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Pseudophoenix sargentii in the Yucatan Peninsula, Mexico

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Pseudophoenix is a typically Antillean insular genus with its original center of distribution on Hispaniola island (Haiti and Dominican Republic). The four species of the genus are found on this island; three of the species are endemic. The fourth one, *Pseudophoenix sargentii*, can be found in the Florida Keys, Cuba, Ambergris Key in Belice, Bahamas, Dominica, and Mexico where it occurs on the Yucatan Peninsula in the states of Yucatan and Quintana Roo, the only continental areas where the species occurs naturally.

The three endemic species from Hispaniola are *Pseudophoenix vinifera* (Martius) Beccari, *P. ekmanii* Burret and *P. lediniana* Read, each of them growing on different habitats (Read 1968). *Pseudophoenix vinifera* grows on dry limestone mountains and hills at 20–400 m elevation with an annual rainfall of 350–500 mm in inland places. *Pseudophoenix ekmanii* grew (so far as is known) in xerophytic conditions inland in an exceedingly dry area of the Peninsula of Barahona in the Dominican Republic. *Pseudophoenix lediniana* grows on outcrops of steep porous limestone cliffs at 150–300 m elevation in xerophytic conditions but with moderate seasonal rainfall, in a very small area of southwestern Haiti.

Pseudophoenix sargentii is a halophytic palm always growing at sea level near the coast, in both xerophytic and humid environments, on well drained soils or sand, sometimes in flooded places but almost always in places with a maritime influence (Read 1968).

The genus was proposed by Wendland and described by Sargent in 1886, typified by *Pseudophoenix sargentii*, and based on collections made by Sargent on the western side of Elliot Key, Florida (Ledin et al. 1958). The genus was traditionally placed in the heterogeneous subfamily Arecoideae. Read (1968) however created a new monogeneric subfamily: Pseudophoenicoideae, with *Pseudophoenix* as the type genus. Moore (1973) placed the genus in the pseudophoenicoid group in the arecoid line, providing neither with a taxonomic status.

Individuals of *Pseudophoenix sargentii* are distinguished by unbranched, erect and unarmed trunks up to 8 m tall; the leaves are pinnate, ascending or drooping with reduplicate pinnae, up to 3 m long, shorter to 2 m in Mexican specimens; the rachis edge and pinnae insertion bear groups of brown scales. Inflorescences are interfoliar, erect or drooping, with branches to the third or fourth order. Flowers are greenish with a pseudopedicel 5 mm long in Mexican specimens (the pseudopedicel is characteristic of the genus). The perianth is in two series of three lobes each; stamens are 6 in number with broad bases of filaments fused to form a very short cup united to the petals; the pistil is conical, with 3 glands at the base and 3 sessile stigmas, and the ovary trilocular with a single ovule in each

locule. The fruit is a waxy-red drupe at maturity, mostly one-seeded but frequently 2–3-seeded; when 1 or 2 seeds mature, the abortive carpels can be seen at the base of the fruit. The epicarp is waxy and thin and the mesocarp fleshy and yellowish; the endocarp is hard and brownish in colour and encloses a free seed with hard endosperm and sub-basal embryo.

Read (1969) distinguished two subspecies and two varieties of *Pseudophoenix sargentii*, *P. sargentii* subsp. *sargentii* with inflorescence erect, and *P. sargentii* subsp. *saone* with inflorescence drooping. Subspecies *saone* was divided into *P. sargentii* subsp. *saone* var. *saonae* and *P. sargentii* subsp. *saonae* var. *navassana*. The same author (1968, 1969) recorded *Pseudophoenix sargentii* subspecies *sargentii* for Mexico.

