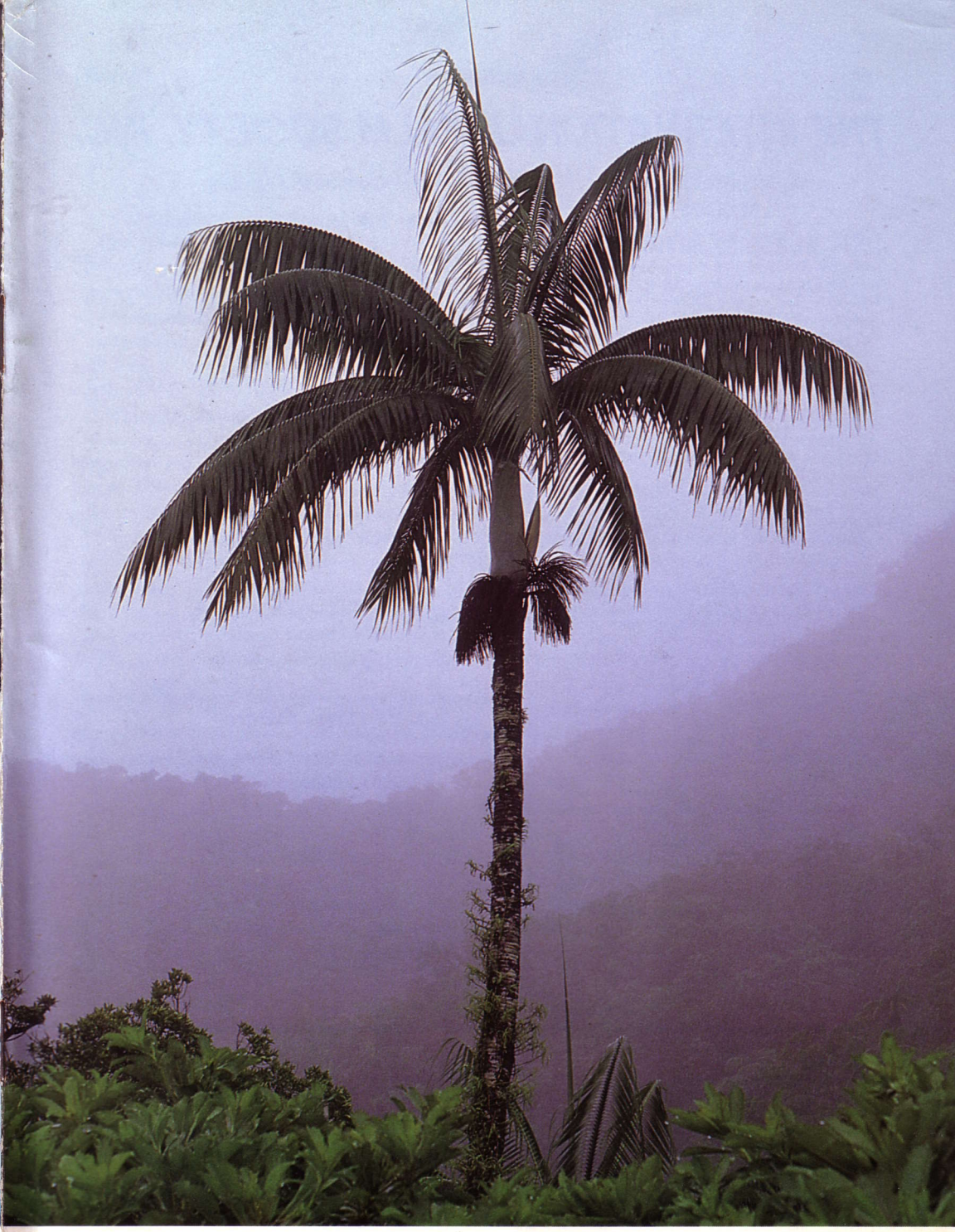

PRINCIPES

Journal of The International Palm Society

July 1989
Vol. 33, No. 3

THE INTERNATIONAL PALM SOCIETY, INC.

THE INTERNATIONAL PALM SOCIETY

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PRINCIPES

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Contents for July

Cover Picture

Clinostigma exorrhiza growing on Taveuni, Fiji. Photo by John L. Dowe.

PRINCIPES

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Editorial

Few plants are able to grow in fast running streams; those that do are referred to as "rheophytes." That a few palms grow in such a habitat is one more expression of the fascinating diversity in the family. The *Geonoma* described in the first article of this issue was recognized as a rheophyte and considered a possible new species by Hal Moore. Gloria Galearno-Garces and Flemming Skov have determined that its correct name is *G. linearis* and that it has a surprisingly wide distribution extending from northwest Colombia to northwest Ecuador where it sometimes forms large populations.

Our second article is a masterful discussion of the conservation status of the palms in Colombia, a country with one of the richest palm floras in the world. Rodrigo Bernal's definitive and up-to-date account of all Colombian palms will be useful in many ways. Those who attended may realize that the paper was first presented in 1986 during the palm symposium at Cornell University.

Since Victorian times Lady Palms have been appreciated as elegant indoor plants. Garden editor and IPS business secretary, Lynn McKamey, has written a new account of the many cultivars of *Rhapis excelsa*. She also discusses the latest information on the other known species of *Rhapis*. The article includes many valuable guidelines for cultivating these attractive palms.

The genus *Guihaia* (pronounced Gwe-hígh-uh) was named for Guelin, China from where one species comes. This palm, the only coryphoid genus with a reduplicate leaf, was first described in 1985 (see Principes 29(1): 3–12). Seeds of *G. argyrata* are difficult if not impossible to distinguish from those of *Rhapis*. About three years ago, seeds of *Guihaia* were shipped from China and sold to nurserymen as *Rhapis excelsa*. More of this intriguing story is presented in a second article by Lynn McKamey.

The study of demography or the timing of different events during growth has been done for only a few palms. Such observations on *Astrocaryum sciophilium* are given by P. Sist in this issue. This kind of information is necessary for understanding the growth processes of many palms.

While this issue was at press, the interim Board meeting of IPS was held in Corpus Christi, Texas. The meeting was an especially important one. New guidelines that are necessary for many facets of our now large and complex society were adopted by the Board. Undoubtedly many of us will be affected in the future by the new policies. Many of them will be published in coming issues of *Principes*. A preliminary write-up of the meeting with news items of immediate concern to members is included in this issue.

NATALIE W. UHL
JOHN DRANSFIELD

Principes, 33(3), 1989, pp. 108–112

Geonoma linearis—a Rheophytic Palm from Colombia and Ecuador

GLORIA GALEANO GARCÉS AND FLEMMING SKOV

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Rheophytes are very rare among the numerous life forms encountered in the Palm family. Van Steenis (1981), in his "Rheophytes of the World," defines a rheophyte as a "plant species which in nature is confined to the beds of swift-running streams and rivers and grows there up to flood-level, but not beyond the reach of regularly occurring flash floods." He refers to four palm species known to him as rheophytes. Dransfield (1978) recognizes three palms as true rheophytes. A *Geonoma* collected in western Colombia by H. E. Moore is illustrated in both mentioned works. It is not referred to as a species, and both authors indicate that this might be an undescribed species.

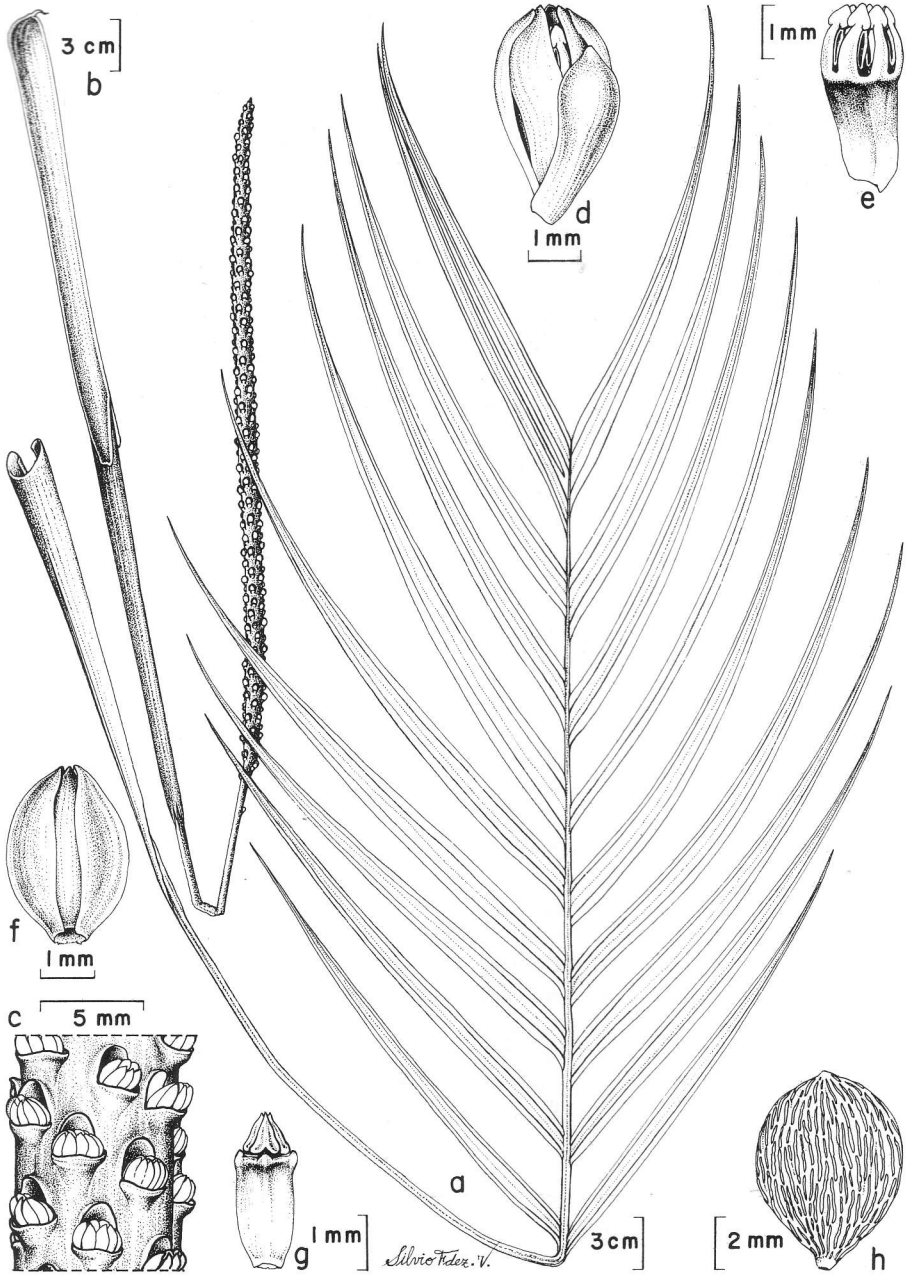
Recent fieldwork carried out in Ecuador and Colombia has produced several vouchers of the rheophytic *Geonoma*, which appears to be common along rivers in lowland rain forest of north-western Ecuador and western Colombia. One of these was collected on the type locality of *Geonoma linearis* Burret and fits the description of this species (Burret 1933)

The type of *G. linearis* was destroyed in Berlin during World War II. Wessels Boer (1968) tentatively included *G. linearis* as a synonym of *G. sodiroi* Dammer ex Burret. His conclusion was based on the study of a sterile specimen (*Killip 35375*, US, COL) which he referred to as *G. linearis*. According to Wessels Boer the Killip collection matches the description of *G. linearis* "so well that it seems to be almost identical with the original specimen." Because the Killip collection also resembled *G. sodiroi* rather well, the two species were considered to be conspecific. Study of a duplicate of *Killip 35375* kept at COL shows that this is not *G. linearis*, but a specimen of *G. deversa* (Poit.) Kunth, with linear pinnae.

Study of all available material of *G. linearis* shows that it is different from *G. sodiroi*. The holotype of *G. sodiroi*, which was kindly made available from P, and several recent collections from the type locality near Santo Domingo in Ecuador show that this species is a small, often stemless, understory palm of Terra Firme forest. It is distinct in having leaves with sigmoid pinnae. *G. linearis* seems most closely related to *G. cuneata* Wendl. ex Spruce, with which it is sympatrically distributed in western Colombia and Ecuador. The populations of *G. linearis*, however, are so distinctive with the consistently riparian habitat, linear pinnae and fibrous fruits, that we considered that *G. linearis* must be treated as a separate species.

A full description of *G. linearis* is given below and, since no isotypes of it are known, a specimen from the type locality is here designated as neotype.

Geonoma linearis *Burret*, Notizbl. Bot. Gart. Berlin-Dahlem 11: 861. 1933 (Fig. 1). TYPE: COLOMBIA: Barbacoas, Río Telembí, 10 Aug 1880, *Lehmann 51* (HOLOTYPE destroyed at B). NEOTYPE: COLOMBIA: Nariño, Municipio de Barbacoas, Río Telembí, 160 m alt., 20 Nov 1986, *Bernal & Hammel 1320* (NEOTYPE COL; ISONEOTYPES: AAU, BH, K, MO, NY, PSO).



1. *Geonoma linearis*. a, leaf; b, inflorescence; c, detail of the spike; d, staminate flower; e, staminal tube with stamens; f, pistillate flowers before anthesis; g, gynoecium with staminodial tube; h, mature fruits (*Bernal & Hammel 1320*).

Solitary or caespitose. Stem erect or procumbent, 0.2–3 m long, 1.3–4 cm diam, green, yellowish-green or light brown, conspicuously ringed, internodes 1–3 cm apart. Sometimes with adventitious roots. Leaves 3–19, spreading; sheath and petiole 23–73 cm long, 0.3–0.4 cm wide below rachis, sheath covered with a dense brown tomentum, marginally fibrous, distal 17–37 cm petiolar-like, concave above, rounded below with a prominent ridge, green, glabrous; blade oblanceolate in outline, up to 45 cm wide; rachis 22–57 cm long; pinnae (4–)7–12 per side, linear to linear-lanceolate, each with 1–3 primary veins, the apical ones up to 5–6 primary veins; basal pinnae 20–33 cm long, middle pinnae 26–34 cm long, apical pinnae 14–21 cm long; primary veins 14–26 per side, emerging at an angle of 20–35° from the rachis, prominent and acute on either side; secondary veins sunken above, prominent and rounded below. Inflorescence interfoliar, erect, spicate; prophyll 8–19 cm long, 1–1.5 cm wide, flattened, membranous, becoming fibrous apically, covered with a caducuous, greyish-brown woolly tomentum; peduncular bract 15–34 cm long, inserted 0.5 cm above the prophyll, otherwise similar to the prophyll, peduncle 17–60 cm long, ca. 0.5 cm wide at apex, compressed, glabrous, apically with up to 8 small, rounded bracts less than 0.3 cm long; spike 9.5–28 cm long, 0.4–0.7 cm diam, purplish-green in fruit, the surface minutely tuberculate; flowerpits bilabiate, spirally arranged in 8–9 vertical series, ca. 2 mm apart, flowerpits ca. 2 mm wide, upper lip entire, short, lower lip rounded shortly cleft and slightly projecting. Staminate flowers obovate to elongate, 3–3.5 mm long; sepals ca. 1 mm long, oblanceolate, acute and thickened apically, shortly ciliate at margins; petals 3–3.5 cm long, oblanceolate, acute and thickened apically, basally fused for ⅔ of their length; stamens 6, basally fused for 1.5–2 mm, the free part linear, 1–1.2 × 0.2 mm, anthers 1–1.5 mm long, linear; pistillode minute, shortly tricuspidate. Pistillate flowers ovoid, 3–3.5 mm long; sepals 3–3.5 mm long, lanceolate; petals ca. 3 × 2 mm, ovate-triangular, basally fused for ca. ½ their length, acute apically; staminodial tube ca. 2 mm long, shortly dentate; ovary subglobose. Fruit ovoid to subglobose, with a narrow base, shortly pointed apically, 6–8 mm long, 4–5 mm diam, black at maturity, the surface somewhat striate, pericarp of fresh fruits very fibrous; seed subglobose, ca. 4 mm diam, dark brown.

Habitat and Distribution: G. linearis is exclusively confined to sides of streams and small, fast-flowing rivers, sometimes even growing partially submerged (Fig. 2). It usually forms large populations. It is found from NW Colombia in the Chocó region through the Pacific lowlands to NW Ecuador, up to altitudes of about 200 meters.

Vernacular Name: "Caló" in San Francisco de Ichó, Chocó. A population is called "calosal." The Cayapa Indians in NW Ecuador use the name "Yullpo-po-chuitapé" and say the plant is a "brojo," a magic plant, used for pains in the stomach (Barfod and Balslev 1987, Barfod et al. in press).

Other Specimens Examined: Colombia: Chocó: Municipio de Quibdó, San Francisco de Ichó, Río Ichó, 150 m alt., 11 Jul 1981 *Galeano & Bernal 450* (COL); 8 km de Tutunendo a San Francisco de Ichó, 150 m alt., 6 Jul 1986, *Bernal et al. 1077* (AAU, BH, COL, CHOCO, FTG, HUA, K, NY). Valle del Cauca: Costa del Pacífico, Río Yurumanguí, entre isla de Golondro y la Amargura, 10–40 m alt., 7 Feb 1944, *Cuatrecasas 16042* (COL, US); about 18 km east of Buenaventura, 50 m alt., 14 Feb 1939, *Killip & Garcia-Barriga 33287* (COL); Bajo Calima, 27 Nov 1974, *Moore 1027* (BH, COL). Ecuador: Esmeraldas: Río Grande, tributary of Río Cayapas at Zapallo Grande, *Barfod & Skov 60115* (AAU); Río San Miguel, one hour upstream from San Miguel de Cayapas; *Holm-Nielsen et al. 25437* (AAU).

