: 5-8 mm.

Color: Café rojizo obscuro a negro.



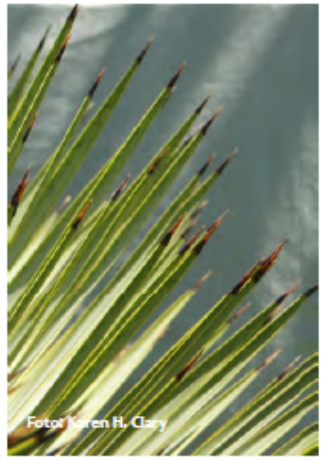
Yucca rostrata

Forma: Cónica.

Largo: 2-6 mm.

Color: Grisáceo.

(En las hojas viejas, el ápice se ve seco bajo la espina, dando la impresión de ser una espina más larga).



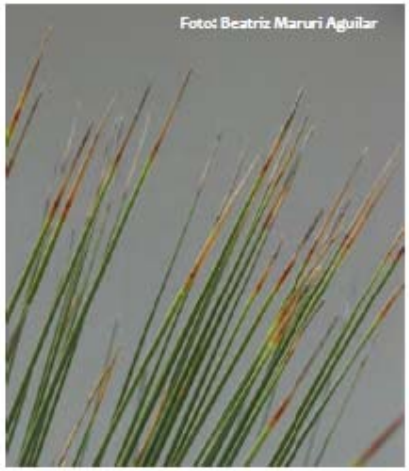
Yucca thompsoniana

Forma: Acicular.

Largo: 3-5 mm.

Color: GRISÁCEO.

(En las hojas viejas, el ápice se ve seco bajo la espina, dando la impresión de ser una espina más larga, hasta de 17 mm).



Dasylirion quadrangulatum

Sin espina terminal.

Color: Rojizo y grisáceo.

(*El ápice de la hoja es seco y truncado*) .

Agave aff. *striata*

Forma: Subulada, angulosa.

Largo: 8-10 mm.

Color: Café rojizo o gris.

Agave striata ssp. *striata*

Forma: Subulada, angulosa.

Largo: 12-19 mm.

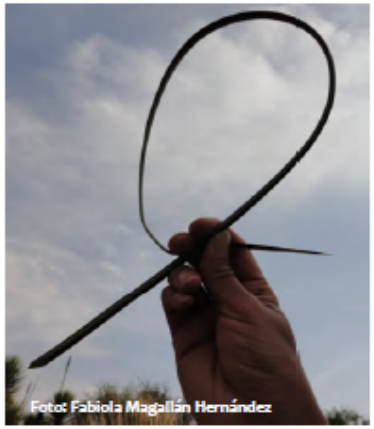
Color: Rojizo en las hojas jóvenes, gris en las más viejas.

RIGIDEZ DE LA HOJA

Yucca queretaroensis

La hoja se ROMPE o secciona al hacer la prueba del nudo.

Se considera rígida.



Yucca linearifolia

La hoja NO SE ROMPE ni secciona al hacer la prueba del nudo.

Se considera flexible.

Yucca rostrata

La hoja NO SE ROMPE ni secciona al hacer la prueba del nudo.

Se considera flexible.

Yucca thompsoniana

La hoja NO SE ROMPE ni secciona al hacer la prueba del nudo.

Se considera flexible.

Dasylirion quadrangulatum

La hoja se ROMPE fácilmente al hacer la prueba del nudo.

Se considera rígida.

Agave* aff. *striata

La hoja NO SE ROMPE o secciona al hacer la prueba del nudo.

Se considera flexible.

Agave striata* ssp. *striata

La hoja se ROMPE o secciona al hacer la prueba del nudo.

Se considera rígida.

CARACTERÍSTICAS DEL TALLO-CUBIERTA.

Yucca queretaroensis

Apariencia: Cubierto de hojas.

Color de las hojas: Gris claro.

Forma de las hojas: Rectas.

Acomodo de las hojas: En escalones.

(*Ocasionalmente se observan plantas con tallos parcialmente cubiertos de hojas secas.*)

Yucca linearifolia

Apariencia: Cubierto de hojas.

Color de las hojas: Gris claro.

Forma de las hojas: Dobladas hacia afuera.

Acomodo de las hojas: Forman un escalón bien definido en la parte superior del tallo; hacia abajo van desvaneciéndose.

Yucca rostrata

Apariencia: Cubierto de hojas, excepto en la base.

Color de las hojas: Gris.

Forma de las hojas: Rectas.

Acomodo de las hojas: Forman escalones bien definidos en la parte superior del tallo; van desvaneciéndose hacia la base.

Yucca thompsoniana

Apariencia: Completamente cubierto de hojas.

Color de las hojas: Gris claro.

Forma de las hojas: Dobladas hacia afuera en diferentes direcciones.

Acomodo de las hojas: Sin escalones, uniforme.

Dasylirion quadrangulatum

Apariencia: Variable: En ocasiones completamente cubierto de hojas; en ocasiones cubierto de la porción basal de las hojas; en ocasiones mostrando parte del tronco, sin hojas.

Color de las hojas: Gris.

Forma de las hojas: Orientadas hacia afuera, en diferentes direcciones.

Acomodo de las hojas: Sin orden visible.

Agave striata* ssp *striata

Sin tallo aparente.

Agave* aff. *striata

Sin tallo aparente.

EJEMPLARES DE HERBARIO.

Yucca queretaroensis

Forma: Linear.

Largo: 45-75 cm.

Ancho: 2-4 mm.

Margen: serrulado, transparente.

Las hojas herborizadas tienen sección transversal romboidal.

Yucca linearifolia

Forma: Linear.

Largo: 34-40 cm.

Ancho: 4-5 mm.

Margen: serrulado[1], color amarillo pálido.

Las hojas son planas en su mitad superior y biconvexas en la mitad inferior.

Yucca rostrata

Forma: Linear lanceolada.

Largo: 35-65 cm.

Margen: serrulado, color amarillo.

Las hojas generalmente son planas.

Yucca thompsoniana

Forma: Linear lanceolada.

Largo: 30-50 cm.

Ancho: 6-12 mm.

Margen: serrulado, color amarillo brillante.

Las hojas generalmente son planas.

Dasylirion quadrangulatum

Forma: Linear.

Largo: 100 cm.

Ancho: 6 mm.

Margen: Liso o muy ligeramente rugoso.

Agave* aff. *striata

(Pendiente)

Agave striata* ssp. *striata

Forma: Falcada.

Largo: 25-60 cm.

Ancho: 10 mm.

Margen: finamente serrulado, color amarillo brillante..