Studied Area

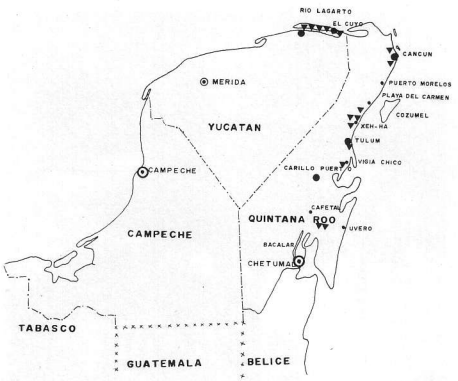
The Peninsula of Yucatan is a very interesting physiographic region. The northern region is almost flat while in the southern part there are some small hills (up to 400 m above sea level) and some depressions. There are no igneous rocks in the Peninsula, which is formed by beds of sedimentary rocks, mainly coralline limestone mostly of Tertiary or Recent origin. One of the most striking physiographic features of the Peninsula is the absence of surface streams. No permanent rivers exist except in the southwestern and southeastern ends. There are some seasonal streams, which carry water for a short time but, as soon as the rains cease, the water is quickly drained to the oceans or below the surface where it forms underground reservoirs called "cenotes," which are very abundant in the northern region. There are some small lakes formed during the rainy season that sometimes remain almost throughout the dry season. The underground water level is shallow, in some cases only 8 m or less deep.

In most of the Peninsula, the climate is warm-subhumid (Aw of Köppen) with several humidity levels and a mean monthly temperature between 20.5 and 30.5°C. The highest average annual rainfall (near 2,000 mm) occurs in the southeastern region, decreasing to the northwest, where the climate is dry (B of Köppen) with a lower average annual rainfall not more than 500 mm. The soils are shallow, calcareous, mainly red or black rendzinas, sands, or several hydromorphic types.

There are several vegetation types in the Peninsula according to Miranda (1964) these being optimum and non-optimum primary associations. As optimum, he distinguished High Evergreen Tropical Rain forest, High Forest with Boreal Elements, High or Median Subperennial Forest, High or Median Subdeciduous Forest, Median Deciduous Forest and Low Deciduous Forest, each one with several variants. The non-optimum primary associations are found in special conditions and are not widely distributed, among them are: corozal, botanal, tasistal, etc., each one characterized by a predominance of palms: *Orbignya*, *Sabal* and *Acoelorrhaphe* respectively.

The Yucatan Peninsula has a very interesting palm flora; 14 of the 21 genera of Mexican palms are found in this area:

Acrocomia
Acoelorrhaphe
Bactris
Chamaedorea
Coccothrinax
Chryosophila
Desmoncus
Orbignya
Opsiandra
Pseudophoenix



1. Map showing the distribution of *Pseudophoenix sargentii* in the Mexican portion of the Peninsula of Yucatan.

Roystonea
Sabal
Scheelea
Thrinax

Ecology

Pseudophoenix sargentii grows mostly near the coast, in Median or Low Subdeciduous Forest or in Coastal Dunes, from the southern part of Quintana Roo (north of Bacalar Lagoon) to the northern coast of the state of Yucatan (near Rio Lagartos). Its distribution is however discontinuous (Fig.1). In Median or Low Forest, the individuals are vigorous up to 8 m tall; these forest types with *Pseudophoenix* are found near the Caribbean coast, from the environs of Bacalar Lagoon to the environs of Cancun in the state of Quintana Roo.

In its southern growing range, this species occurs more than 30 km inland, the farthest inland record known in its range. In this region *Pseudophoenix* grows in a transitional zone between Median and Low Forest; the species is represented by scanty but vigorous individuals up to 8 m tall. The climate in this region (according to data from the nearest meteorological

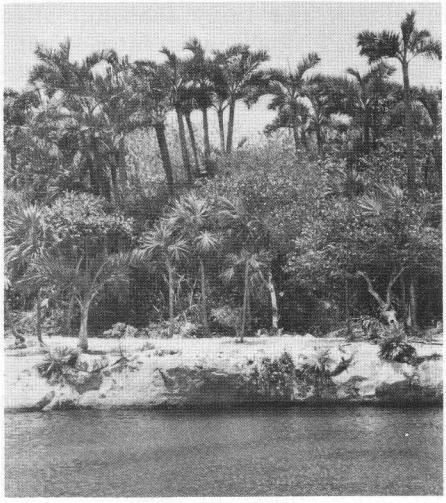
2. *Pseudophoenix* growing 30 km inland in a disturbed Median Forest near Bacalar Lagoon.