2. *Geonoma linearis.* Habit. From Chocó in Colombia. 3. *Geonoma linearis.* Fresh fruits showing the fibrous pericarp.

The biology of *G. linearis* is particularly interesting. Most plants observed are caespitose and have one to many basal shoots, so that a large amount of propagation is apparently due to vegetative reproduction. Many adventitious roots are also of great importance in anchoring the palm to the substrate. This property along with the finely divided pinnate leaves, which offer less resistance to flowing water, is an advantage during flash floods, when the risk of being swept away is high. Although the very fibrous pericarp of the ripe fruits (Fig. 3) suggests that the fruits are adapted to floating, field experiments have demonstrated that the fruits cannot float. Van Steenis (1981) argued that buoyancy is not an advantage for a rheophytic plant, since it could displace the seeds downstream and remove them from the rheophytic niche. Consequently, a peak of flowering and fruiting would be expected during the dry season, when the water level in the rivers are low. Populations of *G. linearis* flower and produce fruits throughout the year; however, in the Chocó region the largest amount of mature fruits is found in July, which is in the middle of the dry season.

Acknowledgments

We wish to thank Silvio Fernández of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, for the line drawing. The Danish Natural Science Research Council supported Flemming Skov's field work. Henrik Balslev and Anders Barfod read and commented on the manuscript.

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News from The Chapters

South Florida Palm Society Fall Sale, 4–5 November at Fairchild Tropical Garden. Contact Lenny Goldstein or Mark Levandoski for additional details.

The Southern California Chapter announces the opening of a **Chapter Palm Garden** in Huntington Beach (Orange County) on 16 September 1989. Contact Ralph Velez or Lois Rossten for further directions and details.

Principes, 33(3), 1989, pp. 113–128

Endangerment of Colombian Palms

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ABSTRACT

The conservation status of all palm species known to occur in Colombia is revised. Twenty two species are considered endangered, and a brief account of each is provided; 17 species are considered vulnerable; 18 species are considered rare; 121 species are insufficiently known; and 80 species are not threatened. The urgent need of further field work is stressed.

Colombia has been recognized long ago as one of the countries with the largest palm floras in the world (Dugand 1940, Corner 1966). Located in the northwestern corner of South America, its palm flora includes both North American genera not found elsewhere in South America (e.g., *Cryosophila*, *Reinhardtia*), and many exclusively South American genera not found in the North American continent (e.g., *Iriartella*, *Leopoldinia*, *Lepidocaryum*). Besides this, the physiographic and climatic diversity of the country, particularly the intricate topography of the Andes, provide a great richness of habitats for palms. Actually, palms grow in almost all of Colombia, except on the highest Andean mountains, and in the driest areas of the country. My latest count of Colombian palms, which includes much unpublished information, gives 261 species in 47 genera. One hundred and one of the species are endemic to the country.

The economic importance of Colombian palms has been recognized since the times of the first explorers (Patiño 1985 for references), and has gained increasing attention in the last decades.

But despite this richness, diversity, and economic importance, Colombian palm flora remains very poorly known, and detailed floristic treatments (Galeano and Bernal 1987) or generic monographs (Balick 1986, Henderson, unpubl.; Skov and Balslev, unpubl.) are just beginning to appear.

Colombian natural vegetation has been greatly modified by man, particularly in the Andean region. As a consequence, many species of plants have become very rare (Fernández-Pérez 1977) or threatened. This is particularly true for palms, which, as pointed out by Moore (1977), have three disadvantages: they have a single growing point; they are widely used by man; and usually they are not very successful in disturbed habitats.

Many species of palms have been described from the Andean mountains and interandean valleys of Colombia, and therefore they are likely to be somehow threatened. Nevertheless, the poor knowledge of many genera, and the lack of extensive field work in search of palms, have made it impossible in the past to assess their degree of threat. Actually, no work has ever been published on the conservation status of Colombian palms. Moore (1977), based on his own field experience in Colombia, pointed out some species that he considered endangered or vulnerable. Galeano and Bernal (1984) made a short review of the endangerment of *Ceroxylon* species; and Ruiz (1984) pointed out the endangerment faced by *Attalea victoriana*.

An indication of our scarce knowledge on this subject is the fact that by September 1986, the Threatened Plants Unit's database at Kew Gardens listed 250 species

of palms occurring in Colombia, of which 215 (86%) were treated as unknown, that is, no information on their conservation status was available.

Extensive field work with palms in Colombia for the last eight years, mostly in the Andean region, has provided the opportunity to gather very valuable information on the distribution and conservation status of Colombian palms, besides the understanding of the identity of the palms themselves. This information is the main body of this work, but information from other sources has also been taken, when available.

A dramatic example of the urgent need of field work to refine our information on this matter is the fact that, based on available data, several Colombian palms were listed as endangered at the TPU's database by 1986, or by Johnson (1986). Our current knowledge, however, shows that several of these species must be transferred from the "Endangered" category, some of them, surprisingly, to the "not threatened" category. This is due to the fact that recent exploration in the Pacific lowlands, where most of the referred species grow, has revealed that they are not so restricted and uncommon as formerly thought.

Geographic Areas

For the purpose of assessing endangerment of Colombian palms, I have divided the country into seven geographic areas (Fig. 1): The Amazon Region, and the Llanos, both located east of the Andes, and roughly separated by Río Guaviare; the three Andean Cordilleras; the interandean valleys of Río Cauca and Río Magdalena; the Pacific Region, west of the Andes; the Northern Plain, north of the Andes; and the isolated Sierra Nevada de Santa Marta. Most of the Llanos and the Amazon Region, the eastern slopes of the Eastern Cordillera, as well as most of the Pacific Region, including the western slopes of the Western Cordillera, are largely undisturbed, and it is in those areas that most of the species I consider not threatened grow. The Sierra Nevada de Santa Marta still has large forested areas, but the status of its palms is poorly known. It is on the Cordilleras, along the Río Cauca and Río Magdalena valleys, and on the Northern Plain, that natural vegetation has been most severely changed, and it is there that most of the threatened palm species occur.

National Parks

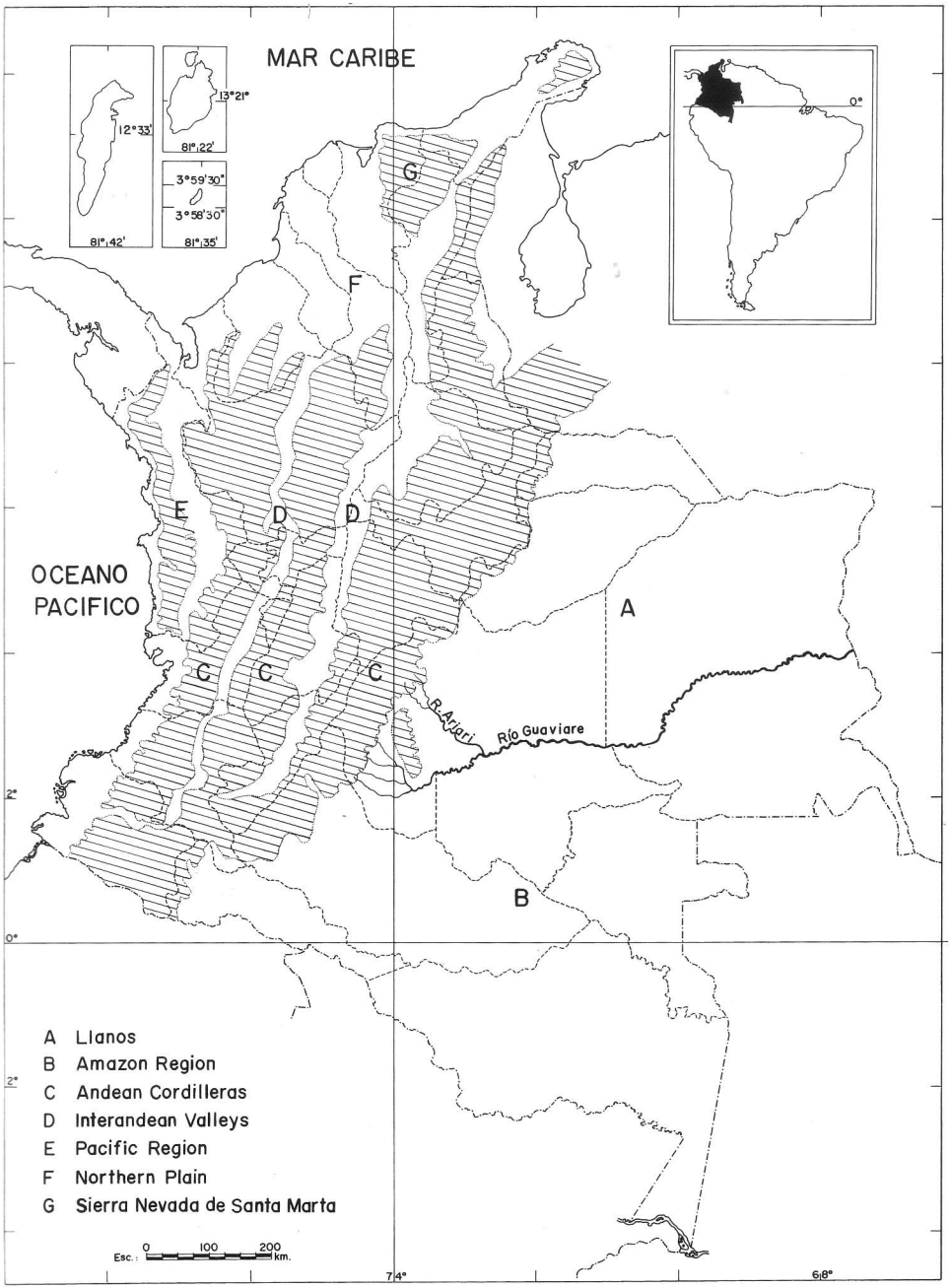
The Colombian system of national parks comprises 32 parks (Fig. 2), with a total area of 48,105 km^2, that is, 4.3% of the country's area (Anonymous 1984). All of these areas are controlled by INDERENA, the national institute for natural resources and environment. Although most climates and vegetational formations are represented within this system of national parks, at least four important areas are not covered in any park. They are: central Chocó, which has been considered the world's rainiest region; the northernmost region of the Central Cordillera; the Río Magdalena valley; and the Río Negro basin, in the Amazon Region. All of these areas have a number of endemic palms, and of many other plants as well.

Two other small, private reservations are worth mentioning. They are: La Planada Reservation, in Departamento de Nariño; and Finca Meremberg, in Departamento del Huila. They are both located in southwestern Colombia.

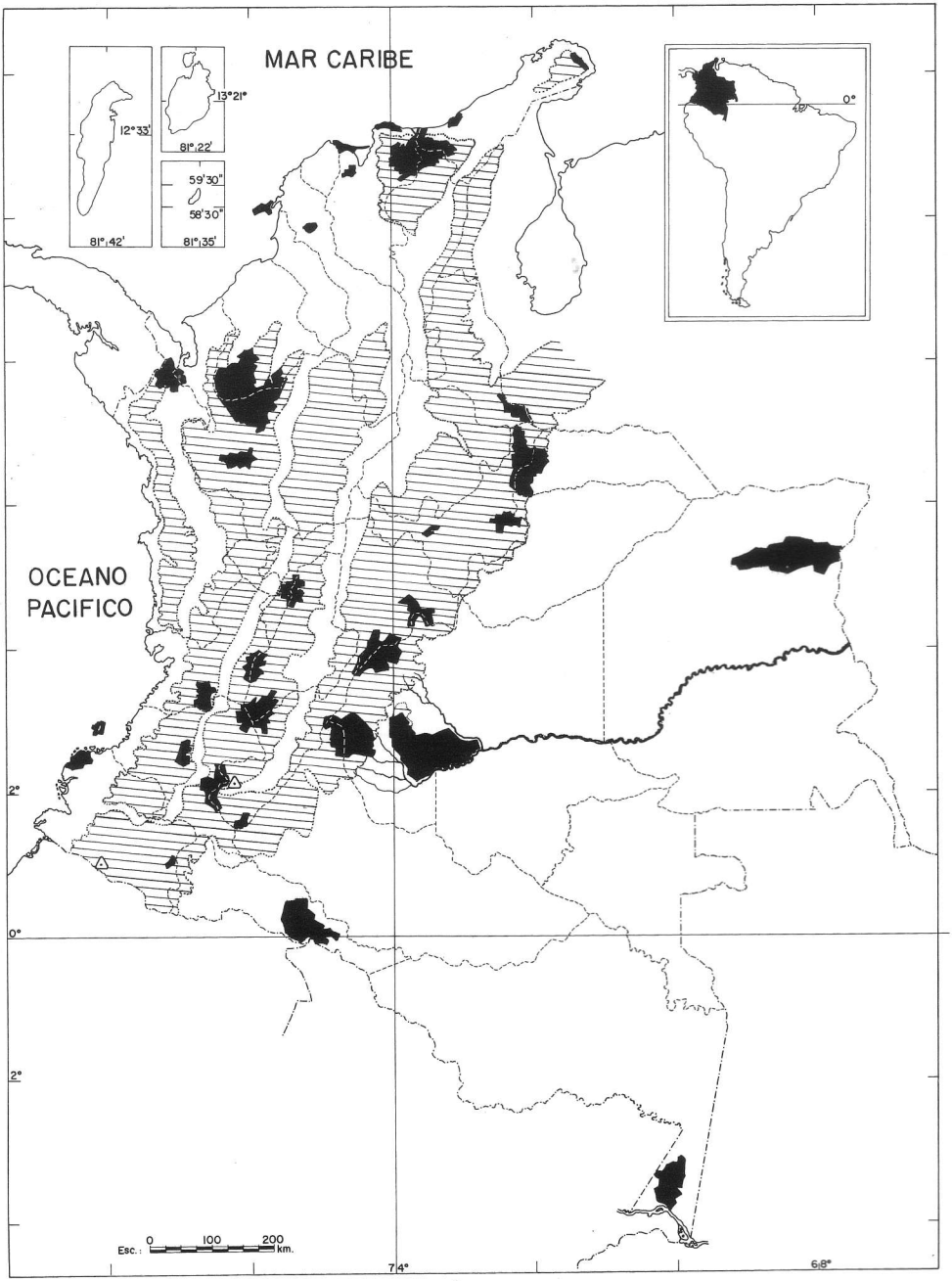
Although palms grow in most of these protected areas, no information exists either on the species found on each of them, or on their conservation status there. Because of this, the occurrence of a species in a national park or a private reservation has not been taken into account to alter the category assigned to that species.

Conservation Status

I have assigned each of the 261 palm species I presently recognize from Colom-



1. Major geographic areas of Colombia.



2. National Parks and private reservations in Colombia.

Table 1. Status of Colombian Palms. Figures presented in this paper, contrasted with those at the TPU's database by September 1986.

Category	TPU 1986	Bernal 1987
Endangered	13	22
Vulnerable	9	17
Rare	0	18
Indeterminate	1	0
Insuff. known	220	121
Not threatened	7	80
Cultivated	—	3
Total	250	261

bia to one of the Red Data Book categories "Endangered," "Vulnerable," "Rare," "Insufficiently known," or "not threatened," as defined by IUCN (Anonymous 1980). So far, no Colombian palm is known to have become extinct. Under the "Insufficiently known" category I have included those species recorded from areas that have been so poorly studied for palms, that it is possible that they are actually not threatened, as is the case for many species of the Amazon Region. Thus, my "Insufficiently known" includes those species usually treated as "Unknown," and marked with a query.

According to my estimate, 22 species of Colombian palms are endangered, 17 species are vulnerable, 18 species are rare, 121 species are insufficiently known, and 80 species are not threatened. Table 1 shows these figures, contrasted with those at the TPU's database by September 1986. This shows clearly how much our knowledge has progressed, but how large the gaps in our knowledge are as yet. In the following account, reasons will be given for the inclusion of every species in the "Endangered" category, followed by annotated lists of the species included in the remaining categories.