stations: Chetumal and Carrillo Puerto, Table 1) is warm-subhumid, with summer rainfall and a decrease at the middle of the rainy season, called "canicula" or "sequia intraestival". The average winter rainfall is 8.7%; the annual precipitation is 1,300 mm and the mean annual temperature is 26°C (Figs. 2, 3). The soils are well drained shallow clay loams overlying limestone, with abundant humus; other soil characteristics can be seen in Table 2-A.

In this region, *Pseudophoenix sargentii* is associated with other palms: *Coccothrinax readii* and *Thrinax radiata* (Quero 1980). Other species growing in these forests are:

Alseis yucatanensis Standl.
Astronium graveolens Jacq.
Bravaisia tubiflora Hemsl.
Chrysophyllum mexicanum Brand

3. *Pseudophoenix* in the same locality as Fig. 2 after burning by man.



4. *Pseudophoenix* in Xel-ha; note *Thrinax radiata* at left and *Coccothrinax readii* at right.

5. *Pseudophoenix* associated with *Thrinax radiata*, *Metopium brownei* and *Agave angustifolia* in El Cuyo region.

Coccoloba spicata Lundell
Exostema mexicanum Gray
Hippocratea excelsa H.B.K.
Luehea speciosa Willd.
Manilkara zapota (L) Royen
Pimenta dioica (L) Merril
Piscidia communis (Blake) Johnst.
Pouteria campechiana (Kunth) Baehni
Protium copal Engl.
Sickingia salvadorensis Standl.
Talisia olivaeformis (H.B.K.) Radlk.
Zanthoxylum microcarpum Griseb.

The region of Xel-ha is striking in the abundance of *Pseudophoenix*, growing in a Lower Subdeciduous Forest from the coast to 1.5 km inland. The palm has great regeneration in this area and there are many young individuals around the mature parent plants (Fig. 4). The climate is very similar to that of the preceding region, with slight variation in the average an-

Table 1. Graphics from Meteorological Stations: Carrillo Puerto, Chetumal, Tulum and El Cuyo

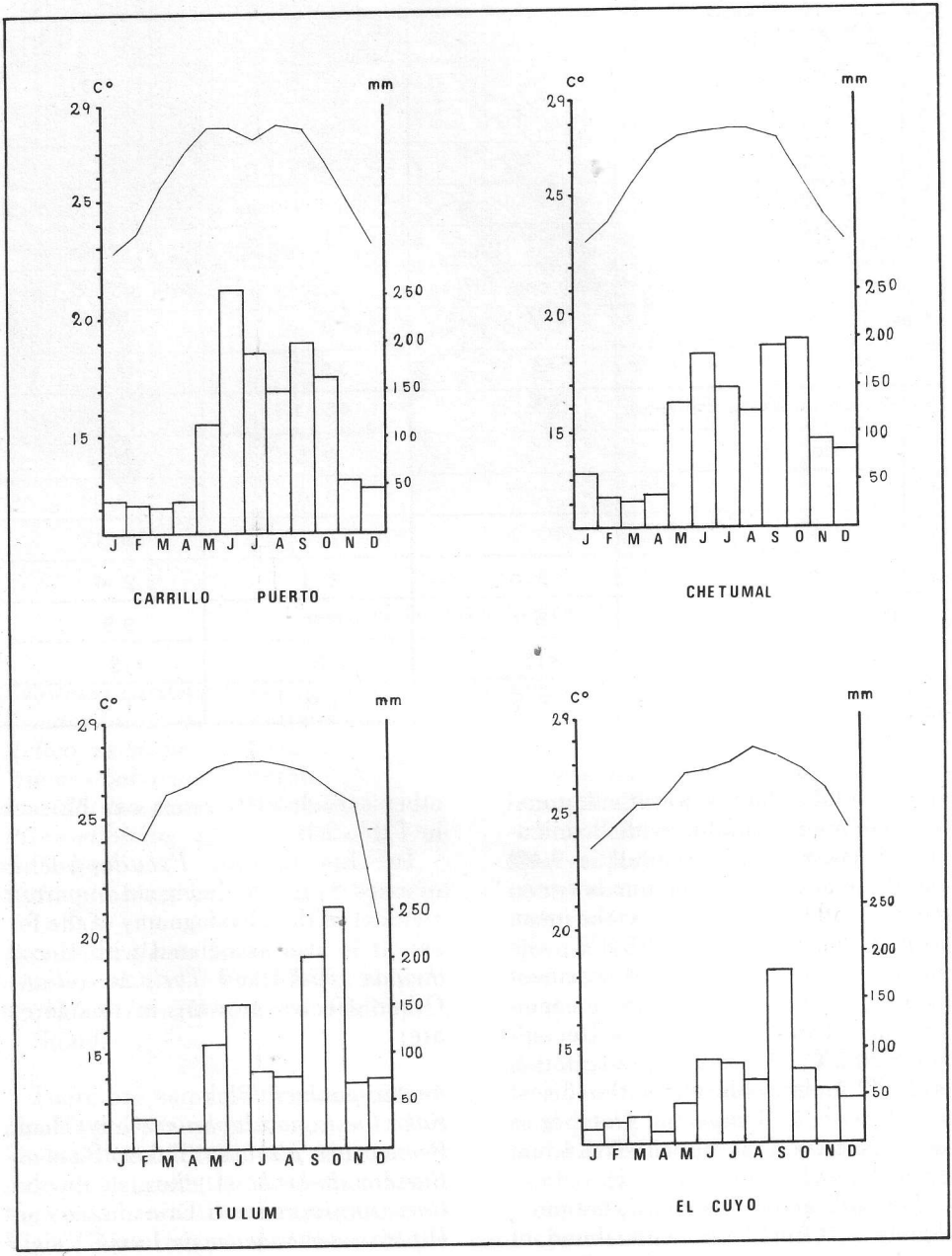


Table 2. Soil characteristics from: A. Environs of Bacalar Lagoon, B. 1.5 km north of Xel-ha, C. El Cuyo region

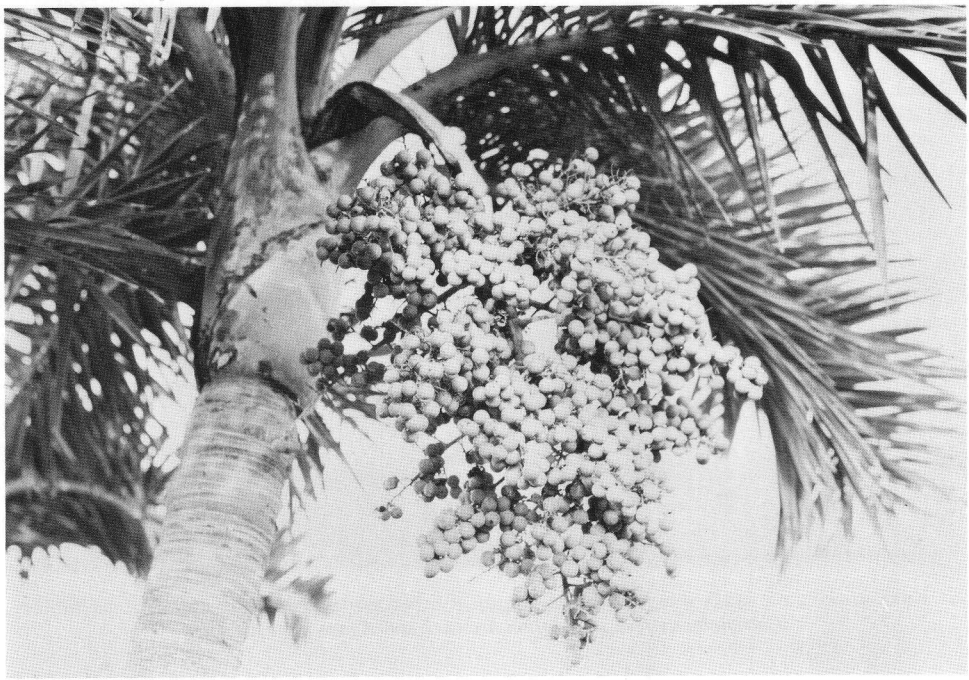
LOCALITY		A	B	C
TEXTURE	Clay %	38	10	10
	Loam %	20	30	6
	Sand %	42	60	80
	Textural Classification	Clay - loam	Sandy - loam	Loamy - sand
Color (dried)		very dark grayish brown	very dark grayish brown	grayish brown
Color (hydrated)		very dark brown	black	dark grayish brown
pH (H_2O) 1:1		7.6	7.4	7.6
Organic Matter %		15.8	33.3	4.9
Total Cation Exchange Capacity mg/100		55.4	45.1	17.6
EXCHANGEABLE BASES	Na^+ " "	0.4	0.5	0.8
	K^+ " "	0.3	0.4	0.1
	Ca^{++} " "	40.3	37.1	13.1
	Mg^{++} " "	3.5	2.1	2.4
Base Saturation		80	88	93
Na Saturation %		<15	<15	<15
P Availability ppm		2.8	1.8	1.4