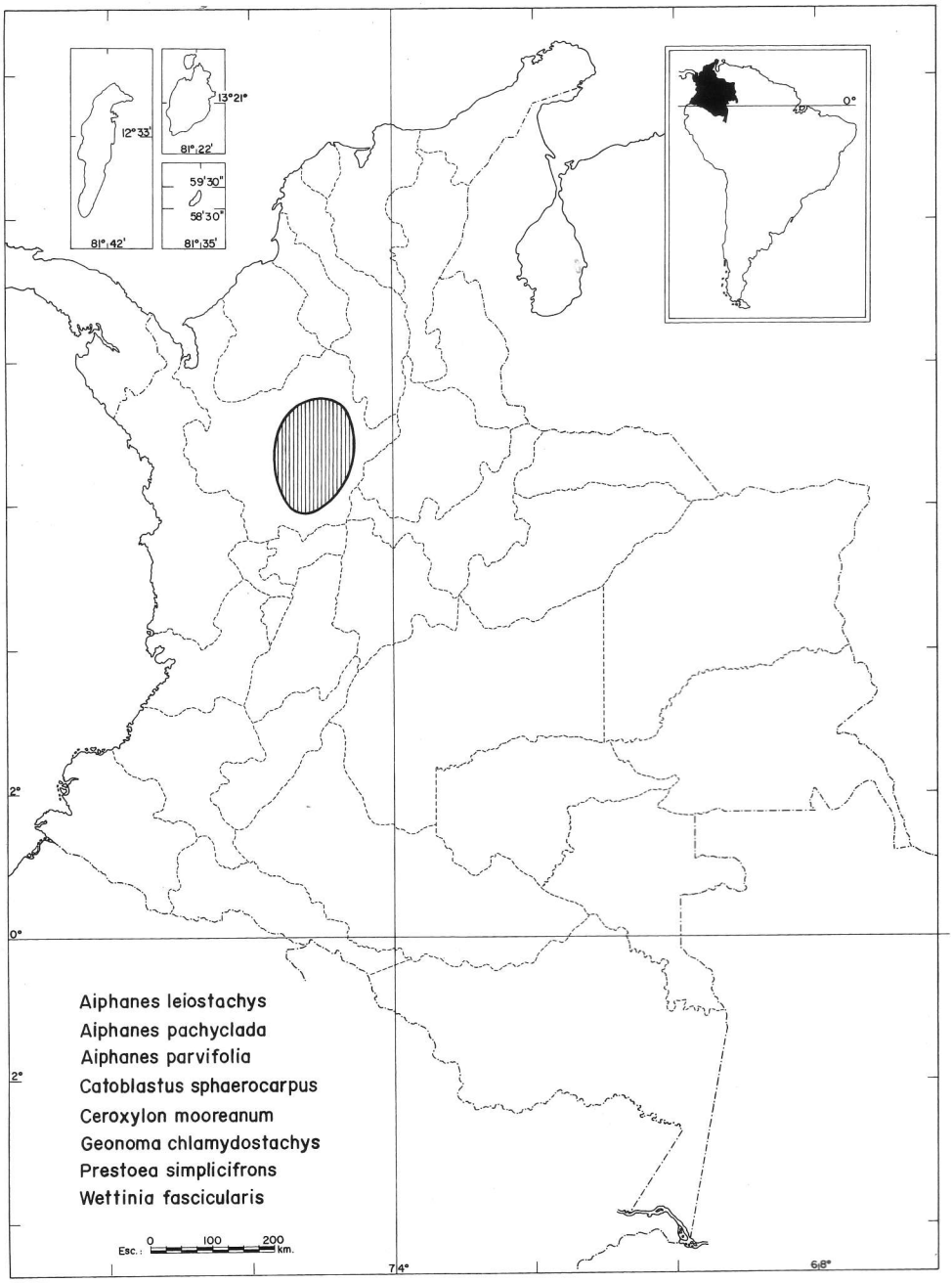
Endangered Species

"Taxa in danger of extinction, and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction" (Anonymous 1980).

There are 22 Colombian species of palms that I consider to fall in this category (Table 2). Fourteen of the species are endemic to Colombia, and therefore they are also endangered at the world level. Eight species

Table 2. Endangered palms in Colombia.

Endemic	Non-endemic
Aiphanes leiostachys Burret	*Attalea colenda* (O. F. Cook) Balslev & Henderson
Aiphanes pachyclada Burret	*Ceroxylon alpinum* Bonpl. ex DC
Aiphanes parvifolia Burret	*Ceroxylon sclerophyllum* Dugand
Attalea victoriana Dugand	*Ceroxylon vogelianum* (Engel) H. A. Wendl.
Catoblastus andinus Dugand	*Geonoma solitaria* (Engel) Jahn
Catoblastus microcarpus Burret	*Phytelephas pittieri* O. F. Cook
Catoblastus sphaerocarpus (Burret) Burret	*Reinhardtia koschnyana* (H. A. Wendl.) Drude ex Dammer
Ceroxylon mooreanum Galeano & Bernal	*Syagrus sancona* Karsten
Cryosophila kalbreyeri (Dammer ex Burret) Dahlgren	
Geonoma chlamydostachys G. Galeano	
Phytelephas karstenii O. F. Cook	
Phytelephas tumacana O. F. Cook	
Prestoea simplicifrons (Burret) DeNevers & Henderson	
Wettinia fascicularis (Burret) Moore & Dransfield	



3. Distribution of some endangered palms endemic to Colombia.

are non-endemic. I will treat the species of each group separately.

Endemic Species

Aiphanes leiostachys

An understory palm, known only from a very restricted area at the north of the Central Cordillera, in Antioquia (Fig. 3), in a largely deforested area. Unlikely to occur in any national park. Apparently a well-defined species.

Aiphanes pachyclada

An understory palm 2 meters tall, known only from two collections in a small area in the Central Cordillera in Antioquia (Fig. 3), where forest has disappeared to a great extent, and is still being actively destroyed. It does not regenerate in open areas, and it has not been found elsewhere in Colombia. Unlikely to occur in any national park. Apparently a well-defined species.

Aiphanes parvifolia

Also an understory palm, known only from two collections in the same area as *A. pachyclada* (Fig. 3). Unlikely to occur in any national park. Apparently a well-defined species.

Attalea victoriana

A stemless palm endemic to the Río Cauca basin, from South Antioquia to north of Valle, up to 1,600 m of altitude (Fig. 4). Most of its range now converted into agriculture, and the palm very scarce, usually with very small populations. Cultivated in gardens in some towns. Indicated as a promising species for its oily seeds (Ruiz 1984). Unlikely to occur in any national park. Probably conspecific with *A. rhynchocarpa* Burret, of the same area, but this does not alter its status.

Catoblastus andinus

A slender palm 6 m tall, known only from two close localities on the Eastern Cordillera in Boyacá and Santander (Fig. 5). Locally abundant in a very small area, not seen further to the north. Does not regenerate in open areas. The stems are cut for use in fence construction. Might be in El Cocuy National Park, but not actually reported so far. Apparently a well-defined species.

Catoblastus microcarpus

A tall palm with distichous leaves. Fairly common in a small remnant forest patch near the type locality (Fig. 4), where forest has almost completely disappeared. A population southeast of this one, at the border of Tamá National Park, apparently the same species, but also very restricted. Does not regenerate in open areas. Apparently well-defined.

Catoblastus sphaerocarpus

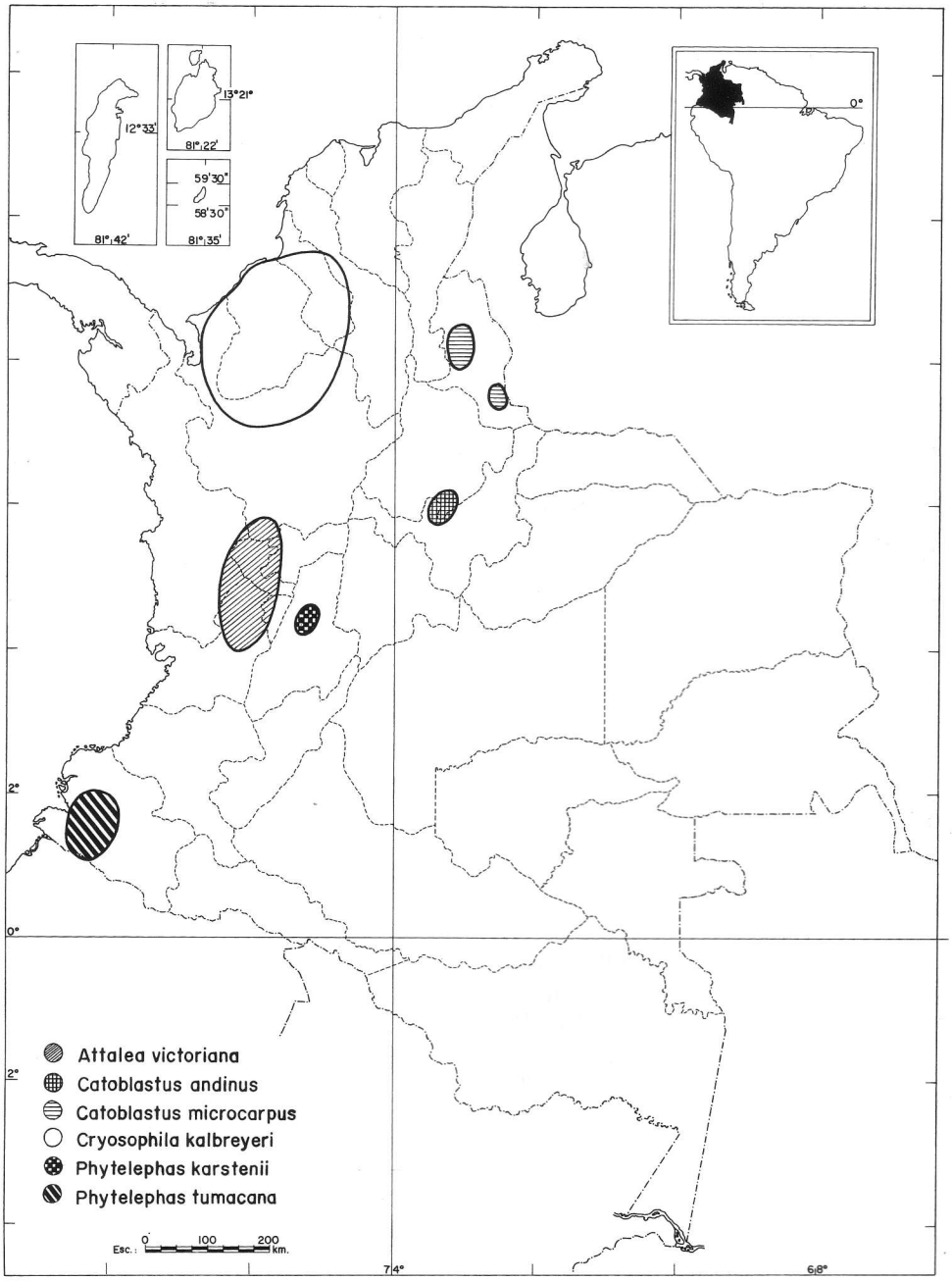
A tall forest palm known only from two localities on the Central Cordillera in Antioquia (Fig. 3), where forest has mostly disappeared. Not found elsewhere. First collected in 1880; the area where it was rediscovered in 1980 has been greatly destroyed after the construction of a new highway between the country's two largest cities. Does not regenerate in open areas. Unlikely to occur in any national park. Apparently well-defined.

Ceroxylon mooreanum

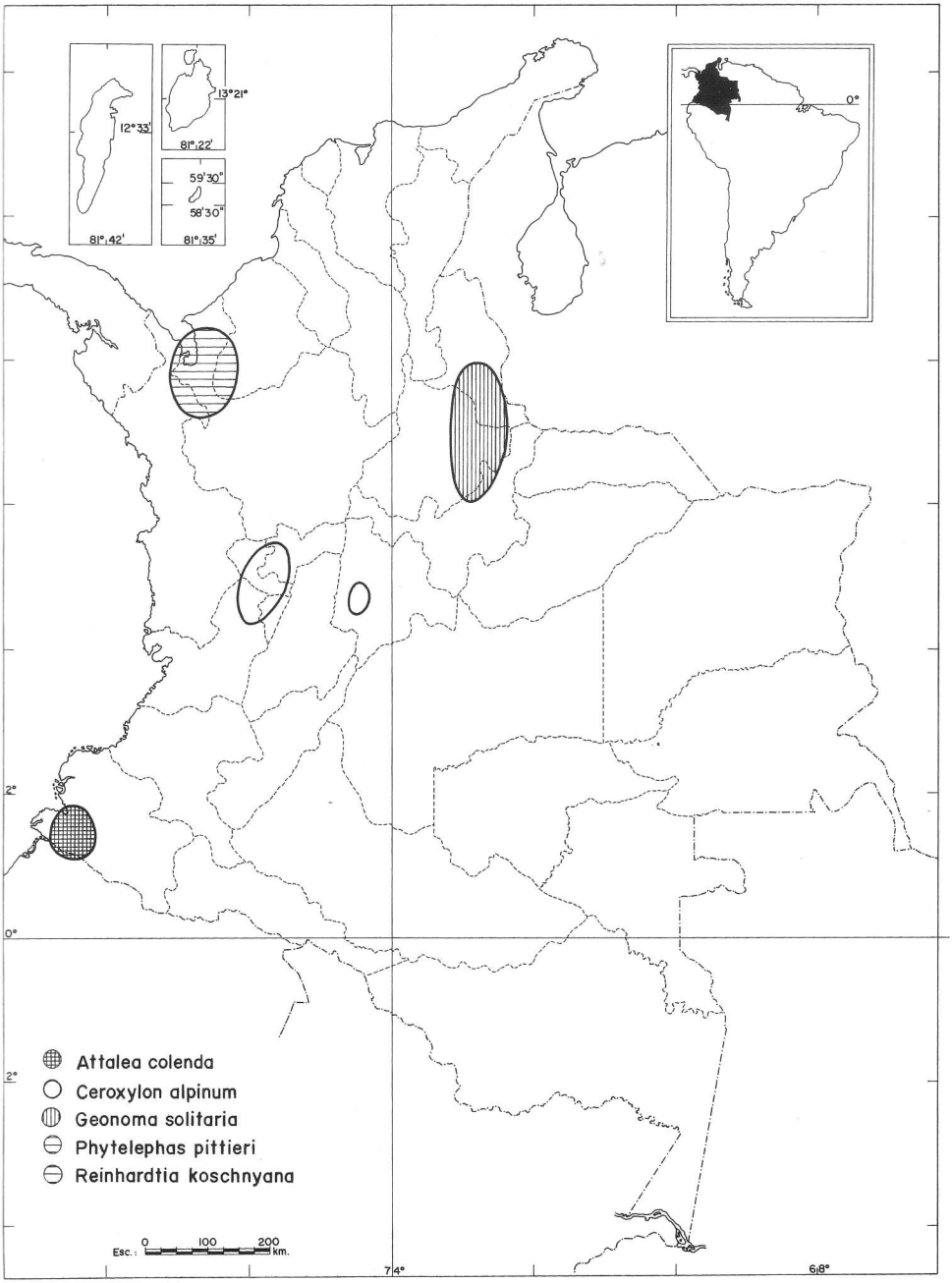
Known only from five individuals, all of them cultivated, but said to have been brought from nearby mountains on the Central Cordillera in Antioquia (Fig. 3), where no adults were seen. Dioecious. Two of the trees are isolated males.

Cryosophila kalbreyeri

Known only from a few localities in northwestern Colombia (Fig. 4), usually in small populations. All areas where it has been found have been deforested or are under threat. No seedlings ever seen in open



4. Distribution of some endangered palms endemic to Colombia.



5. Distribution of some endangered non-endemic palms in Colombia.

areas. Might be in the northern lowlands of Paramillo National Park, but so far not actually reported. Leaves much appreciated for broom-making. Probably conspecific with *C. albida* Bartlett, from eastern Panama.

Geonoma chlamydostachys

First collected as late as 1981, this small understory palm has been found only in the wet forests of the middle Río Magdalena (Fig. 3), where forest destruction has increased after the construction of a highway connecting the country's two largest cities. Like most understory species of *Geonoma*, it probably does not regenerate in open areas. Unlikely to occur in any national park. It could become extinct very soon.

Phytelephas karstenii

Restricted to a very small area near Rovira, Departamento del Tolima (Fig. 4), where some 20 individuals were found in a coffee plantation in 1987 (G. Galeano, pers. comm.). It is said that there are other individuals on another farm. Unlike other species of *Phytelephas*, this one was not seen growing in open areas. Not found in any national park. If this species is different from the one that grows further to the north in the Río Magdalena valley, which seems to be the case (A. Barfod, pers. comm. to G. Galeano), then it is in immediate danger of extinction.

Phytelephas tumacana

Apparently restricted to a small area in Departamento de Nariño (Fig. 4), near the Ecuadorean border, where forest is being replaced by African oil palms. Not reported farther to the north in Nariño or Cauca departments, or to the south in Ecuador. Probably in no national park. Formerly exploited for the vegetable ivory of its seeds. A well-defined species.

Prestoea simplicifrons

Known only from the type locality (Fig. 3), where it was collected in 1880 and rediscovered in 1985. Forest has been almost completely destroyed, and the palm does not regenerate in open areas. Not common in the remnant forest patches. Not found in any national park. In immediate danger of extinction. A well-defined species.

Wettinia fascicularis

Known only from a few localities at the northern end of the Central Cordillera in Departamento de Antioquia (Fig. 3), in remnant forest patches and semi-open areas, where seedlings do not seem to develop into adults. Apparently in no national park. A well-defined species.

It must be stressed that eight of these endangered species (Fig. 3) are endemic to a small area at the northern end of the Central Cordillera in Antioquia, where forest has mostly disappeared or is currently being destroyed. None of them regenerates in open areas. The region is far away from any national park, and there seems to be no definite protection for any of them. The understory species, particularly the species of *Aiphanes* and *Prestoea simplicifrons*, might become extinct very soon.

Only two of the fourteen endangered endemic species are cultivated, both of them as ornamentals: *Attalea victoriana*, and *Ceroxylon mooreanum*. Other species deserve cultivation.

At least one half of these endangered species are known to be useful to man in different ways, and one of them, *Attalea victoriana*, is an oil-yielding plant.

Non-endemic Species

Attalea colenda

Known only from a small area in Nariño (Fig. 5), where forest is being actively destroyed to establish oil-palm plantations.

Table 3. Vulnerable palms in Colombia.

Endemic	Non-endemic
Aiphanes lindeniana (H. A. Wendl.) H. A. Wendl.	*Bactris pilosa* Karsten
Aiphanes linearis Burret	*Ceroxylon quindiuense* (Karst.) H. A. Wendl.
Aiphanes simplex Burret	*Chamaedorea pinnatifrons* (Jacq.) Oerst.
Astrocaryum malybo Karsten	*Elaeis oleifera* (Kunth) Cortés
Astrocaryum triandrum Galeano, Bernal & Kahn	*Geonoma lehmannii* Dammer ex Burret
Catoblastus distichus R. Bernal	*Geonoma lindeniana* H. A. Wendl.
Catoblastus megalocarpus (Burret) Burret	*Geonoma marggraffia Engel*
Euterpe cuatrecasana Dugand	
Prestoea dasystachys (Burret) Bernal, Galeano & Henderson	
Wettinia hirsuta Burret	

Now uncommon, most individuals left in pastures. Not found in national parks. Does not grow north of this area, but is quite abundant in western Ecuador. An important oil-yielding palm (Cook 1942, Acosta-Solís 1971, Patiño 1977, Balslev and Henderson 1987).

Ceroxylon alpinum

In Colombia now restricted to very small populations, usually of scattered individuals, in a small area on the drainages of Río Cauca and Río Magdalena (Fig. 5), between 1,300 and 2,000 m of elevation, mostly in areas of coffee plantations, where it does not regenerate (Moore and Anderson 1976). Dioecious. Considered endangered by Moore (1977). Probably in Los Nevados National Park, but not actually reported so far. Probably also in Venezuela and Ecuador, but identifications requiring confirmation. A well-defined species.

Ceroxylon sclerophyllum

Widespread from Venezuela to Peru (G. Galeano, pers. comm.). In Colombia it is found from Norte de Santander to Nariño, seldom in large populations, mostly scattered individuals, usually in altered areas, with no regeneration. Unexpanded leaves are cut for Palm Sunday ceremonies, which sometimes requires felling the tree. Dioecious. Grows in the National Parks of Tamá and Farallones de Cali. Probably conspecific with *C. parvifrons* (Engel) H. A. Wendl. (G. Galeano, pers. comm.).

Ceroxylon vogelianum

Widespread from Venezuela to Peru, but always extremely uncommon, even in undisturbed areas. Forest has been destroyed throughout a large part of its range in Colombia. Unexpanded leaves are cut for Palm Sunday ceremonies, trees

Table 4. Rare palms in Colombia.

Endemic	Non-endemic
Aiphanes acaulis Galeano & Bernal	*Ammandra decasperma* O. F. Cook
Ceroxylon schultzei Burret	*Bactris coloniata* L. H. Bailey
Chamaedorea murriensis G. Galeano	*Bactris paula* L. H. Bailey
Chelyocarpus dianeurus (Burret) H. E. Moore	*Chamaedorea deckeriana* (Klotzsch) Hemsl.
Desmoncus cirrhiperus Gentry & Zardini	*Geonoma procumbens* H. A. Wendl. ex Spruce
Geonoma divisa H. E. Moore	*Geonoma triandra* (Burret) W. Boer
Oenocarpus circumtextus Mart.	*Reinhardtia gracilis* (H. A. Wendl.) Drude ex Dammer
Orbignya cuatrecasana Dugand	*Synechanthus warscewiczianus* H. A. Wendl.
Phytelephas schottii H. A. Wendl.	*Wettinia oxycarpa* Galeano & Bernal

Table 5. Insufficiently known palms in Colombia.

Endemic

Aiphanes duquei Burret
Aiphanes erinacea (Karst.) H. A. Wendl.
Aiphanes fosteriorum H. E. Moore
Aiphanes gelatinosa H. E. Moore
Aiphanes hirsuta Burret
Aiphanes killipii (Burret) Burret
Astrocaryum cuatrecasanum Dugand
Attalea amygdalina Kunth
Attalea rhynchocarpa Burret
Attalea septuagenata Dugand
Attalea uberrima Dugand
Bactris cuvaro Karsten
Bactris duplex H. E. Moore
Bactris kalbreyeri Burret
Bactris macrotricha Burret
Bactris obovata Burret
Bactris santae-paulae Engel
Catoblastus anomalus (Burret) Burret
Catoblastus cuatrecasasii Dugand
Catoblastus engelii H. A. Wendl. ex Burret
Catoblastus inconstans Dugand
Catoblastus kalbreyeri (Burret) Burret
Catoblastus velutinus Burret
Chamaedorea columbica Burret
Chamaedorea dryanderae Burret
Chamaedorea kalbreyeriana H. Wendl. ex Burret
Chamaedorea latisecta (H. E. Moore) A. Gentry
Chamaedorea sp. (*Morenia corallina* Karsten)
Chamaedorea sp. (*Morenia lindeniana* H. A. Wendl.)
Chamaedorea sp. (*Morenia* cf. *macrocarpa* Burret)
Chamaedorea sp. (*Morenia montana* (H. & B.) Burret)
Chamaedorea sp. (*Morenia robusta* Burret)
Euterpe andina Burret
Euterpe aphanolepis Burret
Euterpe brevicaulis Burret
Euterpe frigida (Kunth) Burret
Euterpe oocarpa Burret
Euterpe parviflora Burret
Euterpe rhodoxyla Dugand
Euterpe zephyria Dugand
Geonoma dicranospadix Burret
Geonoma paradoxa Burret
Hyospathe pallida H. E. Moore
Hyospathe simplex Burret
Hyospathe wendlandiana Dammer ex Burret
Phytelephas dasyneura Burret
Prestoea cuatrecasasii H. E. Moore
Prestoea pubens H. E. Moore
Scheelea humboldtiana (Spruce) Burret

Non-endemic

Acoelorrhaphe wrightii (Griseb & H. A. Wendl.) H. A. Wendl. ex Becc.
Aiphanes orinocensis Burret
Bactris amoena Burret
Bactris aristata Mart.
Bactris caribaea Karsten
Bactris chaetospatha Mart.
Bactris cuspidata Mart.
Bactris fissifrons Mart.
Bactris granatensis (Karsten) H. A. Wendl.
Bactris hirta Mart.
Bactris humilis (Wallace) Burret
Bactris lakoi Burret
Bactris leptospadix Burret
Bactris macana (Mart.) Pittier
Bactris piritu (Karsten) H. A. Wendl.
Bactris riparia Mart.
Bactris schultesii (L. H. Bailey) Glassman
Calyptrogyne ghiesbreghtiana (Linden & H. A. Wendl.) H. A. Wendl.
Chamaedorea bartlingiana H. A. Wendl.
Chamaedorea geonomiformis H. A. Wendl.
Chamaedorea linearia L. H. Bailey
Chamaedorea pauciflora Mart.
Chamaedorea pygmaea H. A. Wendl.
Coccothrinax jamaicensis R. W. Read
Desmoncus tenerrimus (Mart. ex Drude) Mart. ex Burret
Desmoncus vacivus L. H. Bailey
Euterpe catinga Wallace
Euterpe karsteniana Engel
Euterpe oleracea Mart.
Euterpe purpurea Engel
Geonoma aff. *appuniana* Spruce
Geonoma densa Linden & H. A. Wendl. ex H. A. Wendl.
Geonoma heinrichsiae Burret
Geonoma helminthoclada Burret
Geonoma interrupta (R. & P.) Mart.
Geonoma jussieuana Mart.
Geonoma pachydicrana Burret
Geonoma pinnatifrons Willd.
Geonoma pulcherrima Burret
Geonoma pulchra Engel
Geonoma seleri Burret
Geonoma sodiroi Dammer ex Burret
Geonoma spinescens H. A. Wendl. ex Burret
Geonoma triglochin Burret
Geonoma weberbaueri Dammer ex Burret
Hyospathe concinna H. E. Moore
Hyospathe lehmannii Burret
Leopoldinia major Wallace

Table 5. Continued.

Leopoldinia piassaba Wallace
Leopoldinia pulchra Mart.
Lepidocaryum casiquiarense (Spruce) Drude
Lepidocaryum guainiense (Spruce) Spruce ex Drude
Lepidocaryum tenue Mart.
Lepidocaryum tessmannii Burret
Manicaria atricha Burret
Manicaria martiana Burret
Mauritia carana Wallace
Mauritiella aculeata (Kunth) Burret
Mauritiella cataractarum Dugand
Mauritiella martiana (Spruce) Burret
Mauritiella subinermis (Spruce) Burret
Orbignya luetzelburgii Burret
Pholidostachys pulchra H. A. Wendl. ex Burret
Pholidostachys synanthera (Mart.) H. E. Moore
Prestoea brachyclada (Burret) Bernal, Galeano & Henderson
Prestoea latisecta (Burret) Bernal, Galeano & Henderson
Scheelea insignis (Mart.) Karsten
Socratea rostrata Burret
Syagrus inajai (Spruce) Becc.
Syagrus orinocensis (Spruce) Burret
Wettinia maynensis Spruce
Wettinia verruculosa H. E. Moore

often being felled. Dioecious. Grows in El Cocuy National Park, and probably also in Tamá.

Geonoma solitaria

Restricted to a small area of highlands on the Eastern Cordillera, from Norte de Santander to Boyacá (Fig. 5). Named "*solitaria*" by Engel (1865), who saw only one individual at the type locality, and failed to find any other during his travel in the country. Uncommon, most areas now deforested or threatened. Often left in open areas, but seedlings were not seen. Grows in Tamá National Park, and probably also in El Cocuy. Probably also in Venezuela, just across the Colombian border.

Phytelephas pittieri

Grows in a small area in northwestern Colombia, in Antioquia, Chocó, and Córdoba (Fig. 5). Locally abundant at some places, but all forest there being rapidly destroyed. Sometimes left in pastures, but apparently with no regeneration. Dioecious. Grows also in Panama.

Reinhardtia koschnyana

A dwarf understory palm, formerly very abundant in the forests of the Urabá region in Antioquia (Fig. 5), one of the areas of fastest forest destruction in the country, and a center of agricultural development. Does not thrive outside the forest. Apparently in no national park. Ranges from Nicaragua to Colombia, and is considered also endangered in Costa Rica and Panama (Johnson 1986). In immediate danger of extinction.

Syagrus sancona

Grows in several areas of Colombia, most of them now converted into pastures or agriculture, where the conserved palms do not regenerate. Usually uncommon throughout its range. Considered endangered by Moore (1977). Grows in Reserva Nacional Natural La Macarena, but certainly not protected there. Widely distributed in northwestern South America.

Vulnerable Species

"Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing because of overexploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range" (Anonymous 1980).

Table 6. Not-threatened palms in Colombia.

Endemic

Acrocomia antioquiensis Posada-Arango
Aiphanes concinna H. E. Moore
Aiphanes kalbreyeri Burret
Aiphanes monostachys Burret
Attalea nucifera Karsten
Catoblastus pubescens (Karsten) H. A. Wendl.
Catoblastus radiatus (Cook & Doyle) Burret
Euterpe kalbreyeri Burret
Geonoma calyptrogynoidea Burret
Geonoma chococola W. Boer
Lepidocaryum allenii Dugand
Prestoea simplicifolia G. Galeano
Scheelea attaleoides Karsten
Scheelea butyracea (Mutis ex L. f.) Karsten ex H. A. Wendl.
Scheelea excelsa Karsten
Syagrus allenii Glassman
Wettinia castanea Moore & Dransfield

Non-endemic

Aiphanes macroloba Burret
Asterogyne martiana (H. A. Wendl.) H. A. Wendl. ex Hemsl.
Astrocaryum acaule Mart.
Astrocaryum chambira Burret
Astrocaryum jauari Mart.
Astrocaryum macrocalyx Burret
Astrocaryum standleyanum L. H. Bailey
Attalea allenii H. E. Moore
Attalea ferruginea Burret
Bactris balanophora Spruce
Bactris barronis L. H. Bailey
Bactris coloradonis L. H. Bailey
Bactris concinna Mart.
Bactris guineensis (L.) H. E. Moore
Bactris major Jacq.
Bactris maraja Mart.
Bactris monticola Barb. Rodr.
Bactris sigmoidea Burret
Bactris simplicifrons Mart.
Catoblastus aequalis (Cook & Doyle) Burret
Catoblastus drudei Cook & Doyle
Chamaedorea integrifolia (Trail) Dammer
Chamaedorea lanceolata (R. & P.) Kunth
Copernicia tectorum (Kunth) Mart.
Desmoncus orthacanthos Mart.
Dictyocaryum lamarckianum (Mart.) H. A. Wendl.
Euterpe precatoria Mart.
Geonoma acaulis Mart.
Geonoma brongniartii Mart.
Geonoma camana Trail
Geonoma cuneata H. A. Wendl. ex Spruce
Geonoma deversa (Poit.) Kunth
Geonoma euspatha Burret
Geonoma juruana Dammer
Geonoma laxiflora Mart.
Geonoma leptospadix Trail
Geonoma macrostachys Mart.
Geonoma maxima (Poit.) Kunth
Geonoma oxycarpa Mart.
Geonoma piscicauda Dammer
Geonoma pycnostachys Mart.
Geonoma undata Klotzsch
Hyospathe elegans Mart.
Jessenia bataua (Mart.) Burret
Iriartea deltoidea R. & P.
Iriartella setigera (Mart.) H. A. Wendl.
Lepidocaryum gracile Mart.
Manicaria saccifera Gaertn.
Mauritia flexuosa L. f.
Mauritiella macroclada (Burret) Burret
Maximiliana maripa (Correa de Serra) Drude
Oenocarpus bacaba Mart.
Oenocarpus mapora Karsten
Pholidostachys dactyloides H. E. Moore
Prestoea decurrens (H. A. Wendl. ex Burret) H. E. Moore
Raphia taedigera (Mart.) Mart.
Sabal mauritiiformis (Karsten) Griseb. & H. A. Wendl. ex Griseb.
Socratea exorrhiza (Mart.) H. A. Wendl.
Socratea hecatonandra (Dugand) R. Bernal
Socratea montana Bernal & Henderson
Welfia regia H. A. Wendl. ex André
Wettinia cladospadix (Dugand) Moore & Dransfield
Wettinia quinaria (Cook & Doyle) Burret

There are 17 Colombian palm species currently recognized to be vulnerable (Table 3), 10 of which are endemic to the country. All of these species grow on the Andean Cordilleras or in the valley of Río Magdalena, but *Euterpe cuatrecasana* grows also in the Pacific lowlands, and *Bactris pilosa* and *Elaeis oleifera* grow also in the Northern Plain. While for most species the main threat is habitat destruction, the major

threat for *Euterpe cuatrecasana* is the large-scale destruction of its populations for the industrial production of palm heart.

At least 8 of these vulnerable species are useful to man.

Rare Species

"Taxa with small world populations that are not at present endangered or vulnerable but are at risk. These taxa are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range" (Anonymous 1980).

There are 18 Colombian palms that are not under apparent immediate threat, but which are not very common or widespread. They must be considered rare (Table 4). Eight of them are endemic to Colombia. All but two of the species known to be rare grow in the Pacific lowlands or on the western slopes of the Western Cordillera. One species, *Ceroxylon schultzei*, appears to be endemic to the Sierra Nevada de Santa Marta, and another, *Phytelephas schottii*, is quite common in a very small area on the Eastern Cordillera, where it seems to be out of immediate threat. *Oenocarpus circumtextus* is a poorly known taxon that was proposed as an endangered species by Moore in 1980 (Johnson 1986), and maintained in that category at the TPU's database at Kew. However, according to I. S. Turner, of Harare, Zimbabwe (pers. comm.), who visited La Pedrera (the only known locality) in 1983, and collected seeds and photographed the palm, it is not in danger, since there is no threat over the lonely area, the soil being too rocky for agriculture. Therefore, I am treating this species as rare.

Insufficiently Known Species

There are 121 species of Colombian palms that are either very poorly known, or whose range, frequency, and potential or actual threats are not known. All of these palms have been included under the "Insufficiently known" category (Table 5). This figure represents 46% of all palms known to occur in Colombia, and it shows the great need of further field work for palms in this country. Fifty one of these species are endemic to Colombia. It is possible that a number of these palms, particularly those growing in the Amazon Region, could turn out to be not threatened, but, on the other hand, it is very probable that many of the insufficiently known species from the Andean region, most of which are endemic, will be found to be vulnerable or endangered.

Not-Threatened Species

There are 80 species of Colombian palms that I consider to be not threatened (Table 6), 17 of which are endemic. The not-threatened species fall into two groups: most species are considered to be not threatened because they are quite abundant and widespread over a large area of rather undisturbed vegetation, mostly in the Pacific lowlands and the western slopes of the Western Cordillera, or on the eastern slopes of the Eastern Cordillera, the Llanos or the Amazon Region; a few species, on the other hand (e.g., *Acrocomia antioquiensis* and *Attalea nucifera*) grow in quite disturbed areas, but they regenerate and develop in such areas, and their populations do not seem to decrease.

Further field work will no doubt give us a sharper image of the situation. For the time being, the available information already depicts a critical panorama with 15% of the species known to be threatened. It is to be hoped that immediate actions are taken by conservation organizations, so that these unique organisms can be saved from their imminent extinction.

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Rhapis Palms—Cultivated Species and Varieties: Culture and Care of the Ladies

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Rhapis, known as Lady Palms, can be found in homes and gardens throughout the world. The widespread popularity of these multi-cane fan palms can be attributed to their adaptability to a wide range of soils, climates, and environments. Uniquely, they are the only ornamental palms to have named varieties (cultivars) in green and variegated forms. While four species are well known as elegant landscape accents or indoor ornamentals, others remain unknown to cultivation, awaiting collection in remote areas of Southeast Asia.

The genus can be divided into two basic groups: the robust Chinese subtropicals which are native to Taiwan and mainland China, and the smaller Indochinese tropicals indigenous to regions in and around Thailand and Laos.