nual rainfall, that is warm-subhumid with summer rainfalls, with "canicula". Average winter rainfall is 9.4% and there is scanty oscillation between mean monthly temperatures; the mean annual temperature is 25.8°C; the mean temperature of the warmest month June is 27.3°C; the mean temperature of the coolest month December is 20.5°C. The annual precipitation is 1,142.4 mm; March is the driest month with 16.3 mm and October is the most humid month with 254.4 mm (from Tulum station, Table 1).

The soils are very shallow, not more than 15–20 cm deep, with abundant coralline limestone outcrops. The soil is sandy-loam with abundant humus; other soil characteristics can be seen in Table 2-B.

In this region, *Pseudophoenix* reaches 5 m tall, being an important element of the physiognomy of the forest. It is also associated with *Coccothrinax readii* and *Thrinax radiata*. Other species growing in this forest are:

Acacia gaumeri Blake
Bakeridesia notalophium (Gray) Hook.
Beaucarnea pliabilis (Baker) Rose
Bursera simaruba (L) Sarg.
Caesalpinia gaumeri Greenm.
Diphysa carthagenensis Jacq.
Erythroxylon brevipes DC
Esembeckia berlandieri Baill.



6. Close-up of the curved fruiting inflorescence.

Exostema caribaeum (Jacq.) R. & S.
Gymnopodium floribundum Rolfe.
Helicteres baruensis Jacq.
Mimosa bahamensis Benth.
Piscidia communis (Blake) Johnst.
Pithecellobium guadalupense (Pers.) Chapm.
Pithecellobium platylobum (Spreng.) Urban
Randia aculeata L
Thevetia thevetioides (H.B.K.) Schum.
Torrubia linaribracteata (Heimerl.) Stand.

There are some other places where *Pseudophoenix sargentii* grows in this kind of Low Forest, but with scanty individuals; sometimes it is found near the coast behind the mangroves, as at Vigia Chico region; sometimes in the border of flooded soils as near Tulum but in this case 1 km inland; other times in the border of the Sandy Dunes Vegetation, as in the vicinity of Cancun and Tulum. In all these cases, the palms are less than 4 m tall, the leaves are less than 1.5 m long, and the trunks reach 20–25 cm wide.