Rhapis excelsa and *Rhapis humilis* are the oldest cultivated Chinese species, recorded as prized ornamentals in the Far East as early as the 17th Century. These are characterized by having large thick leaves on sturdy canes ¾ to 1¼″ (2 to 3 cm) in diameter which grow more than 8′ (2.5 m) tall. *Rhapis subtilis* from Thailand and *Rhapis laosensis* are "20th century" species, being discovered and named by Odoardo Beccari in 1910 and brought into cultivation during the last two decades. These have thinner, smaller leaves on narrow canes less than ¾″ (2 cm) in diameter and seldom exceed 8′ (2.5 m) in height. Other species were named and described by Beccari and Max Burret during the first half of this century, but remain unknown to the modern world of cultivated plants. However, several of these may be grown by Japanese horticulturists as "misnamed varieties" of *R. excelsa* and *R. humilis*. Obviously, the genus needs further study to establish complete order. This difficult project is being undertaken by Dr. John Dransfield and Laura Fitt of the Royal Botanic Garden, Kew.

Cultivated Species of Rhapis

Rhapis are some of the easiest palms to grow, but each species has its own particular environment and culture requirements; no two can be cultivated alike. This idiosyncrasy provides versatility to the genus; wherever you may live, at least one of the species will thrive in your house or landscape.

Lady palms can be propagated by division or seed, depending on species. *Rhapis* are dioecious, requiring both male and female plants for successful pollination. *R. excelsa* and *R. subtilis* seed are being commercially produced; however, female *R. humilis* and male *R. laosensis* are unknown in cultivation; as a result these species must be propagated by division.

Rhapis subtilis "Thailand Lady Palm"

Rhapis subtilis was introduced into cultivation by Watana Sumawong of Bangkok during the late 1960s. At that time, Thailand Lady Palm was thought to be a miniature form of *R. humilis* and was distributed under that name until 1984 when it

1. Two forms of *Rhapis subtilis* 3′ tall in Miami display the wide variation of leaf shapes in this species.

was recognized by Dr. Dransfield and Ms. Fitt to be Beccari's *Rhapis subtilis*.

Thailand Lady Palm is a small species, seldom exceeding 6′ (2 m) of height. Canes are narrow with neat smooth fiber, brown in color. Offshoots have stiff, brittle roots and sucker close to the main cane, making division almost impossible. Since males and females flower prolifically, abundant amounts of seed are available.

At least two, if not three forms of *R. subtilis* exist (Fig. 1). The tallest type has leaves with broad segments which slightly resemble *R. excelsa*. A second form has tiny canes, small leaves with finely divided segments, and slowly grows 2′ to 3′ (1 m) tall (see *Principes*, 17(1)). A third type appears to be a combination of the others. Cross pollination of these different forms may cause the wide variation in seedlings and mature plants. Unlike the blunt tipped *R. excelsa*, all *R. subtilis* have pointed leaf tips.

Being a tropical, *R. subtilis* requires high humidity and abundant moisture. While all *Rhapis* can attract scale insects, this is the only species severely affected by spider mites. It has a temperature range of 32° to 90° F (0° to 32° C), but prefers 60° to 80° F. Thailand Lady Palm thrives in humid, tropical climates, but seldom adapts to hot dry regions or cool subtropical areas. It can be difficult as a houseplant.

Rhapis laosensis "Laos Lady Palm"

First discovered and named by Beccari more than 70 years ago, this small Lady Palm was brought into cultivation during the 1960s by the late David Barry of California. The few specimens in America are all female divisions of his plants and they have not yet been critically identified as *R. laosensis*.

2. A fine specimen of *Rhapis laosensis*, 6′ tall and 18 years old. Photo courtesy of Fairchild Tropical Garden.

Canes are pencil thin and as with *R. subtilis*, have slick neat fiber. Thin leaves with wide segments curve downward providing a very graceful effect. One of the oldest cultivated specimens is displayed at Fairchild Tropical Gardens in Miami and stands almost 6′ (2 m) tall (Fig. 2). Laos Lady Palm is relatively easy to divide, but remains scarce in supply. Culture is not difficult—thoroughly water when slightly dry and keep temperatures between 30° and 90° F (−1° to 32° C). *R. laosensis*

3. *Rhapis humilis* at The Huntington Botanical Garden, San Marino, California. These are more than 60 years old.

grows best in humid tropical areas, but will adapt to warm subtropical climates.

Rhapis humilis "Slender Lady Palm"

Native to China, this subtropical is the tallest of all *Rhapis*, often exceeding 18′ (6 m) in height. Large leaves with many narrow segments envelop slender canes, creating the name "Slender Lady Palm."

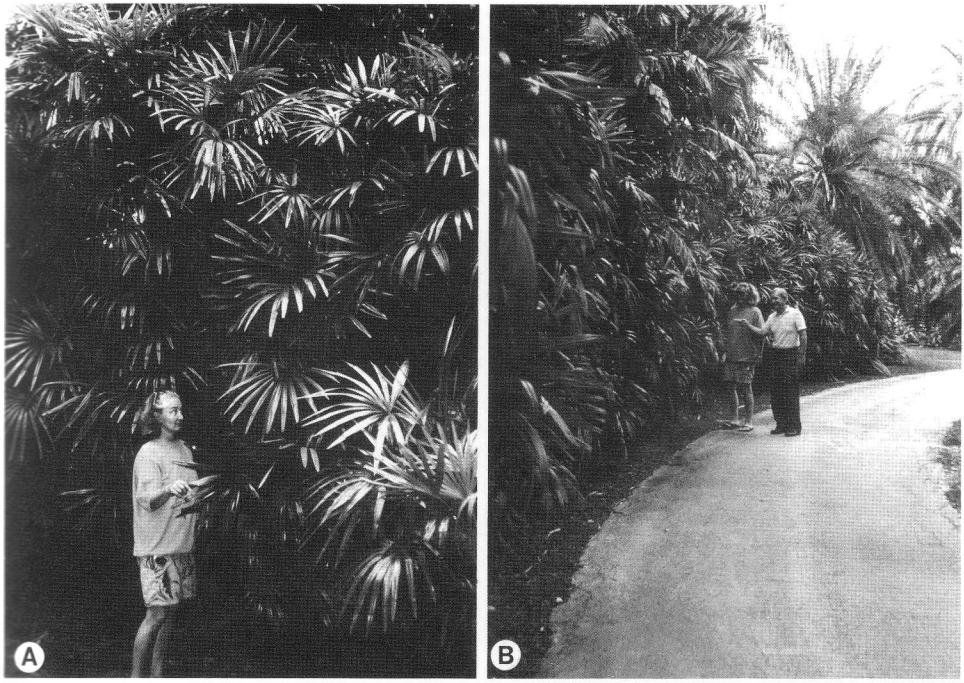
Some of the first imported into America in the early 1900s are still majestically growing at The Huntington Botanical Garden in San Marino, California (Fig. 3). Primarily used as towering landscape specimens on the American west coast, *R. humilis* thrives in cool subtropical climates with temperatures from 18° to 90° F (−7° to 32° C). Those grown in tropical regions suffer in hot summer heat and can exhibit slow growth and loss of vigor.

Only male plants are known in cultivation; therefore, propagation must be by division. Small container specimens under 6′ tall are scarce since roots are brittle and slow to establish; as a result, clump divisions are more successful than single cane separations.

Rhapis excelsa "Large Lady Palm" and "Miniature Lady Palms"

Rhapis excelsa is the most well-known and widely cultivated species, easily adapting to most interiors and tropical or subtropical landscapes throughout the world. It has a multitude of named varieties in green and variegated forms.

Historically, *R. excelsa* have been used as classic ornamental palms for more than 300 years. They were cultivated by the Japanese elite in the early 1600s, intro-



4. A. Lynn McKamey at one end of the serpentine hedge of *Rhapis excelsa* (Large Lady Palm) at Fairchild Tropical Gardens in Miami. B. Lynn McKamey and Paul Drummond at the other end of the same hedge.

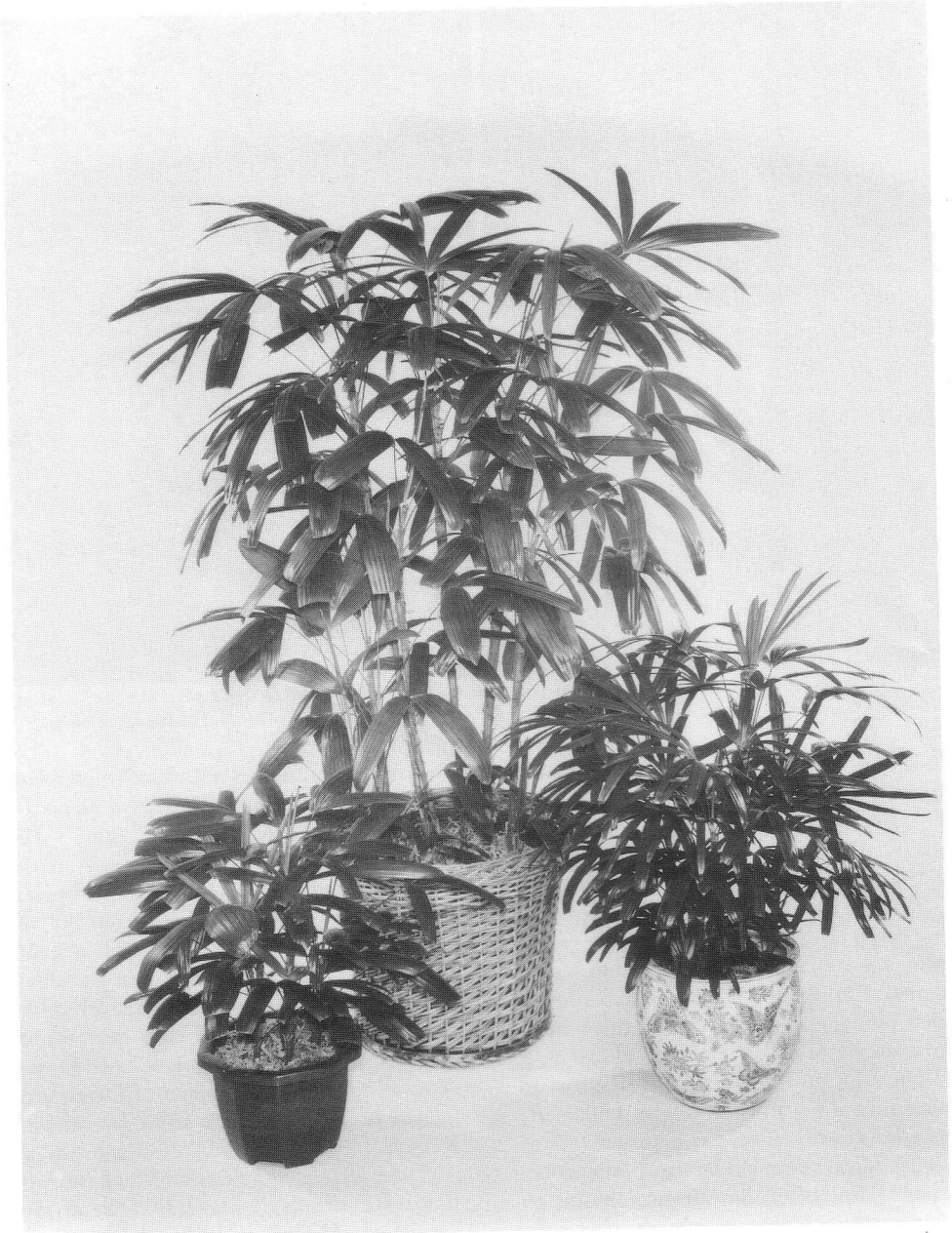
duced to Europe in 1774, and became prized American "parlor palms" during the 1850s. The popularity of this species can be attributed to its ease of care, durability, insect resistance, and long life.

Rhapis excelsa consists of two groups: the common "Large Lady Palm" grown from seed or divisions, and the highly refined "Miniature Lady Palms" developed by Japanese enthusiasts into named varieties by selective cloning.

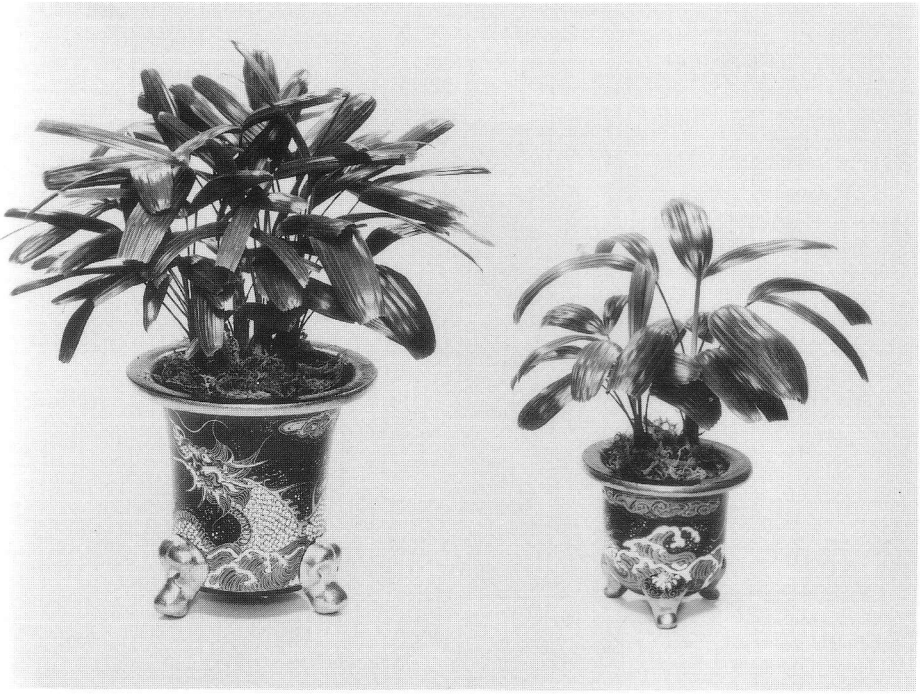
The "Large Lady Palm" can grow to more than 14′ (4 m) of height. Unlike *R. humilis* which has tall, slender clusters of stems, *R. excelsa* clumps can gain enormous width, often having a diameter as wide as their height (see back cover). In 1939, Fairchild Tropical Gardens of Miami planted twelve single cane divisions 6′ (2 m) apart; today, these multi-cane palms stand in a 10′ to 12′ (3 to 4 m) tall hedge which is more than 9′ (3 m) wide and 80′ (26 m) long (Fig. 4).

Large thick leaves with blunt tips have wide segments, giving *R. excelsa* its occasional name "broadleaf lady palm." Its sturdy canes are covered with coarse, dark brown fiber. This species tolerates tropical and subtropical temperatures from 20° to 100° F (−5° to 38° C) and will accept both humid and dry climates. It is a prolific producer of rhizome offshoots which adds fullness and provides an easy method to increase numbers by division. In addition, seed is often available from Taiwan and should be available soon from growers in Florida.

The green and variegated Japanese cultivars of *Rhapis excelsa*, collectively known as Miniature Lady Palms, were developed through selective cloning of choice, unusual specimens from Taiwan. Each named variety has a unique leaf shape and growth habit (see *Principes* 18(3) and 27(4)). Because of a preference for miniature plants, the Japanese propagate the



5. Named varieties of *Rhapis excelsa*. Left to right: *R. excelsa* 'Koban' 2½′ tall, *R. excelsa* 'Tenzan' 6′ tall, and *R. excelsa* 'Daruma' 3′ tall. Photo by Rhapis Gardens.



Two examples of Miniature Lady Palms which stay very compact and bushy: on the left is *R. excelsa* 'Kodaruma' more than eight years old and only 18″ tall in a 7″ pot; on the right is *R. excelsa* 'Gyokuho' which is five years old and 12″ tall in a 5″ pot. Photo by Rhapis Gardens.

lowest growing strains and further "dwarf" the palms by restricting root systems in tiny pots, using coarse sand or small gravel, and limiting fertilizer applications. However, if these cultivars are given unrestricted growth conditions, some "miniatures" such as 'Koban,' 'Daruma,' and 'Tenzan' can eventually exceed 6′ (2 m) in height (Fig. 5). When I wrote the book *Secret of the Orient* (McKamey 1983), the estimated maximum height of Japanese cultivars was 4′; we now have many specimens 8′ (2.5 m) tall. This interesting discovery has led to the nickname "Texas sized dwarfs," although I am sure others can grow them just as large! However, some cultivars such as 'Kodaruma' and 'Gyokuho' are true dwarf Ladies by staying relatively short and reaching only 4′ of height after 30 years (Fig. 6).

Growth rates of *Rhapis excelsa* vary with culture and environment. In commercial production with 80% shade and subtropical temperatures, the slow growing Miniature varieties can add 3″ to 6″ (7 to 15 cm) of height each year, whereas Large Lady Palms usually increase 8″ to 12″ (20 to 30 cm). If *Rhapis* are grown indoors as houseplants, these rates decrease considerably.

Although some young seedlings of common *R. excelsa* may first resemble certain named varieties, most will eventually develop the same basic "standard" appearance and leaf shape. In contrast, the named varieties will maintain their distinctive characteristics, a result of long-term selective cloning.

Variegated *Rhapis* are seedling sports. Within a random group of 10,000 seedlings, perhaps only five will sprout striped leaves, and of these just one may remain

7. *Rhapis excelsa* 'Zuikonishiki,' a variegated cultivar shown in a 6″ pot. This specimen is 15″ tall and eight years old. Photo by Rhapis Gardens.

a stable plant and retain a good striping pattern. This is then propagated by division to provide the basis of a new variegated cultivar. In Japan, only a few named varieties display perfect stripes on every leaf; most have random striping patterns—no two are exactly alike. Usually, new offsets will carry the striping habit of the leaf directly above on the "mother" cane. *Rhapis excelsa* 'Zuikonishiki' is one of the most popular variegateds, being easy to grow and a prolific producer of offshoots (Fig. 7). However, it generally yields less than 40% choice pups with the other 60% being an interesting assortment of those having more green than white stripes or more white than green. The rare, very finest variegated pups are classified 'Ayanishiki' whereas those with mostly white leaves are renamed 'Zuiko-Lutino.' The creamy-white stripes in these cultivars contain "golden chlorophyll" which can support growth and sustain the plant. Other varieties such as 'Kotobuki' have stripes with albino cells which are extremely sensitive to strong light or extreme heat.

On a stable plant, a variegated pattern cannot be experimentally controlled or changed, but brightness of stripes can be enhanced with proper culture. An example is 'Chiyodazuru,' one of the most popular in Japan, which has narrow stripes on green leaves. Intense sunlight and heat can fade leaves, or strong fertilizer can mask, but not delete, the stripes. For best color, this variety needs cool temperatures, medium light, and medium fertilizer rates—easily accomplished by growing indoors or in dense shade.

Other Japanese Cultivars of Rhapis

Japanese horticulturists have developed more than 100 named cultivars. While most of these are varieties of *R. excelsa*, called KANNONCHIKU, others are green and variegated cultivars of SHUROCHIKU, translated "*Rhapis humilis.*" Although these will eventually reach 6′ (2 m) in height and do resemble a delicate, dwarf form of the towering *R. humilis* grown in California, they may prove to be an Indochinese species more closely related to *R. subtilis*. Several inflorescences await inspection by Dr. Dransfield and Ms. Fitt, so the mystery may soon be solved.

Those familiar with Japanese cultivars may have noticed or obtained Ladies such as *Rhapis* 'Himedaruma' classified as a KANNONCHIKU (*R. excelsa*); however, it is noted in the book *The Miniature Palms of Japan* to be of the "imported group" (i.e., from places other than Taiwan and southern China). On inspection, 'Himedaruma' appears to be *R. laosensis* as is another variety 'Otohime.' I suspect, therefore, that some of the curious cultivars of KANNONCHIKU could be identified as some of the lost species of Beccari and Burret. Time and taxonomy will tell.

Rhapis are a fascinating group of palms, having captured the love and admiration of plant collectors for centuries. The charm and elegance of this diverse family of Ladies

8. An interesting group of *Rhapis excelsa* in Riverside, California.

provide unlimited choices for everyone . . . anywhere.

Culture Tips for All Rhapis

Light. In landscapes, all species of *Rhapis* prefer filtered light or partial shade. Locate in east, south, and north exposures or under a canopy of trees. Placement in full sun without protection will cause unattractive yellow-green leaves, stress, and slow growth. Indoors, all *Rhapis* grow best in bright, indirect light near a window or skylight. *R. excelsa* is the most adaptable to low light areas.

Watering. Rhapis should be thoroughly watered by soaking or drenching the entire root system. *R. subtilis* must be kept constantly moist; if it dries, it will decline or die. *R. excelsa*, *R. humilis*, and *R. laosensis* should be allowed to become almost dry between thorough irrigations. Twice each year, potted *Rhapis* should be drenched several times (leached) to flush impurities and excess soluble salts.

Soil. Rhapis will grow in almost any well-drained soil, but prefer a mixture rich in humus (pH 5.5 to 7.0). Pot in African violet type mix or plant slightly above ground level, amending your garden soil as needed. All roots and the base of canes should be covered to retain moisture and stimulate the addition of new offshoots.

Potting. Lady Palms prefer to be slightly root-bound. Soil density should be firm—not loose, not packed—and allow water to slowly filter through.

Fertilizer. All *Rhapis* are relatively slow-growing plants and need very little fertilizer. As a guideline, apply only ½ the recommended rate required by other plants in your home or landscape. Let leaf color be a guide: rich green indicates that fertilizer levels are adequate; apply nutrients when a slight overall yellowish color is detected.

Rhapis can suffer from trace element deficiencies which produce yellowing leaves, distorted new growth, or general decline. Since the exact cause of a deficiency can often be hard to determine without laboratory tests, use fish emulsion whenever a problem is suspected.

A Warning for Excesses. Rhapis and many other palms can be highly sensitive to excessive boron, fluoride, and chlorine in water supplies, which will cause fast spreading black tip burn. Use the purest water available until the problem is corrected.

Brown Tips. Slight brown tip fringe is common on all *Rhapis*. Black tip burn is not typical and can be caused from improper watering, overfertilizing, and other excesses.

Damaged leaf tips can be trimmed with serrated scissors (pinking shears). Cut in line with the leaf tip, move the scissors slightly sideways and cut again. Single cuts result in too large a zig-zig; double cuts resemble the natural leaf tip.

Dried and Brown Leaves. Leaf damage is usually caused from extreme heat, allowing the palm to dry out, or not thoroughly watering the entire root system.

Pests. Scale is the enemy of all *Rhapis*; spider mites are a major problem for *R. subtilis*. Since scale can hide in the fibrous leaf bases, contact sprays such as malathion are seldom effective. A systemic insecticide which is absorbed into the plant system provides the best protection or control. Since spraying *Rhapis* in hot summer weather can cause leaf burn, use a systemic insecticide labeled for soil application.

Root Rots. Rhapis are very resistant to pathogens; however, *Fusarium oxysporum*, *Pythium*, *Rhizoctonia*, and *Penicillium* (pink rot) can periodically infect *Rhapis*. Use a "broad-spectrum" root fungicide labeled as a soil drench to provide prevention or control.

Lethal Yellowing. Rhapis palms are not known to be susceptible to this fatal disease. During the severe outbreak of L.Y. in Miami, Florida, all species of *Rhapis* grown in the area remained completely unaffected.

Freeze Damage. Protected Lady Palms can often survive temperatures below their recommended low. The tallest canes may be damaged or frozen, but provide protection for lower, younger offshoots. In extreme lows, all visible canes will die, but new offshoots may sprout by summer.

Division. The best time to divide *Rhapis* is during spring or early summer when the palms are actively growing. Single cane divisions should have at least six leaves and several roots before being separated. Pot into well-drained soil using containers just slightly larger than the root system. Remove several lower leaves on each cane to reduce stress. Place in a humid area or mist daily until the palms resume active growth.

Seed. Be aware that *R. subtilis* seed looks exactly like *R. excelsa* which matches *Guihaia argyrata*, a recently discovered Chinese relative which sprouts grass-like leaves with silvery undersides (see page 00 and *Principes*, 29(1). To avoid surprises and a possible mixture of potluck palm seed, commercial growers should know their seed sources.

Rhapis usually flower during spring, need hand-pollination for best crop, and are harvested in late winter. After cleaning the seed, lightly press into well-drained soil and keep moist. Seed should sprout within 50 to 120 days. Immature seedlings of *R. excelsa* and *R. subtilis* look alike until about two years of age when character leaves distinguish one from another.

Airlayering. Yes, *Rhapis excelsa* can be airlayered.

Variegateds. Easy to grow, but require excellent culture and good quality water for best appearance and growth. They prefer 70–90% shade or indirect interior light, and temperatures between 60° to 80° F (15° to 26° C) to maintain growth and vigor. Striped *Rhapis* are slower growing than green forms and require less fertilizer—too little is far better than too much

which can cause leaf burn and root damage.

Landscape Use. Rhapis excelsa adapts to most tropical and subtropical landscapes. *R. subtilis* thrives in warm, humid regions. *R. humilis* prefers subtropical landscapes with cool summer nights.

Indoor Use. Rhapis excelsa is the most adaptable of all species to interior conditions.

Acknowledgments

My thanks to Richard Douglas for proofreading this article and for his helpful comments, and to my husband Kenneth McKamey, who never complains of taking yet another photo of *Rhapis* for me.

Extensive Collections of Rhapis

Fairchild Tropical Gardens in Miami, Florida: *Rhapis excelsa* including green and variegated cultivars, *R. subtilis*, *R. humilis*, *R. laosensis*, and *Rhapis* sp.

The Huntington Botanical Garden in San Marino, California: *Rhapis humilis*, *R. excelsa* and cultivars, *Rhapis laosensis*, and *Rhapis* sp.

Opryland Hotel Conservatory in Nashville, Tennessee: *Rhapis excelsa* including rare variegated and green cultivars and *R. subtilis*.

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Note: The back issues of *Principes* listed above are available at $6 each (postpaid) from The International Palm Society Business Office, P.O. Box 368, Lawrence, KS 66044.

Principes, 33(3), 1989, pp. 139–140

Millions of Alleged Rhapis excelsa Seed Sprout into Guihaia argyrata

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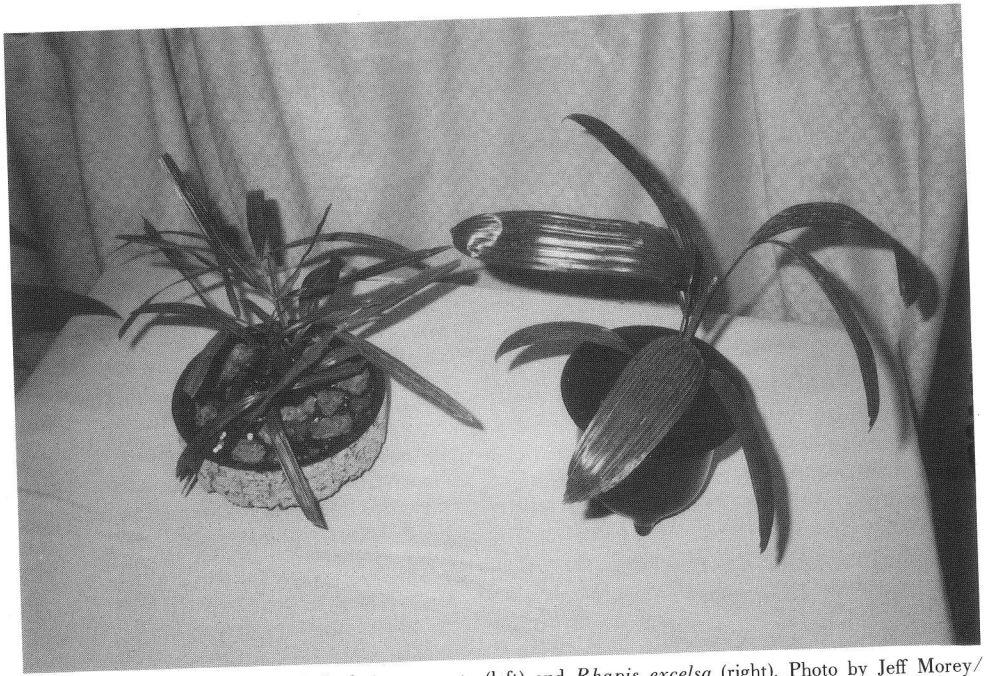
Rhapis excelsa is a versatile ornamental species, extensively used as houseplants, landscape specimens, and patio accents. However, supply of this popular palm seldom exceeds demand since seed is scarce and propagation is primarily by division, a slow process of increasing numbers.

During 1985, so-called *Rhapis excelsa* seed from mainland China suddenly became available from Far Eastern dealers. While some growers were suspicious that the seed might be the tropical *Rhapis subtilis* from Thailand, many nurseries quickly obtained seed before the supply ran out. After the buying frenzy was over, more than 10



1. Three year old seedlings of *Guihaia argyrata* (left) and *Rhapis excelsa* (right). Photo by Jeff Morey/ Brantwood Publications.

million alleged *R. excelsa* seed were estimated to have been purchased by American and Australian growers, sending panic of future oversupply throughout the nurseryworld. Since *R. excelsa* have never been known to produce seed in these vast numbers, many nurserymen began to doubt that it was *Rhapis* of any kind.

Growers from both hemispheres experienced germination rates of 20% to 80%. As seed began to spout, thin grasslike leaves appeared, quite unlike any known species of *Rhapis*. Initial growth was extremely slow, and many seedlings struggled to survive, despite excellent culture. Three year old plants are now half the size of comparable *Rhapis excelsa*; underside of leaves are silvery; leaflets are split into many narrow segments. The largest plants display dark brown trunk fiber and the formation of small offshoots.

Dr. John Dransfield and Dr. Natalie Uhl have recently determined that this clustering fan palm is probably *Guihaia argyrata*, a new Chinese genus closely related to *Rhapis*. During 1984, Dr. Dransfield and two Chinese botanists, Lee Shu-Kang and Wei Fa-Nan, were responsible for identifying and naming this palm from Guangxi and Guangdong providences in China.

Guihaia grows on limestone hills in warm temperate to subtropical climates and should be hardy to 20° F (−5° C). Mature size is about 3′ (1 m). Dr. Dransfield observed *Guihaia* growing in shade and full sun; therefore, these palms could prove to be small, interesting ornamentals for commercial use. In the landscape, *Guihaia* might be a miniature substitute for *Chamaerops humilis* which can grow to large proportions. Several years of cultivation will be necessary to prove if *Guihaia argyrata* could be a successful indoor plant.

Further information about *Guihaia* can be found in *Principes* Vol. 29, No. 1 and in "Genera Palmarum."

Principes, 33(3), 1989, p. 141

PALM LITERATURE

Proceedings of the First Symposium on the Date Palm, March 1982

The First Symposium on the Date Palm was held from March 23–25, 1982, at King Faisal University, Al-Hassa, Saudi Arabia. Research on date palm has been done in different parts of the world; however one cannot find results of these researches in a single source. In the symposium up-to-date achievements from around the world were brought to light and discussed. The proceeding contains most of the papers presented at the symposium. The selected 78 papers contained in the volume represent contributions from 14 countries. Seventy-five percent of the papers of the proceeding are in English and the remaining 25% are in Arabic language. However, the abstracts of papers are in both the languages. The book consists of separate sections on date palm culture, date palm pests and diseases and control, date technology, storage, and processing, economics and marketing of dates, and other related subjects. The proceeding is the first of its kind as far as date literature is concerned. Researchers, students, teachers, extension workers, farmers, and others interested in date palm may use it as a source book of information for many years to come.

A copy of the proceeding can be obtained by contacting/writing to the Office of the Director, Date Palm Research Center, King Faisal University, P.O. Box 400, Al-Hassa 31982, Saudi Arabia.

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Annual Reports of Date Grower's Institute

Date palm (*Phoenix dactylifera* L) is probably the oldest plant species cultivated by man. Date palm literature is old and widely scattered and often inaccessible. Reports of Date Grower's Institute, published from Coachella Valley, California, U.S.A., constitute probably the first exclusive and unique publication on the date palm. This yearly publication was started with the initiation of the Date Grower's Institute in 1924. In fact the Institute was originated for local date growers but it achieved an international status in the date world. After 54 years of service to date growers and industry, the publication of report ceased in 1979. It was available to a wide range of people—growers, researchers, teachers, extension workers, etc. All used it to publish their findings and observations as well as for obtaining information concerning date palm. The 54 volumes of annual reports are like a treasure of information on date palm. No other source in the world has ever published as many papers on date palm as one can find in the Annual Reports of Date Grower's Institute.

The articles and papers published in the reports cover a broad spectrum of date culture and science, from origin and history to culture, production, processing, utilization, marketing, etc. No date literature collection could be complete without inclusion of Date Grower's Institute reports. The reports are useful to all interested in date work—teachers, researchers, students, extension workers, growers, industrialists, etc. The D.G.I. reports (set of 54 volumes) are available from The U.S. Date and Citrus Research Station, Indio, California, U.S.A.

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Principes, 33(3), 1989, pp. 142–151

Demography of Astrocaryum sciophilum, an Understory Palm of French Guiana

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The relatively simple growth form of palms has prompted the interest of many population ecologists in recent years (Bannister 1970, Van valen 1975, Sarukhan 1978, Savage and Ashton 1983, de Steven 1986, Sist and Puig 1987, Sist 1989).

Although the systematics and ecology of palms in French Guiana are quite well known (Wessels Boer 1965, De Granville 1978, Kahn 1983), demographic studies have been slow to develop.

In 1985 I started research on the demography and population dynamics of five common palm species in French Guiana (Sist 1989). My purpose was to follow the process of natural regeneration of palms in a tropical rain forest and to point out population strategies of palms in relation to their ecology. The demographic structures of these populations have been analyzed by defining several developmental stages.

Palm fruits are an important food source for a wide range of mammals and birds. These animals play a fundamental role not only in the regulation of palm populations through seed predation, but also in seed dispersal which, in turn, will determine the distribution of seedlings. The rodents of South America have been the subject of studies (Morris 1962, Smythe 1978). Other important predator-dispersal agents, at my study site in French Guiana, include the white lipped peccary and several arboreal mammals of French Guiana (Charles-Dominique et al. 1981).

This paper summarizes the first results of a study of the demography and seed dispersal of the palm *Astrocaryum sciophilum* (Miquel) Pulle. The establishment growth occurring in seedling and juvenile stages is described and correlated with their mortality rate.

The relatively high density of this species in the understory of Guianan forests allows analysis of population dynamics in a relatively small area.