This palm is most abundant in a littoral strip, 60 km long and 500 m wide on the northern coast of Yucatan. This strip limits a coastal lagoon from El Cuyo to Rio Lagartos. The climate is warm and dry (BS of Köppen), the mean annual temperature is 25.9°C, the coolest month is January 23.5°C, the warmest August 27.7°C, so there is a low thermic oscillation. The annual precipitation is 720.2 mm; April is the driest month (13.1 mm) and September the most humid (186.4 mm). A "canicula" is also present (from El Cuyo station, Table 1). The soils are loamy-sand with scant humus (Table 2-C). In the region of El Cuyo, the palm reaches 3 m tall, but it is com-

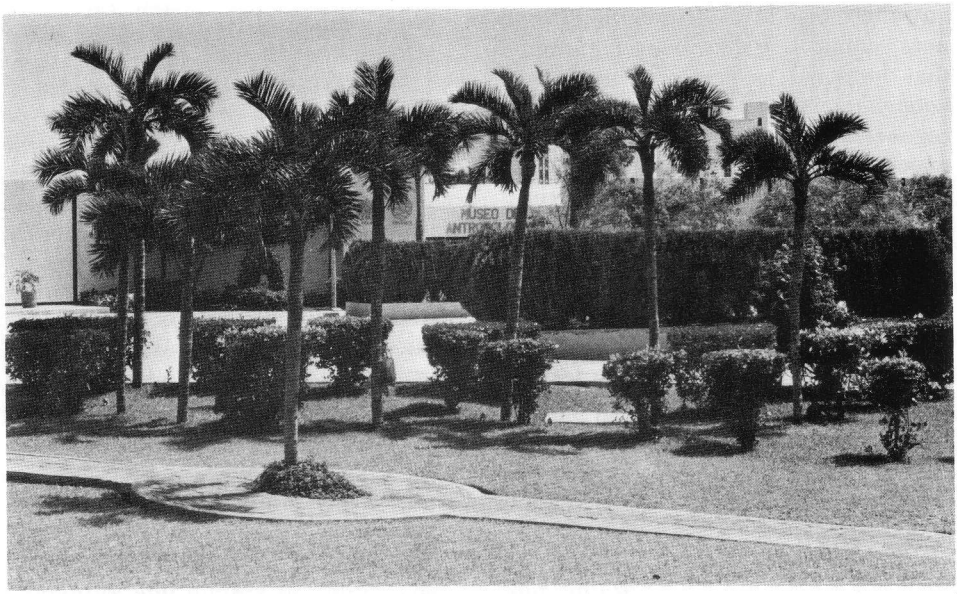
7. Kuká growing on sandy dunes near Rio Lagartos; other associated plants are: *Thrinax radiata*, *Coccoloba uvifera*, *Metopium brownei* and *Agave angustifolia*.

mon to find flowering and fruiting individuals not more than 1 m tall. Another interesting aspect of this palm population is the great regeneration, evidenced by abundant young plants around mature individuals. (Figs. 5, 6, 7). *Pseudophoenix sargentii* is one of the most important species growing in these sandy dunes; other associated species are:

Acanthocereus pentagonus Br. & Rose
Agave angustifolia Haw.
Amaranthus gregii Wats.
Ambrosia hispida Pursh.
Bumelia retusa SW
Caesalpinia caccalaco H & B
Cakile edentula (Bigel.) Hook.
Caparis incana H.B.K.
Coccoloba uvifera (L) Jacq.
Coccothrinax readii Quero
Cordia sebestena L
Croton punctatus Jacq.
Distichlis spicata (L) Greene
Ernodea littoralis SW
Gossypium hirsutum L
Hyperbaena winaerlingii Standl.
Jacquinia aurantiaca Ait.
Lycium carolinianum Wal.
Malvaviscus arboreus Cav.
Metopium brownei (Jacq.) Urban
Monantochloe littoralis Engelm.
Neea choriophylla Standl.
Pithecellobium albicans (Kunth) Benth.
Pithecellobium guadalupense (Pers.) Chapm.
Rhacoma gaumeri (Loes) Standl.
Suaeda linearis Moq.
Thrinax radiata Lodd. ex J. A. & J. H. Schult
Tournefortia gnaphalodes (L) R. Br.