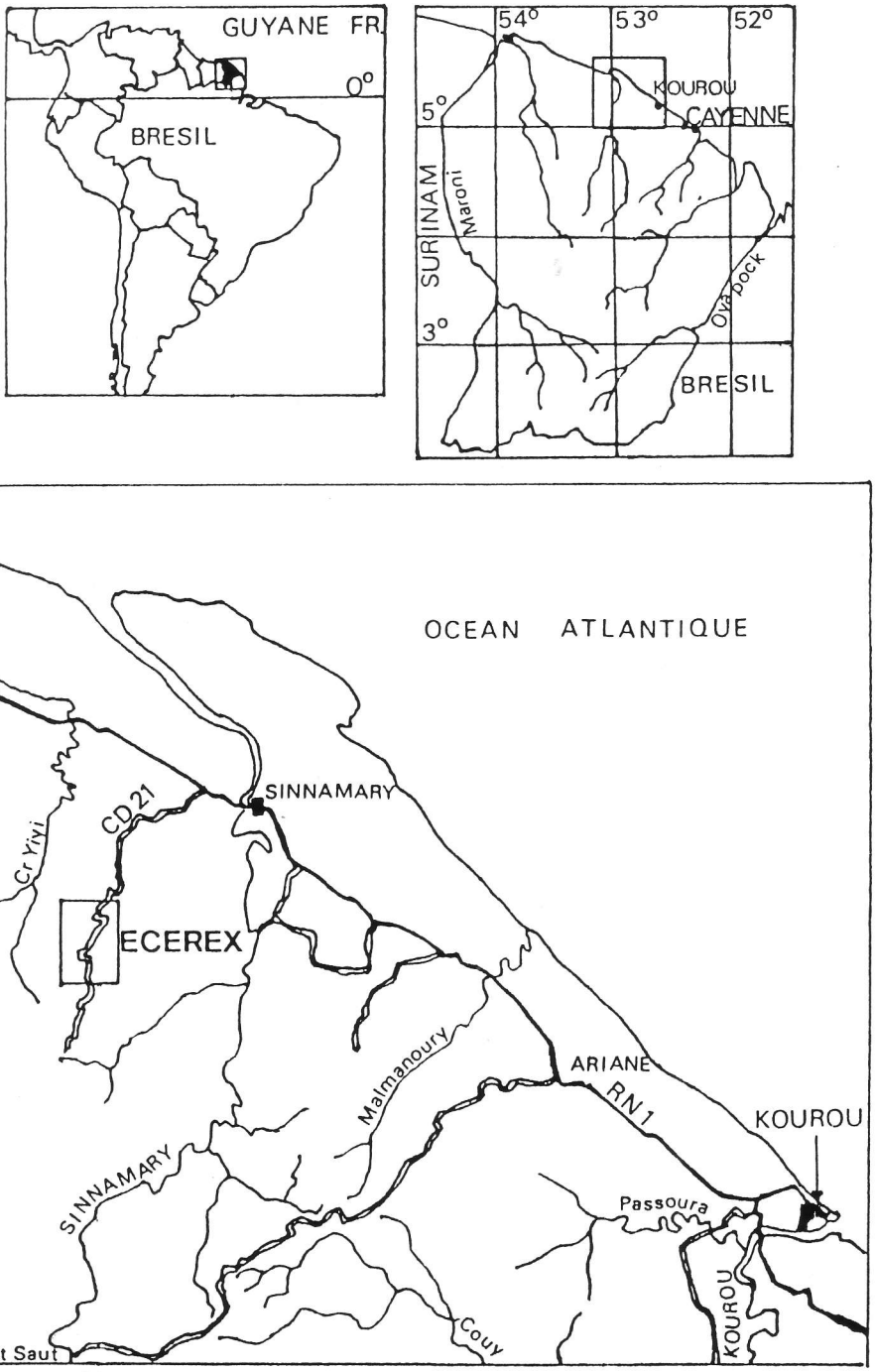
Study Area

The study was conducted at the field station of "Piste de Saint Elie" (Fig. 1) which was created in 1977 for experimental studies of forest ecology, regeneration, and soil erosion ("ECEREX" programme, Sarrailh 1980). This area is covered by tropical rain forest and most of the canopy trees (DBH (diameter breast height) > 20 cm) belong to three families in the following proportions: Lecythidaceae (26%), Caesalpiniaceae (22%), Chrysobalanaceae (12%) (Puig et Lescure 1981).

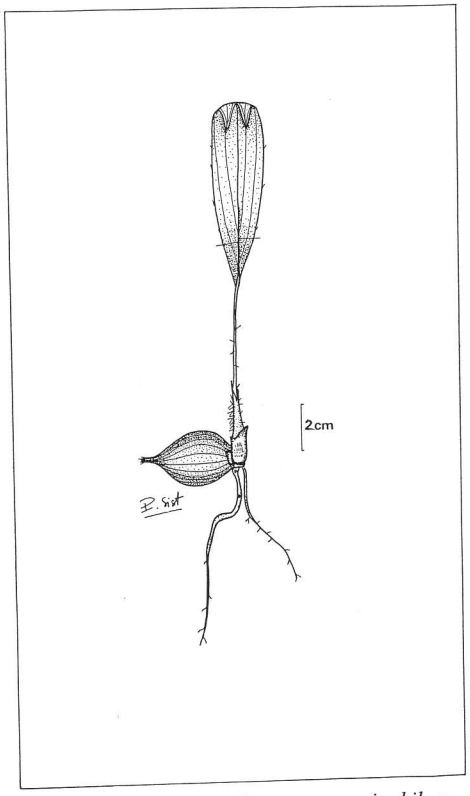
There is a dry season of three to four months, from August to November, and a long rainy season for the rest of the year. However, the rainy season is often interrupted in February or March by a short but variable dry season. Annual rainfall at the station in 1986 was 3,010 mm, and the number of rain days was 268.

Methods

Three populations of *A. sciophilum* were studied in three different plots (B, D1, D2) of 2,500 m^2 each. Plots B and D1 differ



1. Location of the study area.



2. Young seedling of *Astrocaryum sciophilum*.

from each other in the type of drainage. Plot B is characterized by impeded vertical drainage whereas D1 and D2 are on well drained soil with free vertical drainage (Boulet 1978). Plot D2 is actually a continuation of D1 and was marked out in February 1986, to test whether doubling the surface area would result in a proportional change in the number of palms present.

Study of the demography and population dynamics of this species was simplified by defining several developmental stages of the palm. The criteria used were the degree of leaf division, leaf number, and leaf size.

Since plants exhibit great plasticity in growth rates, plant age is not always useful (Harper 1977) nor can age be assumed from size. In order to estimate the age of palms it was necessary to know the growth rate, including the time passed in the acaulescent, establishment growth, phase. Growth rate of *A. sciophilum* varied greatly and depended on external conditions but also on the developmental stage of the palm. For this reason, analysis of the demographic structure of palm populations was approached on the basis of stages of development rather than age per se.

The population in each plot has been mapped to follow the spatial distribution of palms and knowing the behavior of seed dispersal agents to explain this distribution. Rodents such as squirrels, agoutis or acouchis are known to scatterhoard fruits, particularly endocarps of palms, near objects such as tree bases, logs, roots, and beneath lianas (Morris 1962, Smythe 1978). In addition to the white lipped peccary they are the only mammals able to masticate very hard endocarps such as those of palms. In order to find the consequences of the feeding behavior of these rodents on the spatial distribution of seedlings, I measured the distance from each seedling to the nearest object following the method of Kiltie (1981). The process of seed dispersal was also assessed by searching for endocarps or fruits in a plot of 280 m^2 (called E) where there were only two fertile *A. sciophilum*. The soil was racked to a depth of 5 cm, all intact, decaying or masticated endocarps were counted, and the distance from them to the nearest object measured.

Study Species

Description. Astrocaryum sciophilum (Arecoideae: Cocoeae: Bactridinae, Uhl and Dransfield 1987) (Fig. 6) is the commonest understory palm in the lowland forests in the interior of French Guiana. This solitary palm develops an unarmed stem usually 2 to 5 m tall but reaching a height of 12 m in well developed specimens. The crown is composed of 10 to 14 leaves, 6–7 m long with 75–85 pairs of pinnae, whitish abax-

Table 1. Morphological characteristics of developmental stages in plots B, D1, and D2. S, Seedlings; N = Number of individual (D1 + D2 + B); L cm = Mean leaf length; NL = Mean Leaf Number; NPi = Mean Pinna Number per leaf.

Stages	S	J1	J2	J3	A
N	231	88	25	20	24
L cm	59 ± 4	155 ± 7	295 ± 20	560 ± 34	630 ± 35
NL	4 ± 0.22	6 ± 0.34	8 ± 0.68	8 ± 0.64	9 ± 0.91
NPi	0	4 ± 0.51	18 ± 0.83	106 ± 15	145 ± 9

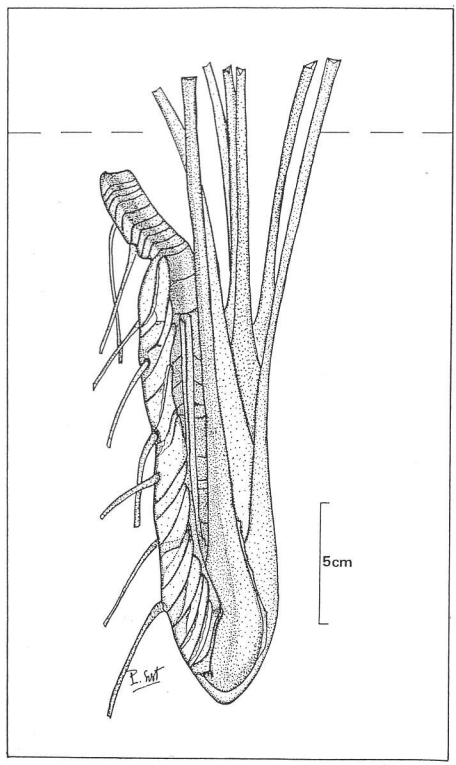
ially and inserted at regular intervals on the rachis. The lower faces of the rachis and the petioles are armed with flat spines, 1–25 cm long, arranged in oblique rows. The single seeded fruits are covered by prickles 0.5 cm long and are obovoid in shape, about 6 cm long, 3–4 cm in diameter. The mesocarp is fibrous, and the very hard endocarp protects the single seed which contains a white endosperm with a central cavity.

In the study area *A. sciophilum* grows mainly on the crests or slopes of hills but rarely on flooded sites (Sist 1989).

Developmental stages. Five developmental stages have been defined (Table 1):

1. Seedlings: the first leaf or eophyll (Tomlinson 1961) is entire, 18–20 cm long and 3–4 cm wide, slightly indented at apex. The petioles of their leaves bear some black filiform spines (Fig. 2). I define as seedlings the palms with only entire leaves. The seedlings in plots B, D1, D2 (Table 1), have 4 entire leaves 18–120 cm long. This developmental stage includes individuals of different size with two common characters: the absence of division of leaves and the low number of leaves.
2. Stage 1 juveniles (Fig. 7) possess 6 leaves 120–250 cm long which are poorly divided into 1 to 8 pinnae (Table 1).
3. Stage 2 juveniles (Fig. 8) are palms with 8 well divided leaves (4–23 pairs of pinnae), 250–450 cm long.
4. Stage 3 juveniles (Fig. 9) have 8–11 leaves longer than 450 cm and composed of 30–70 pairs of pinnae.
5. The adult stage is defined as palms able to flower.

Seedlings and juveniles appear acaulescent but develop, in fact, an underground, positively geotropic stem. This results in the stem growing down in the soil (about 40–50 cm in depth for stage 2 juveniles, Fig. 3). The largest of stage 2 juveniles build the basal upward-growing part of the

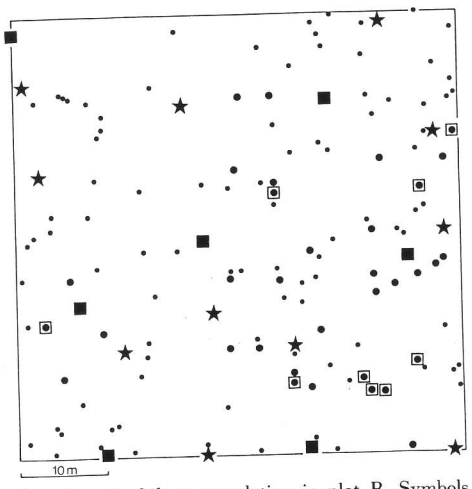


3. Underground stem of *A. sciophilum*, juvenile stage 2.

Table 2. Demographic structure of the three populations in plots B, D1, D2, and D. N, Number of individuals.

Stages	S	J1	J2	J3	A
NB	84	29	9	7	11
%B	60	20.71	6.43	5	7.86
		Total NB = 140			
ND1	71	36	6	5	4
%D1	58.20	29.51	4.91	4.10	3.27
		Total ND1 = 122			
ND2	76	23	10	8	9
%D2	60.32	18.25	7.94	6.35	7.14
		Total ND2 = 126			
ND	147	59	16	13	13
%D	59.27	23.80	6.45	5.24	5.24
		Total ND = 248			

stem which corresponds with the end of the establishment growth phase (Tomlinson and Zimmermann 1966). Stage 3 juveniles present an underground stem with a negative geotropism and the same morphology as that of adults. This pattern of growth has already been described for other Amazonian palms including *Jessenia bataua* (Mart) Burr. and *Syagrus* sp. (Castro dos Santos 1981) but I did not find any published descriptions of this growth form in *A. sciophilum*.



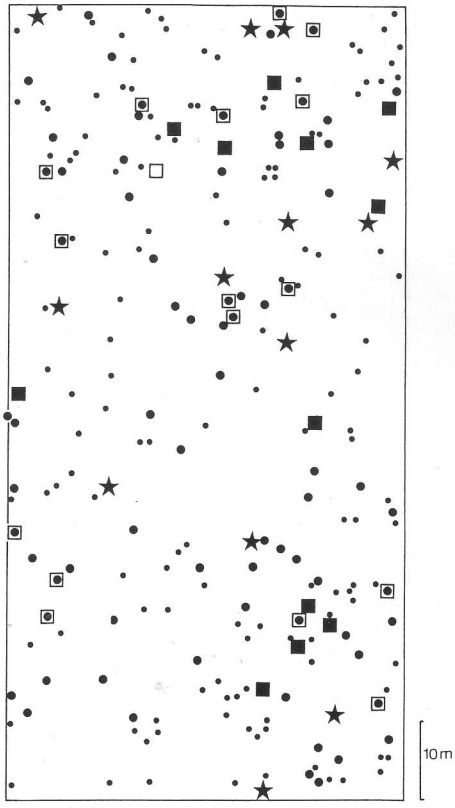
4. *A. sciophilum*, population in plot B. Symbols for Figs. 4 and 5: ● Seedlings, ● Juveniles 1, □ Juveniles 2, ■ Juveniles 3, ★ Adults.

A strong correlation has been found between leaf length and the number of pinnae ($r = 0.995$; $N = 258$, $p = 1\%$; $Y = 0.23X - 38.58$; X = length leaves, Y = number of pinnae). The length of leaves and the number of pinnae are thus the main indicators which express the ontogenic stage of the species. Because of its relatively high density and the definition of easily identified developmental stages, *A. sciophilum* is a suitable species for population ecology studies.

Demography

The proportions of individuals in the 5 developmental stages (Table 2) do not differ in the three populations ($G = 8.07$, $df = 8$, $p = 1\%$). The absence of differences between the two populations in plots D1 and D2 ($G = 3.33$, $df = 4$, $p = 1\%$), and the fact that D2 is the continuity of D1 allows grouping of these two into one population; 2,500 m^2 seems to be an adequate area for studying the population of *A. sciophilum*. The plots D1 and D2 are henceforth considered as one plot of 5,000 m^2 and called D.

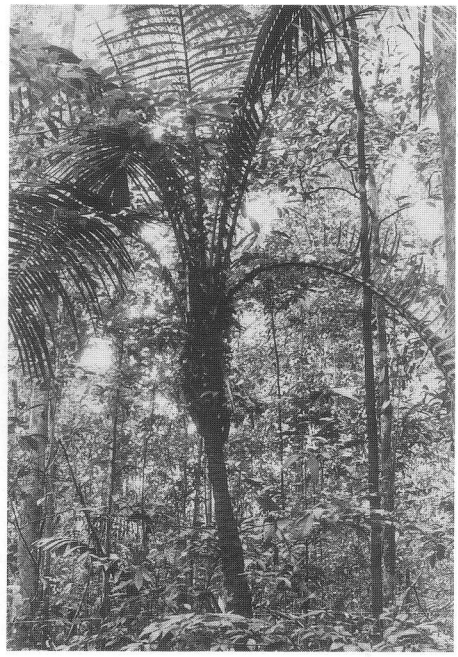
Seedlings are the main component of the population, comprising 60% of the total population in B (Fig. 4) and 59% in D (Fig. 5). Immature plants (i.e., seedlings



5. *A. sciophilum* population in plot D. Symbols: see Fig. 4.

and juveniles) represent 92.74% of the total number of individuals in B and 94.74% in D, whereas adults with 7.86% in B and 5.42% in D are the minority (Table 2).

Seedlings and juveniles 1 apparently suffer high mortality rates (Table 3) which could be correlated with the increase in the number of leaves and of pinnae, occurring in the transition from seedlings to juveniles 1 and from juveniles 1 to juveniles 2. On the other hand, juveniles 2 suffer lower mortality (78% and 81% respectively in B and D reach the stage 3 juvenile). In this transition, even if the number of pinnae increases (Table 3), it does not involve a high mortality. However, in contrast to the first two transitions, the mean number of leaves is constant. So



6. Mature *A. sciophilum*.

leaf number may be correlated with mortality for the smallest individuals (i.e., seedlings and juveniles 1). Large juveniles 3 did not suffer any mortality in the two plots.

One of the causes of mortality is debris fall. The development of a subterranean stem with a positive geotropism (Fig. 3) protects the meristem of old seedlings and juveniles from falling branches or trunks. Youngest seedlings which still possess a superficial stem, at about 5 cm in depth, are more likely to be damaged by fallen branches but it is not unusual to see older juveniles that have survived after a trunk or a big branch has fallen in the middle of the crown. The development of an underground stem with positive geotropism undoubtedly is of high adaptive significance to such events.

Spatial Distribution

The relatively high abundance of *A. sciophilum* in plots B and D (Table 2)

7. Individual at juvenile stage 1.

allows for quantitative analysis of the spatial distribution of populations. In plots B and D, seedling distributions, in terms of the entire plots, are random ($S2/X = 1.10$ for B, N = 60 subplots each of 25 m^2; $S2/X = 0.97$ for D, N = 120 subplots each of 25 m^2; no significant difference with a Poisson distribution for p = 1%). The total population has the same distribution as that of seedlings ($S2/X = 0.97$ for B and $S2/X = 0.96$ for D; no significant difference with a Poisson distribution for p = 1%).

Seedlings are, in reality, preferentially localized near objects (Table 4) and this particular distribution must be correlated with the feeding behavior of acouchis and agoutis. These rodents are known to make caches containing generally one seed (Morris 1962, Smythe 1978). This could explain both the absence of seedling aggregates near objects—the greatest number of young seedlings closed together and around the same object is 3 individuals in plots B and D—and the random distribution of seedlings in regard to the entire plots.

Predation and Seed Dispersal

In plot E, I found 72 endocarps of *A. sciophilum* but only 5 of them were intact. The inspection of the other 67 endocarps by G. Dubost (pers. comm.) indicates that 90% of them had been masticated by the squirrel *Sciurus aestuans*. The eaten endocarps represent 93% of those that show seed predation. The squirrel is the only mammal able to reach the infructescence in the middle of the leaf crown by moving on the upper and spine free part of the rachis. Other rodents and peccaries consume the fruits which have fallen on the soil.

Eaten endocarps are more often found near objects than are the seedlings (Table 4). The fact that 32% and 41% of the

8. Individual at juvenile stage 2.

9. Individual at juvenile stage 3.

seedlings in plots B and D are more than 50 cm from an object while few of the endocarps in plot E were that far away (20%), suggests that the rodents both scatterhoard and recover more seeds near large objects than in the open forest floor.

Furthermore caches made by rodents can be visited by other animals such as peccaries, which preferentially seek seeds near objects (Kiltie 1981).

Discussion and Conclusion

The demographic structure of two populations of *A. sciophilum* is characterized by a high proportion of immature individuals and particularly of seedlings and young juveniles.

Seedlings and juveniles 1 apparently represent the two critical developmental stages as they suffer the highest level of mortality. This could be correlated with the increase in the number of leaves occurring at the transition from seedling to juvenile 1 and from juvenile 1 to juvenile 2.

It would be very interesting to know if the development of an underground stem is a general pattern of palms which spend a long part of their existence in the understory before developing a trunk.

The seeds suffer higher mortality due to predation by rodents and particularly by the squirrel *Sciurus aestuans* than the smallest individuals of *A. sciophilum*. Seed predation must be regarded as an important factor in the regulation of the popu-

Table 3. Rate of individuals reaching the next developmental stage.

Stage	S	J1	J2	J3
Plot B	35%	31%	78%	100%
Plot D	40%	27%	81%	100%

Table 4. Distribution of endocarps in plot E and of seedlings in plots B and D with respect to the nearest object. Classes: I, 0–10 cm; II, 11–20 cm; III, 21–30 cm; IV, 31–40 cm; V, 41–50 cm; VI, >50 cm. N.E.E., Number of Endocarps in plot E. N.S.B., Number of Seedlings in plot B. N.S.D., Number of Seedlings in plot D.

Classes	I	II	III	IV	V	VI	Total
N.E.E.	24	11	9	6	4	13	67
N.S.B.	37	6	5	7	2	27	84
N.S.D.	58	9	13	5	1	61	147

lation of *A. sciophilum*. The rodents, by hiding endocarps one by one near objects, create a random distribution of the seedlings and the whole population, in terms of the entire plots. The proximity of an object usually does not inhibit the development of the palm since it is common to see mature *A. sciophilum* growing directly at the base of large trees.

Summary

The present results deal with the demography and the seed dispersal of *Astrocaryum sciophilum*, the commonest understory palm in the French Guianan primary forest. The demography of two populations is analyzed by stages defined by the degree to which leaves are divided, the number of leaves, and leaf size.

The population structure is characterized by a high proportion of small immature palms. Seedlings and young juveniles represent the two critical developmental stages, as they suffer the highest level of mortality. Establishment growth occurring in seedling and juvenile phases is marked by the development of an underground stem with positive geotropism, which protects the meristem of large seedlings and juveniles.

Seeds are submitted to higher predation by the squirrel *Sciurus aestuans* than the smallest individuals of *A. sciophilum*. The rodents by storing endocarps one by one near objects create a random distribution of seedlings and the whole population, in terms of the total areas tested.

Acknowledgments

I thank G. Dubost who inspected the eaten endocarps I submitted to him and determined the squirrel *S. aestuans* as the main predator of them. I am grateful to Dr. J. B. Fisher for his help in the English manuscript and his valuable advice. Sincere thanks to M. F. Prevost and W. Hahn who kindly reviewed an earlier version of the manuscript.

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LETTERS

15 November 1988

Dear Dr. Uhl,

I thought you might be interested in knowing a bit more about the *Corypha umbraculifera* in this area. A German visitor was in the Garden yesterday. He told Don Evans that he saw several Talipot palms flowering in his travels through the Caribbean. He did not mention specifics.

Also yesterday, I received a letter from Mrs. Elizabeth Lee of Ft. Lauderdale telling me about two *C. umbraculifera* which are flowering in the town square on the island of St. Christopher (St. Kitts).

It might be interesting to ask readers of *Principes* if they know of any others in flower. The information might be valuable to someone's research one day.

CHUCK HUBBUCH
Fairchild Tropical Garden

Dear *Principes*,

While it is gratifying to see any palm depicted in a U.S. postage stamp; I was somewhat dismayed to see *Sabal palmetto* presented as a pinnate palm. The portrayal of the palmetto trunk however more correctly resembles the palm we in South Carolina know and love. I wonder what the chances might be of getting the U.S. Postal Service to issue a postage stamp honoring *Sabal palmetto* which actually has a picture of *Sabal palmetto* on the stamp?

GREGORY E. FLYNN, JR.
Travel Editor View Magazine

Eds. Note: Several other readers noticed this which is apparently due to the artist's depiction.

BOOKSTORE

COCONUT PALM FROND WEAVING (Wm. H. Goodloe, 1972, 132 pp.) 4.95

COCONUT RESEARCH INSTITUTE, MANADO (P. A. Davis, H. Sudasrip, and S. M. Darwis, 1985, 165 pp., 79 pp. color) 35.00

CULTIVATED PALMS OF VENEZUELA (A. Braun, 1970, 94 pp. and 95 photographs.) 7.95

***EL CULTIVO DE LAS PALMAS EN EL TROPICO** (in Spanish, A. Braun, 1988, 65 pp., some color and line drawings). 9.95

EXOTICA (4) (A. Graf, pictorial encyclopedia, 2 vols., including 250 plant families, 16,600 illust., 405 in color, 2590 pp.) 187.00

FLORA OF PERU (Palms) (J. F. MacBride, 1960, 97 pp.) 8.00

FLORIDA PALMS, Handbook of (B. McGeachy, 1955, 62 pp.) 1.95

FLORIDA TREES AND PALMS (L. and B. Maxwell, 30 palm species, 120 pp.) 6.00

GENERA PALMARUM (N. W. Uhl and J. Dransfield, 610 pp.) 74.95

HARVEST OF THE PALM (J. J. Fox, 1977, 244 pp.) 24.00

INDEX TO PRINCIPES (Vols. 1–20, 1956–1976, H. E. Moore, Jr., 68 pp.) 4.00

MAJOR TRENDS OF EVOLUTION IN PALMS (H. E. Moore, Jr., N. W. Uhl, 1982, 69 pp.) 6.00

OIL PALMS AND OTHER OILSEEDS OF THE AMAZON (C. Pesce, 1941, translated and edited by D. Johnson, 1985, 199 pp.) 24.95

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PALEM INDONESIA (in Indonesian) (Sastraprdja, Mogea, Sangat, Afriastini, 1978. 52 illustrations, 120 pp. For English translation add $2.00) 5.50

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***PALMS OF THE NORTHERN TERRITORY (AUSTRALIA)** (A. White, 1988, 41 pp., 21 photographs, some color) 5.95

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PALMS OF MALAYA (T. C. Whitmore, 1973, 132 pp.) 31.00

PALM SAGO (K. Ruddle, D. Johnson, P. K. Townsend, J. D. Rees, 1978, 190 pp.) 10.00

PALMS OF SUBEQUATORIAL QUEENSLAND (Robert Tucker, 1988, 91 pp., 12 pp. color, many black and white photographs and maps) 20.00

REVISIONS OF THE PALM GENUS *SYAGRUS* MART. AND OTHER SELECTED GENERA IN THE *COCOS* ALLIANCE (S. Glassman, 1987, 222 pp.) 19.95

SECRET OF THE ORIENT DWARF RHAPIS EXCELSA (L. McKamey, 1983, 51 pp.) 3.95

THE GENUS PTYCHOSPERMA LABILL. (F. B. Essig, 1978, 61 pp.) 6.50

THE INDIGENOUS PALMS OF NEW CALEDONIA (H. E. Moore, Jr., N. W. Uhl, 1984, 88 pp.) 12.00

TROPICA (A. Graf, 7000 color photos, 1138 pp.) 125.00

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***A NEW PRITCHARDIA FROM KAUA'I, HAWAI'I** (Reprint from *Principes*, R. W. Read, 1988, 4 pp.) 2.00

FURTHER INFORMATION ON HARDY PALMS (J. Popenoe, 1973, 4 pp.) 2.00

NOTES ON PRITCHARDIA IN HAWAII (D. Hodel, 1980, 16 pp.) 2.50

RARE PALMS IN ARGENTINA (reprint from *Principes*, E. J. Pingitore, 1982, 9 pp., 5 beautiful drawings) 2.75

PALMS—ANCESTRY AND RELATIONS (B. Ciesla, 1979, a chart) 6.00

PALMS FOR TEXAS LANDSCAPES (R. Dewers & T. Keeter, 1972, 3 pp.) 1.25

PINANGA ISSUE OF PACSOA (#16, 1987, 17 pp.) 2.50

THE HARDIEST PALMS (J. Popenoe, 1973, 4 pp.) 2.00

*New arrival

The palm books listed above may be ordered at the prices indicated plus $2.00 extra per book to cover packaging and postage. (California residents please add 6% sales tax.) Foreign checks must be in U.S. dollars and payable on a USA bank. In some countries it is possible to send International Money Orders through the Post Office. Please include your International Palm Society membership number. Send check payable to The International Palm Society to Pauleen Sullivan, 3616 Mound Avenue, Ventura, CA 93003, U.S.A. ALL SALES FINAL.

Principes, 33(3), 1989, pp. 00–00

The Interim Board Meeting at Corpus Christi, Texas

On Thursday and Friday, 1–2 June, fifteen board members and two past presidents of IPS made their way to the Marriott Hotel on the bay front in downtown Corpus Christi. Present were: directors Kyle Brown, Jim Cain, Don Evans, Walt Frey, Jules Gervais, Lennie Goldstein, Inge Hoffmann, Jerry Hunter, Lynn McKamey, Paul Mahalik, Pauleen Sullivan, David Sylvia, Bill Theobald, Natalie Uhl, Ross Wagner (Fig. 1), and former presidents Paul Drummond and Dick Douglas. Our hosts were the McKamey family, and Rhapis Garden staff members, secretary Candy Sloan, and managers Glenn Kelly and Hop Maclay.

The session began on Friday morning with a tour led by Glenn and Hop to view some of the highlights of Corpus Christi. From the hotel we went out Ocean Drive, a boulevard with *Washingtonia*, *Trachycarpus*, and *Phoenix* down the middle and numerous *Sabal mexicana*, *Chamaerops humilis*, and *Phoenix* along the way. The trip continued over the causeway to north Padre Island where we drove in part on the flat beaches to Port Aransas. A chunky ferry carried our two vans back to the mainland and we travelled north to Rockport for lunch at the Sandollar Pavilion on the Bay, followed by an early afternoon tour of Fulton House, the restored nine-

1. After the Corpus Christi meeting the directors of IPS who attended assembled in front of the Marriott Hotel. Left to right, upper row: Lennie Goldstein, Inge Hoffmann, David Sylvia, Jim Cain, Paul Mahalik, Don Evans, Bill Theobald; front row: Kyle Brown, Jerry Hunter, Walt Frey, Natalie Uhl, Pauleen Sullivan, Lynn McKamey, Ross Wagner, Jules Gervais.

2. The Fulton House, restored nineteenth century home of Robert's brother, with row of large *Sabal mexicana* on lawn in front.

teenth century home of Robert's brother (Fig. 2). The house was remarkable for its modern features including air conditioning, indoor bathrooms, a basement clothes-dryer, and sturdy antihurricane construction. The restoration is more interesting because it includes many of the original furnishings. The high point of the tour came next, a visit to Rhapis Gardens where an acre of glass houses and another acre in shade housing covered benches of grape ivy (*Cissus rhombifolia*), and 15 green and variegated forms of Polyscias. Of most interest to us were the long rows of *Rhapis excelsa*, 12 named varieties represented and showing different leaf forms and growth habits, including single-canned divisions and eight-foot tall multi-canned specimens. Subsequently all descended on the huge McKamey ranch house, designed by Lynn and Kenny to accommodate the beautiful antique furniture they inherited from Kenny's grandfather. There over 40 people unanimously approved the beef and sausage of Mac's south Texas barbecue. At the barbecue and throughout the meeting the visitors were courteously assisted by Koko, Jeff, and Kara McKamey whose presence and efficiency added much to the occasion.

The Board Meeting, starting early Saturday morning, was an especially important one in planning the future of our ever-growing Society. Because we now have nearly 3000 members in over 70 countries, the business of organizing and directing is becoming more and more complex. At the Australian Biennial Meeting last September, Ed McGehee appointed committees to establish policies for *Principes* publication, Revolving Fund publication, Conservation, Chapter relations, Endowment Fund, and the Seed Bank.

After Ed's unexpected death, Vice Pres-

ident, Jules Gervais, accepted the office of President and worked with the various committees so that guidelines and procedures could be reviewed and approved at this mid-term meeting. These will give clear directions to our Society and allow us to improve and expand our organization and member benefits. A new Vice President, David Tanswell of Australia, was elected and two new directors, D. Jerry Hunter of California and William F. Theobald of Florida, were approved to finish the terms of the late Iris Bannochie and Ed McGehee.

During the meeting the Seed Bank Directors, Inge Hoffmann and David Sylvia, whose dedication and efforts have brought the services of the Seed Bank to new highs, resigned because the volume of extra work has become too great for them to handle. They were given a vote of thanks and appreciation, and have kindly offered to cooperate toward a smooth transition. New directors when established for the Seed Bank will be announced in *Principes*.

Other items of special interest to all include the following:

Visa-Mastercard will be accepted for dues from now on.

All overseas members will receive *Principes* by a special Airlift service, providing more efficient and faster service.

New dates for the **1990 BIENNIAL** are June 17–22 in Hawaii with a proposed optional post-meeting trip to Singapore and Peninsular Malaysia.

The Board Meeting lasted until late Saturday afternoon when several members went to Rhapis Gardens to admire the *Rhapis* and acquire some of the special variegated ones. Dinner that night at the Old Mexican Restaurant in Corpus Christi was another delicious Texas experience. On Sunday, 4 June, participants went by motorcade to San Antonio to enjoy the River Walk, the Alamo, and other downtown sights, and finally on Monday to tour the San Antonio Botanic Garden with its new high tech palm house and conservatory.

NATALIE W. UHL

CLASSIFIED (continued)

INDONESIAN PALM AND CYCAD SEEDS. For swap or in commercial quantities: *Rhopaloblaste ceramica, Drymophloeus oliviformis, Calyptrocalyx spicatus, Gronophyllum microcarpum,* and many other species. *Cycas rumphii* also. Want to buy seed from Latin America, Pacific islands, and Madagascar. JACK HAMZAH, % Conoco Indonesia, P.O. Box 367, Jakarta 10002, Indonesia.

PALM SEEDLINGS. 4″, gallon, and 2 gallon palms shipped countrywide, barerooted, in moist sphagnum. *Ravenea, Neodypsis lastelliana, Coccothrinax crinata,* rare ptychospermas, solitary caryotas, *Zombia, Kerriodoxa,* rare *Chrysalidocarpus* spp., *Oraniopsis, Hyphaene, Gulubia, Cryosophila,* unusual livistonas, *Arenga undulatifolia.* Please send stamped envelope for listing. CAROL GRAFF, 6600 S.W. 45 St., Miami, FL 33155. (305) 666-1457.

Back Cover

Behind the museum at the Huntington Botanical Garden, a lovely walkway meanders past a rounded clump of *Rhapis excelsa* 8′ tall and leads to a cluster of towering *Rhapis humilis* more than 18′ tall. The mild subtropical climate of southern California is perfectly suited for these two species of Lady Palms, especially for *R. humilis* which grows best in areas with cool summer nights. *R. excelsa* easily adapts to this arid region as well as to humid tropical climates. These and other cultivated *Rhapis* are discussed in this issue of *Principes*. Photo by Kenneth McKamey.