Comments

Pseudophoenix sargentii is a typical littoral species that grows also a short distance inland in places with high marine influence. Read (1968) states that dry fruits have air spaces surrounding the seeds enabling them to float for some time, so they could have been transported by Caribbean ocean



8. *Pseudophoenix sargentii* in cultivation at Cancun.

currents from Hispaniola to those places where the palm grows at present.

As previously stated, Read (1968) reports *Pseudophoenix sargentii* subsp. *sargentii* characterized by the straight and erect inflorescence from Yucatan. However, a great variation in the inflorescence form can be found, some individuals bearing straight and some curved inflorescences, the straight ones being more abundant. This no doubt weakens the subspecific categories proposed by Read (Read pers. comm., Fig. 6).

The occurrence of this palm in the Yucatan Peninsula is very interesting. It presents discontinuous distribution and grows in two different conditions: in forest in the state of Quintana Roo and in dune vegetation in the state of Yucatan. The environmental conditions differ in soil and climate: the soils are loamy-sand in northern Yucatan and they are clayey-sandy-loam with abundant humus in forests of Quintana Roo. The climate is drier in the dunes, while it is humid in the forests. In my opinion, the presence of this palm in these two different regions is due to its arrival on the Yucatan Peninsula at two different times; it must have arrived earlier on the Caribbean coast of Quintana Roo. There are some geological maps of the Peninsula of Yucatan that suggest the occurrence of an ancient coastal line in those places where *Pseudophoenix sargentii* grows now, 30 km inland.

This population of *Pseudophoenix* is now under weak marine influence and this may be, in part, the reason for poor regeneration of the palm in the region. On the other hand, the region of sandy dunes on the northern coast of Yucatan is younger than the ancient coastal line of Quintana Roo. According to the maritime stream maps, the palm could have arrived directly from the Antilles or from the region of Quintana Roo.

Nevertheless this species is in much greater abundance in Mexico than

anywhere else in its distribution (Read pers. comm.). It has been mentioned that there are two regions where *Pseudopheonix* is very abundant with high regeneration; accordingly, it might be expected that in a few more years the species would have a wider distribution. However, expansion is not possible due to natural circumstances and human intervention. In Quintana Roo, the distance from the coast, the mangroves, some flooded soils, and clay soils are limiting or restrictive factors for the establishment of *Pseudophoenix sargentii*; on the Peninsula the coastal lagoon in the northern Yucatan is restricting colonization by the palm.

Man, however, is the main limiting factor. The opening of new lands for growing various crops such as sisal and coconuts in the north of Yucatan, or the destruction of vegetation in order to establish new population centers results in new open lands that are barriers to *Pseudophoenix* colonization.

Man has also been directly decreasing the natural population of *Pseudophoenix sargentii*; in the last ten years, since the tourist complex of Cancun in Quintana Roo was created, this palm known as *kuká* and *yaxhalalche*, has been widely gathered and used as an ornamental palm, not only in Cancun, but commonly in places such as Cozumel, Isla Mujeres, Playa del Carmen, Vallodolid, Merida and in many other smaller towns near its natural habitats (Fig. 8).

The reasons for the widespread cultivation of *Pseudophoenix sargentii* are on the one hand the beauty of the palm, and on the other hand, the ease of culture. A person who cultivates them told me: ". . . es una palma muy noble, pues es muy facil de sacar y ademas puede estar tirada mucho tiempo en el suelo antes de ser plantada, resiste el transporte por mucho teimpo y no se seca . . . ."*

I have confirmed the "nobleza" of *Pseudophoenix sargentii* by growing some individuals at the Botanic Garden of the National University of Mexico. The specimens have survived traveling from the Yucatan to Mexico City (approximately 1,800 km), sometimes taking more than 15 days, and have grown well in cultivation. This has permitted the public visiting the Botanic Garden to get acquainted with a beautiful tropical palm, that in Mexico grows only on the Yucatan Peninsula.

Acknowledgments

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* ". . . it is a very noble palm, for it is easy to dig out of the ground and also it can lie on the ground for a long time before it is planted, it resists traveling for a long time and does not wither . . . ."